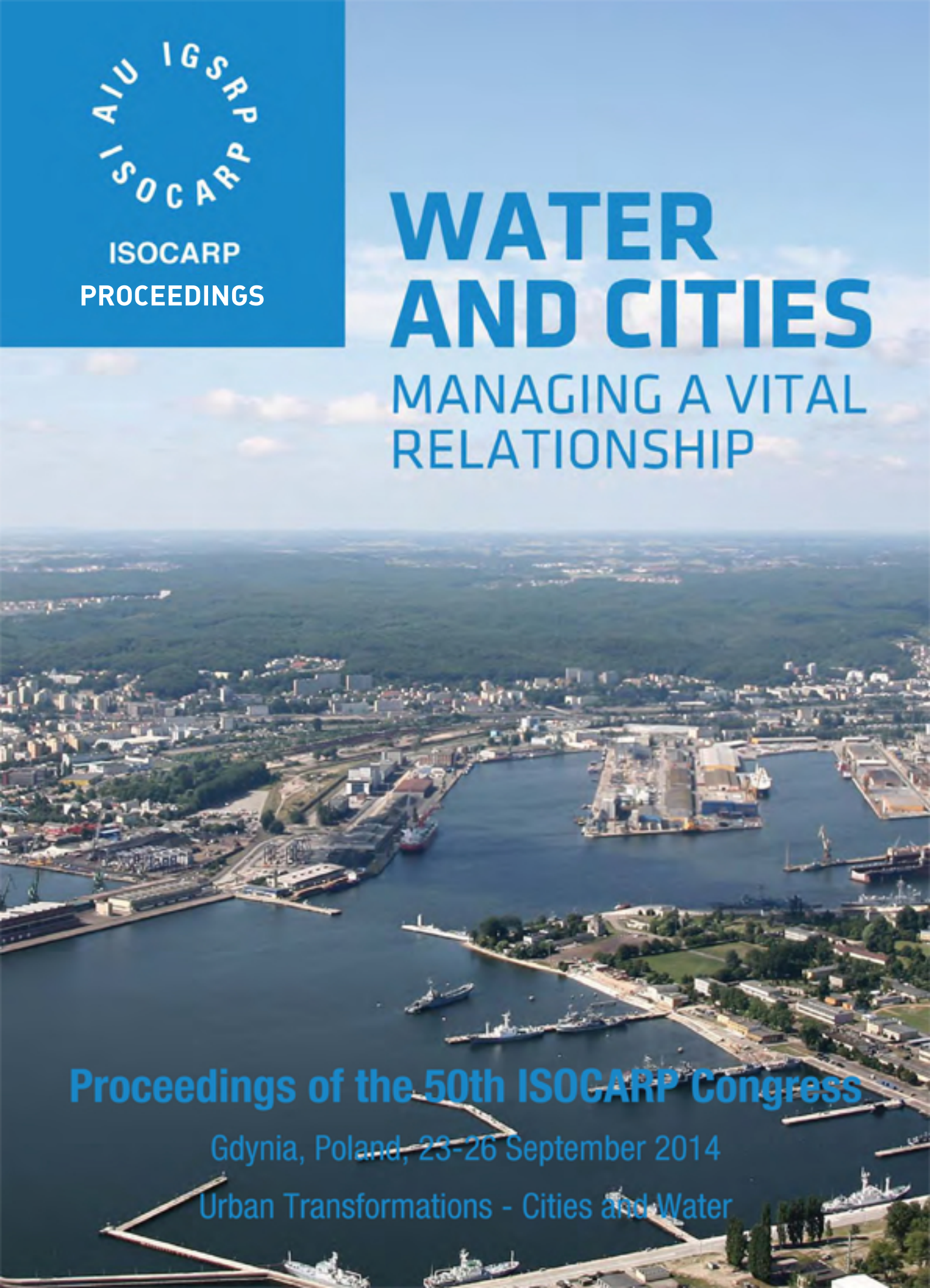
ISOCARP

PROCEEDINGS

WATER AND CITIES

MANAGING A VITAL RELATIONSHIP



Proceedings of the 50th ISOCARP Congress

Gdynia, Poland, 23-26 September 2014

Urban Transformations - Cities and Water



ISOCARP
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International Society of City and Regional Planners
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Proceedings of the 50th ISOCARP Congress
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Urban Transformations: Cities and Water

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50th ISOCARP

International Planning Congress

Urban Transformations - Cities and Water

GDYNIA, POLAND, 23-26 September 2014

Short outlines of submitted papers in the different tracks (alphabetically per track)

1. Urban Design, Landscape and Livable Cities

Abdelmalik Rafif, Kenana Engineering and Technical Services, Khartoum, Sudan
Thirsty land that underwent a huge renovation for an urban agro-industrial project
Water can change everything to a livable one. This paper will illustrate the change on a thirsty area that based on the need for water underwent a huge urban agro-industrial project.

Bos, Caroline, UNStudio, Amsterdam, the Netherlands; Karakiewicz, Justyna, University of Melbourne, Melbourne, Australia
Water as Shape Shifter: Exploring innovative approaches to water related urban design
This paper will focus on urban proposals for Melbourne's Elizabeth Street, as well as the cities of Hangzhou and Bogota, highlighting recent urban designs that take into account the performative qualities of water. (Peer-reviewed)

Candia, Claudia, Politecnico di Milano, Milan, Italy
The regeneration of the historic Redefossi canal in Milan
Several diverse contemporary architectural projects are proposing to transform an ancient subterranean canal beneath the historic centre of Milan that would revitalise the Porta Venezia quarter with a series of new public spaces featuring uncovered sections of the historic Redefossi waterway.

Chen, Yi, Nanjing University Urban Planning and Design Institute, Beijing, China
Urban renewal as the main planning philosophy in China's new urbanization process
This study wants to explore the innovations in planning methodology under China's rapid urbanization background. By summarizing the projects in China, the research on a new philosophy of the master plan is carried out. (Peer-reviewed)

Dong, Zheng; Zhou, Jian; Tongji University, Shanghai, China
Research on the spatial form of the waterfront of Tongli´s historic town in south Yangtze River
Combining quantitative and qualitative analysis, this paper uses the methods of morphology and typology to research the waterfront land parcels, building texture and spatial sequences of Tongli´s historic town in the south of Yangtze River, in order to find out certain rules to guide the conservation and development practices.

Dziubinski, Dariusz, Wroclaw University of Technology, Wroclaw, Poland
The Odra River scenarios
The Odra river in Wroclaw is a "hole" in the city, and areas along the river are "holes in a hole". The current planning is sort of a one-dimensional approach. This paper, analyses the situation and gives proposals of scenarios for creating livable spaces at the water.

Kolesova, Evgenia, Institute of spatial planning Urbanica, St. Petersburg, Russian Federation
Waterfronts in Russia
This paper looks at the prerequisites for the development of waterfronts in Russian cities and presents their development.

Ladzianska, Zuzana; Finka, Marǒs, SPECTRA Centre of Excellence EU, Bratislava, Slovakia
Riverfront redevelopment projects on the River Danube in Bratislava
The aim of the comparison is to outline the probable key behind the success and failure of two Danube riverfront redevelopment projects, Eurovea and River Park, situated in the city centre of Bratislava. Both projects can be found adjacent to the historical city centre, joined by the quayside walk. (Peer-reviewed)

Marwa, Samuel Mugo, Mysticah Designs and Associates; Mwangi, E., Caleb Africa, Nairobi, Kenya
Restoration of Riverine waterfronts through integration of greenways in Kenya
Waterfronts in Kenya have become the backyard and waste disposal points in urban areas as habitat for informal settlements. Could these areas become the welcome points of towns and cities giving identity and placeness? The paper seeks to incorporate greenways in restoration of riverine waterfronts in settlements.

Meng, Zhaoyang; Hu, Zhiliang; Li, Ruofan, Tianjin Urban Planning and Design Institute, Tianjin, China
High quality living environment in high density waterfront
The paper intends to investigate how to achieve a high quality living environment in a high density waterfront site. It will also look to how the proposed density can be delivered in coherent urban block patterns in the intervention site.

Miyamoto, James; Barki, José; Kós, José, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil
Rio de Janeiro´s waterfront: Will it be good?
Currently, under the initiative of the Municipal Government, in Rio de Janeiro, the deployment of a renewal project in its central waterfront docklands is underway. It is time to point out factors and measures that can provide a city with surprising environments: lively, integrative, sustainable and beautiful. (Peer-reviewed)

Moreau, Edouard, Off-The-Grid Studio, London, United Kingdom
The challenges of unlocking urban waterfronts development potentials in West Africa
Waterfronts of existing large cities in West Africa will experience in the next decades massive transformations. Their current conditions vastly differ from the pre-conditions of the well-known case studies in developed countries. There is a need to develop a better understanding of these conditions and appropriate planning approaches.

Moreira, Inês, Universidade de Lisboa, Lisbon, Portugal
Water dialogues: The influence of the Tagus estuary on the development of metropolitan Lisbon

The main objective of the paper is to explore the role of the water in metropolitan Lisbon, its influence on the location and morphology of the specialized areas and the changing nature of their relationship (for energy and food production, raw material, transport or leisure). (Peer-reviewed)

Pols, Leo, Netherlands Environmental Assessment Agency, The Hague, the Netherlands
Envisioning support for a green and livable delta in the Netherlands
The Dutch want more space for natural processes, but without losing the safety and economic possibilities. We developed the Delta Envisioning Support System to bridge differences and identify synergies, so we can find new opportunities for more natural dynamics, greener technology, sustainable agriculture and waterfronts related to port channels.

Liu, Guanpeng; Qin, Mengdi, Tongji University, Shanghai, China
Ecological urban design strategies based on water and wind simulation: Revival of riverside negative urban spaces
This project studies the application of urban design using analysis and simulation of both the river and the wind, to propose eco design strategies on riverside urban spaces, water management and activities along waterfronts. These strategies are implemented on a real project in China to make it more informed and data-based. (Peer-reviewed)

Reiss-Schmidt, Stephan, City of Munich, Munich, Germany
Munich and the River Isar - Opportunities and challenges for sustainable Urban Design
The River Isar is crucial for the identity and urban quality of Munich (1.4 million inhabitants). While the southern part has been renaturified, the design of the inner city Isar is still discussed. This case study shows a cooperative planning process to integrate different intentions of stakeholders.

Ryser, Judith, CityScope Europe, London, United Kingdom
Water in cities: For whose benefit?
This paper conducts the critical evaluation of waterfront developments and their beneficiaries, and the role and responsibilities of planners in this process.

Stangel, Michal, Silesian University of Technology, Gliwice, Poland
River related urban design and regeneration concepts for small Polish cities
Rivers are often key elements of urban regeneration strategies. Neglected waterfronts are rediscovered, cities are “turned towards the water', and the leitmotif of water emerges in theming public space and urban (re)branding. The discussed projects include riverside development for advancing beyond the genocide trauma of the city of Oswiecim (Auschwitz).

Stupar, Aleksandra; Djukic, Aleksandra, University of Belgrade, Belgrade, Serbia
Globalizing the Belgrade waterfront: Mega-projects for a sustainable future?
Considering the complexity of the Belgrade waterfront areas and the history of their decline, this paper analyses two recent mega-projects for these sites. Providing a critical insight into possible

impacts on urban development, the arguments pro and contra mega-projects will be evaluated, defining a preferred direction for a sustainable implementation. (Peer-reviewed)

Yang, Jianqiang; Tang, Yezheng, Southeast University, Nanjing, China
Heritage value evaluation and its preservation of Beijing-Hangzhou Grand Canal (Wuxi section)
Beijing-Hangzhou Grand Canal (Wuxi section) is one of the earliest sections that are open to navigation. Nowadays, it still plays an important role in urban social and economic development. This paper evaluates its heritage value, studies its heritage type and constitution, and puts forward some protection and re-utilization measures. (Peer-reviewed)

Zaman, Jan; Geldof, Charlotte; Geens, Sara, Ruimte Vlaanderen, Brussels, Belgium
Can research by design on regional level help to introduce new concepts in spatial planning?
In this paper, the authors want to explain their revelations on recent research by design on regional levels, that is initiated or realised by the Flemish spatial development department. They focus on the most recent findings and research and discuss about the possibility to explore new dimensions and future thinking. (Peer-reviewed)

Zhou, Xuan, China Academy Urban Planning and Design, Beijing, China
Shaping and controlling the city skyline on the eastern side of West-Lake in Hangzhou, China
This paper promotes the ideas and methods of guiding the landscape control of West Lake in Hangzhou, which shapes the city changes and at the same time seeks to protect the long profound historical cultural inheritance of Hangzhou effectively.

Zumelzu, Antonio; Ostrowski, Daniel; Murua, Matias; Navarro, Sebastian; Toro, Melisa; Rodriguez, Alex, Universidad Austral de Chile, Valdivia, Chile
Centrality and urban transformation: An exploration of the process of live centrality in waterrelated cities in southern Chile
The aim of this paper is to explore how different spatial configurations are influenced by the process of live centrality and how this plays a critical role in the formation and location of centers, both at a local and city-scale. The study focuses on a middle-size fluvial city in Chile.

2. Social Aspects, Collaborations and Governance

Brennan, Sarah, the Development Planning Unit, The Bartlett, University College London, London, United Kingdom

Future city visions and socio-environmental justice in Dar es Salaam, Tanzania

The paper explores the implications of smart cities visions on citywide planning in Dar es Salaam.

Britto, Ana Lucia; Costa, Isabella; Andrade, Victor, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

The river for the people: The case of Das Pedras River's revitalization on the West Zone of Rio de Janeiro

In search of an urban design that reconciles the water sensitive design and gives answers to urgent housing demands and livability, this work addresses the critical relationship between the Rio das Pedras slum, in the west zone of Rio de Janeiro, and the river through an urban design proposition and reflection.

Chatterji, Tathagata, Manipal University, Manipal, India

Reclaiming the river - Politics of planning in Calcutta's post-industrial restructuring

Looking through the prism of spatial reconfiguration of the extended Calcutta metropolitan belt, due to economic restructuring, this paper brings out the complexities of brownfield urban regeneration in a globalising city of the Global South, due to the socio-economic realities of poverty and population. (Peer-reviewed)

Chen, Song, Tongji University, Shanghai, China

From life to manufacture, from manufacture to leisure: Evolution and development of the river system of Chinese ancient city Luoyang under different social backgrounds

With the transformation of different social backgrounds and ideologies, the relationship between the Chinese ancient capital form and the function of the rivers can be categorised in several words: Life and 'etiquette', leisure and livable.

Ekong, Faith, University of Uyo, Uyo, Nigeria

Evolution of new coastal urban lifestyles in West Africa: Implications for sustainable African cities

The study aims at examining the possible evolution of new lifestyles over time resulting from the urban expansion and the wider implications of these especially for the socially excluded- fisher folks, wetland farmers, indigenous people, women and the youth of West Africa in these urban centres.

Feng, Qiong; Wu, Min, Tongji University, Shanghai, China

Reservoir urban space quality improvement on the post Three Gorge era: Case study on a few towns

The paper is a study on the human settlement improvement strategy in landscape, culture and social construction for the immigration of new towns caused by Three Gorges project.

Fu, Wei, Peking University, Beijing, China

The impact of water resource planning on water issues in Beijing, China

The lack of empirical studies measuring whether the impact of plans is good for environmental problems or not represents a great gap in planning research. According to spatial-temporal characteristics of water planning correlating to water problems, the findings indicate that water planning worsened water problems in Beijing, China.

Janssens, Nel, Chalmers University of Technology, Department of Architecture, Gothenburg, Sweden, KU Leuven, Faculty of Architecture, Campus Sint-Lucas Brussels, Belgium; Geldof, Charlotte, Magnificant Surroundings, Ghent, Belgium

The Future Commons 2070: The ethical problem of the territorialization of the North Sea

In this paper the authors address the ethical question planners are confronted with when land-win projects as newly created islands and sea wards harbour extensions are becoming topics of high interest to policy makers and project developers. As starting point for the discussion we present the Future Commons 2070 map.

Lin, Ying, Huazhong University of Science and Technology, Wuhan, China

Multi-department cooperativeness with urban planning, land use and water management for the implementation plan of waterfront urban design – Case study of Yangzi waterfront commercial district in Wuhan, China

Based on the Wuhan case, this paper figures out the methodology of multi-department cooperativeness involving program establishment, framework organization and policy making, and gets conclusions of detailed contents, review approach, permits conditions, effective collaboration, etc., so as to promote the land and water resources use being coordinating with urban construction.

Lozano, Claudia, El Colegio de México (COLMEX), Mexico City, Mexico

Flood risk mitigation: Public policy vs. actual practice

The aim of this paper is to find out why we have not being able to transit from the political discourse to the actual practice regarding risk management, especially the flood and risk mitigation, since these have been the most frequently occurring disasters events since 1900. Case of study: Mexico.

Lu, Yuan, Tongji University, Shanghai, China

The study of renovation and usage situation of the waterfront public space - The case of Suzhou creek in Shanghai

The paper deals with the renovation of the waterfront public space and the usage situation of people in the Suzhou creek.

Maiello, Antonella; Britto Nogueira De Paiva, Ana Lucia; Quintslr, Suya; Giliberti Bersot Gonçalves, Thiago; Aló Rodrigues Araujo Da Silva, Mariana, Federal University Of Rio De Janeiro, Rio De Janeiro, Brazil

Bridging formal and informal systems in water and sanitation governance: A socio-technical perspective

Water and sanitation governance requires the respect of social entitlements as well as an adequate level of technical solutions. When these two components are not present informal solutions arise, producing new alternative systems. We deal with these issues, investigating an informal system in a municipality of Rio de Janeiro Metropolitan Area. (Peer-reviewed)

Mamo, Zegeye Cherenet, HafenCity University, Hamburg, Germany

Changing patterns: Major water-bodies and urbanization in Ethiopia

The current formal and informal contest for land around major water bodies in Ethiopia, for both habitation and production, implies the emerging change in the longstanding highland centered urbanization of the country. Understanding the phenomenon within its historical and contemporary contexts is a key to reformulate policy and planning guidelines.

Mecanov, Dragana, Projmetal ad Beograd, Belgrade, Serbia

Concepts of urban development for "Sava Amphitheater" in Belgrade through XX and the start of XXI Century

'Sava amphitheater' is a central part of the City of Belgrade, which is urbanistically unsolved for centuries, and the challenge for planners, architects, and political, social and economic structures as well. It is located on the banks of the Sava River, which flows into an important European river Danube.

Melo, Cíntia, Universidade Federal de Minas Gerais, Itauna, Brazil

The right to adequate housing and the right to a balanced environment: A false conflict – The case of Vila Acaba Mundo (Belo Horizonte - Brasil)

This paper discusses the possibility of regularization in areas of environmental protection. It will present the case study of Vila Acaba Mundo, a Brazilian slum. Its occupation dates back more than 60 years, however there are some springs and two streams that cross the area.

Mliczynska Hajda, Dagmara, Institute of Geography and Spatial Organization Polish Academy of Sciences in Warsaw, Bytom, Poland

Waterfront revitalization - The innovative component of the Territorial Capital

Waterfront revitalization is widely used as a city transformation strategy. How does the innovative concept of Territorial Capital refer to the contemporary practice of waterfront revitalization, does it reflect the transformation in urban governance, which Harvey describes as the path from managerism to entrepreneurism?

Morgado, Sofia; Moreira, Inês; Vargas, José, University of Lisbon, Lisbon, Portugal

Where land and water meet, people join together and (re) create

This paper focuses on the involvement of local communities in the use of waterfronts, inducing positive spatial and social change, in the current context of minimum resources, by taking advantage of the human and social capital.

Mukoya, Kent; Mbutu, Mwaura, Nairobi City Water and Sewerage Company, Nairobi, Kenya

Social approach in increasing access to safe drinking water and sanitation to the urban poor: Lessons and challenges from Nairobi City and Sewerage Company, Kenya
Kenya's new constitutional demand holds the right to safe water and sanitation for all citizens. (Peer-reviewed)

Olufemi, Olusola, Self-Employed, Oakville, Canada; Ojo, Olajide, University of Ibadan, Ibadan, Nigeria
Water scarcity and women's food provisioning work in Ibadan, Nigeria
Water scarcity threatens women's food provisioning work and ethic of care. Women's domestic and economic labour revolves around water availability and accessibility. It is imperative that women's practical and strategic water needs are met through equitable access to water distribution, low cost water technologies, effective use and participation in decision-making. (Peer-reviewed)

Repp, Annegret; Weith, Thomas; Gaasch, Nadin, Leibniz Centre for Agricultural Landscape Research (ZALF), Müncheberg, Germany
Ways of integrating water and land management at the urban-rural interface
Land and water demands are characterized by dense interdependencies across the urban-rural interface. Joint research on Sustainable Land Management takes a trans-scalar and trans-sectoral perspective, tackling these linkages. Several regional projects provide examples for integrative land and water management and hence for advancing governance approaches at the urban-rural interface.

Rizzo, Agatino, Lulea University of Technology, Lulea, Sweden
Politics and processes of sea-megaprojects in the Arab Gulf region: The Pearl Island in Doha, Qatar as a case of study
In this paper we present the biggest, sea-reclaimed urban project in Qatar (i.e. The Pearl Island) to analyse politics and processes of mega water-developments in the Arab Gulf Region. (Peer-reviewed)

Rossetti, Irene, Università Iuav di Venezia, Rome, Italy
Participatory experiences for the environment in Reims 2020
When a political project and participatory practices observe and define the urban space, there can be a new sort of planning for a French city, Reims and its environment (peer-reviewed).

Saghin, Irina; Ianos, Ioan, University of Bucharest, Bucharest, Romania
Water resources as a fundament for infra-regional cohesion in Romania
This paper aims to identify how a more efficient management of water resources can accelerate infra-regional and trans-regional cohesion. The hypothesis is the following: where water resources are sufficient and well-managed, there are prerequisites for a sustainable and cohesive development.

Tang, Yuanzhou; Chen, Xiaojing, China Academy of Urban Planning and Design Shenzhen, Shenzen, China
Creating valuable waterfront life in a transitional period: The case of Shenzhen

This paper takes Shenzhen, a rapidly industrialized and urbanized mega city, as a case to study how its waterfront serves multiple functions against a highly complicated and rapidly changing development background, and how urban planning practice facilitates the shaping and interchanging of these functions.

Tiger, Fern, University of Washington Tacoma/Fern Tiger Associates, Tacoma, United States of America

Bringing voices together to create a waterfront vision

Albany, California struggled for decades with divided opinions on the future of its San Francisco Bay waterfront. A multi-faceted approach to community education/engagement included an issue-specific magazine mailed to every resident and 50 highly-interactive sessions bringing 1-in-10 Albany adults to the table – resulting in a community-wide vision.

Torres, Yuri; Costa, L., Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil

Digital narratives of waterfront sports practitioners in the urbanscape

Our contemporary urban dynamics are driven by connected citizens and subsumed by timely encompassing narratives in open spaces. This study gives visibility some of Rio´s waterfront recreational activities recorded by connected sportsmen and discuss its repercussion in the fields of landscape architecture and urban planning. (Peer-reviewed)

3. Economic, Leisure and Tourism Aspects

Azimov, Sardar, Cerway, Paris, France

Taghazout Bay: Setting a sustainable development strategy with HQE sustainable planning certification

An exemplary development and planning project that promotes a reasonable tourism development model towards socio-economic development strategy which is paying heed to preserving the environmental amenities of the area. A concerted and comprehensive approach to sustainable development which is given credibility and catalyzed by the HQE™ certification for sustainable planning.

Bach-Glowinska, Joanna, Jaroslaw, W., Grechuta, B., Przeworska, J., Koprowska, M., Pujdak, B., Zuk, M., Romasiuk, I., Rosciszewska, M., Maciaszek, K., Maczka, E., Gdansk Development Agency, Gdansk, Poland

Assessing pathways into a low carbon and climate responsible Gdansk

A basic question today is the sense of the use new ideas in shaping Polish cities- not as technologically advanced as others. The key is to understand good practices in designing and implementing new approaches. The comparative research Glasgow and Gdansk has been undertaken by Gdansk Development Agency in Jan 2014.

Bocian, Anna, Wroclaw University of Technology, Wroclaw, Poland

Office building concentrations and waterfronts

How to join office buildings and waterfronts to design an attractive urban tissue for citizens and a friendly work milieu for employees.

Byrd-Olivier, Victoria, Detroit Future City, Detroit, United States of America

Detroit Riverfront and the Future City

Investment in the Detroit riverfront is critical to catalysing the revitalization of the city, but further collaborative master planning is necessary to ensure quality, equity and access.

Chen, Jie; Luan, Feng, Tongji University, Shanghai, China

Exploitation of living - leisure costal waterfront of coastal tourist cities - Take Haikou City and Sanya as comparative study cases

In this paper we take Haikou City and Sanya as a comparative example and try to make out how to improve the rational use and quality of the living-leisure costal waterfront by studying the allocation, functional layout and forms of their typical living-leisure costal waterfront. Participatory experiences for the environment in Reims 2020 (peer-reviewed).

Chen Xie; He, Xiaofei, Jiangsu Institute of Urban Planning and Design, Nanjing, China

Waterfront tourism: A way of development transition of Port Town

This paper will discuss the way of urban transition for a declining port town, named Liuhe town. This paper believes that tourism is main key method to lead the port redevelopment and furthermore to

help the urban economic regeneration. Meanwhile, this paper points out three special issues in China.

Chen, Yue, Southeast University, Nanjing, China

The evolvement of Suzhou's land-and-water fabric in three periods of its urbanization (1229-2013)

This paper aims to explore the evolvement of Suzhou's land-and-water fabric and urbanization process from 1229-2013, arguing that it is the urban trend which sequentially consumed the old urban fabric, suggesting a new open space network along the old waterways as a study before the master plan. Participatory experiences for the environment in Reims 2020 (peer-reviewed).

Gossop, Chris, MKParks Trust, Milton Keynes, United Kingdom

A new inland waterway for the 21st century - Reawakening a 200 year old vision

Two centuries after an initial vision founded in Britain's Industrial Revolution, the planning of the Bedford and Milton Keynes Waterway is now well advanced. Intended as the core of a linear park, how realistic is the project in economic terms and is the section by section approach an appropriate one?

Huang, Wei; Cheng, Wei, ???, Nanjing, China

Study on the renewal and redevelopment of a waterfront industry park based on quantitative analysis: A case study on the first phase of Suzhou industrial park

Taking phase one of Suzhou Industrial Park (SIP) as an example, the redevelopment methods of the waterfront industry park based on a key quantitative analysis is shown.

Martyniuk-Peczek, Justyna; Martyniuk, Olga, Gdansk University of Technology, Gdansk, Poland

Accelerator of the entrepreneurship - Suburbs in the coastal metropolis of GOM

Dynamic changes of suburbs based on movements of people and enterprises from central city into the outskirts are currently one of the main research questions. It seems that the characteristic element of the Polish suburban landscape and Pomeranian region is a large number of SME sector businesses located there.

Gladkaya, Olga, Morozova, Olga, St. Peresburg National Research University of Information Tecnologies, Mechanics and Optics, St. Petersberg, Russian Federation

Tourist cluster placement as a tool of urban areas development on the basis of local authentic features and resources usage

The research shows the effect of tourism cluster placing on the socio-economic development of the city. Kronstadt city, located on Kotlin Island, is the object of our research. The main goals of the project are: modernizing the existing resources, creating a positive image of the territory and effective usage of the territory.

Huang, Wei; Cheng Wei, Nanjing, China

Study on Renewal and Redevelopment of a Waterfront Industry Park Based on Quantitative Analysis: A Case Study on the First Phase of Suzhou Industrial Park

Taking the phase one of Suzhou Industrial Park (SIP) for example, the redevelopment methods of waterfront industry park based on the key quantitative analysis is shown.

Pais, Paulo, Câmara Municipal de Lisboa, Lisbon, Portugal

Return the riverfront to the enjoyment of the people - The case of Lisbon

Lisbon's new vision is defined as having three major objectives: more people, more jobs and a better city. The historical relationship between the city and the Tagus estuary requires particular attention to the regeneration of the riverfront in the framework of urban planning, to have a better and an attractive city.

Ramage, Julie, the Glasgow School of Art, Glasgow, Scotland

Creative on the Clyde: A case study of the role of the cultural and creative sectors on regeneration of the City of Glasgow's waterfront

This paper presents a case study of the regeneration of the waterfront of the City of Glasgow in Scotland. It looks at the various investments in cultural assets and creative industries initiatives and considers the importance of these to wider regeneration.

Reardon, Mitchell; Weber, Ryan, Nordregio, Stockholm, Sweden

Urban regeneration and the role of blue infrastructure in Stockholm's green profile

In recent years, Stockholm's environmentally sustainable approach to urban development has risen to international prominence. A major component of its success has been the development and promotion of flagship eco-district projects. This paper explores the connection between Stockholm's renowned eco-districts and the growth of its clean/green tech sectors.

Saraiva, Miguel; Roebeling, Peter; Fidelis, Teresa; Martins, Filomena, University of Aveiro, Aveiro, Portugal; Palla, Anna; Gnecco, Ilaria, University of Genova, Genova, Italy

Assessing the socio-economic benefits from green/blue space rehabilitation: A case study for the Confluence area in Lyon

This paper aims to demonstrate the added socio-economic value of green/blue spaces in urban areas. The hedonic pricing simulation model SULD is applied to the case of Confluence in Lyon, France. Scenario simulations are performed for the establishment of urban parks, requalification of riverfronts, and development of road infrastructure. (Peer-reviewed)

Schuett, Rolf, Independent Consultant, Nochowo, Poland

Revitalisation of the 'Ribera de los Ingenios' in the historical core of Potosi, Bolivia

This paper outlines a proposed scheme for urban conservation and integral development in a historical city in Bolivia. The strategy combines heritage conservation, participation, cultural research and ecological revitalisation as a chance to reduce poverty and reorient domestic economy.

Tertel, Anna, Warsaw University of Technology, Szczecin, Poland

Mysteries of Szczecin historic islands

This paper describes reasons for promoting historic architecture for ecosystems within city structures such as in Szczecin to develop flood management, describe and qualify water, create

polder area and protect old hydrological structures from damage for evolution in time for future inhabitants. (Peer-reviewed)

Tillner, Silja, Willinger, A., Architects Tillner & Willinger, Vienna, Austria

The Wien River as a cultural axis - Transforming a threat into a resource for economic development in Vienna, Austria

The Wien River flows through densely populated districts, the former landscape has become a highway with land resources for buildings and open space. The potential linkage of monuments in Wien River Valley with a “cultural axis” and an open space network would renew its identity and stimulate economic development. (Peer-reviewed)

Trojanowska, Monica, Gdansk University of Technology, Gydnia, Poland

The health impact of urban parks along waterways

Well-designed parks along waterways could promote the health and well-being of local inhabitants. They could integrate the nature into the life of people and bridge the diverse population of town dwellers. The therapeutic landscape is a relatively new landscape design approach that could be applied to urban design. (Peer-reviewed)

Yan Qin; Pan Yin, Vocational College of Chongqing Architecture, Chongqing, China

Study on planning and design of new urban business district of riverfront - Taking Jiajia in Sichuan province for example

The paper shows detailed design specifics of the riverfront business district design concept to meet the needs of the development of the new urban district.

Zagow, Maged, Tanta University, Tanta, Egypt

Urban Revitalization through studying the patterns of activities and its geometries in cities

This paper investigates patterns that emerge in cities socially and economically and proposes a link between these patterns and future development. (Peer-reviewed)

Zang, Shan; Luan, Feng, Tongji University, Shanghai, China

Exploring the characteristics of shoreline development and utilization in coastal tourism cities under the stage of rapid urbanization

This paper tries to explore the characteristics of shoreline development and utilization in coastal tourism cities and the coupling relationship of city layout under the stage of rapid urbanization.

Zhang, Xinyue, China Academy of Urban Planning and Design, Beijing, China

Property-led Urban Waterfront Redevelopment in China – A Case Study of Wuchang Riverside Business District Redevelopment Project

Does property-led urban waterfront redevelopment act as an economic catalyst for local development or just as cosmetic and distraction? By analyzing the operational mechanism of public-private partnership rested in Wuchang Riverside Business District Redevelopment Project, this paper reveals the facts behind-the-scenes.

Zheng, Jun; Chen, Xie, Jiangsu Institute of Urban Planning and Design, Nanjing, China

Conservation and transition: the industry chosen of the historic towns of China of Shaxi Town in Jiangsu Province Riverside Area

This paper is based on the Shaxi Master Planning which concerns the main task of Shaxi urban transition as changing the current economic development model from manufactory-led to service-led.

4. Water Management

Ayangbile, Oluwabukola; Adeleye, Bamji, University of Ibadan, Ibadan, Nigeria

Residents' water needs in the indigenous core of Ibadan City, Nigeria

The physical availability, accessibility, sufficiency and safety of water and sanitation efforts are a major challenge in Beere, a notable slum in Ibadan, Nigeria. This has resulted in indiscriminate waste disposal, and major health challenges. This paper therefore assesses the availability of portable water and sanitation practices in Beere, Ibadan.

Du, Ningrui; Tang, Wenzhuan, Wuhan University, Wuhan, China

Spatial impacts on water systems and the transition of planning in urbanized areas - Case study in Wuhan, China

It is essential to integrate space for water system into spatial planning. Therefore, the spatial planning system in China needs to be transformed and the integrated water-spatial planning framework is established for the future urban development. (Peer-reviewed)

Glaudinova, Mekhirbanu, International Educational Corporation, Almaty, Kazakhstan

Water in medieval culture and architecture of Turkic people of central Asia

This paper discusses water in the religion, architecture, town planning, irrigation, sacred wells and basins in ancient and medieval temples. This paper also looks at water supply systems and types of hydraulic engineering constructions in Turkic cities.

Gnanasekaran, Shanmuga Priya, University of Colorado Denver, Denver, Colorado

Analysis of urbanization of water in India: Implications for policy and practice

This paper examines decision practices regarding rural-urban water transfers, and the consequences of these practices particularly for rural supplying regions in India, in order to recommend improved means for transacting such transfers.

Magazowski, Christoph; Peters, Irene, HafenCity University Hamburg, Hamburg, Germany

A pricing scheme for new sanitation system services

This paper analyzes the hypothesis that NDSS should be implemented because they are able to face the current challenges and they have a cost advantage compared to the centralized system.

Maneewan, Chayanun; van Roon, Marjorie, University of Auckland, Auckland, New Zealand

Effectiveness of constructed wetland systems for mitigating urban runoff and water contamination: A review of recent advances in a tropical climate

The ongoing urbanization of Bangkok has resulted in increased impervious surfaces, high degree of contamination, increased water runoff, and decreased water quality. This study examines the potential of constructed wetlands for contaminant removal and runoff reduction in tropical regions that are parallel to the Bangkok areas. (Peer-reviewed)

Mc Millan, Marissa, Port Of Spain, Trinidad and Tobago

Flooding in the suburban of Diego Martin Trinidad and Tobago
On 11th August 2012 Diego Martin was declared a disaster area once again. The community occurred over 0.1 billion (TT) dollars in damages. An efficient institutional and regulatory planning framework is crucial to effective flood management and IWRM. (Peer-reviewed)

Meenar, Mahbubur; Featherstone, Jeff; Magaziner, Jaime, Temple University, Ambler, United States of America
What makes implementation happen? Can we fool Mother Nature and atone for our past sins? Lessons learned from an urban revitalization plan for a flood prone office park
The paper is based on an exploratory case study that describes the process of developing an urban area revitalization and transportation improvement plan and then explores and analyzes the connection or conflict between applied planning research and its implementation over the period of six years. (Peer-reviewed)

Meng, Dejuan; Wei, Baoyi; Yang, Dongfang; Jiang, Qigui; Huang, Pengfei, Beijing Municipal Institute of City Planning & Design, Beijing, China
Evaluation of impact of urbanization on urban pluvial flooding in Liangshui River Catchment, Beijing
The impact of urbanization on pluvial flooding is evaluated in Beijing. The peak flow of Liangshui River simulated by Multipoint Inflow Model exhibits noticeable increasing, which is attributed to expanding impervious areas and improving rainwater drainage system capacity.

Naimi, Ait-Aoudia, Blida University, Bilda; Berezowska, Azzag, Epau, Algiers, Algeria
Household water consumption in Algiers facing population growth
The paper is an analysis of domestic water consumption related to population growth and the means implemented to meet the needs of households. (Peer-reviewed)

Onyemenam, Prince, University of Ibadan, Ibadan, Nigeria
Impact of urban transformations on water resources and water management in Delta State, Nigeria
The support provided for the water supply and sanitation sectors in Developing countries by the World Bank and member countries of OECD increased steadily from 1986 – 1996, rising from 3.4% to 6.6% (World Bank 2004). Nigeria is a major partaker in this program. The paradox. What went wrong?

Prusicki, Marco; Landsberger, Martina; Loi, Maria Cristina; Caja, Michele; Lorenzi, Angelo, Politecnico di Milano, Milan, Italy
A new great project for the ancient system of waters in Milan
The extraordinary “system of water” of Milan is a great project delineated over the centuries that played a crucial role for Milan and its territory, now in crisis. Four different researches can be put together to delineate a new great project for the ancient system of waters in Milan.

Santoso, Amy, Broadway Malyan, Singapore, Singapore; Papenborg, Lukas; University of Antwerp, Antwerp, Belgium

Hard versus soft: A comparative study of multi-functional urban water defense in New York City and Singapore

The purpose of this paper is to compare the two different types of water defenses in Singapore and New York City, where hard and soft approaches are employed.

Schretzenmayr, Martina, ETH Zürich, Zürich; Feiner, Jacques, Urban & Regional Planner, Chur, Switzerland

Flood Protection as initiator for cross-border spatial development planning

Focusing on the case study of the Linth plain, we will demonstrate that flood protection has to be accompanied by urban sprawl prevention as the abolition of flood danger enables urban development on areas with former building ban, and that these projects give the opportunity to progress with cross-border planning. (Peer-reviewed)

Sretovic Brkovic, Visnja; Brkovic, Matija, University of Belgrade, Belgrade, Serbia

Small urban streams in Belgrade – Prospective new urban landscapes

Belgrade, once rich with small urban streams, today has only a few left. Neglected, polluted and not regulated at all, they adversely affect the environment and the local communities. The paper explores opportunities for revitalization of such streams using decentralized open small-scale systems for the storm water collection, use and treatment.

Tai, Yuting, Technical University of Delft, Delft, the Netherlands

Towards a livable and water sensitive Delta City - The impacts of market-driven urban development on water related urban issues of Guangzhou, the Pearl River Delta of China

This paper focuses on the understanding of the impacts of rapid urban development on water related urban issues through morphological analysis. It provides scientific basis for integrated urban planning and flood management to optimize ecological, economic and socio-cultural values of water while mitigating flood risk in the urban context.

Uttarwar, Purushottam, Delhi Development Authority, New Delhi, India

Role of water in stabilising cities

Water has been most important natural resource for flourishing of not only citied but also human civilisation. Urbanisation is rapid & irreversible process. Cities are going to stay and survive. Big question is how to plan cities and bring sufficient water to city. Source of water cannot dictate location.

Van Roon, Majorie; Dixon, Jennifer; Rigold, Tamsin, University of Auckland, Auckland, New Zealand

Watershed urbanisation: Planning responses to cumulative estuarine contamination

The paper examines the changing response within local and regional plans to the growing awareness over 40 years of accumulation of copper and zinc in an estuary, the watershed of which has been

progressively urbanising. A science and engineering awareness and local government amalgamation preceded the current planning response.

Yuan, Lin, Tsinghua University, Beijing, China

The traditional wisdom of flood mitigation in Dujiangyan irrigation region and its contemporary relevance

This paper takes the traditional Dujiangyan irrigation area in China as a unit for human living, tries to comprehensively explore the measurements for flood mitigation within the region in ancient times, summarizes the traditional “adaptation” wisdom and explains its basic philosophical spirits and contemporary relevance. (Peer-reviewed)

Zhang, Mengjie; Zhou, Junqing; Shi, Senwen; Xu, Liquan, Huazhong University of Science & Technology, Wuhan, China

Study on planning an ecological stormwater regulation system based on LID (Low Impact Development) Mode - A case study olf Chaihu Town, Zhongxiang City in Hubei Province

This paper sets Chaihu Town, Zhongxiang city of Hubei Province as an example, analyzing the ecological and hydrological conditions of Chaihu Town, applying LID mode, putting forward the ecological storm water regulation system planning strategy which adapts to the development of small towns.

5. Environment, Ecosystem and Climate Change

Abuje, Sunday; Mugwima, Njuguna; Mugo, Sammy, Jomo Kenyatta University, Nairobi, Kenya
Environmental challenges of waterfronts in developing countries: The case of Kisumu public waterfront, Kenya
Urban waterfronts in the developing world face environmental and physical challenges that are slightly similar to those experienced in the developed world after the industrial revolution. Solutions to these challenges should however take a different approach since most of the developing world has not undergone rapid industrial development yet.

Adebayo, Abimbola, The Federal Polytechnic, Ado-Ekiti, Nigeria
Urban transformation of coastal cities - Case study of the Eko Atlantic Shoreline Protection and Reclamation Project
The Lagos coast has been suffering high rates of erosion since the construction of three harbour moles at the tidal inlet connecting the Lagos Lagoon to the South Atlantic Ocean. A lesson for Nigeria and especially Lagos is the need of a paradigm shift in their coastal management.

Adeleye, Bamji; Ayangbile, Oluwabukola, University of Ibadan, Ibadan, Nigeria
Flood vulnerability: Impending danger in Sabon-Gari, Minna, Niger State
High demand for housing in Sabon Gari has prompted landowners to develop their properties with little regard for Government's approved set-backs and even along water ways making the inhabitants highly vulnerable to flooding. This study examines building vulnerability to flooding and the danger poised at Sabon Gari, Minna, Niger State. (Peerreviewed)

Agrawal, Mahak, School of Planning and Architecture, New Delhi, India
Conservation and revitalisation of River Yamuna and its ecological reserves for national capital of India, Delhi
Delhi, India's capital, has witnessed rise and fall of numerous empires, majority of which came up along the river Yamuna. However, post-independence in 1947, the city's population grew, the role of water body changed and despite continuous efforts put by the Government, ecology of the river remains in uncertainty. (Peer-reviewed)

Beriatos, Elias, University of Thessaly, Volos, Greece
Spatial-environmental planning for coasts and maritime areas: Greece in the Mediterranean context
This paper investigates legal and policy documents as well as related planning instruments, from the UN and European Union, concerning integrated policy for environmental protection and spatial planning of coastal and maritime areas in Greece and Mediterranean, and attempts a critical approach for their substantial implementation.

Gligorijevic, Zaklina; Macura, Vladimir, Urban Planning Institute of Belgrade, Belgrade, Serbia

Natural core of Belgrade – Urbanization for sustainability
The presented study contributes to a long term Belgrade Waterfront research project, but focuses on the important question: what are the sustainable solutions for the development of the "Natural Core of Belgrade", the 200 ha area around the mouth of the Sava River to River Danube?

Guo, Xiaodi; Jiao, Jiao, Jiangsu Institute of Urban Planning and Design, Suzhou, China
China's water sensitive urban design and its sustainable management - Case of Wisdom Valley of the Suzhou Science and Technology Town Urban Design
This paper proposes to use mature domestic and foreign concepts and approaches of Water Sensitive Urban Design to guide the water resource management in a typical city of Southern China, aiming at supporting the construction of ecological planning projects.

Hu, Zhiliang; Wang, Jun, Tianjin Urban Planning & Design Institute, Tianjin, China
Research on planning strategies about the hydrological effect of a city in a hilly area - case study of overall planning: Industrial Park in China's Hunan province
It is a new practice of overall planning in a hilly city to reduce the interference of the hydrologic cycle which is caused by urbanization construction.

Huang, Nien-Ping, Delft University of Technology, Delft, The Netherlands
The redefinition of the sustainable development capacity in Taiwan Northeast Coastal National Scenic Area
The research goal is to redefine the development capacity in Northeast Coastal National Scenic Area for specific types of development which helps the completeness of the existing local development plan response, national and regional policies, as well as local needs. (Peer-reviewed)

Jiang, Li; Liu, Xiao; Huang, Zhengwei, Shanghai Tongji Urban Planning & Design Institute, Shanghai, China
Ecological planning approach for city water system - A case in the county center of Luoning in Henan Province, China
Based on previous research findings, this paper proposes an ecological planning approach for the city water system and applies it to the project in Luoning which is a small Midwestern county in China.

Kaczorowska, Anna, Chalmers University of Technology, Gothenburg, Sweden
Ecosystem services and urban resilience – Case of Stockholm
Urban ecosystem services are currently promoted in Sweden in the planning for more dense and sustainable cities. This paper focuses on the opportunities and challenges involved in the process of integrating the concept of ecosystem services into urban planning in Stockholm and examines tools used to plan for urban resilience.

Liu, Dan; Hua, Chen, Urban Planning and Design Institute, Hangzhou, China
Transitioning to climate resilient city— A case study in Hangzhou City (China)

In the Chinese context, adapting to challenges of rapid urban growth and climate change will require new mechanisms for urban transformation. Drawing on information from a review of policy documents, this paper aims to understand key issues in transitioning to climate resilience in Chinese cities through a study of Hangzhou.

Nguyen, Phuong Nga; Lawson, Gillian, Guaralda, Mirko, Queensland University of Technology, Brisbane, Australia

The transformation in a waterfront community in the Mekong Delta, Vietnam: Conflicts between urban planning and social practices to cope with flooding

This paper aims to identify the transformation in a waterfront community to reveal how flooding adaptation in the Mekong Delta is in contrast to current urban planning and locals' practices. Findings are feasible to give a voice to local communities in the struggle to guide urban development in flood-prone areas.

Ornek, Muhammed; Özer, Erbu, Florida International University, Miami, United States of America

Utilizing open simulator as a virtual learning environment for landscape grading education

The goal of this study is to facilitate learning of basic landscape grading principles by visualizing the context in a three-dimensional virtual environment and allowing students to learn through experiencing topographical conditions in such an environment.

Raut, Sandeep Kumar, Town and Country Planning Organisation, Ghaziabad; Raut, Papiya Bandyopadhyay, School of Planning and Architecture, New Delhi, India

Combating urban Heat Island through the spatial integration of land-uses and water bodies

The paper examines the alarming impact of change in land-uses on micro climatic zones and thereby generating the effect of 'Urban Heat Island'. The paper offers the various low-cost, innovative and traditional options to combat the effect of UHI through sustainable spatial integration of land-use and conservation of water bodies. (Peer-reviewed)

Ruchkinov, Igor, Perm National Research Polytechnic University, Perm, Russian Federation

Development of the system of nature reserves in the context of problem solving landscape and environment strategy in Perm

In this paper an analysis of the nature reserve system is made, as well as routes forward for the nature reserve system in the context of landscape and environment in Perm city are made.

Simsek Ilhan, Bige; Özdemir, Zeynep, Amasya University, Amasya, Turkey

Public space production as a part of urban riverfront development scheme: A contemporary approach for Turkey, case of Amasya

This paper focuses on the production of contemporary public spaces along the urban riverfront as the catalyst of the sustainable waterfront development scheme and draws a theoretical framework via determining the key concepts necessary to formulate a conceptual agenda to evaluate the situation in Turkey within the case of Amasya.

Sliwa, Marcin, Norwegian University of Science and Technology, Trondheim, Norway

Mexico City: Reconnecting an inland metropolis to water

Rapid growth of Mexico City caused the disappearance of almost the entire lake on which it was established. The paper will discuss a few examples of the recent proposals to reconnect the city to water and analyze the rationale behind those projects. (Peer-reviewed)

Stanganelli, Marialuce; Gerundo, Carlo, University of Naples Federico II, Naples, Italy

Regulating ecosystem services to improve natural cooling in metropolitan areas

Planning and assessment methods for climate regulating services: role of green spaces and water basins in urban areas for climate change adaptation. (Peer-reviewed)

Villa, Marcela, Ricardo Palma University, Lima, Peru

Understanding population and fluvial dynamics for a physically safe urban sustainable development model for Pucallpa

An aggressive land use change from natural ecosystems of the Central Amazon rainforest in Peru to economically integrated areas and incremental growth of large urban riverine settlements like Pucallpa has resulted in ecologically-vulnerable areas. Understanding of hydrological and land processes combined with risk-disaster assessment would lead towards a sustainable city. (Peer-reviewed)

Wirz, Nicole, ISOCARP, Basel, Switzerland

Swiss Standards for Sustainable Development: A juxtaposition – The Standard for "2000-Watt Sites" and the Swiss Standard for Sustainable Construction (SNBS)

Sustainability is an innovative factor in planning. This paper evaluates Swiss Standards for Sustainable Urban Development. It presents the results of a juxtaposition of the Standard for "2000-Watt Sites", based on the concept of the 2000-Watt Society, and the recently developed Swiss Standard for Sustainable Construction (SNBS).

Xu, Xingjing, CIUC, Tongji University, Shanghai, China

What can Chongming Island learn from the eco-island cases of the world?

Learning from cases of the world within the ecological, economic and social perspectives, Chongming Island is making its way towards becoming an eco-island.

Yang, Tianren; Wu, Chengzhao, Tongji University, Shanghai, China

Restoration of urban scenic fringe areas in water town: Strategies and approaches to Slender West Lake

To support co-evolutionary development and positive interactions between urban land and urban scenic area in water town, landscape approaches for managing fringe areas within their broader water ecosystem and urban context have been put forward, by considering the interrelationships of their physical forms, natural features, and urban ecosystem restoration. (Peer-reviewed)

Yao, Guipeng; Zhang, Yu; Yi, Wu, Jiangsu Institute of Urban Planning and Design, Nanjing; Haiwei, Yin, Nanjing University, Nanjing, China

Construction of a greenway network based on the ecological restoration of the old course of Yellow River in an economically underdeveloped region of China

To improve the ecological and landscape features along the old course of Yellow River in the north of Jiangsu Province, the project plan is committed to construct a regional greenway network with multiple functions to enhance the ecological and recreational connection of cities in an economically underdeveloped region.

Zhong, Rui, Tongji University, Shanghai, China

The ecological sensitivity analysis in ecological urban planning: A case study of Shanghang County, Fujian province

Based on the eco-city planning of Shanghang County, this paper does research on the ecological sensitivity analysis. Using single factor analysis and superposition algorithm, it gets a comprehensive sensitivity regionalization map. Then it classifies the area into five different sensitive grades to provide planning basis for urban sustainable development.

Zhuang, Ziying; Zhang, Liye; Zhang, Xuewei; Qian, Yun, Beijing Forestry University, Beijing, China

Analysis of the characteristics of San Du Ao's raft settlements in Fujian

Introducing the unique unity settlements—floating rafts. Analyzing the threats which the fishing raft settlements encountered in sustainable development in recent years and presenting strategies for the purpose of achieving raft settlements' ecological sustainable development.

6. Ports, Transportation and Infrastructures

Akhavan, Mina, Politecnico di Milano, Milan, Italy

The port development and changing port-city relation imposed by globalization trends in emerging global cities of Middle East- The case of Dubai

This paper shall study Dubai' port, planned to become the hub-port of the region, as a case study of the relation between port and city. The aim is to examine the impact of new port development on the city's growth, under globalization trends.

Bi, Yu, Tianjin Urban Planning and Design Institute, Tianjin, China

From an industrial corridor to a livable urban area - Rebuild Haihe River Waterfront

This paper attempts to discuss industrial waterfront redevelopment issues in a burgeoning city. How to transform an old industrial district into an attractive public waterfront area is the greatest challenge for local planners. It takes a closer look on these projects and offers a feasible framework for future practices.

Birik, Melih, Kirkalreli University, Istanbul, Turkey

Morphological assessment of Istanbul Beyoglu Peninsula while reproducing the urban waterfront

Istanbul's city centre is under risk of turning its back on the waterfront, in spite of its deep roots integrating the identity with the water. In this assessment, the spatial qualifications of the Beyoglu Peninsula waterfront will be examined according to morphological values in order to re-associate with its hinterland. (Peer-reviewed)

Dai, Kan; Ma, Dan, China Academy of Urban Planning & Design, Beijing, China

The urban design strategy research on the revitalization and redevelopment of the harbor area in China - Taking the Urban Design around West Harbor in Qinhuangdao as an example

The Urban Design around West Harbor in Qinhuangdao has focused on the spatial pattern of Interaction between harbor and urban, the gradient exploration model of waterfronts, the shaping to the context protection and the special area, the construction of infrastructure in modern city and the technique using of applicability engineering. (Peer-reviewed)

Erbas, Adem Erdem; Demir, Orhan, Mimar Sinan Fine Arts University, Istanbul, Turkey

Challenges and conflicts in achieving the sustainable waterfront development in Izmit Bay: The case of Evyap Port

In this paper the most recent port developments of Izmit Bay (Turkey) are analysed and interpreted in the context of sustainable development strategies, metropolitan plans, and broader economic trends, legislative and institutional frameworks.

Izydor, Marek, Skanska S.A., Gdansk, Poland

Development of public spaces as a part of urban waterfront regeneration strategies - A critical approach

This paper deals with the phenomenon of urban waterfront regeneration and the role the public spaces systems play in the process of planning and implementing the particular projects. It attempts to understand the evolution of waterfront and post harbor area by taking Gdynia as a case study.

Jiang, Yang; Chen, Yulin, Tsinghua University, Beijing, China
Integrating cycling with urban riverfront revitalization in motorizing integrating cycling with urban riverfront revitalization in motorizing cities: A case of Kunming, China
This paper develops a systematic and operational method to count and analyze bicycle data, and illustrates its application and value in an urban riverfront revitalization project in Kunming, China.

Kielbinska, Katarzyna, Gdansk University of Technology, Gdansk, Poland
Water related esthetics - The phenomenon of new structure in the post-industrial shipyard areas
The direction of the main movements that are made in the European cities determines not only structural but also esthetic changes. This paper follows the topic of visual diversity of postindustrial waterfront cities and its relation to the local identity and cultural changes that are provided.

Krosnicka, Karolina Antonina, Gdynia Maritime University, Gydnia, Poland
Where does the container terminal really end?
Container terminals are crucial for the logistics of a modern city, and together with the related functional objects they are a necessary spatial element of the contemporary settlement network.

Küblü, Yasemin, Istanbul Technical University, Mersin, Turkey
Water as an urban element
Being in a relationship with water is always a privilege for a city. Galata: Small business, education, culture, trade, green characteristics. Gaining the harbour city's characteristics back.

Oktavianus, Adrianto, TU Berlin, Berlin, Germany
Analysis of maritime infrastructure in sea port in Indonesia using fuzzy cognitive mapping
This paper analyses the main causes that led to the worse condition of seaport infrastructure in Indonesia using Fuzzy Cognitive Mapping. FCM conducted as a modeling technique based on logic and fuzzy theory. The result is to show how the interaction among the elements which causes the problem.

Pittaluga, Ilaria, University of Genoa, Genova, Italy
Pollution management and environmental sustainability of harbors: The MESP project
The intensification of maritime traffic needs to be accompanied by a sustainable management of port areas so to reduce harmful consequences. The MESP project addresses the reduction of water, air and noise pollution deriving from port activities through the implementation of a multidisciplinary approach, which encompasses technological, regulatory and administrative solutions.

Rembarz, Gabriela Maria, Gdansk University Of Technology, Gdansk, Poland
Technical infrastructure in remodeling industrial functions around the Gdynia harbour basin

This paper looks at planning for large-scale technical infrastructure for areas along waterfronts in Gdynia. It also analyses the redevelopment model of harbor areas on the larger scale of the Polish experience in coordination with the urban transformation of the last 25 years. It makes remarks for a larger comparable analysis on waterfront remodeling from the shipyard functions into the modernized industrial usage.

Rita, Juliet, CPCS Transcom Limited, Uthiru, Kenya

Economic transformation of the Dar es Salaam Port: Lessons for the Lamu Port in Kenya

This paper looks at the economic transformation of the Dar es Salaam port from a purely transport hub to a mixed-land use port city.

Simic, Ivan; Stupar, Aleksandra, University of Belgrade, Belgrade, Serbia

Sustainable design models for the Belgrade Waterfront District 'Bara Venecija"

This paper will analyze the possible effects of various theoretical concepts of sustainable and ecological design which could be applied in the case of Belgrade waterfront 'Bara Venecija'.

Skodra, Julita, University of Duisburg-Essen, Essen, Germany

Emscher conversion and quality of life

Emscher conversion presents an opportunity for the improvement of health and quality of life in the process of urban transformation of the shrinking region. Citizen participation allows for tailor-made solutions.

Soltaniehha, Mahdokht; Peric, Ana; Scholl, Bernd, ETH Zurich, Zurich, Switzerland

The Port of Piraeus: Industrial zone or urban continuity

The potential for future transport-oriented development in the port city of Piraeus. (Peer-reviewed)

Teughels, Philippe, AG Vespa; Smits, Filip, City of Antwerp, Antwerp, Belgium

The Antwerp waterfront

In the 20th century, a series of northward port expansions rendered former port-related areas in Antwerp obsolete. The city wants to reinforce the relationship between city and water, river and port by investing slowly but steadily in the areas around the docks and along the River Scheldt.

Verdelli, Laura, University of Tours, Tours, France

Heritage, city's (port) iconography and collective imaginary of port cities

"Heritage" has become a magic word for any urban development project. This paper will discuss how the presence of heritage inside ports areas is today exploited to build the discourse on urban renewal, to attract tourists and to build connections between port and cities, counting on the power of memory.

Wang, Xingping; Zhu, Qiushi; Li, Yingcheng; Southeast University, Nanjing, China

Research on the trend of city integration in the high-speed corridor area between Shanghai and Nanjing

This paper focuses on the high-speed corridor area between Shanghai and Nanjing in China. 12 cities are selected as sites where questionnaires are filled out by passengers in the city's main transportation stations such as railway stations and bus stations.

Wu, Juan; Shen, Rui; Liu, Chengcheng, Tianjin Urban Planning and Design Institute, Tianjin, China

Study on harbor city's development model and spatial structure in China - Case on Tianjin

Based on Concentration Index and location quotient theories, the writer calculates China's harbor cities' RCI to determine their development model and features. Case on Tianjin, article analyzes port-city spatial structure evolution and stage features. Then, several proposals are put forward to promote port-city interactive and Bohai Coastal Region's integration development. (Peer-reviewed)

Wu, Min, Tongji University, Shanghai, China

The interactive mechanism among urban agglomerations, industrial clusters and port groups in the Bohai Economic Rim

This article analyses the process and the interactive mechanism among urban agglomerations, industrial clusters and port groups in the Bohai Economic Rim to get the industry - city - port relationship of each city, decide which system development lags behind, and provide certain guiding for the future development and planning.

Zajac, Agnieszka, Autonomous Municipal Ghent Development Authority, Ghent, Belgium

Braving a new life in the Old Dockyards – Towards an integrated approach

This paper looks at the reconversion of the neglected port area into a vibrant and new city district. Ghent shows how the city can reuse its inner structure and how the water structure can change the future of the city. This paper also looks at the sustainable and water sensitive related urban planning as the basis for a successful city evolution.

Zhao, Liyuan; Wang, Xingping; Zhu, Kai, Southeast University, Nanjing, China

Industrial Development Zone: China's contemporary characteristic city development pattern

This paper conducted an analysis on the characteristics of development process and planning and construction of China's industrial development zones, summarized basic characteristics of China's characteristic city development pattern under the promotion of industrial development zones, and explained the current problems, accepting typical cities in Yangtze River Delta as cases.

Track 1: Urban Design, Landscape and Livable Cities

50th ISOCARP Congress Proceedings



Thirsty Land That Became a Huge Renovation for Urban Agro-Industrial Project

RAFIF ABDELMALIK, Kenana Engineering and Technical Services, Ltd, Sudan

1. Introduction

"And made from water every living things" Alanbia Surah, Verse 30, Holy Qura'n

This paper will illustrate the change has been made through water in a piece of land that named "Thirsty land"- at the White Nile State, Sudan -to be a livable land under huge agro-industrial project "White Nile Sugar Project". The project aims to develop the community and enhance the surrounded area. The impact of this project exceeds the project area to the state and the whole country. The urban planning based on water parameters transformed the land and its inhabitants from being only consumers of service and agricultural products into important resource-conserving, health-improving, sustainable generators. The change that has been made on the land affected the people life style in their new settled villages which re-planed based on the new urban water master plan.

The change on the White Nile state after the White Nile sugar project basically infrastructure, urban planning, and many other aspects established are designed and supervised by Kenana Engineering and Technical Services (KETS) teams. The sugar project is conducted as agro-business development.

Agro-processing is the "subset of manufacturing that processes raw materials and intermediate products derived from the agricultural sector. Agro-processing industry thus means transforming products originating from agriculture, forestry and fisheries." (FAO 1997). It has the potential to contribute to a range of economic and social development processes, including increased employment generation, income generation, poverty reduction and improvements in nutrition, health and overall food security.

Nevertheless, there remain substantial barriers to fully developing the agribusiness potential evident across the continent. Agribusiness is a broad concept that covers input suppliers, agro-processors, traders, exporters and retailers. Agribusiness provides inputs to farmers and connects them to consumers through the financing, handling, processing, storage, transportation, marketing and distribution of agro-industry products.

2. Acknowledging the past in the area

Sudan is endowed with vast and diverse agricultural resource base that provides various means of sustaining a livelihood. Sudan irrigated schemes are the largest in the world. Water resources include the Blue, the White, other large rivers, lakes, and swamps. Annual rainfall can reach as high as 2,200mm in Equatorial. Rainfed areas produce livestock, lumber, grain, tree crops, along with rivers, lakes, and coastal areas with rich fishing opportunities. There are significant amounts of forestry resources, including large teak plantations, extensive gum Arabic groves, and many national parks and forest reserves. These forestry resources can provide the basis for a sustainable timber and wild life tourism industry. These natural endowments are not equally distributed over the 2.5 million square kilometers of the Sudan. The quality of soil and availability of water varies, large areas require careful management for sustained production, and climate varies from the extreme dry in the far northwest to the tropical in the south with substantial rainfalls. Some parts of the country are susceptible to periodic droughts of long duration, and most of the country is sparsely populated because of

the arid conditions and the heavy rural urban migration. In spite of its wide and diverse agricultural resource base relative to population size, Sudan's economic performance is substantially below its potentials. This provides a general expiation to the puzzle that the majority of its population have no reliable accessibility to sufficient quantity and quality of nutritious food.

On that basis, WHITE NILE SUGAR project is located in the White Nile State in the central plain area of Sudan, some 150 kilometers south of the capital city Khartoum. The project is planned to occupy about 165000 feddans of land with a length of 50 kilometers North/South and a width of 20 kilometers East/West. It is surrounded by Gezira and Managil Scheme in the east, Khartoum-Rabak highway in the west, Alkawa town in the South and Hashaba Project Canal in the north.

The White Nile State lays between latitudes 12o and 13.3o N and longitudes 31o and 33.3o E, straddles the White Nile South of Khartoum and borders six states as shown in Figure 1. It has a population of about 2.731 million growing at a 2.5% rate and distributed over eight localities, namely Rabak, Kosti, Alquiteina, Aldueim, Umrimta, Algabalain, Alsalam, and Tendelti. With a total area of 39,704 km2, the average population density can be computed at 44 persons/km2. Kosti is the most populated locality followed by Aldueim, Alquiteina and Rabak, but Kosti and Rabak are the most densely populated localities. The State is home to significant numbers of refugees of about 153,000 in 2006 forming nearly 10% of the population and also a transit point for IDPs returning to the south and South Kordofan. Most of these IDPs have been settled in, around Kosti and in many other camps as shown in Table 1.



Figure 1: White Nile Sugar Location

Table 1: Population data of the White Nile state

	2003					
	Area	**Population**	**Pop-density**	**No. admin units**	**No. townships**	**No. villages**
Alquiteina	3266	245183	75	4		
Aldueim	7437	295695	40	4	23	218
Rabak	1589	239665	151	3	65	73
Kosti	3383	404763	120	5	83	133
Tandalti	8924	142530	16	3	20	86

Source: Central Bureau of Statistics, Sudan 2003; 2008

Agro-ecologically, the State is within the semi-desert zone, characterized by sandy areas in various areas and with annual rainfall varying from 300 mm in the north to 600 mm in the south. Transport connections to other parts of the country are reasonable where accessibility is enabled year-round with road and railway means as well as river links to South Sudan.
Engagement of household heads in different major occupations among the sampled households is shown by Table 2. A high portion of the total sampled households are farmers at the household head level, reaching 64% on average but with high percentages in Tandalti, Kosti, Alsalam and Algabalain localities. In Aldueim, Rabak and Umrimta, around half of the sampled household heads are farmers, while the ratio is much smaller in Alquiteina. Wage labor is the second important livelihood activity that is spread over all localities, but with particular importance in Rabak, Umrimta and Alquiteina. With its general low share in household's head livelihood, trading is more of an activity in Alquiteina, Aldueim and Umrimta. The other proportionally higher livelihood engagements in Alquiteina and Aldueim comprise various levels of employees, unemployed, and fishermen.

Table 2: Occupation by Household Heads at White Nile State

Locality	**Farmer**	**Wage & Skilled Labor**	**Trader**	**Other**
Tandalti	90	4	2	4
Kosti	85.7	8.6	5	0.7
Alsalam	78.4	16.2	2.7	2.7
Algabalain	77.8	15.9	0	6.3
Aldueim	55.3	26.2	7.8	10.7
Rabak	54	39.1	0	6.9
Umrimta	46.3	41.5	7.3	4.9
Alquiteina	22	45.9	10.6	21.2
Avarage	63.5	24.3	4.8	7.4

Source: Central Bureau of Statistics, Sudan 2003; 2008

One correlate of the food security status is the occupation of the household head. In the analysis, household heads are aggregated according to the frequency of occurrence of their main occupation. The high majority of such occupations are farmers (63%) and wage and skilled labor (24%). A diversity of other occupations dominated by traders including few pastoralists, fishermen, unemployed and housewives are grouped together due to their small frequencies (12%). The average dietary intake shown in Table 3 places farmers in a middle rank: with higher energy intake than the labor group but lower than those having other occupations. Yet, the difference between the farmers' and labor' averages are not significant.

Table 3: The Average Dietary Intake at White Nile State

Household Occupation	Energy Intake	Number	percent
Farmer	3127	384	63%
Wage & Skilled Labor	2962	147	24%
Others	3626	7	12%
All	3148	605	100%

Source: Central Bureau of Statistics, Sudan 2003; 2008

Education and health services can be considered as having a two-way links to food security; influencing it and being influenced by it. The approach for assessing these two variables in the study is based on the data collected through the household questionnaire and another simplified questionnaire directed to village leaders to provide basic information on these services. Beginning with the village-leaders' information, Table 4 shows in its upper part the number of amenities by locality based on the data from each of 28 out of the 30 villages covered. In the lower part, the population size served by each amenity is derived based on population estimates by village leaders, which is nevertheless cannot be considered accurate but it gives a good grasp of the general directions.

Primary schooling is prevalent, although five of the villages (18%) still lack primary schools. There is also high primary school pressures in Kosti, Algabalain and Umrimta as can be discerned from the high population served. Secondary schools are on the other hand scanty; five in all 28 villages and reveal much high intensity of served population. Medical centers seem to have a better distribution but the rate per 1000 population served is low and 19 out of the 28 villages (68%) are still deprived of such a service. Hospitals are scarce; the only one in close reach for some rural communities is Kosti hospital, although some may have relatively easy access to other hospitals in main urban centers. Like medical centers, midwives seem to have a better distribution at the locality level, but it has to be taken into consideration that 12 of the villages (43%) have no trained midwives leading to suffering and pressure on neighboring ones. Generally, the rural areas of Algabalain, Alsalam and Tandalti suffer from high deprivation in the educational and health services in question.

Table 4: Services average distribution at White Nile State

Locality	Estimated Population	Primary Schools	Secondary Schools	Medical Centers	Hospitals	Midwives
Alsalam	4250	2	0	0	0	0
Aldueim	13500	4	1	2	0	5
Algabalain	8900	2	0	0	0	3
Kosti	27355	4	2	2	1	3
Umrimta	8360	2	1	2	0	2
Alquiteina	9743	5	0	2	0	5
Rabak	13945	4	1	2	0	2
Tandalti	6000	2	0	1	0	1

Source: Central Bureau of Statistics, Sudan 2003; 2008

The distribution of waste disposal measures depicted in Table 5 is evident of a wide deprivation of sanitation means; 65% on average with lack thereof in Alsalam and high percentages in most of the other localities. Pits are common in almost all localities but with relatively higher importance in Alquiteina, Rabak, Tandalti and Umrimta, while siphons and wells are scarce. The results are suggestive for the need for interventions for improving sanitation in the State's rural areas to upgrade health standards as a means of support to food security.

Table 5: the average distribution of water source at White Nile State

Type	Alsalam	Alduiem	Algabalain	Kosti	Alquiteina	Rabak	Tandalti	Umrimta
Well	38	33		53	3	35	1	90
River		17	76	9	1	1	31	
Hafir	24	33		26			17	
Pump		9		1	42	2	1	
Tap		1		1	21	21	16	
Canal			21				20	
Well+Hafir	19	7		4				10
Canal+Tap	11			3			14	
Canal+Hafir								
Canal+River			3	4				
Hafir+River	5							

Source: Central Bureau of Statistics, Sudan 2003; 2008

A range of policies, institutions and services are more directly relevant to the agribusiness sector. These include inter alia: building the necessary industrial capabilities and capacities; upgrading technology and innovation in terms of product and processes; strengthening managerial capacities in the field of production efficiency and business linkages, and cross-border cooperation; building capacity to trade in agro-industrial products; participating in global, regional and local value chains; improving rural infrastructure and energy security; promulgating standardization and quality control measures, and establishing associated accreditation bodies; promoting institutional services for agribusiness; and mobilizing public-private sector cooperation on agribusiness development. Increasing the scale and competitiveness of Africa's agribusiness sector is critical—for farmers, agro-industrial enterprises and industry-related services. Indeed, the key challenge for developing agribusiness in Africa is the upgrading and improvement of manufacturing capacities and capabilities to overcome constraints related to the development of efficient industrial enterprises capable of competing in international, regional and domestic markets.

3. Implementation of the project

Urban agriculture-led growth played an important role in slashing poverty and transforming the economies. Two key characteristics of urban agriculture during the early stages of development justified its place in early development thinking. First, urban agriculture produces goods that directly satisfy basic human needs. Second, agricultural production combines human effort with natural resources, such as land and agro ecological assets. Early development theorists believed that, since natural resources were assumed to be freely available, agriculture could grow independently of other economic activities. As urban agriculture is the largest employer in most developing countries, growth in the sector also has a large impact on poverty reduction by creating income opportunities for the poor in both the farm and nonfarm economy while lowering food prices for poor rural and urban consumers. By increasing food security, agriculture also improves nutrition and in turn promotes productivity. At the same time, it decreases a country's dependence on imported food, which often cannot be obtained without sufficient and stable levels of foreign exchange.

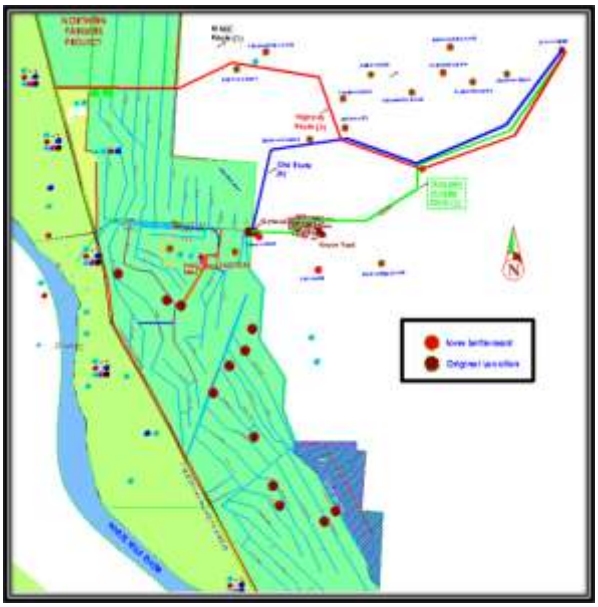


Figure 2: Resettlement plan of the White Nile Sugar Project

The implementation started on many aspects by Kenana Engineering and Technical Services (KETS) design and construction teams. The resettlement was main point. 7 villages were removed from the project area to the surrounded zone as shown in Figure 2. One big village still settled within the project. The project offered services facilities to the villages at the project zone. Table7 will illustrate the implementation of services on different villages within and around the project that designed by the Kenana Engineering and Technical Services (KETS) Teams. The new settlements were designed to accommodate all resident with full services, green spaces, and network. Extra lands were offered to the extended families. Each and every house was linked by water system. Seven completed health center were established. Nine primary and other nine secondary schools were built. As well, rehabilitation processes were alien on the existing settlements. 21 schools, water sewage network, 4 health centers, and roads were rehabilitated.

Table 7: facilities within White Nile Sugar project

	Before the project	**After the project**
Educational Facilities		
Male-primary school	0	5

Female-primary school	0	4
Male-secondary school	0	5
Female-secondary school	0	4
Health Facilities		
Health centers	0	7
Pharmacy	0	7
Laboratory	0	7
Equipment	0	100%

Source: KETS Database

4. Master plan

The area is almost flat and leveled Plains with no rhythm. The Climate is arid continental with two distinct seasons; dry season from November to June and wet season from July to the end of October. The site is almost completely bare of natural vegetations. Most of the soils of the site have an EC of 0.85 to 2.9. Areas with EC 5.84 are considered saline, average PH of the site soil is 8.23. The area is characterized by harsh environmental conditions presented by high temperatures, rainfall below 400mm/ year and low humidity; yet scarcity of natural vegetations. Water is the denom of the project. The main canal direction draw the outlines of the project fellow that with branch canals. All roads and infrastructure designed to be parallel to the canals.

Traffic analysis was the guide to design network of the project. According to the topography, wind direction, soil type, and … the location of the township were designed. Figure 3 depicts the irrigation network. The Main Canal running eastwards is served by two pump stations. Two Major Canals branch from the Main Canal and run westwards on the northern and southern sides of the Main Canal to serve the northern Agricultural Management Area (AMA). Within this northern AMA, the land slopes mostly from contour 387.00m to 386.00. As given by Figure 3 the Area is mainly accessible at present and in the foreseen future by Khartoum – Rabek highway which is a part of the National Network. The proposed Managil highway will link the Project Area directly to the national highway through a Y Junction with Khartoum –Rabek highway.

The location of the Factory being almost fixed on the highest contour line (387m) and the land west of the Factory, almost at same, level, being wisely reserved for the Township, then obviously the location of the Township is given. Since as given El Managil High way road starting from a Y link with Khartoum – Rabak High way is defined to run eastwards between WNSP main and southern major canals, then, obviously, the sound access to serve both the Factory and the Township branches from Managil Highway southwards. The branching point of the Access Road as indicated by the drawings is proposed to be after the Managil Road crossing Minor canal 18 at about 150 meters.



Figure 3: Irrigation Layout

At starting point, the area on the northern side of the Sugar Transport route being adequate to accommodate the Township Residential Community group and their related facilities and services, the southern side is proposed to accommodate other functions complementary to the township as shall be explained. The Township primary function being the accommodation of the Factory Workforce as well as being WNSP Settlement of the 1st order, the concept and the objectives can be summed up as follows:

i. Proximity and safe, easy and efficient accessibility of the 1st functions, including HQ Administration, secondary schools and Hospital to the AMA Centers.

ii. Proximity and safe, easy and efficient accessibility of the Residential Community groups to the Factory and their Central Amenities.

iii. Properly planned healthy and efficient functioning of all activities, with the least friction, catering for the dimension of time, and giving a sense of community belonging and an atmosphere those are conducive for work within economic limits.

iv. Equipping the township with all infra-structural Plants and networks and with all other complimentary functions to work as self-independent.

v. Residential community groups to be planned as safe living environments with social intimacy and adequate traffic segregation.

vi. High quality landscaping within and on line periphery including parks, park ways, playing fields etc. that not only make the township pleasant for its citizens but also attractive for visitors.

vii. Maintenance of international standards of a healthy atmosphere with the least pollution of air, water and Land

The Township Structure Plan (2010 – 2020):
In satisfaction of the Planning determinants, the concepts and objectives and on the assumption that the Township Population would be about 7,500 persons by the year 2020, the Township structure plan (2010 –2020) has been prepared as exhibited, which is self-explanatory. The following is a brief of the main aspects:
Accessibility: The Township is approached through the district road (50mwide) branching from Managil – Rabiak highway and running parallel to the western side of the Factory. The Township Central spine Road (40m wide) branching from the District Road serves all Township activities. The planning and grouping the Township activities on the two sides of the Central Spine Road in order to satisfy the stated objectives and in particular the objective of minimizing traffic hazards and of creating safe and attractive living environments led to the preference of staggered and looped Local Roads (LLR) branching from the Central Spine Road (CSR) to encircle and to serve each of the 4 Residential Community Groups (RCGs) with Access Roads (AR) to serve the back of the residential Blocks of flats as cul – de – sac. Thus creating a safe and efficient accessibility.
ii. Proximity : Despite the 1.5 km protective green buffer west of the factory western side to avoid the baggasse hazards, yet the remotest residential blocks are only about 2.5 km from the factory i.e. the remotest permanent factory workforce can reach it within less than 5 minutes by car. Apparently the Township Central Facilities are so located to be within walkable reach of all RCGs.
iii. Functional Zones:
a- The functions of the 1st Order namely the administration, the high secondary schools and the hospital are located on the face of the Township in order to be as close as possible to the AMA Centres and separated with a western green buffer so as not to mix with the other township functions.
b- The Bachelors Quarters, the Guest House, and the Top management villas are located south and north of the Central Spine Road (CSR) with green buffers of both the eastern and western sides.
c- The residential Community Groups (RCGs) are located on both sides of the Central Spine Road (CSR), each encircle with the staggered looped Local Road (LLR) with safe living environments.
d- Each of the two RCGs on the north and south sides of CSR are separated by a green buffer to accommodate their primary schools for boys and girls.
iv. Protection : The objective of mitigating and minimizing the environmental hazards facing the Township in particular, including the baggasse threat from the factory boilers, burnt cane ash, and dust and noise of sugar cane transporting trucks have led to the creating of over 2 km green buffer from the boilers location as well as creating well over 350 m buffer with shelter belts plantation on its northern, southern and western sides.
v. Landscaping: The Township is planned as a “garden City” – i.e. landscaping within the Township green buffer spaces and within the RCGs and other activities constitutes its heart and spirit, not to mention the surrounding buffer zones and parks.

Furthermore the Township has been located over two Km away from factory hazards creating on the eastern side about 90 hectares of Public Parks. All Settlements are wrapped with shelter belts, with widths reaching about 300 metres in the case of the Township, for protection against smoke and ash resulting from burning of Sugar Cane at harvest time.
Thus what is vitally required is the FULL LANDSCAPING of each Settlement at all levels as planned including the overall Settlements shelter belts, green buffers, parks, public Buildings gardens, sheet street trees, housing yards …. and plants.

5. PARADIGM IMAGE OF THE AREA

Today's cities are part of the global environment. Their policies, their people and their quest for productivity have an impact far beyond the city borders. City level experiences are essential to the formulation of national policies, and city and national policies in turn translate onto the global level. Today, global policy makers recognize that cities have a tremendous impact on issues ranging from local economic stability to the state of the global environment.
No single recipe for managing change can be applied to all cities. Cities are affected by their location, their climate and natural features. Cities and urban settlements don't operate in isolation— they are part of a national structure, subject to central government, strengthened or limited by regional and national infrastructure, budgetary policies, development priorities, and de-centralization
Highways and transport systems have been built in tandem to support this physical growth. Valuable farmland has been eaten up and car dependency has increased.
However the proposed Settlements Structure plans allocation of substantial spaces for landscaping and the irrigation networks around the settlements making raw water available throughout the year constitutes great resources for full landscaping of the settlements necessitated by the following objectives:
1. Protection of environment from pollution.
2. Increasing humidity.
3. Purifying atmosphere from dust and smoke.
4. Providing shade.
5. Minimizing noise.
6. Decreasing temperature.
7. Bordering Cities, towns, and residential areas.
8. Separate between facilities
9. Beautification.
10. Helping relaxation and alleviating psychological stresses

As exhibited by the Settlements development plans substantial areas have been allocated for landscaping with the objective of creating a Garden City Concept to change the dreary and harsh environment presented by high temperature, law humidity, scarcity of vegetation and haboobs and fine dust hazards.

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Water as Shape Shifter
Exploring innovative approaches to water related urban design

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Abstract

This paper takes a phenomenological approach to uncover the urban potential of qualities related to water that are transformative, atmospherically evocative, and addressing questions of control, or lack of control over environment and ecology. In many cities today plentiful hidden water supplies exist underneath the streets, parks and buildings. From Quito to Melbourne, the richness of underground canals could provide valuable utilitarian and atmospheric resources to the city. Case studies from Seoul, Cheoggyechen, and Bogota's Juan Amarillo Greenway, are instances of recent urban designs that take into account the performative qualities of water.

Water, a Living Substance

Like air, water is an element indispensable to life. It is both an immersive and an emergent medium, and has the unique property that it occurs in highly diverse manifestations. It can be fresh, or saline, liquid, frozen, vaporous, and in all these forms water is in continuous flux. The dynamics of water are expressed as rushing currents, beating waves, shifting tides yet, even when still, water is full of movement. Within its depths, as on the surface, constant flows are caused by the engagement of water particles with other elements and materials. The H2O molecule bonds in chemical reactions with other substances, and all sorts of animate and inanimate matters pass through the water and stir its surface, thereby generating incessant ripples, vortexes and surges at all scale levels.

Our human experience of water, even just considering its liquid incarnation, is also marked by diversity; we are familiar with water in large or small volumes, streaming or stagnant, wild or contained and sanitized, problematic through absence, scarcity or overabundance, and know that it is there even when we don't see it, as it wells up and trickles hidden from view below the earth.

Ever since antiquity water has been popular subject of philosophical debates. Thales of Miletus (fl. c. 585 BC) was probably the first Greek philosopher to identify water as a primary material element or source (arche) of all life on earth. It is possible that Thales followed the traditional Homeric world-image and more precisely that of Oceanos; the river source of all mortal and immortal life. Thales believed that the earth floats on water like a raft.

More recently, Deleuze and Guattari (1988) used water in order to describe the opposition between the smooth space of becoming and contrasting it with striated spaces of stabilized identity. In some ways the urban water edge could be described in the same way. It is an interface between something static, controlled and that which is dynamic. We can describe this edge in dialectic oppositions like striated and smooth, solid and void, order and chaos, nature and artificial; or we can leave some grey areas which are not determined or over

specified and these grey areas and specifically interesting when considering the role of the water in urban structure.

Urban design potentials of water

The premise of this paper is that urban design need not focus on technological and pragmatic water-related solutions alone but can also explore more imaginative ways to use the singular properties of water as a hyper dynamic medium. Interesting examples from the art and design world show water being used in unexpected ways The Ice hotel in Jukkasjarvi in Northern Sweden started out as an art project in 1989, and has since led to several temporary hotels and bars built with snow and ice blocks in several parts of the world. On the other side of the water spectrum is the vaporous Blur Building that was constructed for the Swiss Expo by Diller and Scofidio in 2002. This temporary pavilion consisted of a platform in the lake of Yverdon which was covered in nozzles spouting a fine drizzle which effectually created a man-made cloud through which the visitors walked.

Such imaginative examples of water related design are very rare and short-lived, yet their relevance could be significant and much longer lasting. While whimsical and poetic, rather than efficient and pragmatic, these constructions convey a timely message by alluding to qualities related to water that are transformative, atmospherically evocative, and addressing questions of control, or lack of control. Technology and climate change play an implicit role; thus both projects can even be argued to contribute to a sense of ecological awareness.

Our question is: to what extent does current urban design utilize the particular transformative, evocative, hyper dynamic and evasive properties of water? In short: are there urban designs thinkable that work with steam and ice, or underground streams, rather than the more obvious water-related situations such as a riverfront, lakeside and so on? Related to this first question is a second question: can water-related urban design find new types of application in an urban context by explicitly working with the innate transformative capacities of water? Finally, the question could be asked if such urban designs could derive added value from this quality, and if these would be in line with the more atmospheric and thought-provoking qualities associated with the Ice Hotel and the Blur Pavilion mentioned above? We will present some perspectives from our academic and practice backgrounds and evaluate these in the light of this question.

A phenomenology of flow

Locating this exploration in a context of recognized urban design practices would lead us to consider this a form of urban ecology with a phenomenological focus. A phenomenological approach entails an understanding of place as the infinite and fluid entirety of place-related experiences. (Norberg-Schulz, 1976). Rather than defining an environment, a place, in as concrete and specific terms as possible only, describing its dimensions, population, geographical data and so on, this idea of place contains all the tangible things which are encountered through the senses. Yet, at the same time it is acknowledged that the material aspects, the colours, substances, shapes, and textures, all have affluences that jointly produce a final, elusive affect: atmosphere. As Mark Wigley notes: ‘Atmosphere seems to start precisely where construction stops.(…) It is some kind of sensuous emission of sound, light, heat, smell and moisture; a swirling climate of intangible effects generated by a stationary object “. (Wigley, 2009). Atmosphere, then, is the agent that bestows upon places their unique identity in concurrence with their specific cultural and environmental constitution.

With its emphasis on subjective experience, phenomenology disrupts the scientific striving to equate reality in an objective, value-free manner. Phenomenology always addresses the relations between the environment and the things in it through the ways in which this environment is inhabited, used, or perceived. In the field of urban design the most prominent phenomenological theory of our time has probably been Paul Virilio's reflections on the consequences of velocity and technology. More recently, however, the voice of anthropologist Tim Ingold has emerged, whose insights build on the combined thinkings of Deleuze, Bruno Latour and J.J. Gibson. Ingold has developed the concept of 'weather-world' that he opposes to landscape, which, to him, is too closely associated with scenery, 'an art of description that would see the world spread out on a canvas' Ingold, 2011). The weather world includes transformative elements such as light, sky, and water in all its manifestations. Inhabiting the world is 'not, then, to be stranded on a closed surface but to be immersed in the incessant movements of wind and weather, in a zone wherein substances and medium are brought together in the constitution of beings that, by way of their activity, participate in stitching the texture of the land." (Ingold, 2011). What we think of as solid surfaces are really permeable thicknesses that we move through rather than on top of. While current thinking addresses infrastructure, including the water ways within cities, as a type of network, with nodes and lines, Ingold proposes that we instead move to a more enveloping concept of a meshwork of interwoven lines of movement and growth. The ideas of weather world and meshwork bring us closer to understanding the transformative and pervasive capacities of water and the many forms and ways this tantalizing element can be utilized in urban design.

Liquid attributes

> *Water is sometimes sharp and sometimes strong, sometimes acid and sometimes bitter, sometimes sweet and sometimes thick or thin, sometimes it is seen bringing hurt or pestilence, sometime health-giving, sometimes poisonous. It suffers change into as many natures as are the different places through which it passes. And as the mirror changes with the color of its subject, so it alters with the nature of the place, becoming noisome, laxative, astringent, sulfurous, salty, incarnadined, mournful, raging, angry, red, yellow, green, black, blue, greasy, fat or slim. Sometimes it starts a conflagration, sometimes it extinguishes one; is warm and is cold, carries away or sets down, hollows out or builds up, tears or establishes, fills or empties, raises itself or burrows down, speeds or is still; is the cause at times of life or death, or increase or privation, nourishes at times and at others does the contrary; at times has a tang, at times is without savor, sometimes submerging the valleys with great floods. In time and with water, everything changes.*
> Leonardo Da Vinci (1452-1519)

Water and water infrastructure has always been an essential element of any cities. But our attitude to water has been constantly changing. London, like many other cities around the world relied heavily on all the rivers and streams for its drinking water, for transport, for mills, for tanneries and for waste removal. As early as the thirteenth century, London's rivers such as the River Fleet were already considered polluted and surrounded by poor-quality housing. After the great fire of 1666, Christopher Wren proposed widening of the river and transforming it into a canal, similar to those in Venice today. Unfortunately this idea was rejected and River Fleet was paved over, to become an underground river. Later, the rivers Walbrook, Tyburn, Moselle, Westbourne, and Hackney and Stamford brooks followed the same fate and River Brent and River Rom were partly covered. Today most of us consider London as a one-river city. In Medieval times, the river Thames played the role of a major street in the city even though it was not a place to be appreciated or admired. During the early 19th century, this river was an open sewer. The modern sewerage system was put in place in 1858 and remediation started, but it took over one hundred years to rediscover the beauty of the waterfront of the Thames. Widespread appreciation and value of waterfront developments are a recent phenomenon. What once was a working water's edge has today become a recreational opportunity. What one has been undesirable has become very

desirable. Our attitudes and desires have changed because we were able to reassign meaning and associate different values to the place.

The same can be said about the way we have perceived our infrastructure. In the past two centuries, urban infrastructure has been added to cities in order to promote efficiencies, health and safety, facilitating the exchange of goods and, therefore, improving city economies. We can now move faster, and further, we can rely on electricity, gas, and water, in order to perform the simplest tasks. Infrastructure has become an essential part of our lives; we have become dependent on it. Since the industrial revolution, infrastructure investments in our cities have supported growth and expansion of the urban fringe while the center often decays. As Nadisand MacKenzie (1993) point out, urban infrastructure (especially some urban transport) is increasingly seen as a threat to urban health, safety, economic efficiency and quality of life.

Unfortunately most of the systems installed operated, and still operate, entirely independently of one another (often in competition) and share little physical space. Our capacities are usually upgraded by adding to the inventory of systems, not through replacement or enhancement. Our question is if this can be done in ways that, besides utilizing the functional benefits of water supplies, also produce the atmospheric qualities invoked by our reference projects, the Blur Building and the Ice Hotel. Is water brought (back) into the urban realm in ways that enhance the human experience?

Case studies

We progressively changed our streams, brooks and rivers into sewage pathways and we have hidden them in underground pipes, away from our view. Through this, we have changed something that was previously a common good, available to everyone, to something that is now privatised and controlled by either the state or private initiative. We have also changed our most important ingredient of life into something that we to have to conduct our daily lives and something that we need to hide and avoid. Harbour edges, docklands, river front until recently were the places to be avoided. Fortunately, around the middle of last century, we started to rediscover the value of the hidden asset of water. Underground streams that few years ago were polluted and hidden from our view started to become primary attractions and sources of economic prosperity. They also are becoming a common good for the public, and great benefit for the developers. We will examine a few case studies to understand the consequences.

SEOUL, Cheonggyecheon stream



Figure 1: Cheonggyecheon stream before and after restoration

One of the main and probably the most famous examples is Cheonggyecheon stream in Seoul. The original water course was dredged and straightened nearly two hundred years ago, during the Taejong reign in the Joseon Dynasty (1400-1418) in order to provide a drainage system for the city. With an increase population and shantytown development along the stream edge, the water in the stream had become very polluted and the stream was gradually covered during the middle of the twentieth century. The shantytown disappeared and was replaced with urban structure (Cho, 2010). In 1976 a 5.6 km elevated highway was built but, twenty-five years later, the highway was in need of substantial repairs. At the same time, the authorities discovered that the polluted underground water course was full of dangerous gases. The risk of explosion and the cost associated with removal of the gases, combined with the cost for needed improvements of the elevated highway, were high.

The Seoul city government recognised the investment potential of spending the sums in renovation of the stream rather than repair of the highway. By removing the road and digging out the stream, a 5.6 km green recreational space was created. The water quality has been greatly improved and Cheoggyenchen has become a central gathering space for the city (Shin, 2004). The elevated highway that previously subdivided the city and created an unpleasant environment around it was changed to an inviting and exciting public space.

BOGOTA Eje Ambiental de la Avenida de Jimenez de Quesada



Figure 2: Le Corbusier's Plan for Bogota

After the Second World War, Europe experienced a massive exodus of its population to North and South America. With many Europeans arriving to cities like Bogota, a new wave of European urban ideas started to be implemented. Le Corbusier was invited to Bogota in 1947 to develop the Plan Pilot for Bogota. The Plan consisted of two stages. The Pilot Plan set out the city limits, zoning and road systems and a classification as a guide to regulate the growth of the city and the basis for developing the second stage, the Regulatory Plan which was developed by José-Luis Sert, then president of CIAM, and his associate Paul Lester Wiener. The Regulatory Plan was delivered in 1953, two years after the Pilot Plan was adopted, defining the systems use of different areas, population densities, heights of the buildings and construction methods.

For many years, Le Corbusier's Plan for Bogota remained unrecognized and unappreciated. Although never realized, the Pilot Plan for Bogota represents a significant shift in Le Corbusier's thinking. The first glimpse by Le Corbusier of Bogota was through the window of an airplane. In the period before his arrival in Colombia in June 1947, Le Corbusier has been considering the

hypothesis that the airplane offered a privileged point of view to help establish the bases of contemporary city. This perspective was never more clear than at the moment he saw Bogota from above, elevated on the large plateau, 2500 m above the sea level, bounded by the steep mountains on one side and the river at the other. The mountain, over 3000 m in height, serves as the background of the city, before dropping down into the valley. In this view, Le Corbusier could clearly see the limitations of contemporary two dimensional planning.

> *The evolution of the science of urbanism had happened of the practice of a realism in two dimensions, that was based on the operation of extension of the streets, towards one in three dimensions, that allow to incorporate as a new factor the height and to think in volumetric terms. In short, urbanism must make volumes, transforming itself into the putting on stage of these in space. Thus the architecture will follow the condition of Nature and it will become ordered, arranging itself with formal and compositional criteria of order, under the laws of communications, the relations of the channels of circulation and mobility, that is to say, the streets.*
> (Le Corbusier, 1999).

Le Corbusier believed that cities follow the laws of nature; their locations close to water, in protective surroundings and with easy access to some source of natural capital that could provide income such as food sources such as fish and agriculture or mineral such as coal, obsidian or gold or simply key points on a trade route. He also believed that a city's history would define the urban landscape. He proclaimed that the urbanism in three dimensions […] would have to be able to resist the formalist deviation, situating the contemporary city's project in its appropriate context: the territory and its geographic base (Aris, 2010).

In many respects, the Pilot Plan of Bogota was a reinterpretation of the principles described in the Charter of Athens adopted by CIAM. This advocated four purposes related to everyday life: to live, to work, to circulate and to recreate. It used the existing city structure and its network of avenues, carreras and streets, but applying to them a process of classification and redefining the hierarchy of routes of transportation in agreement with the 7V system (Lampunzina, 2010). It was important for Le Corbusier to define the limits of the city, and surround both the plots and the city limits with green recreational space. The city was to be fourteen kilometres long from south to north and three kilometres deep from east to west. Fig 2 shows how Le Corbusier was incorporating nature and built form into one overall concept. The streams and valleys flowing from the Andes formed linear parks that dissected the city structure with green fingers. The new network was planned to overlay an existing fabric of the city in a three-dimensional manner. Following the set of new superimposed rules and guidelines, which were derived from the preexisting conditions and were put in place to establish new urban order, the volumes, streets, and spaces, and buildings overlap and confront with geography and with history in three-dimensional composition. Although Le Corbusier does not mention the fourth dimension, this became a very important element of his proposal. In this project, he departs from his previous conceptualisation of the city as a machine as a utopian ideal city to a form that is not finalized and over described but, instead, an open proposition for viable urban growth (Frampton, 2002).



Fig 3 la Avenida de Jimenez de Quesada

One of the young Colombian architects working on the project with Le Corbusier was Rogelio Salmona. Although Salmona frequently argued with Le Corbusier, he worked with Le Corbusier in the Rue de Sevres studio in Paris for nearly 9 years, from 1948 till 1957, before returning to Bogota, where he became one of the most respected Colombian architects. Salmona reintroduced the San Francisco River into the city, realising at least in part one of Le Corbusier ideas for landscaped streams coming down from the mountains, infiltrating the city with water and providing pedestrian green infrastructure. The project was built between 1997 and 2001 together with Luis Kopec. The Eje Ambiental de la Avenida de Jimenez de Quesada (the Jimenez de Quesada Environmental Axis) starts at the foot of the Monserrate Mountain and is 2.8 km long. In 1917 the road parallel to the river was constructed and named Gonzalo Jimenez de Quesada Avenue. In the 1930s it was decided to channel the river underground for health reasons and to widen the road. It took another fifty years to bring the water back into the public domain. Today the water is no longer polluted and contributes greatly to the public realm.

Conclusion

Each of the case studies demonstrates that uncovering the potential of water in urban design is not without its challenges, but is ultimately perhaps the most rewarding intervention a city can undertake for its population.

In Cheonggyecheon, the popularity of the new water way is illustrated each year by the thousands of dollars that are collected from the streams and donated to charities; money that has been thrown there by tourists and visitors. Although previously 168 000 cars were travelling along the highway each day, few traffic problems have been created in the area by replacing the highway with the stream and changing the mode of movement from cars to pedestrians (Park, 2007).

In Bogota, partially based on Le Corbusier's vision of combining the existing landscape with a proposed new urban structure, the San Francisco river has been reopened. Le Corbusier's Pilot Plan of Bogota is based on the original colonial grid plan. The plan runs north to south, parallel to the mountains that provide spectacular background. Valleys with water streams, rivers and brooks dissect the 13-kilometre strip. Today, unfortunately, only one fragment of the valley still remains, forming part of the Parque Nacional around the Arzopispo River. Some other rivers are still visible within the city structure in form of canals, but many have

disappeared underground. The re-introduced San Francisco stream runs down the hill towards Candelaria, the old city centre. This semi-pedestrian street is surrounded by native trees and public spaces inviting people to relax, providing a cool and refreshing atmosphere to what is sometimes a very hot and polluted place. The Transmilenio bus route runs parallel to the stream allowing commuters easy access to many parts of the city. This environmental axis comes close to Le Corbusier original idea. It offers recreational space, separates pedestrian from vehicular traffic while affording access to public transport and other parts of the city. Most of the time the area is full of people, making it safe and pleasant to walk through.

Returning to the cities the hidden streams that once formed the starting point of their foundations, brings urban populations more than just the chance to enjoy some greenery in their leisure time; uncovering these live flows is a literal 'breaking through the surface' and acknowledgement of the 'irrepressibility of life' in the weather world. (Ingold, 2009)

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The regeneration of the historic Redefossi canal in Milan

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Plans to breathe new life into the ancient and largely forgotten subterranean waterways that meander silently under the historic centre of Milan are gathering pace. Naturally, as with any significant urban transformation it is proving controversial but it has at least put these dormant canals and their potential at the centre of Milan's urban planning debate.[1]

This Paper focuses on a waterway neglected by contemporary projects of urban transformation and unknown to most the Milan's residents: The Redefossi, a canal that despite dating back to the XIV Century still flows under Milan. Having surrounded the city of Milan for centuries as a military and fiscal limit, the Redefossi was later fortified with defensive embankments. However, the most significant period of the canal's history was in the XVIII Century, when a section of its bed was widened and it played a key role in the urban regeneration of the Porta Venezia quarter. The first public garden of Milan was planned along its route, as well as important public buildings. Eminent artists and architects such as Giuseppe Piermarini and Luigi Cagnola contributed to this momentous urban renovation, giving identity to the new public spaces of the Age of Enlightenment. The fate of this remarkable canal reached a pitiful turning point at the end of the XIX Century. At this time water was considered merely an obstacle to urban growth. Consequently the administration of the City Council decided to remove all visible surface traces of the Redefossi in the city centre, by covering it over indiscriminately. So brutal was this intervention that some buildings were constructed directly above the waterway as if to prevent the reversibility of the covering process.

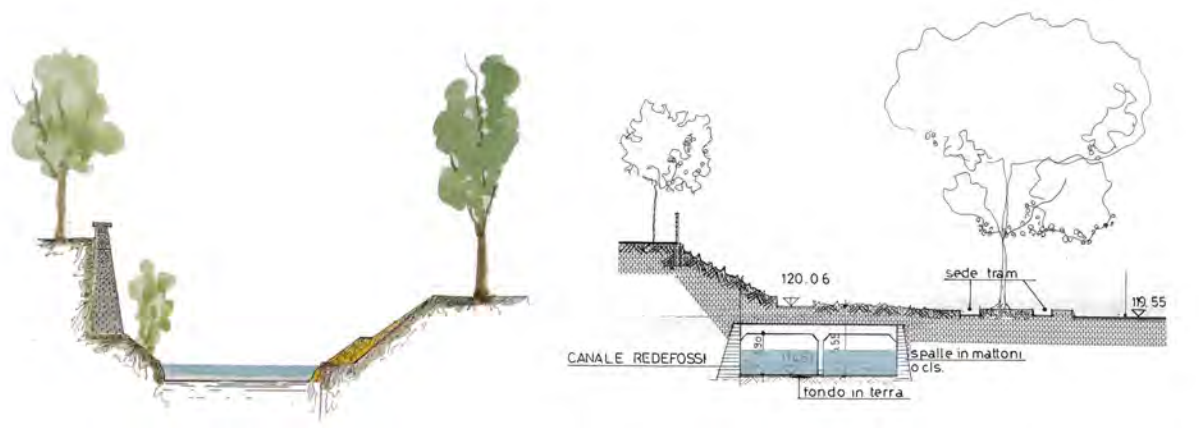


Figure 1: Comparison between two sections of the Redefossi from 1872 (left) and 1996 (right)

Galvanised not only by the contemporary belief that visible flowing water improves the quality of an urban space, but also by the historical importance of the Redefossi, which could bring renewed meaning to the city, this canal has became a central topic of my Ph.D. thesis and also of several research projects involving professors and students at the Politecnico di Milano.[2]

1. Origin, form and significance of the Redefossi canal

At the beginning of the XIV Century, when the City's only protection was its medieval walls, Azzone Visconti, lord of Milan ordered a far wider boundary to be built. The result was the Redefossi, a canal that has existed ever since and been fed in the main by the river Seveso that runs through the fringes of Milan.

A process of fortification began soon after. The Redefossi started to be reinforced with ramparts and bastions, although these defences were never enough to provide truly effective military protection. Instead, it began to operate as a commercial border which explains why for many years the name "*cinta dei dazietti*" (the customs houses' belt), was attributed to the canal. The original shape of the Redefossi was polygonal with each separate vertex guaranteeing visual control over the two convergent segments of the canal and each housing a city gate and border control, located in close proximity to a territorial road.

It remained like this until the first years of the XVI Century when an even more effective boundary and defence became essential. Important figures contributed to plans for the fortification that aimed to modify and reinforce the wider boundary of the City, until then dictated by the canal. Notable among these was Leonardo da Vinci, who lived in Milan intermittently during this time**.** Three of his surviving drawings show a map of Milan and illustrate the position of the Redefossi. These drawings may well have been part of a proposal for fortifications.

Leonardo's idea was for a reinforced boundary that would keep the Sforza Castle inside the walled city, in pursuit of a concentric urban shape pivoting around the medieval *Broletto*. In stark contrast to this was the fortification project of the military engineer Gian Maria Olgiati, which began construction in 1549 and made a new urban boundary composed of the reconfigured Redefossi and its fortifications while keeping the castle at the perimeter of the City. The new boundary excluded some of the hamlets previously protected by the Redefossi canal, and made its North West segments redundant. The city maps of the XVI Century, and in particular Lafrery's map from 1573, illustrate the reformed Redefossi as a significant defensive moat around the walled city.



Figure 2: The Redefossi and the Sforza Castle on maps by Filippini (1722), Leonardo da Vinci (1510), Lafrery (1573)

The influence of the original Redefossi and its later reconfiguration on the urban form of Milan is highly significant. This Paper will mainly focus on a stretch of the reconfigured canal and its military embankments, which played a critical role in the evolution of the first public

area of the City. However, it is important to note, that parts of the original XIV Century excavation of the Redefossi, that were made obsolete by the plans for further fortification, have left deep traces on the modern urban map. A particular example of this is Via Paolo Sarpi - a street planned in 1876 by engineer Angelo Fasana, as part of a wider project to develop the area outside the city walls - and that clearly and precisely corresponds to the position and form of a section of the ancient canal.

2. The North East of Milan

In the XIV Century the North East vertex of the Redefossi was dug beside the territorial lane passing from the North East medieval gate, Porta Orientale. Since then a gate has existed at the intersection of the new canal and the lane. This access to the city was later fortified with a bastion and is today at the heart of the thriving Porta Venezia area of Milan.

In 1488, the Lazzaretto was constructed beside the canal and became one of the most notable buildings of the Milanese Renaissance. It incorporated a 370 x 370 metre enclosure and was used to house and isolate victims of the plague. The Lazzaretto was the only major building to be constructed outside the urban boundary for centuries.

2.1 The canal section at the Northeast of Milan

A close look at the Pianta di Milano degli Astronomi di Brera, an important map from 1807-1810, reveals that the Redefossi's North East section, between Porta Nuova and Porta Venezia, was the widest waterway of the city, and unlike many of the others was not navigable or used for productive or defensive reasons.



Figure 3: Montage of projects for public spaces between Sforza Castle and Porta Venezia on the Pianta di Milano degli Astronomi di Brera.

This was due to one of the methods adopted by hydraulic experts between 1780-1789 to solve a severe flood issue which was damaging several parts of the city along the Redefossi canal including the arched bridge of Porta Venezia and its bastion which had been suffering erosion since the XV Century. These problems started when the Redefossi, previously fed by the river Seveso, started to receive water from the river Adda through the Naviglio della Martesana. A man-made and navigable canal that still flows underground, and feeds the Redefossi.

The strategy adopted to alleviate this critical situation was the diversion of the Redefossi's water to the river Lambro, and involved digging a new channel from the Southern part of the canal. The Redefossi still has this configuration today.
However, in 1784 the engineer Carlo Prada decided to widen and make the section of the canal between Porta Nuova and Porta Venezia more linear to control the strength and pressure of water. It is worth noting that this simple hydraulic improvement was accompanied by massive urban development lead by the greatest architects and administrators of the time.

2.2 The interventions of the Neoclassical architects

At the end of the XVIII Century, Milan's first public outdoor spaces were created along the banks of the widened Redefossi. Neither the city walls or the canal played a defensive role anymore. However, a series of architectural projects in the vicinity of Porta Venezia, close to the territorial road to Vienna and along the banks of the canal aimed to create several outdoor public spaces for Neoclassical Milan.

The first of these projects occurred in 1798 when the Lazzaretto was transformed into a public square for large celebrations and tournaments. The project was led by Giuseppe Piermarini The most established architect of the time, Several monumental gates were built to open up the enclosed courtyard. Soon after another of Piermarini's projects that transformed the walls and moat into a raised public walkway and tree-lined promenade and gave beautiful views of the countryside and the Alps beyond, changed the spirit of the area definitively. This project also involved the Boschetti, a linear garden stretching to the new raised walkway and accessed by a monumental staircase. This became the first element of what was to evolve into Milan's “Giardini Pubblici” Park.

From 1801, while under Napoleon's rule, the area around the castle, now cleared of its fortifications, came under the scrutiny of Giovanni Antolini, a hydraulic expert and architect. He proposed a grand project for a civic acropolis, made up of a collection of public buildings organised around the castle and along a circular canal. This plan was eventually rejected by the Milanese administration in favour of the grandeur of a project by Luigi Canonica featuring a large, square shaped military parade ground flanked by the castle and decorated with avenues of trees and constructed between 1803-07. This project became a second focal point close to the starting point of Corso Sempione, a new territorial road pointing towards the North West.

Soon after the raised public walkway was extended from Porta Venezia to the area of the castle. The architect Pietro Gilardoni led the works for the Eastern part of the walkway while Canonica himself designed the arrival point of this extension in the form of an amphitheatre.

Meanwhile, to strengthen the system, a design competition for a Menagerie was launched 1808. In which architects Luigi Cagnola, Luigi Canonica and Giuseppe Zanoia presented two landscaping projects once again set alongside the North East

section of the Redefossi, between the former Lazzaretto, (now a public square) and the arrival point of the Martesana canal at Porta Nuova.

The area immediately around the Redefossi between Porta Nuova to Porta Venezia became a favoured place for public leisure during the Neoclassical Period and has maintained its popularity ever since.

In the XIX Century several public Baths, facilities and green spaces, including the newly transformed "Giardini Pubblici" Park were built along its banks to meet the needs of a growing population and an expanding industrial city. It also became first the venue in Milan for fairs expositions.

Early in the XX Century an ornate stone balustrade was added to the Northern bank giving a unique urban character to the canal. Nevertheless the Redefossi's existence then reached a turning point.



Figure 4: The Porta Venezia section of the Redefossi canal just before it was concreted over

3. The covering process

While the use of water was valued as an exciting aesthetic element of urban design during the Neoclassical period, it was barely a Century later that this enthusiasm evaporated completely. The first official evidence of a hardening of attitude towards the presence of canals within the city appeared with the Milanese "Piano Beruto" planning ruling of 1884, named after the Council engineer who signed it off.

The principal aim of the "Piano Beruto" was to steer the flowing water away from the city centre. Canals were now not only viewed as obstacles hindering the pursuit and craving for modernity but also as unhygienic, the antithesis of civic pride and impeding urban growth.

But it wasn't only the canals that this reversal in planning sentiment threatened, it also sought the removal of the ancient walls, and consequently most of the tree-lined walkways that flourished above them. The fate of both the Redefossi canal and the raised walkway was sealed.

However, in the Porta Venezia area, due to the presence of the Giardini Pubblici park, it was eventually decided to conserve the section of the walkway planned by Piermarini as an extension of the Park. Conversely the fate of the Redefossi as a visible entity and feature took a backward step with two interventions by the City Council: The sale of a building plot for two houses and the construction of a school in Porta Nuova directly above the canal bed with the school's main entrance facing the new vehicular road rather than the raised walkway.

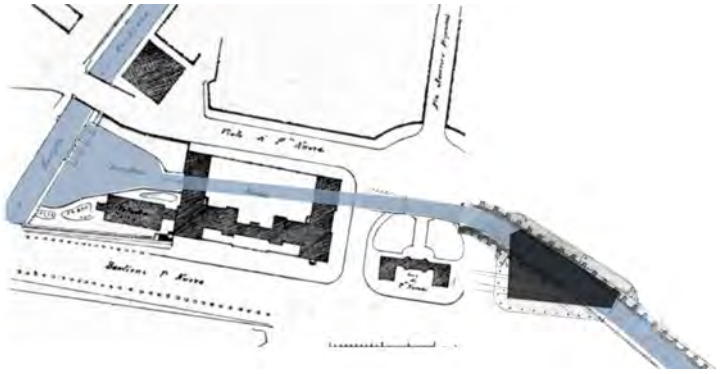


Figure 5: The school and the building lot directly above the concreted canal in Porta Nuova

An opportunity to concrete the Porta Venezia section of the canal alongside Piermarini's walkway came along just before the International Exposition held in Milan in 1906. Due to the vicinity to the Central Station and to the venues required for the event, private entrepreneurs obtained licenses to erect temporary hotels above this section of the Redefossi in return for paying the cost of concreting over the canal. This was one of the first times reinforced concrete was used in Milan.



Figure 6: The Redefossi section of Porta Venezia in 1905



Figure 7: Temporary hotels erected above the Redefossi. The raised walkway is visible behind them (1906)

Since then, the whole Redefossi canal has gradually been concreted over and its memory inevitably largely forgotten. Today the only occasion that the river Seveso or the Redefossi canal is mentioned is usually regarding hydraulic issues or flooding.

4. Proposed architectural projects

The legacy of both the waterway system and the interventions of the Neoclassical architects is today only evidenced by localised remains and anomalies in urban structures. Today Milan does not have visible waterways apart from a few sections of canals in the South West "Navigli" district.

However, to satisfy Milan's craving for new public buildings and provide new high quality open spaces, the Redefossi could be transformed back to centre stage in the North East of Milan. This paper presents three diverse architectural projects united in their common aim to expose sections of the covered portion of the Redefossi to daylight again. The architectural solutions all have a strong relationship with water, not least taking advantage of its possible use for producing sustainable energy.

5.1 A"square of water" in Porta Nuova

The project provides both a monumental entrance for the Martesana Canal as well as marking the point of origin of the Redefossi Canal. The new urban elements carefully relate to the surviving structures of the ancient canal system and to pre-existing public buildings. In particular the project involves the area around the tunnel called Tombone di San Marco, which was the entry point for water to pass under the city wall. Here, in what is a fragmented part of Milan lacking of recreational spaces, the project proposes several new walkways on different levels and a sunken public square containing a large rectangular water feature filled by the Martesana Canal. This will provide a new public focal point and meeting place with a variety of facilities. In addition, the difference in height between the new square and the two canals would generate modest yet meaningful hydraulic energy.



Figure 8: Plans of different layers (Candia - Cerisola - Spelta - Villa, 2011)

5.2 Rethinking the street of the Central Station

The re-opening of the Redefossi Canal also represents an opportunity to confront the unresolved relationship between the historical city and Milan's Stazione Centrale.
Today the junction between the street of the station and the underground canal is dominated by a bland square, the surface of which is mainly dedicated to vehicular traffic. The project aims to redesign the square, creating new public spaces and a new building pointing towards the Station with a large terrace. A second building at the starting point of the new canal (at the point where the river Seveso met the Redefossi) would provide space for exhibitions. Finally, a raised walkway featuring a tree-lined promenade running alongside the canal, would connect the two buildings to what remains of the ancient city wall. This walkway will provide a direct relationship between the new public buildings, the transport system and the “Giardini Pubblici” Park.

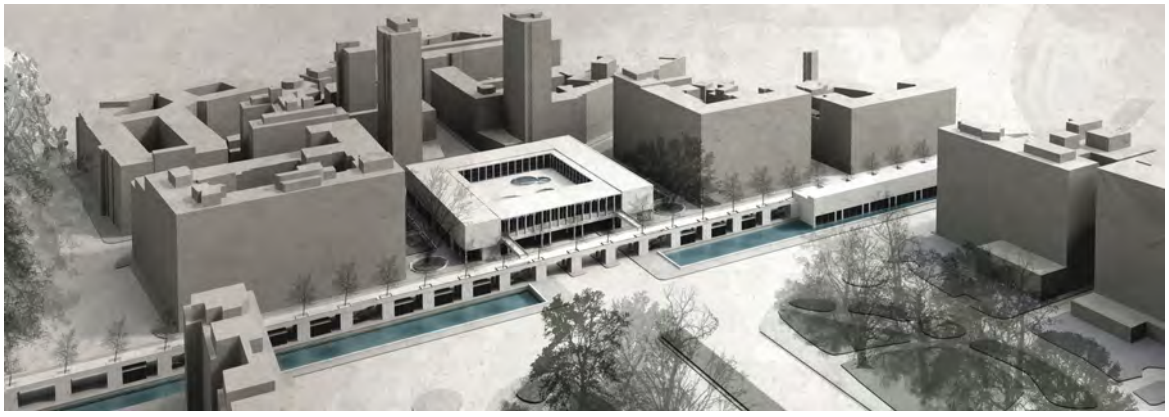


Figure 9: View of Piazza della Repubblica (Cislaghi - Citterio - Giampietro - Nassivera, 2012)

5.3 A recreational centre between the city wall and the canal

Proposing a recreational centre for the Porta Venezia area, the project explores the important, yet currently hidden relationship between the city wall, the Redefossi Canal and the “Giardini Pubblici” Park. This will include:
Uncovering a concreted section of the waterway corresponding to the length of the Park.
Make visible parts of the ancient City wall currently covered by an embankment.

Improve the pedestrian accessibility to the Park from the Porta Venezia quarter, thanks to two bridges on the Redefossi and a public passage through the embankment, avoiding the cross of the raised and congested road existing above the embankment.
The recreational centre, much of which would be below ground, would house a grand indoor swimming pool. This pool, placed inside the embankment, on one side would flank the historic brick wall, on the other it would gain views of the re-opened canal.
Lastly, a pavilion from the XIX Century, existing in the park, would be converted and linked to the centre.

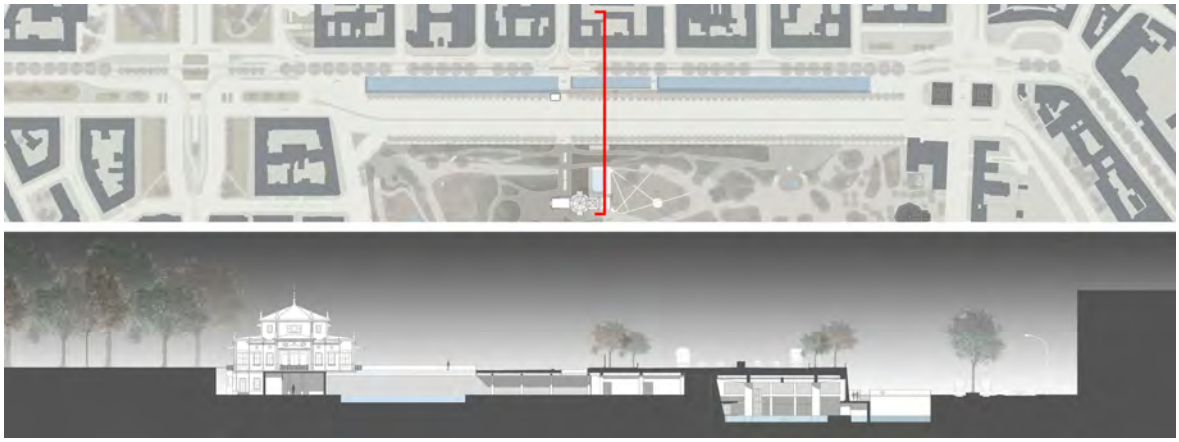


Figure 10: Plan and section (Marchesi - Schiavone, 2013)

5. Conclusion

One of the objectives of this ongoing research is to learn and analyse how a forgotten waterway can give insights into the evolution, form and structure of the City of Milan. At the heart of this research there is the firm belief that in order to understand a city it has to be considered as having undergone over many centuries a complex sedimentation process of developments. Some of which have been achieved while others were not accomplished. The result is that every urban transformation should be considered taking into account both the traces of evidence that are visible and those which are not. Waterways are of primary interest as they have often left the deepest marks and vestiges from which we can understand the past and present.

Canals that are neglected now because of their recent history or hydrological problems have exciting potential. The Redefossi could become a rejuvenated part of Milan's heritage and a focal asset for projects aiming to improve the North East of the city. Some of the projects from the Neoclassical period, that had urban water at their core, represent significant models to guide contemporary urban projects aiming to provide new high quality open spaces that will enhance the quality of life and respond to the contemporary needs of the city.

Endnotes

1. For details about Milan's water system and ongoing contemporary projects see the paper presented at this congress by M. Prusicki, M. Caja, M. Landsberger, M. C. Loi, A. Lorenzi, “A new great project for the ancient water system of 'Milano Città Metropolitana'”. (Track 4, Water Management)

2. Projects by: students: *Candia, Cerisola, Cislaghi, Citterio, Giampietro, Marchesi, Nassivera, Schiavone, Spelta, Villa; professors: M. Prusicki, G. Cislaghi, A. Schiavo, P. Sacerdoti.*

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Urban Renewal as Master Planning Philosophy in China New Urbanization Strategy: Chaonan Desakota as a Case Study

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Abstract

Massive city development and construction have occurred in post-open door China, hundreds of new cities and new towns appeared in China. However, people found an awkward issue in these cities. Ghost city or empty city appears in many parts of the country. Because of the low qualified urbanization, environmental and social problems become more and more. The traditional blue print master plan is so popular across China that every city drew its own time and time in last thirty years. This top-down urban planning philosophy really stimulated China development. But now, this planning philosophy failed in many planning practices.

New urbanization strategy (NUS) is proposed under this background and became one of the hottest words in China. According to NUS, China is undergoing two important processes. One is that urban renewal became the main topic of Chinese urbanization; the other is that private sector became the key driver instead of Top-bottom plan, which mean that urbanization based on new urban area construction is changing to urban regeneration and bottom-up became the main planning approach in this new urban era. Renewal is no longer an urbanization process but a methodology. Instead of traditional blue print plan, renewal philosophy could help the plan more practical. This new planning philosophy eventually forces the government to corporate with or even to rely on the private sector.

The paper examined a very special case of Desakota in Chaonan district, Guangdong Shantou. Desakota is a special phenomenon in the urbanization process Asian countries, as well as an important field of urban studies. Desakota almost contains all typical factors of NUS. In Desakota area, the traditional blueprint master plan shows its weakness in intervention. Therefore, it becomes a big challenge that how to develop a long-term vision, to give reasonable recent actions, to effectively solve the region's economic development, as well as to improve the environment problems in this kind of areas. This paper takes the practice of the master plan of Chaonan, Shantou, trying to integrate the blueprint and action planning, and

sums up the Structural Progressive Renewal (SPR) as the new master plan methodology.

Key Words: Structural Progressive Renewal, Master Planning, New Urbanization Strategy, Desakota, Chaonan

1. Introduction

1.1. New Urbanization Era

After Reform and Open Door Policy, China has experienced more than thirty years' fast development. The urbanization of China also entered the rapid process after 2000s. The mechanism behind this process is so called Urban Growth Theory. Cities in China are changing faster than ever. The size of the cities became larger and larger. Urban growth theory brought to China's rapid development, but the problems behind also became more prominent. As some scholars (Cheng Dalin, Zhang Jingxiang, 2004) mentioned: China is still using government's power, but not civil society, to push high economic growth. This situation will still continue for a while. However, the social problems during urban development by simple or even brutal interference are threatening the future of the city's long-term development.

Before Open Door policy, most of city development was inside the old city. In a certain sense, early urbanization after 1949 in China was inner city re-development. In a long period, China controlled the size of large cities. Even in the law, it is emphasized that large city is forbidden to develop. Small towns were the main urbanization driver in after 1980s. However, after 1990s, a country wide development zone construction appeared in China. Industry parks are so popular that almost every city wants to build its own industry zone. Compared with the old city, the construction cost of new development zone is very low which could really decrease the land trade prize and attract potential investment. Industry zone became the main industrialization power. Later, some of the industry zones even grown up to industry satellite towns, and finally new cities. For example, main city of Guangzhou located in north side of Pearl River before 1990s. With the development of industry in Haizhu District and Panyu County, the boundary of the main city largely increased. So far, Panyu became the district of main city. City sprawled so fast that push the change of the original administration area. Real estate development is taking place of industry. Urban growth machine finally formed. However, urbanization process in China comes to the cross. The low quality urbanization increase the size of city, but a lot of issues appeared, the waster of land, pollution of environment and so on.

More and more people, including the scholars, officers and citizens, realized the Urban

Growth Theory could not support the next stage development in China. A transition of urbanization model should start. Under such a background, China center government proposed the New Urbanization Strategy (NUS).

1.2. Urban renewal become main topic in NUS

One of the key ideas of the NUS is to control size of the city. Local government is forbidden to stimulate local economy by means of land finance. In the past ten year, it is very common in China that the local government used the urban land resource to exchange the investment opportunities from private sector. In order to reduce the cost of the land and purse a short-term reward in local government finance, both local government and developer focused on the new town and new urban area development. The results are the decadence of inner city and emerging of bubble economy. In some region, some cities enlarged twice in such a short time. And in most of Tie 3 or Tie 4 cities, no resident and no enterprise moved to these new urbanized are. Land resource and finance are seriously wasted. In this case, urban renewal is becoming one of the hot topics in urban planning field, and also became the main approach and idea in NUS.

According to the NUS, development should be more human-oriented. In the past thirty years, the importance of economy growth ranks the first. NUS pointed out, human-oriented and fair share are two key words of new policy. Urbanization should guide rational population flow, promote agricultural transfer of population urbanization, and steadily push forward the urban basic public service. Urbanization also need to cover the demands of people, improve life quality, promoting the all-round development of people and social fairness and justice, so that all the people share the outcomes of the modernization construction.

In the next phase of urbanization, a compact city concept is widely accepted. City construction land strictly controlled within 100 square meters per capita. Built-up area population density increased gradually. Green production and green consumption have become the mainstream of the city's economic life. Steadily promote the development of compulsory education, employment services, basic old-age pension, basic medical care and health, affordable housing and other urban basic public services cover all resident population. NUS also emphasize to improve the ecological environment, air quality gradually improved, guarantee the safety of drinking water.

The core of new urbanization is not the development based on sacrifice of agriculture, ecology and environment. Urbanization should focus on farmers, integrate urban and rural development. It also should equalize public services, promote economic and social development, and achieve common prosperity.

1.3. Market become the main driver in NUS

Although China government still plays a leading role in national economy and state-owned companies occupy a large part in economic actives, no one could deny the private sector in China became much stronger than before, especially in the past ten years. Bottom-Up urbanization feature is much more obvious in some developed areas, such as YRD and PRD. According to the trend of social economic development, the ultimate development of the city will give way to entrepreneurs and entrepreneurs form the city (Jessop, Sum, 2000). China center government also proposed the new policy, together with NUS, that market is encouraged to be the key intervention factor in national economy life. Urbanization, urban renewal and urban planning in the traditional Top-Bottom paradigm received a great challenge.

In fact, in PRD and YRD, private sector has been a kind of main power in local urbanization. Compared to the private company, local government appears weak in the economic activities. Reflected in the urban construction, self-organizing space which led by local private sector appears across these areas. It could be predicted that market driven urbanization would take place of traditional intervention mechanism. It is also the time to change the planning paradigm. Otherwise, the blue print could only regard as a vision but not a real plan.

1.4. Urbanization focusing on small scale area in NUS

Just as is mentioned above, urban growth theory will be taken place by new development model. The new town and new urban area rapid growing era ended. With the urbanization step into the urban renewal era, urbanization turns its focus to small scale urbanizing activity. In urban development, urban update of this mode is happening in the community, or more smaller-scale level. The ambitious urban construction will change to some small scale but delicate area.

For example, Shantou is one of China's first five SEZs (Special Economy Zone). The market economy was introduced very early in the Chaozhou-Shantou area. Combined with Mercantilism of Chaoshan's local culture, private economy in the Chaozhou-Shantou area is very powerful. Most of the urbanization activities are small size renewal. Of course, local community and private company play the leading role in most of the construction.

1.5. Challenges of Master Plan in NUS

Own to the development model in recent thirty years, master plan philosophy is economy

growth. The main mechanism of master plan relies on the urban growth machine. Local government set up a partnership with private company. By selling the land development authority in a low price, the city attracts the private investment. Then, the economic activity encourages the city to become larger and larger. However, the logic doesn't work in the NUS era. Master plan need to face new challenges.

- Under the pressure of environment deterioration, traditional low quality industrialization and urbanization could not continue any longer. The method of attracting investment with low environmental and land cost could not last. Master plan should regards environment protection as a key point.
- With the cost increasing, not enough development factors could be shared by such a huge country. What is worse, the high quality investment is always very competitive. The drivers of traditional master plan are changing. Compare to the past thirty years, no more large investment could happen. Middle or small investment with high quality will take place of it.
- Existing urbanized area is large enough or even more than real demands. Limitation of new area development will be the main trend across the country. Urban renewal will take place of new town development. The main areas of master plan are changing.
- Market will play a leading role in NUS. Master plan should fully consider the demands of private sector. In the case, master plan could be implemented in the real world.

2. Desakota: a typical case in urban renewal and a difficult one in NUS

2.1. Desakota and Desakota in China

Desakota model theory is defined as early as 1985 by the Canadian scholar McGee (1991). He studied the Asian developing countries and regions, such as Java, Indonesia, Thailand, India, China, and Taiwan's economic core area. Then, he proposed a new urbanization theory – Desakota, which is similar to western country metropolitan areas but with a totally different development background. The main features includes relatively dense population, farmers and decentralized management style rice cultivation as traditional industries; the original center of the city outward diffusion of industrial development in rural areas and non-agricultural industries formed; variety of land use for agriculture and non-agriculture staggered layout; persons and goods within the region has a strong fluidity and mobility; on the management of non- the formal sector is widespread.

Based on part of the McGee's points, Ginsburg (1991) pointed out that the region Guangzhou,

Shenzhen and Hong Kong as the center consolidation area (PRD) will become China's regional representative Desakota case. Zhou Yixing (1991) thought McGee called Desakota specific performance in China is the form of metropolitan interlocking regions, which are integrated by many cities and regional areas which maintain close social and economic ties with neighboring regions. Xue Fengxuan, Hong Kong scholar, studied past 15 years urbanization in PRD. He think although PRD regional characteristics consistent with McGee's Desakota model in many ways, there are still a significant differences in population flow characteristics, power and other aspects (Xue Fengxuan, Yang, 1997; Xue Fengxuan, Cai, 1998).

2.2. Research progress of Desakota

In the field of planning practice, the study on Desakota region is still in theoretical discussion stage, and more focused on the study of urban and rural integrated development. Yuan Qifeng (2005) researched a typical Desakota region in Nanhai eastern area in Guangdong. He pointed out that the urban and rural integration strategy may hinder the level and quality of urbanization. Li Chen, Fan Hua (2013) explores the urban core of the Shantou City. They studied the Desakota encountering the development of urban and rural areas "Space - economic" double lock and other issues. They summarized the status of the spatial characteristics of the region, and from an integrated way, explore the development of dynamic and spatial patterns of the three aspects of urban and rural spatial co-ordinate the path of such areas (Hoang Huu Phe, Patrick Wakely, 2000)

In the planning practices of Chinese Desakota region, some of them have realized the characteristics and dynamic mechanism of Desakota areas, and proposed some approaches initially, but, in the planning methodology and specific planning organization, they still ultimately return to the traditional blueprint planning model. In these studies, they ignored the Desakota regional markets led economic development character, powerful and ubiquitous private informal sector, land use and other typical features of highly promiscuous, resulting in the implementation of traditional planning. Finally, the plan ultimately failed

2.3. Why select Desakota as a typical case

Obviously, Desakota is a very special model in NUS process. It has at least two features. Firstly, Desakota area almost contains all reality problems in NUS. Maybe it is one of the most difficult models in NUS study. Secondly, Desakota has several key characters which are similar to NUS environment assumption, which include limitation of land use, urban renewal as major development model, private sector is very strong.

3. Key issues of Desakota in NUS

3.1. Positioning dilemma: Water became the biggest problem, but not the identity

Chaonan used to be named as water city in Chaoshan region. The water body in Chaonan is very rich and landscape there is very impressive even before 1980s. When we interviewed the local resident, they told us they could travel in boat and swim in rivers when they were younger. However, the water smells terrible now.

Because of the low qualified industrialization, most of the water was polluted. Lianjiang River, the biggest water body in Chaonan region, is one of the dirtiest water in China. There is a town called Guiyu near this river. The major industry of Guiyu is dispose of IT rubbish from all over the world. The primary treatment process made the water quality worse and worse.

3.2. Special dilemma: highly developed urban and rural area, land use totally in a mess

Space fragmentation is very common in Desakota area. Not only severely disordered urban construction land development, but also urban and rural land use is out of control. It is very hard to effectively distinguish between what is real legal construction land. The extremely strong local society power makes government management passive in these areas. This brings a considerable challenge to urban planning, especially master plan.

By analyzing Chaonan new construction land change between 2003 and 2012, it is obviously that the increased rural settlements essentially sprawl from original urban and rural settlements in rural villages (Fig.1). The original continue spread. The land of towns and villages, each village and rural area connected with each other land use extensive, industrial and residential space lack of a clear structure of land use

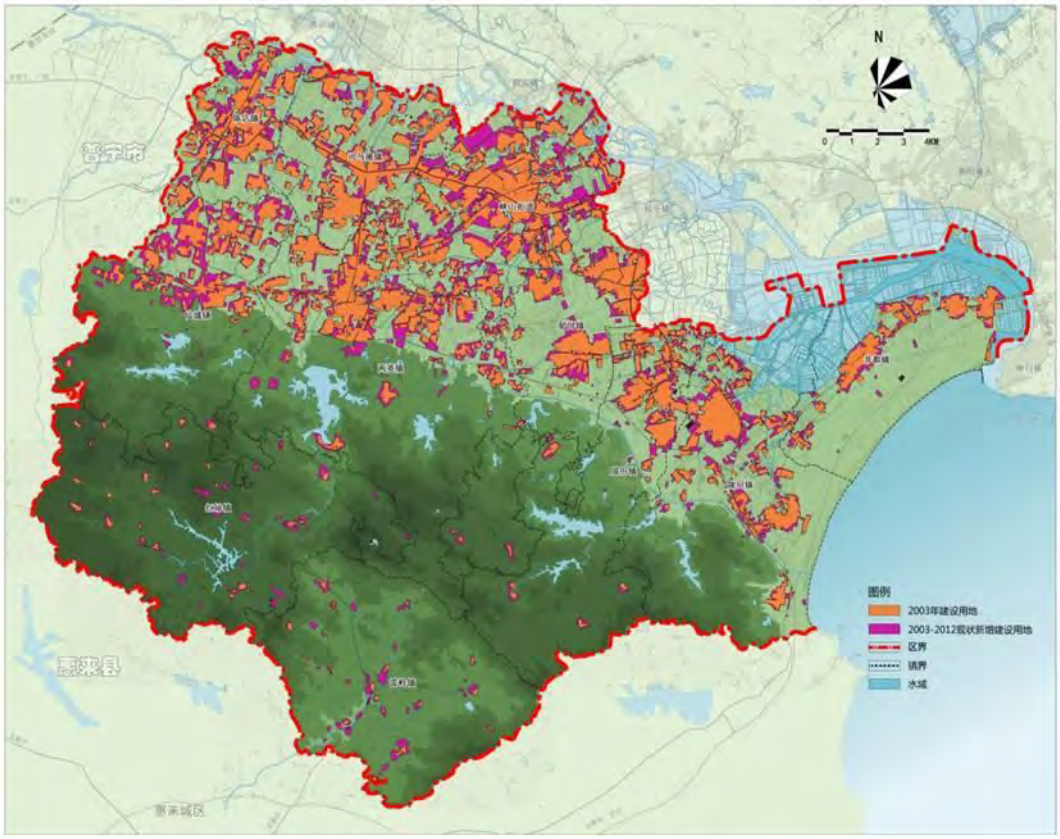


Figure 1, spatial distribution change of new construction area (2003-2012)

3.3. Industry dilemma: fragmented, low-level industrialization

At the beginning of reform and opening door policy, flexible organizational model of export-oriented private economy is indeed greatly facilitated the economy development in YRD and PRD. However, a general increase in labor costs, the global shift to low-end manufacturing to start large-scale lower-cost countries and regions today, Desakota fall into a common industry profit margins continue to be squeezed traditional labor-intensive, the market is preempted, the transition upgrade difficult low-level industrial lock dilemma.

In Chaonan, for example, after 30 years' development, the manufacture in the private economy, such as textile and clothing, household chemicals, stationery, plastic products and other industries, is still missing and famous brands competitive products. Most of the manufactures still use the OEM model. Industrial level is still at the low end of the industry chain (Tab. 1). Regarding the services sector, the development has been very weak. In 2011, Chaonan service sector accounted for 35 percent, while the highest town - XiaShan reached more than 50%. Compared with 2003, the proportion of the region's service industry only improved 5 percentage

Table 1 Chaonan major industry output and the number of enterprises (2010) Unit: million home,%

Category	Textile	Household chemicals	Stationery	Printing and Packaging	Plastic Products	Electronic appliances	The region's industrial
Output value	274.27	45.88	21.82	13.16	45.49	16.8	484.1
The number of enterprises	2788	219	97	154	427	127	4366
（%）	63.86	5.02	2.2	3.53	9.78	2.9	100

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3.4. Public Service predicament: serious lack of facilities, service capabilities shortage

Shortage of public services is another common problem in Desakota region. Local government is in a weak situation. City and district government final is always in an embarrassing situation. In steady, town and village government are more powerful. Therefore, the education, health care, environmental protection and other public service facilities construction rely on the town and village level administrative units. On the one hand, this situation resulted in service fragmented and a large number of low-level redundant constructions, low levels of basic public services; On the other hand, it is difficult to achieve a city scale and standards of public service supply.

This dilemma is particularly happens in the Chaonan. Cultural and recreational facilities for example, the total amount of district level libraries, galleries and other cultural institutions only two in Chaonan, the rest are village level. In medical facilities aspect, the average hospital bed in district is only 1.2 beds per thousand capitals, and the same number in center town is only 2.5 per thousand capitals. This statistics is far below the Shantou City 5 per thousand capitals standard (Fig.2).

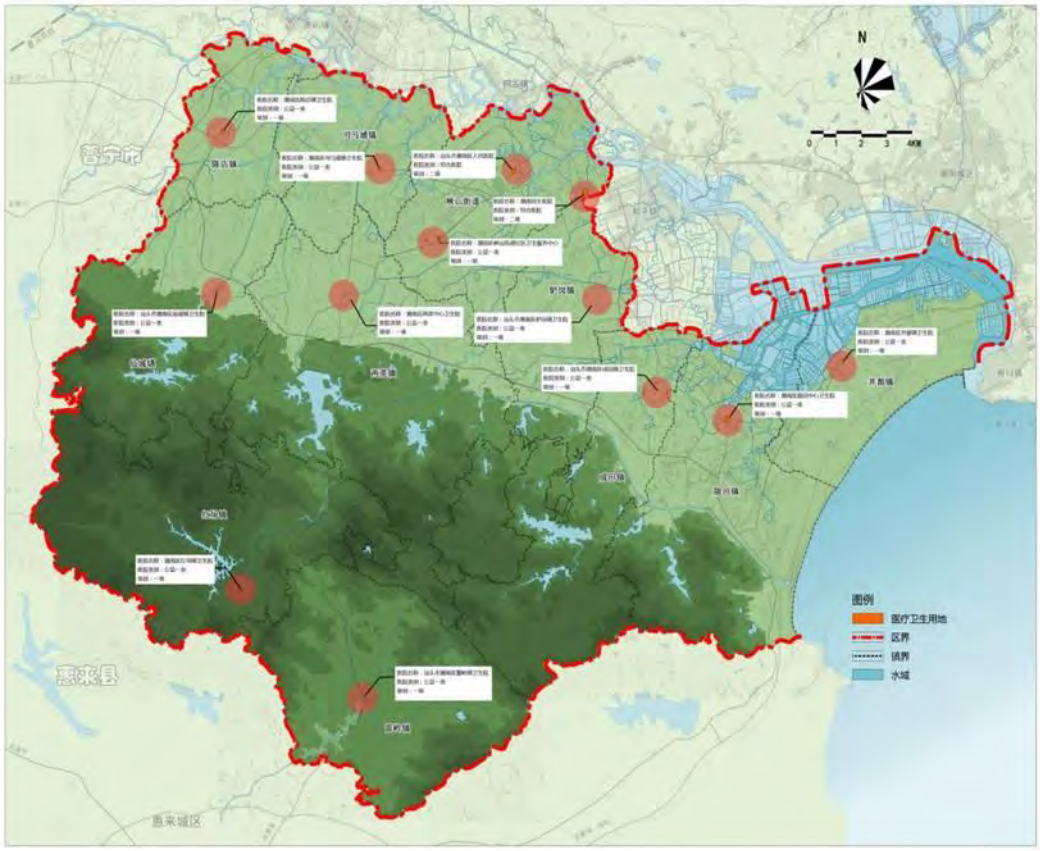


Figure 2 Distribution of medical facilities in Chaonan

4. Structural Progressive Renewal (SPR): innovation of master plan methodology

4.1. Traditional master plan methodology could not solve the current Issues

Traditional master plan methodology focuses on development (Fig.3). It relies on one long term blue print to control the urban and region development. It is very hard for traditional plan to solve the new problems of space organization, industrial development

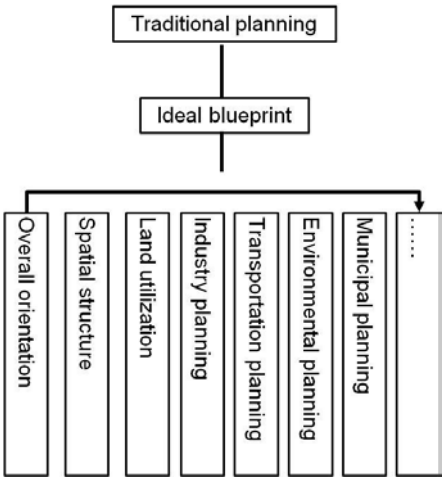


Figure 3 Framework of traditional master plan methodology

4.2. SPR, renewal as planning philosophy

SPR is a methodology innovation of the traditional master plan approach, especially under the background of new urbanization issues. SPR abandon the traditional master plan ultimate blueprint and large project driven model. With full respect for the decisive role of the market in the economic development, SPR regards renewal progress as an evolutional process in the city and region. On the one hand, SPR focuses on structural plan in order to ensure long-term vision of urban and rural space; on the other hand, it also emphasizes the action plan. A number of strategic projects actions are proposed in the short term plan. Based on these two main approaches, SPR makes the urban renewal as planning philosophy, and turn the renewal as a way to solve the NUS challenges (Fig.4).

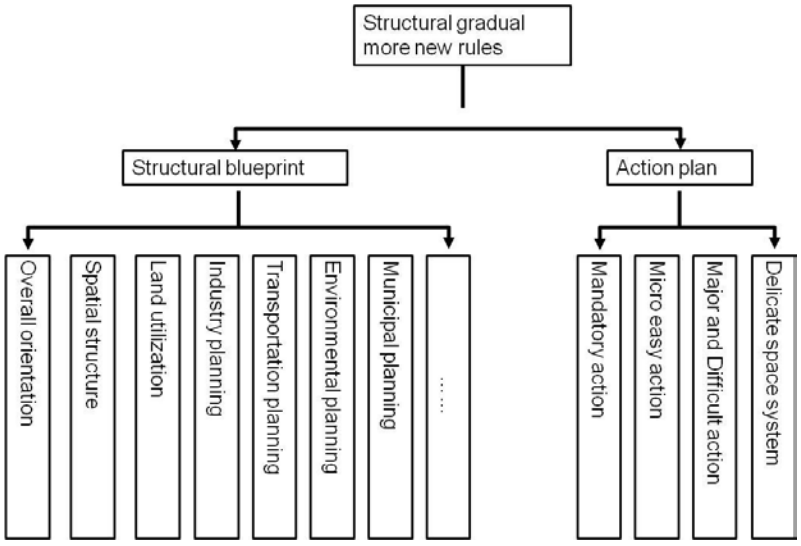


Figure 4 SPR framework

5. SPR in Chaonan master plan project

5.1. Structural plan: core structure of long-term urban and rural development vision

Structural plan is the key to SPR. In the long-term master plan, it is very important to determine the core structure for the whole area. The core structure contains a serious of structure plan, including spatial structure, green space structure, and industry structure and so on. In the structure plan, the long term strategy, the main development framework and the major protected areas are fixed.

- *Spatial structure: eco-urbanized metropolis network in the region*

The spatial structure of Chaonan district contains two development corridors and one metropolis network. Two development corridors include northern Lianjiang river plain development corridor and the eastern coastal development corridor. One metropolis network

refers a regional eco-urbanized area which connects to Shantou City. The network in Chaonan includes one center town, ten normal towns and a number of development units, such as village, resort and other development cluster. The metropolis is based on the vast rural area, which includes the south hilly area, farming are and ecologic protected area (Fig.5, Fig.6).

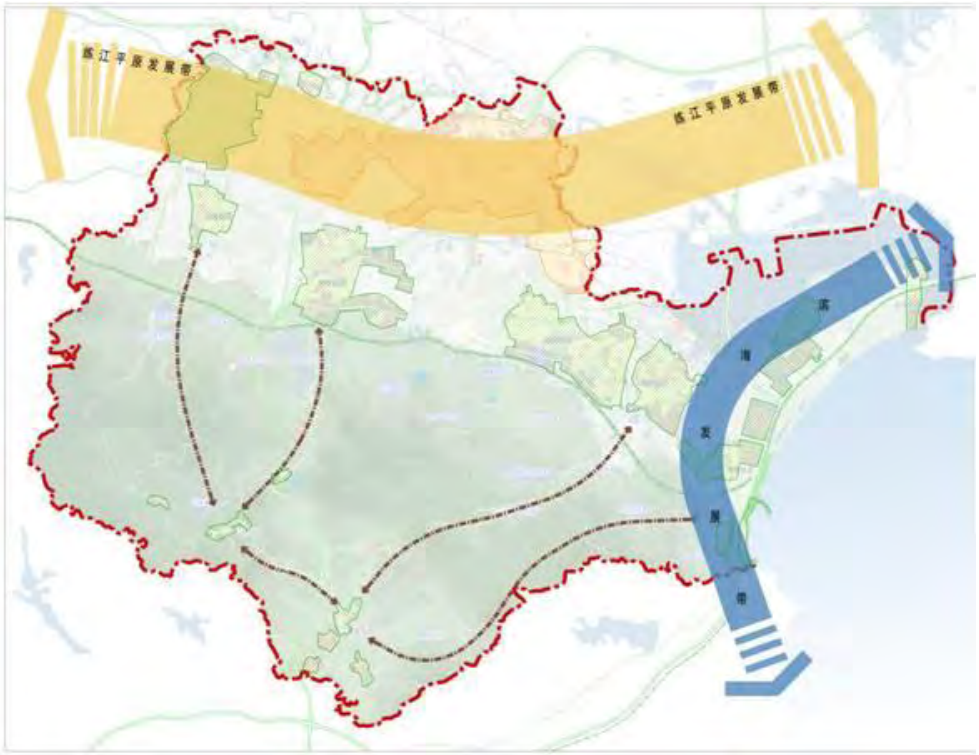


Figure 5 the regional spatial structure plan

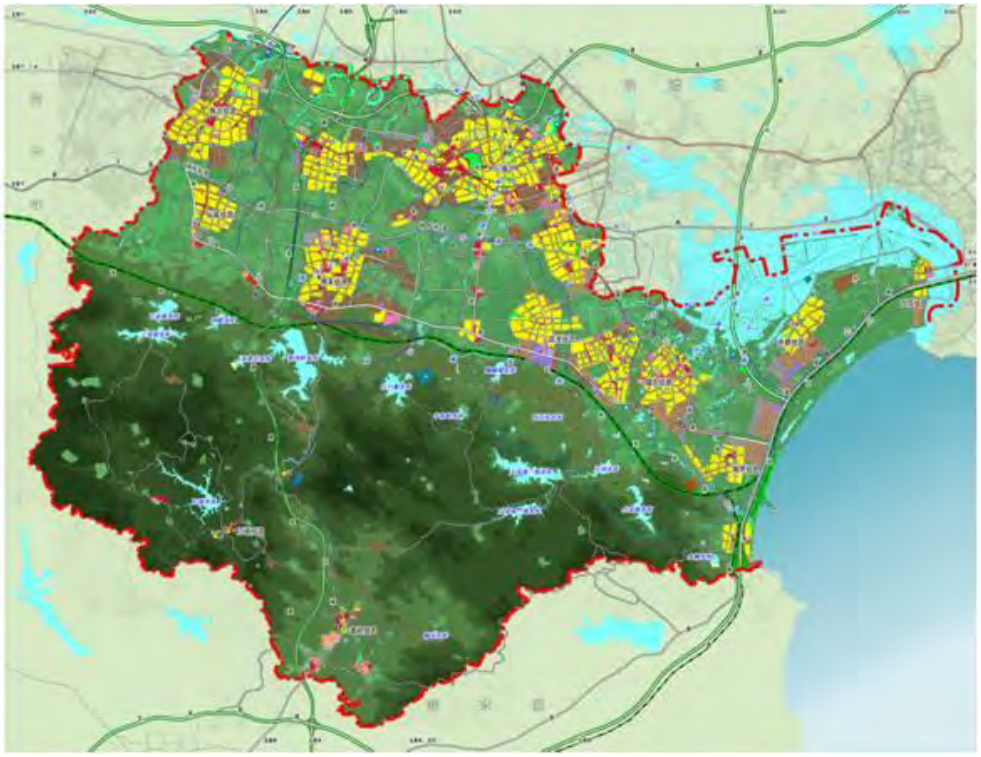


Figure 6 the regional land-use plan

- *Water system structure: renewal of water townscape*

Chaonan used to be water town in Shantou City decades of years ago. The sprawl of the towns badly damaged the original water system. According to the water system structure plan, three main natural rivers would be restored to connect the south hilly area and Lianjiang River and another two natural river would be restored to connect the Lianjiang River and sea (Fig. 9). On the one hand, keep these natural rivers could solve drains in case of heavy rains; on the other hand these waterways will also serve the residence for green connection and recreation routes, connection for increasing the biodiversity and harvesting and buffering water along the system.

- *Transport Structure: smart transport network*

In transport structure, in order to connect regional transportation facilities, highway, expressway, as well as passenger and cargo transportation and other regional transportation infrastructure are planned. In addition, large regional transport infrastructure of railways, highways, etc. are encouraged to be shared in the region to improve accessibility between Chaonan and other surrounding cities and towns.

According to the Desakota feature, most of the infrastructures fragment across the district. Therefore, a smart planning of road system is need. In between the central town and its inner area, urban road traffic system is planned to achieve convenient interface between the core

areas and other towns or clusters. Transportation services are also planned to improve to support the core areas. Combined with urban renewal, transport structure plan also fully exploits the potential use of existing road reconstruction, improve microcirculation system of road (Fig.7)



Figure 7 Chaonan Comprehensive Transport Plan

- *Industry structure: industrial system rooted in bottom-up economy form*

The organization economy activity in Chaonan is rooted in the local commercial culture. Almost all of the local economy is self-organizing. Private sector is very powerful in Chaonan or even in Chaozhou-Shantou region. Therefore, it is impossible to plan a new industry system here. A smart way is to enhance the quality of the existing industry and encourage inducing the promising one (Fig.8).

Firstly, guide existing enterprises to expand their products into home textile products, textile products and other related industrial direction. Based on the traditional branding, guide manufacture extends to the design, development, branding, marketing and other high-end fields in the industry chain. Thus help the local industry integrate the production, processing, improve industrial competitiveness and enhance independent innovation capability.

Secondly, develop the modern service sector. Besides enhancing the quality of living type service, the producer services should be highly encouraged. The plan of industry structure help guide the development of R & D, marketing, service and other high-end expand.

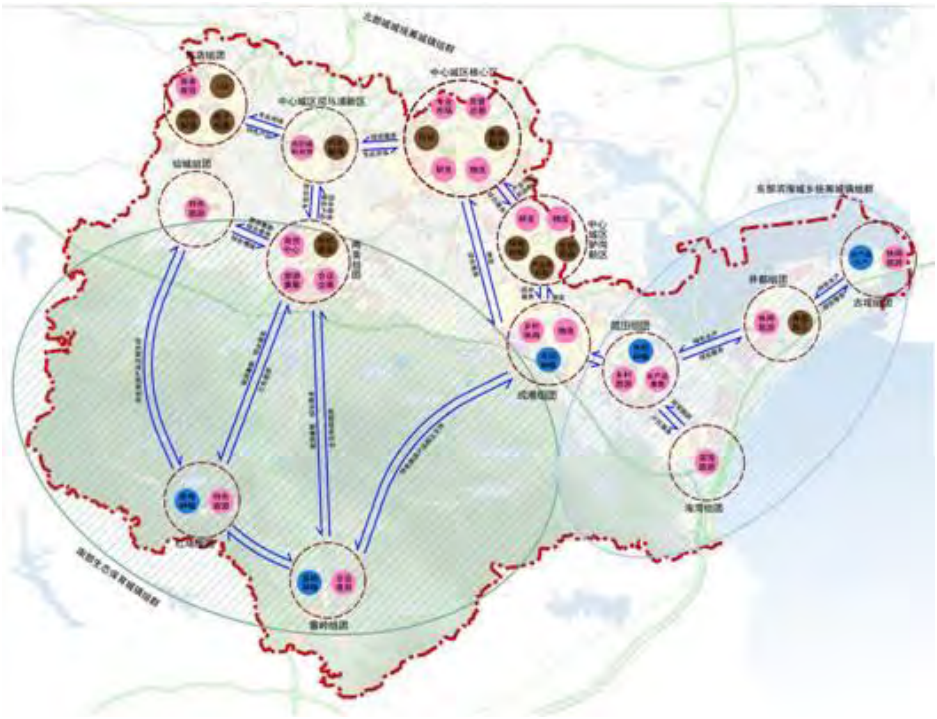


Figure 8 Chaonan industrial arrangement plan

- *Green space structure: regional greenbelt system under the framework of the agricultural landscape*

The principle of green space structure is to fully respect the existing ecological texture, identify the main characters of Lianjiang river plains, south hilly area and the eastern coastal regions. Based on which, the green space structure plan would set up regional ecological patterns coincide with existing texture to form and optimize the basic landscape structure, including hill, water, city, fields, forest and sea.

The overall ecological patterns strategically establish the regional ecological structure. The structure includes regional ecological green, urban green space and agricultural green, so called pan-green land system. Regional ecological green contains regional ecological corridors, regional parks. Urban green space contains city parks, street green, park and square, protective green. Agriculture green contains rural areas, woods and urban agriculture, etc (Fig.9)



Figure 9 Regional green space system plan

5.2. Strategic Action Plan: an evolutional renewal approach based on the core projects

Strategic action plan is based on structure plan. All of the actions are carefully selected to induce the development. Specifically, the strategic action plan includes mandatory project action, delicate space development, micro and easy project action and significant difficulty project action

- *Mandatory project action*

Through a series of mandatory project actions, the whole district basic ecology framework is ensured. Major projects actions include: firstly, safe food production base plan. The base covers most of the eastern costal area, which is also the traditional agriculture area. Secondly, regional water network recovery plan. The plan divides the regional water system into several protected levels, including drinking water source protected areas, and public landscape protected area, pollution control area, and natural ecological water protected area, water conservation areas and productive shoreline. Thirdly, south hilly area recovery development plan.

Water body renewal is one of the most important actions. The action focus on two aspects: one is to enhance the quality of the water; the other is to recover the network of the water. Several actions are planned. First, strengthen the propaganda of environmental protection, urged residents to change the bad habits, improve the living water pollution phenomenon. Each district should actively enhance the pond, small canals and other sewage polluted point. Second, focus

on strengthening the practicing river pollution control. The river training management project to project provincial, city, district planning emphasizes the coordination management. Third, strengthen the protection of the coastline. Increase the construction of waste treatment station, avoid coastal become garbage landfill. Fourth, to ensure the absolute safety of Nanshan drinking water source. Any development Nanshan should make no pollution without sacrificing the environment.

- *Delicate space development*

Delicate space is a kind of tiny project. This type of project could act as a catalyst to stimulate the surrounding area development. Delicate spaces include urban and rural settlement type, industry type, natural ecological type and historic type ddelicate space (Fig.10)

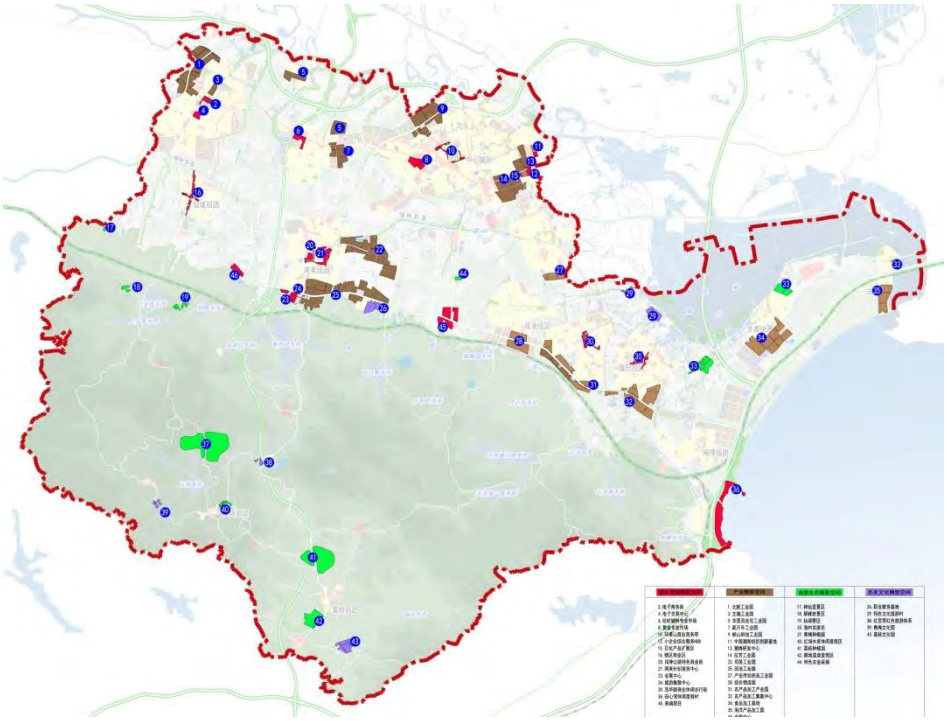


Figure 10 Delicate space arrangement plan

- *Micro and easy project action*

Micro and easy project refers to some small action which could achieve a practical effect. This type of action includes traffic-optimized action, smart growth of industry, remodeling texture space and making up public service. Traffic-optimized action, for example, adopts the relative modest cost to enhance the accessibility (Fig.11,12).

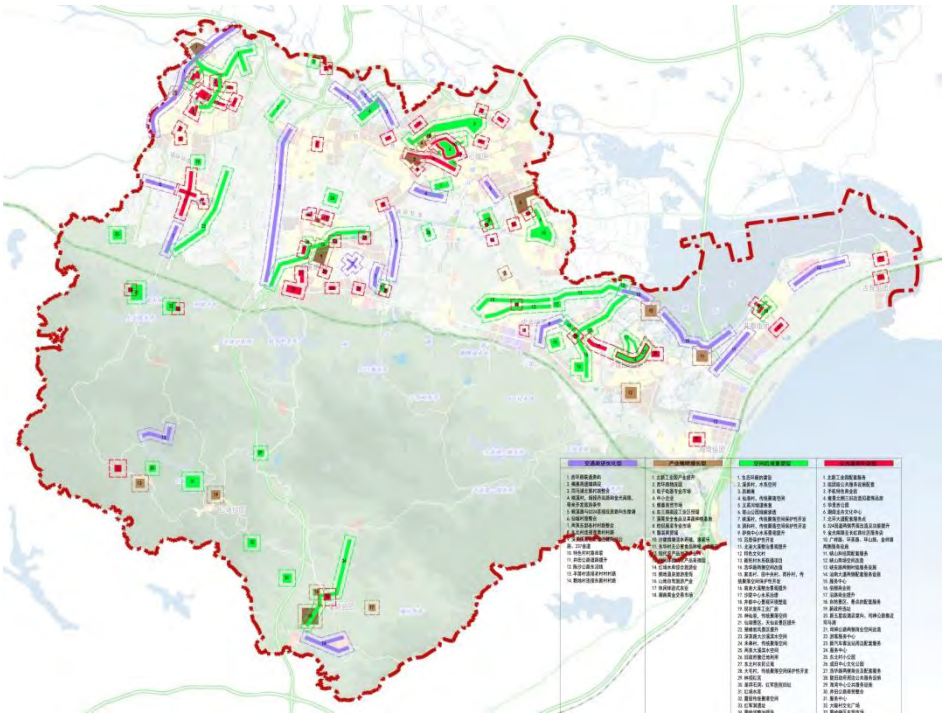


Figure 11 micro and easy projects action plans

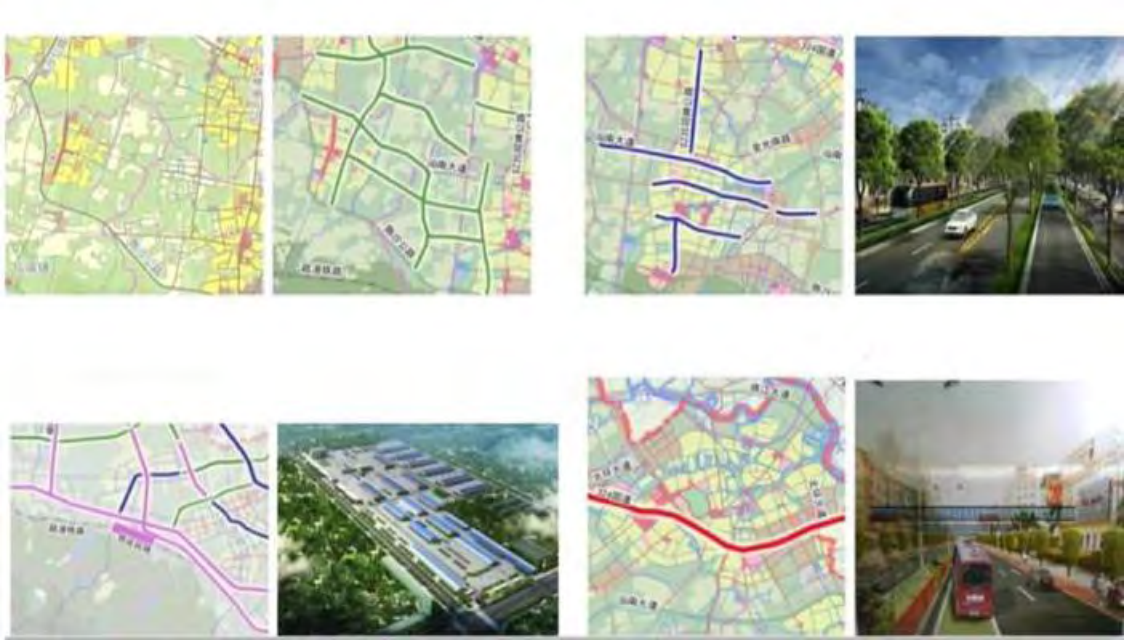


Figure 12 transport micro and easy action

- *Significant difficult project action*

This type of project is significant for Chaonan development. However, it is also hard to realize. Normally, this type of project could not be achieved by Chaonan alone. It could be carried out by regional level, for example, Shantou City or Guangdong Province.

Significant difficult project include Lianjiang river recovery, Xiashan and Liangying river recovery. Shannan road, G324 integrated reform plan and Guang'ao Port Railway infrastructure project are all significant difficult project. For this type of project, the action plan

for the project and consider, leave enough development space in order to ensure that the appropriate time in the future operability of the project and a vision for coherence (Fig.13).

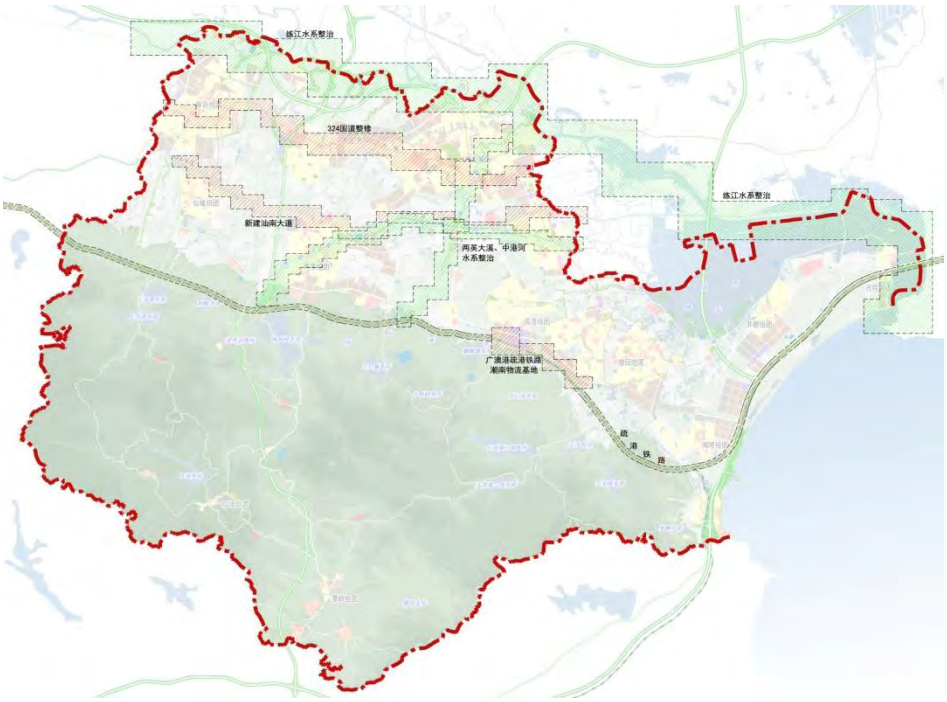


Figure 13 Significant difficulty projects action plan

6. Summary: SPR method application and prospective

At present, China's economic and social development is experiencing a transition period. Under this background, traditional master urban planning methods, inherited from the planned economy era, could not fit the nowadays NUS situation.

SPR was first introduced as a new method of master plan in Chaonan. It has achieved good results in planning practice. Integration of the structure plan and action plan, and make the urban renewal as planning philosophy not only provides a new way of thinking for the master plan, but also for the master plan in the future of the market becoming leading role.

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The Research of Spatial Form about Waterfront of Tongli Historic Town in South of Yangtze River

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Abstract:

The waterfront space of Tongli historic town in south of Yangtze River reflects the most significant landscape characteristic of historic water towns. Based on the research of the waterfront land parcels, building texture and spatial sequence, this paper points out there are certain rules on the number of waterfront land parcels per one hundred meters and the acreage of them. The shapes of waterfront land parcels are mostly rectangular. The building textures in waterfront land parcels are mostly enclosed courtyard and the full occupation of small land parcels. The buildings are always facing the river. Meanwhile, the height, width and depth of the buildings represent certain rules. This paper also finds out there are certain rules on the width of waterfront streets and the aspect ratio of adjacent buildings in every spatial sequence type. These certain rules can be used to guide the conservation and development practice of Tongli historic town.

1. Introduction

Simple and unsophisticated natural landscape of small bridges, running water, and household around in the historic water towns in south of Yangtze River have already been well-known in the world. Undoubtedly, running water is fundamental to the historic water towns (Zhang, 2002) and the place where the landscape characteristic of historic water towns can most likely be reflected and perceived is the waterfront space, which carries significant value in the space construction of historic water towns.

Tongli historical town is generally acknowledged as one of the six most famous historic water towns in south of Yangtze River. As a more complete conservation one, Tongli historical town has particularly prominent landscape characteristic. However, in the conservation and development process, as parts of the prominent landscape, some waterfront space in Tongli historic town has been destroyed. Furthermore, although the government and developers want to protect the waterfront space now, they just don't know how to manage and construct in the development and renewal process. As a result, it is essential to explore the value of the waterfront space in Tongli historic town and inherit these values in the conservation and development practice.

2. The Overview of Tongli Historic Town

Tongli historic town is located in the north of Wujiang, Jiangsu province and it's coordinates is 120 ° 44 ' E, 31 ° 09' N. Situated near the Taihu Lake and surrounded by rivers and lakes, Tongli historic town is a typical water town in south of Yangtze River with the area of about 58 hectares.

The construction of Tongli historic town was originally started in the early Northern Song Dynasty (Zhou, 2007). In Yuan and Ming dynasties, the township gradually moved south to the historic town's current address where the rivers were more intensive. Due to its unique

geographical environment, traffic mode with outside was mainly by boats. As a result, Tongli was rarely under the threat of war. In the early Qing Dynasty, with the rapid growth of the population, the township began further expansion and some silted rivers were turned to land. In the mid-Qing Dynasty, the network of the rivers in the township was basically fixed. During the late Qing Dynasty and the National Republic of China, the slug township with rich space layers was formed, which was developed in accordance with the river network (Yang, 2001). (Fig.1)

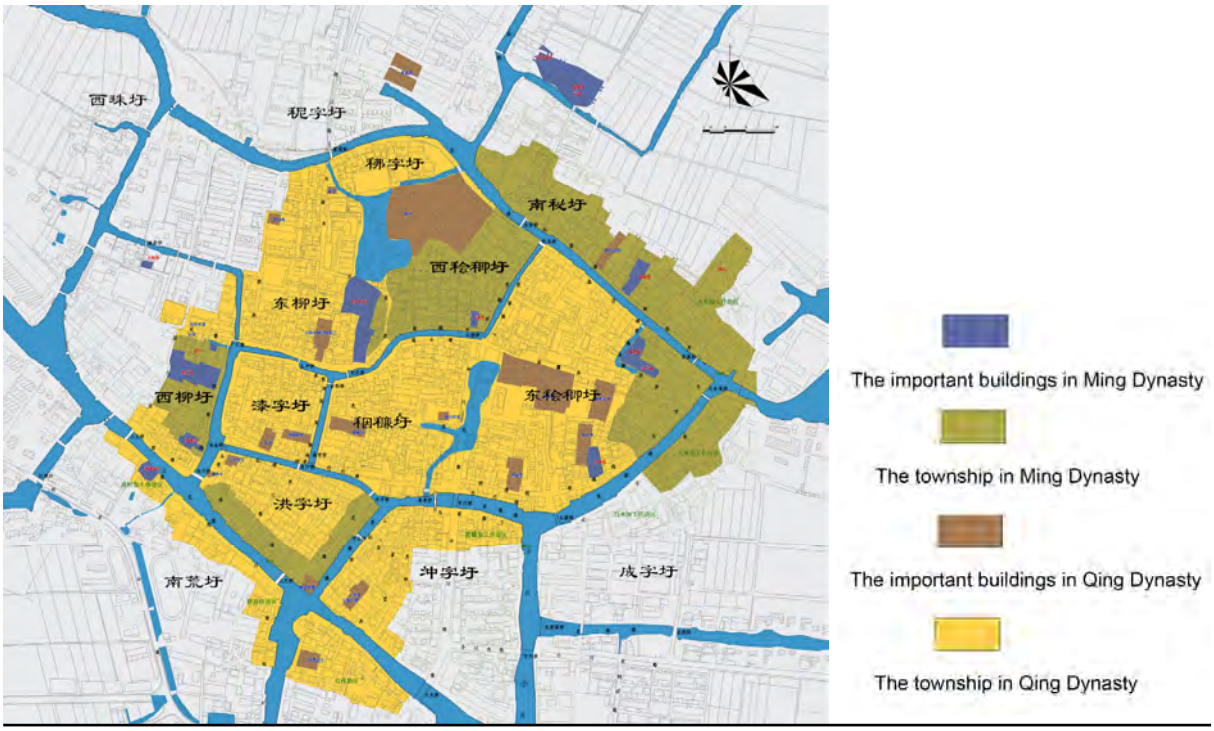


Figure 1: The township of Tongli in Ming and Qing dynasties
Source: The 2011's Conservation Plan on Historical and Cultural Town of Tongli

3. The Review of Related Research

Until now, most of the researches on spatial form about waterfront of historic towns in south of Yangtze River are qualitative analysis, and then classified the space into several categories. Duan et al. (2002) researched the waterfront of Tongli historic town through the cross-section and spatial sequence analysis, and classified the waterfront into six types. Using the same method, Ji (2008) researched the waterfront of historic water towns in south of Yangtze River and pointed out several kinds of spatial sections and three types of construct modes. Based on these researches, Jin (2008) studied exterior space of waterfront architecture in historic water towns in the north area of Zhejiang province in China, classified the space into two original types and discussed its natural contact landscape. Feng (2013) placed the river as the reference, studied whether the buildings on both sides were directly on the river and then according to the conclusions, Feng classified the waterfront of Tongli historic town into three types.

Although these researches are detailed and convincing, they are ineffective to guide the practice. Many construction projects which are in line with the conclusions have a negative impact to the waterfront space. Taking the large commercial district located in the southwest of the historic town as an example (Fig.2), the waterfront of the district can be classified as Mode C (River-Street-Shop-Street-Shop) according to the classification system proposed by Duan et al. (2002), but the spatial form has been very different from the traditional waterfront of the historic town and it is hard to integrate the spatial form into the traditional spatial form (Fig.3).



Figure 2: The satellite image of a commercial district located in the southwest of Tongli historic town

Source: Google map, © 2014 Google



Figure 3: The different spatial form of the commercial district

Source: Photographed by the author

4. The Study Area and Method

4.1 The Study Area

As some waterfront space in Tongli historic town has been destroyed, in order to explore the value of the waterfront space in Tongli historic town, it is essential to select the waterfront space which keeps the traditional characteristics. In the 2011's Conservation Plan on Historical and Cultural Town of Tongli, the experts from Shanghai Tongji Urban planning and Design Institute and the Tongli Town Government evaluated the rivers which had more concentrated historic buildings along them, whose spatial scale was appropriate and whose local traditional landscape features were significant as traditional landscape rivers. Meanwhile, according to the current situation and historical evolution, they also delineated the core conservation area of the historic town, in which the traditional landscape was more intact. (Fig.4). This study area of this paper is the waterfront space on both sides of the traditional landscape rivers, except for the space which is not in the core conservation area of the historic town. As a result, the study area maintains significant traditional characteristics of the waterfront space in Tongli historic town.

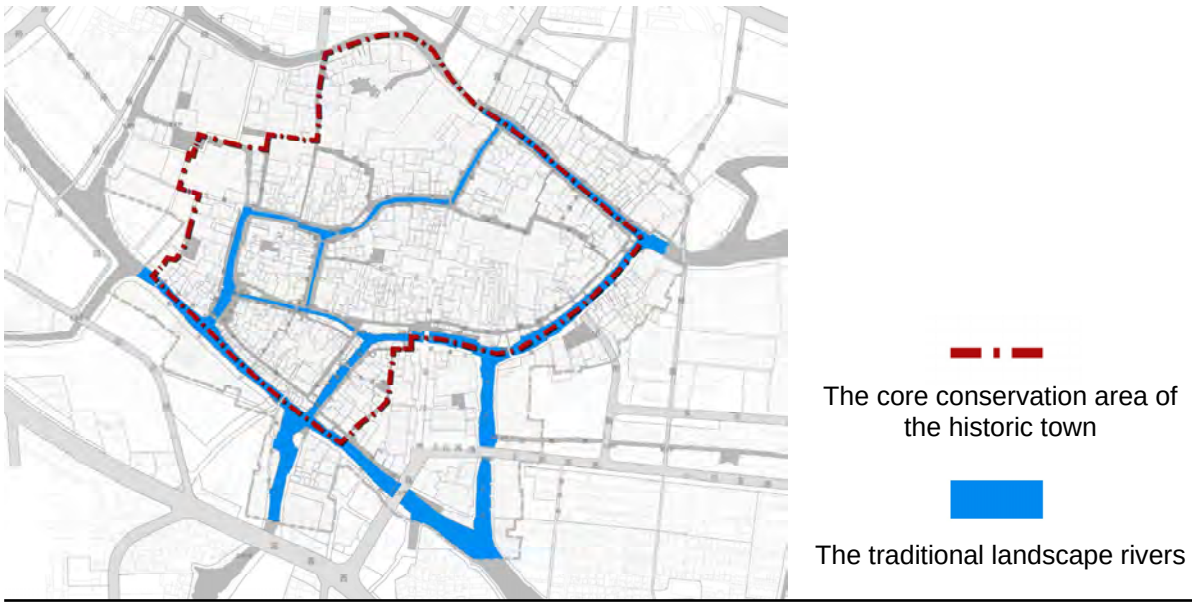


Figure 4: The traditional landscape rivers and the core conservation area of the historic town

Source: The 2011's Conservation Plan on Historical and Cultural Town of Tongli

4.2 The Study Method

The studies of Urban Morphology hold the opinion that the smallest unit of the city is a single land parcel and the buildings in it (Duan, 2009). The studies also consider the characteristics of the units define the outlook and scale of the urban spatial form (Duan, 2009). As a result, this paper uses the methods of morphology and typology to research the waterfront land parcels and the buildings in them.

Given the methods which are qualitative analysis and then classify the space into several categories are ineffective to guide the conservation and development of the historic town, this paper combines quantitative and qualitative analysis to explore the inherent characteristics of the waterfront space by measuring and statistics. In addition to the study of the waterfront land parcels and the buildings in them, this paper also includes a quantitative study of the waterfront spatial sequence in order to supplement the above-mentioned qualitative analysis.

5. The Spatial Characteristics of Waterfront Land Parcels

5.1 The Selection of Waterfront Land Parcels for the Studies

In order to fully reveal the characteristics of the waterfront space, this paper selects the land parcels which have a significant impact on the waterfront spatial form in the study of the land parcels' shapes and acreage. The selected land parcels include the ones on the river, the ones directly next to the river and the ones behind them which become important parts of waterfront space as the buildings in them are higher than the buildings in the land parcels in front of them.

When studying the number of waterfront land parcels per one hundred meters, this paper selects the land parcels on the river and directly next to the river, as the measuring and statistics objects are the waterfront interfaces of those land parcels in this study.

5.2 The Shapes of Waterfront Land Parcels

Depending on the shape feature, the waterfront land parcels can be divided into five categories: the shape of category A is similar to a rectangle (the aspect ratio is obviously not equal to 1), the shape of category B is similar to a square, the shape of category C is similar to"⌊", the shape of category C is similar to "⊥" and category E is for other complex shapes (Fig.5). After counting the numbers of every category, it can be seen from the statistical results that the shapes of the waterfront land parcels are mainly belong to A and B. The two categories account for 84% (Fig.5). The result reflects the basic shape of the waterfront land parcels is rectangle. Besides A and B, the numbers of C and D also occupy a certain proportion. "⌊" and "⊥" can be understood as the combination of rectangles, so they have the similar characteristics with rectangles. As a result, the shapes of waterfront land parcels reflect the significant rectangular characteristics.

5.3 The Number of Waterfront Land Parcels per One Hundred Meters

Starting from the first land parcel at one end of a river, along the river bank, the number of land parcels within 100 meters can be counted out. And then starting from the second land parcel next to the first one, another number of land parcels within 100 meters along the river bank can be obtained. After all the river banks are completed, the statistical results will come out. Seen from the results, the minimum number is 4, while the maximum is 18. The numbers are mainly between 5 to15 (Fig.6), which reflects the small-scale feature of the waterfront space. Arranging the numbers according to the measuring sequence, it can be seen that the

larger number segments and the smaller number segments are alternating, which reflects the waterfront land parcels are alternating between dense and sparse (Fig.7).

Another statistical indicator related to the number of land parcels within 100 meters is the waterfront interfaces' lengths of waterfront land parcels. According to the statistics, the waterfront interfaces less than 10 meters account for 66% and the ones account for 29% between10 to 20. Most waterfront interfaces are within 20m (Fig.8). The maximum length is 84m, but this land parcel is located at the corner and intersection of rivers, as a result, its impact on the waterfront spatial form is largely weakened (Fig.9).

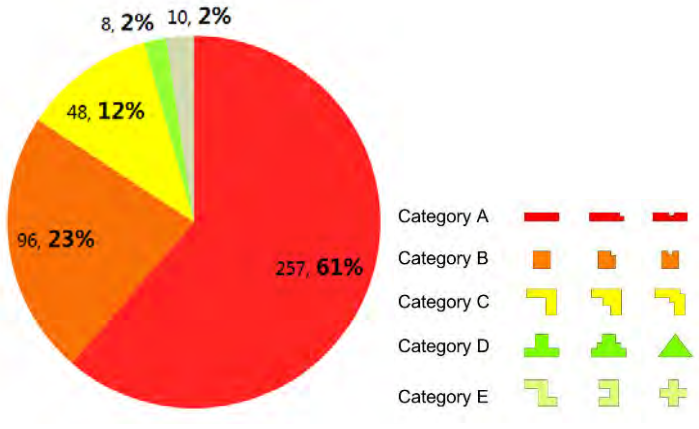


Figure 5: The statistics *for waterfront land parcels shapes*

Source: Drawn by the author

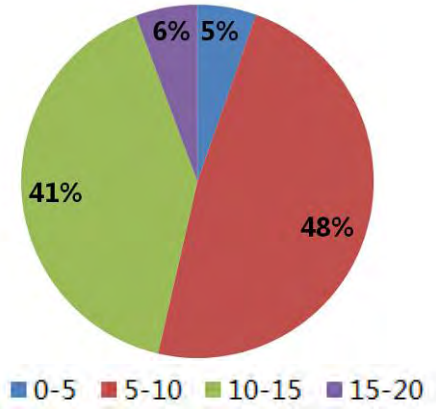


Figure 6: The statistics *for the number of waterfront land parcels per 100m*

Source: Drawn by the author

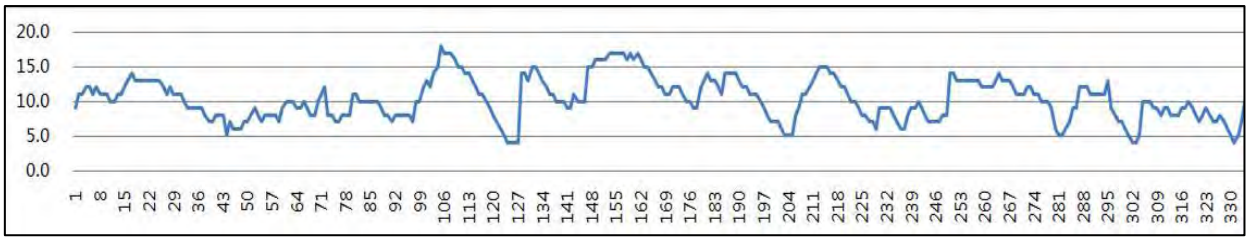


Figure 7: The Arrangement of the land parcel numbers per 100m according to the measuring sequence

Source: Drawn by the author

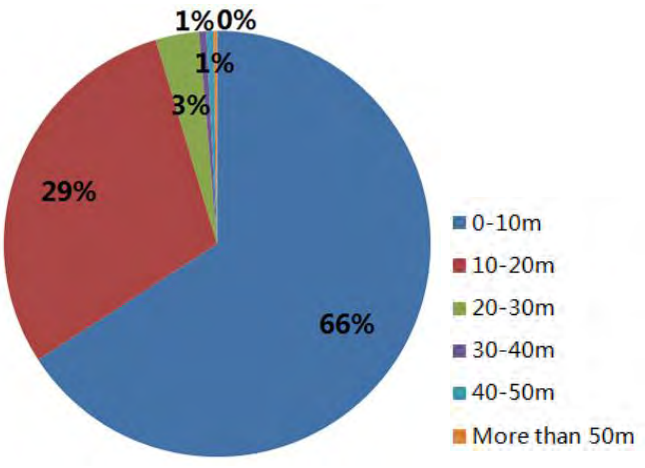


Figure 8: The statistics *for the waterfront interfaces' lengths of waterfront land parcels*

Source: Drawn by the author



Figure 9: The land parcel with the maximum waterfront interface length

Source: Drawn and photographed by the author

5.4 The Acreage of Waterfront Land Parcels

After measurement, the minimum acreage is 5.15 m^2, while the maximum is 2107.2 m^2. According to the statistics, most of the land parcels acreage is less than 300 m^2 (0-100 accounted for 54%, 100-200 accounted for 22 %, 200-300 accounted for 11%). Small land parcels become the main elements of the waterfront spatial form (Fig.10). With further increase in land acreage, the number dropped sharply. There are also large land parcels around 2000 m2, becoming the landmark of the waterfront space.

Such a situation may arise: one land parcel with large acreage replaces many small land parcels whose acreage belongs to most ranges divided above. In this situation, the proportion of each range may change little, but the waterfront space will be serious damaged in fact. In order to avoid that, it is essential to analyze the sums of land parcels' acreage in every range. According to the statistics, the sums of land parcels' in every range present a more balanced status (Fig.11).

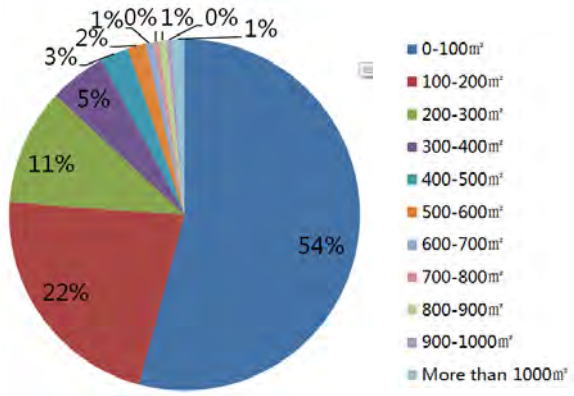


Figure 10: The statistics for the acreage of waterfront land parcels

Source: Drawn by the author

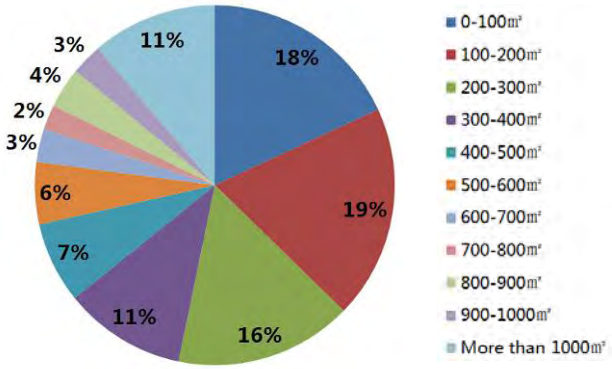


Figure 11: The statistics for the sums of land parcels' acreage with in every range

Source: Drawn by the author

5.5 The Regulation and Guidance for the Waterfront Land Parcels

In the conservation and development practice, it is essential to avoid large and irreversible changes to the proportion of each range in every study above, ensuring the variation of the proportion within reasonable limits. The larger proportions stay ahead and the smaller proportions still exist. As a result, the basic characteristics of the waterfront space will be maintained and the diversity will also be guaranteed. In addition, the maximum and minimum in every study should not be largely break. Too much breakthrough will definitely lead large change to the proportion. At last, the significant rectangular characteristics and the characteristics of alternating between dense and sparse should be regulated and maintained too.

Outside of the study area, some land parcels have already destroyed the waterfront space. Taking the villa district located in the southwest of the historic town as an example (Fig.12), an enormous land parcel replaced the original small land parcels. With the 140m long waterfront interface and acreage of 24694.2m^2, this land parcel destroyed the original proportion of the waterfront land parcels' shapes, acreage and waterfront interface length. As a result, it is hard to coordinate with the traditional waterfront space and be excluded from the study area of this paper.



Satellite Image | Building Texture in 1999 | Waterfront Space

Figure 12: The satellite image, building texture in 1999 and waterfront space of the villa district

Source: Google map, © 2014 Google; The 1999's Conservation Plan on Historical and Cultural Town of Tongli; Photographed by the author

6. The Spatial Characteristics of the Waterfront Buildings

6.1 The Selection of Waterfront Buildings for the Studies

In order to fully reveal the characteristics of the waterfront space, this paper selects the buildings which have a significant impact on the water front spatial form, including the ones on the river, the ones directly next to the river and the ones which become important parts of waterfront space as they are higher than the buildings in front of them. It can be easily known that these buildings are all in the waterfront land parcels. Meanwhile, some annexes and makeshift buildings in waterfront land parcels which are blocked by walls and higher buildings in front of them are excluded from the study objects.

6.2 The Texture of Waterfront Buildings

Duan et al. (2002) classified the spatial form of traditional neighborhood in Tongli historic town into three types: one single courtyard, courtyards group and one single house. Based on the classification, through the study of the current situation and the historical evolution, the traditional waterfront building texture can be classified as two original types: enclosed courtyard and the full occupation of small land parcels. The combination of multiple courtyards becomes courtyards groups, some courtyards become the combination of courtyard and single house after demolition and re-construction in the history (Fig.13). In addition, the land parcels which are on the river always have a street behind them for the traffic, which determines the small depth of the land parcels. As a result, the courtyard can't be constructed in some of them and it turns to the small land parcels fully occupied by one single house (Fig.14).

There is a special case in the study area which is generally located in the historic town center (Fig.15). Two buildings built in the 1980s are juxtaposed. However, as the acreage and the waterfront interface length of their land parcel are within the middle range, the shape is similar to square, blocked by lush trees and courtyard wall, this special case has little impact on the waterfront spatial form. And because of that, the rivers next to them are still evaluated as traditional landscape rivers. Meanwhile, as the characteristics of the land parcels belong to the larger range, there is almost no effect on the results of the study on the waterfront land parcels.

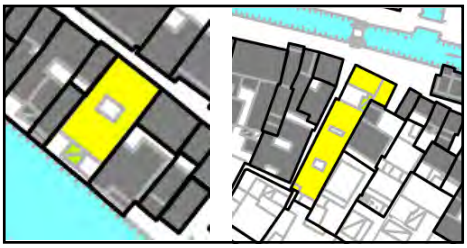


Figure 13: The text evolved from enclosed courtyard
Source: Drawn by the author



Figure 14: The full occupation of small land parcels
Source: Drawn by the author



Figure 15: The special case of the building texture
Source: Drawn by the author

6.3 The Orientations of Waterfront Buildings

Depending on whether the buildings are north-south oriented and whether the buildings are facing the river, the orientations of the waterfront buildings can be classified into four types (Fig.16). Seen from the figure 19, 96% of the waterfront buildings are facing the river, with 36% of the buildings are facing the river and east-west oriented. The reason for the major proportion and the abandonment of north-south orientation is the boats were the mainly type of transportation in Tongli historic town and the waterfront were the most important place for people's lives and communication. As a result, the rivers became the origin of the spatial form in the historic town.

Another 4% which do not face the river are due to two situations. The principal one is these buildings face the streets which are perpendicular to the river. The other situation is the special case mentioned above, as the two buildings are juxtaposed, one of them don't face the river.

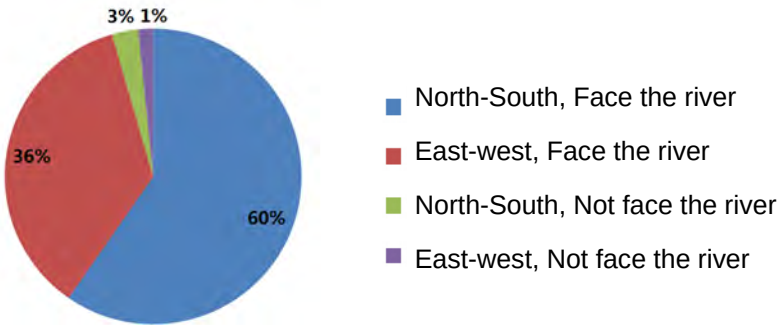


Figure 16: The statistics for the orientations of waterfront buildings
Source: Drawn by the author

6.3 The Widths, Depths and Basement Area of Waterfront Buildings

The widths of waterfront buildings vary from 1.2m to 42m. According to the statistics, most (92%) of the buildings' widths are shorter than 15m (Fig.17). Compared with the waterfront interface lengths of land parcels, the interfaces of the buildings are even shorter, which highlights the dense arrangement and small-scale characteristics of the waterfront spatial form.

The depths of waterfront buildings vary from 1.3m to 20.5m. According to the statistics, most (92%) of the buildings' depths are shorter than 10m (Fig.18). Compared with the widths of waterfront buildings, it can be seen that the waterfront buildings present the flat shapes whose widths are longer than the depths.

The basement area of waterfront buildings varies from 2.55 m^2 to 558.6 m^2. According to the statistics, most (89%) of the buildings' basement area is less than 100m^2 (Fig.19). Compared with the acreage of waterfront land parcels, the basement area is relatively much smaller.

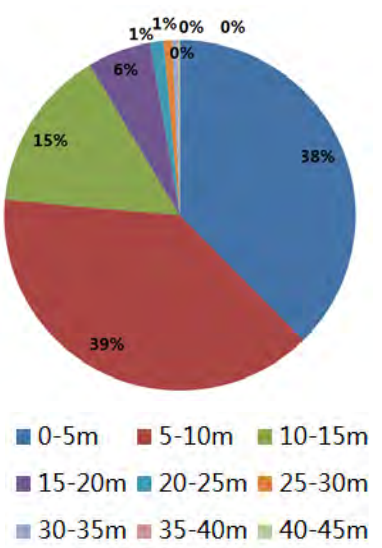


Figure 17: The statistics for the widths of buildings
Source: Drawn by the author

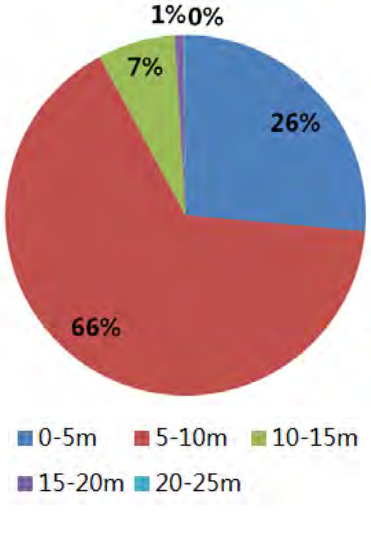


Figure 18: The statistics for the depths of buildings
Source: Drawn by the author

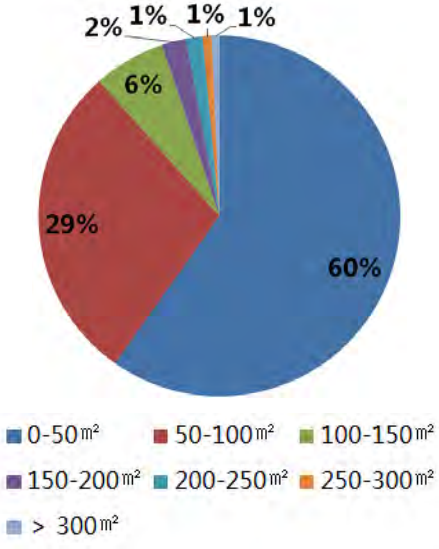


Figure 19: The statistics for the basement area of buildings
Source: Drawn by the author

6.4 The Heights of Waterfront Buildings

The vast majority of waterfront buildings are one floor or two-story, with each type nearly accounting for 50% of all the buildings studied. According to measurements, the cornice heights of one floor buildings are between 2.8-3.5m and 5-7m for the two-story buildings. There are four three-story buildings which are fairly coordinated with the traditional spatial form because of the two-story buildings around them. The only four-story building is a special case, the height of which is hard to coordinate with the surroundings. However, as the acreage and the waterfront interface length of its land parcel are within the middle range, the shape is similar to rectangle, the width, depth and basement area are also within the middle range, this building has little impact on the overall waterfront spatial form of Tongli historic town and almost no effect on the results of the studies above.

6.5 The Regulation and Guidance for the Waterfront Buildings

Similar to the waterfront land parcels, it is essential to avoid large and irreversible changes to the proportion of each range in every study above, ensuring the variation of the proportion within reasonable limits. As a result, the basic characteristics of the waterfront space will be maintained and the diversity will also be guaranteed. In addition, the maximum and minimum in every study should not be largely break. For the special cases mentioned above, renovation and demolition are the solutions.

The negative example takes the new commercial district located in the southeast of the historic town (Fig.20). Although it is designed carefully and the widths of the buildings are within the proper range, the juxtaposed buildings with three-story and depths of 17m are difficult to coordinate with the traditional spatial form. Compared with the prosperous commercial waterfront in the study area, this district is very languished, which reflects the problems of spatial form.



Satellite Image Waterfront Space Languished Status

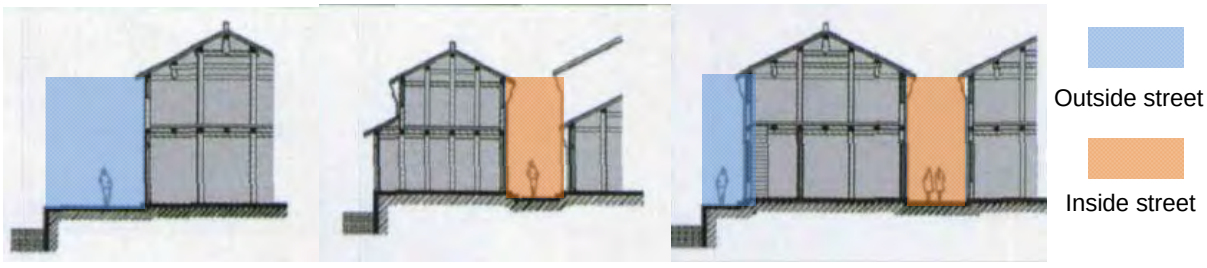
Figure 20: The satellite image, waterfront space and languished status of the new commercial district located in the southeast of the historic town

Source: Google map, © 2014 Google; Photographed by the author

7. The Spatial Characteristics of Waterfront Spatial Sequence

7.1 The Study Objects of Waterfront Spatial Sequence

Ji (2008) researched the waterfront of historic water towns in south of Yangtze River and pointed out three types of construct modes: River-Street-House-Street-House, River-House-Street-House and River-Street-House. Based on the classification, the waterfront streets can be classified into two types: the outside streets and inside streets (Fig.21). And the quantitative analyses are about the widths of the street and the aspect ratio of adjacent buildings.



River-Street-House River-House-Street-House River-Street-House-Street-House

Figure 21: The outside streets and inside streets

Source: Ji (2008), "The Analysis of Spatial Structure about Waterfront of Traditional Towns in Southeast China"

7.2 The Widths of Waterfront Streets

As the control of the construction is relatively weak in the Ming and Qing dynasties, the widths of the waterfront street are changing along the river. In addition, the streets are always wider near the bridges, meeting with people's needs to go through the bridges and communicate with each other. Measuring the width of the street every 10m along the river, it can be seen from the statistics that the widths of outside streets are mostly smaller than 10m (92%) and the widths larger than 10m are always measured near the bridge. The widths of inside streets are also mostly smaller than 10m, but the proportion of widths smaller than 5m has greatly increased in comparison with the outside street and there is no width larger than 15m. This reflects the inside street are more narrow and the change of the width is much smaller (Fig 22).

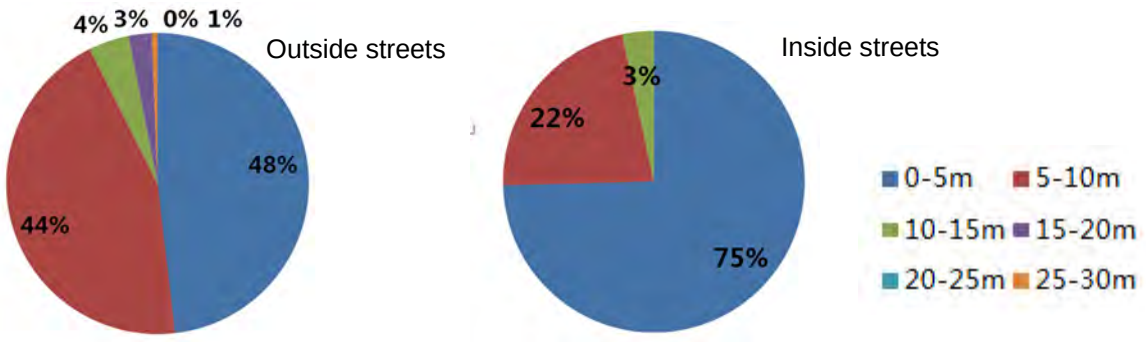


Figure 22: The statistics for the widths of waterfront streets
Source: Drawn by the author

7.3 The Aspect Ratios of the Streets and Adjacent Buildings

The ratios of the outside street widths and the heights of the adjacent buildings are mostly (80%) between 0.5-2. The space where the ratios are large than 2 is mainly near the bridge. The ratios for the inside streets are mostly (86%) between 0-1.5 (Fig.23). Overall, the aspect ratios of the streets and adjacent buildings are more suitable for people , which are very different from the open streets in the big cities. In addition, the inside streets are more closed than the outside street.

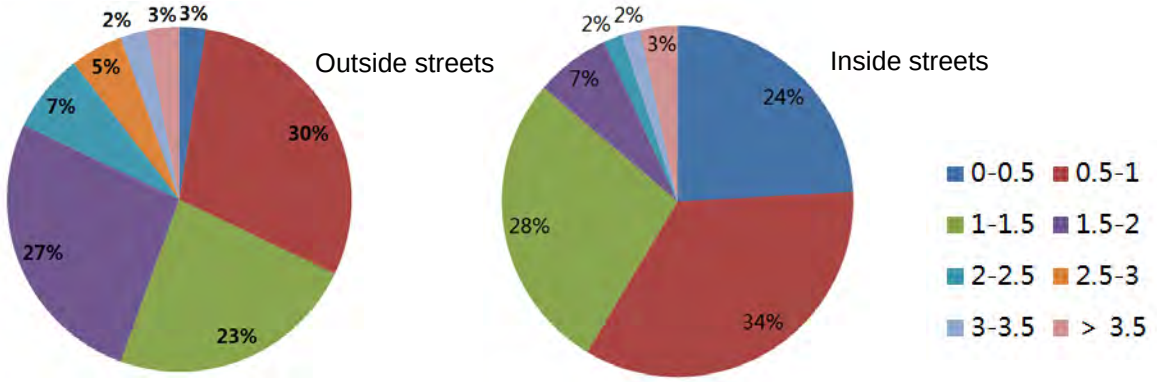


Figure 23: The statistics for the Aspect Ratios of the Streets and Adjacent Buildings
Source: Drawn by the author

7.4 The Regulation and Guidance for the Waterfront Spatial Sequence

In the conservation and development practice, it is essential to avoid large and irreversible changes to the proportion of each range in every study about the waterfront streets above. Meanwhile, keeping the widths of the streets changing along the river and maintaining the spatial scale of the squares near the bridges are also important for the characteristics and value of the waterfront spatial form.

The negative example takes the new commercial district mentioned above which is located in the southwest of the historic town (Fig.2 and Fig 3). The widths of outside streets are 18.14m with no change along the river. And because the adjacent buildings' cornice heights are 3.5m, the aspect ratios of the streets and adjacent buildings are much larger than the traditional waterfront streets. As a result, the space is too open to coordinate with the study area. Similarly, this district is very languished too.

8. Conclusions

Nowadays, the conservation of historic towns has been widely accepted and endorsed. However, due to the lack of studies, some constructions which actually destroyed the waterfront spatial form of Tongli historic town were accepted by the government and be praised highly by the developers.

Combining quantitative and qualitative analysis, this paper research the waterfront land parcels, the waterfront buildings and the waterfront spatial sequence, revealing the characteristics and value of the waterfront of Tongli historic town. The study results can be used as guidelines for the government to manage the conservation and development of Tongli historic town. The proportions and the values in every study can be monitored and early warning can be provided if there were problems in the conservation and development practice.

Historic towns in south of Yangtze River are always constructed because of the water and the culture is similar too. As a result, the methods used in this paper can be applied to other historic towns in south of Yangtze River, the conclusions of this paper should be consistent with the general rules on the waterfront spatial form of historic towns in South of Yangtze River.

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"The Odra River Scenarios"

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Synopsis:
The Odra river in Wroclaw is a "hole" in the city, and areas along the river are "holes in hole". The current planning is sort of one-dimensional approach.
In the paper, I analyze the situation and give proposals of scenarios for creating livable spaces at the water.

1. The Hole in the City

When we look at the map of Wroclaw, the river – the Odra is blue, on satellite views – it is green. This simple observation seems important to me in assessing the situation of the river within the city.
Physically, the Odra River is present in the city, but it is detached from its structure. With its dynamic, unpredictable nature only a few sections of riversides are urban in nature - mostly high waterfronts. Along most river banks in the city green areas prevail: grasslands, squares, parks, boulevards that create an ecological corridor visible on a satellite map.
The river bed and its adjacent areas create a wide hole which divides the city. The crossing from one bank to the other is like passing the border to another city. The average length of the bridge in the city center (without counting the crossings through the islands) is more than a hundred meters, which shows the scale of the problem.

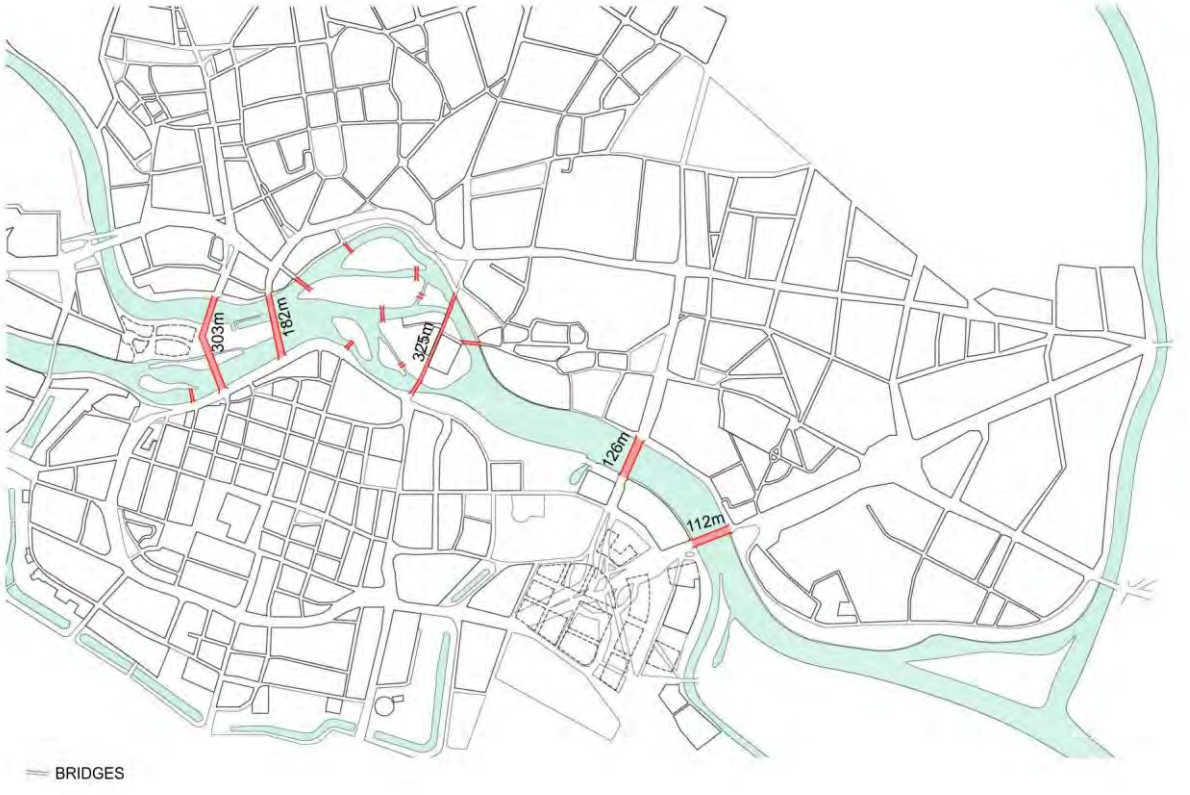


fig.1. Bridges. Illustration of author.

1.1. Holes in the Hole / Functional Enclaves

For centuries, the river was used as back, supporting areas of the city, a secondary utilitarian element - for defense, transport, industry, warehouses, sewage, etc. Areas along the river (apart from the green zones) were unwanted due to the way in which they were exploited and were not bond to the structure of the city[1]. They rather tended to develop into independent,

closed enclaves that did not bring the river closer to the city at all. However the public part of the city benefited from the river intensely yet indirectly - through enclaves. At the intersection of such enclaves and the city there flourished the trade of imported, processed or manufactured goods. This functional detachment of enclaves resulted in a lack of links established between the structure of the city and – along the river – the enclaves themselves, too.
When in the 20th century streets were built along the quays, this detachment became even more evident. With the absence of bonds with the fabric of the city they became holes, holes in the hole. Actually, this situation is still relevant today. Areas on both sides of the river have been to a large extent occupied by either industrial and storage facilities or their residues. New developments (such as housing estates) that replace them in the process of transformation are located in the same holes.

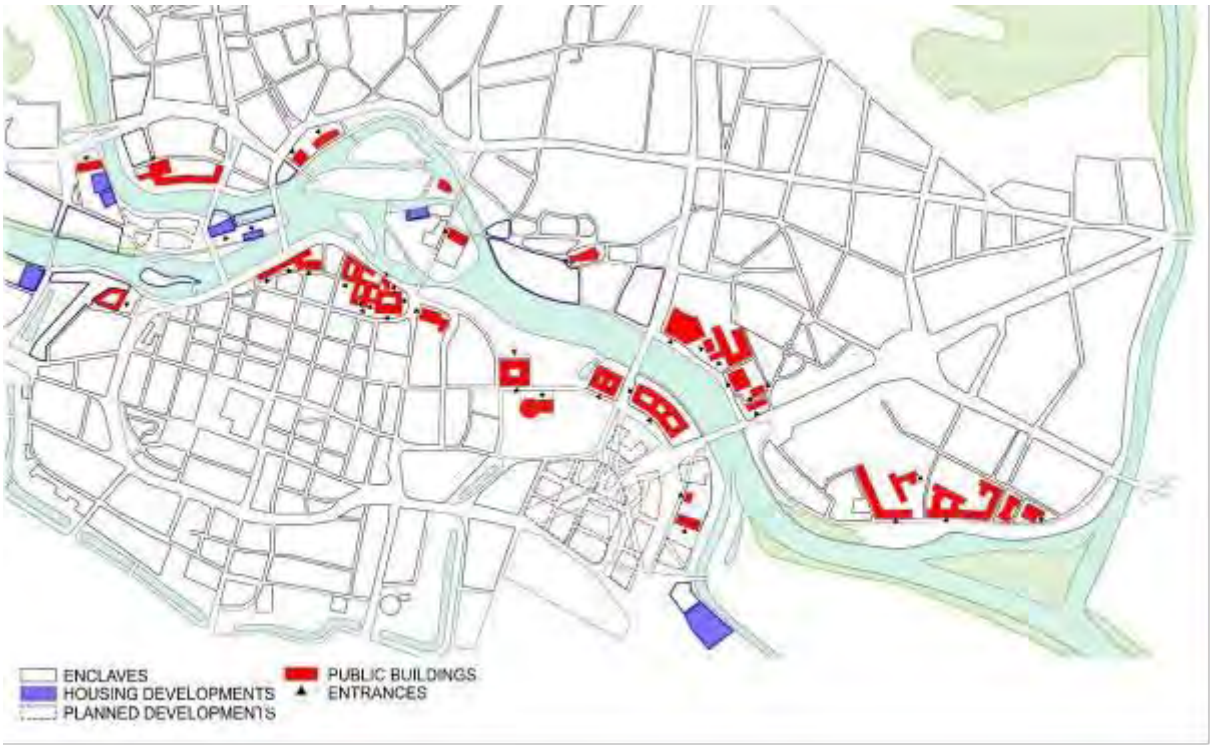


fig.2. Enclaves, housing developments and public building with entrances. Illustration of author

1.2. Boulevards

In the immediate vicinity of the urban fabric (the old city structures) boulevards were created along the river embankments. But even these places do not allow full contact with water. The need to protect urban areas against flooding forced high waterfronts. The city and water are at different levels.
The idea of boulevards continues to be present in the developments of private housing estates[2] (eg. in Zyndrama of Maszkowic or Kurkowa Streets). Their common feature is the high waterfront, therefore they are cut off (high) from the river. At the water level you can find only individual anglers, drunks and truants (e.g. in Grodzka or Zyndrama of Maszkowice Streets). Access to the water level is possible only in places where housing condominiums are combined with marinas (such as Topacz or Angel Wings marinas), however they are not fully available to the public.
Exceptions include urban green areas situated by the river (The Eastern Islands, Xawery Dunikowski Boulevard, boulevard along Wybrzeże Wyspiańskiego and embankment at the zoo), however their potential is not entirely used[3].
Paradoxically, spending time near water (by the water) is most successful in areas outside the city center and takes on a more or less informal nature (barbecuing on a meadow, ad hoc summer beer gardens, boat and kayak rentals).



fig.3. Boulevards and green areas. Illustration of author.

1.3. Barriers in the City Structure

The nature of the river enforced certain spatial and functional decisions to be taken in the past. Today, they result in barriers to its availability. But the structure of the city itself constitutes a barrier, too.

The layout of main active public spaces is concentrated in the city center (the main Market Square, Solny Square and main shopping streets leading to them)[4]. All connections outgoing from the center and leading to the river actually run into the void. The building alignment from the Odra River side (e.g. along Grodzka Street) forms a border which one can cross only in few points. Entrances to public buildings or areas are situated at the other side.

Also the building fabric that once used to fill the islands was destroyed or underwent clearing-up demolition, thus functional connections across islands were severed (e.g. on Piasek Island). Public spaces that were once located by the river, for example in the area of today's Bema Suare (Gneisenau Platz) or on the northern side of Grunwaldzki Bridge (Kaiser Strasse) and Pokoju Bridge (Adalbert Strasse), have been disarranged by the traffic system, and thus lost their character of active nodes (trade, services) that attracted people.

Wroclaw is one of few cities in Poland that is largely situated on islands which are connected with the "mainland" with several bridges and footbridges. At the moment, there are 117 bridges, including 27 footbridges (in Warsaw there are 11 including the planned ones, 18 in Cracow and about 17 in Gdańsk). This situation results in the lack or impediment of connections in directions that are perpendicular or parallel to the river.

As enclaves have lost their industrial and port functions, apart from overcoming the initial barriers that have always been present between them it is also necessary to re-create lost connections with the city, although the principles applied in this case should be different.

At the moment, Wroclaw does not use the river either in a historical way – with a strictly utilitarian approach, or in a modern way - as an oasis of an open public space and leisure and recreation zones in the city.

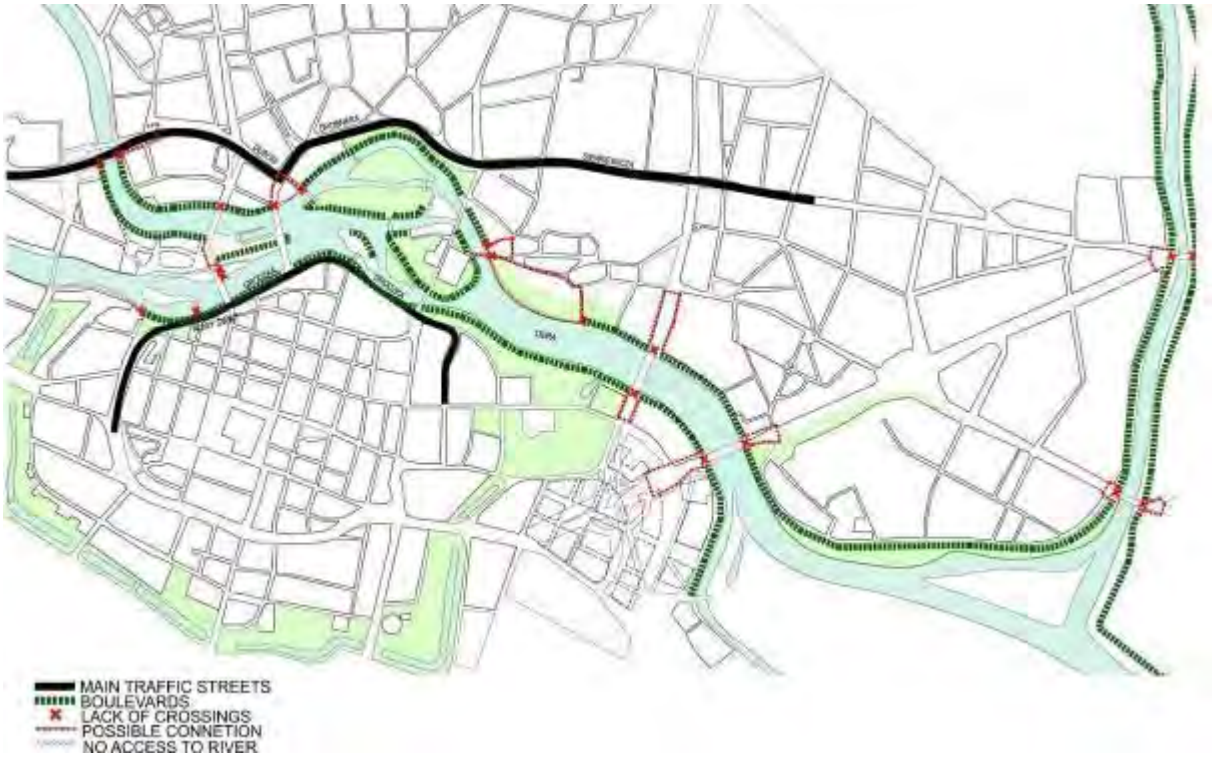


fig.4. Barriers. Illustration of author.

1.4. *Strategies*

Therefore, while thinking about the river in the city two strategies could be proposed.

The first strategy is an instant project, in which the riverfront would developed as a grand scale, comprehensive venture. However, this unique option that could have an impact on the whole city (just like for the main arterial routes), is highly questionable. Apparently, the limit for our capabilities is regulating the river for flood protection, which has been the focal point of all EU-funded governmental programs for the Odra River. The inertia of decision-making process for their implementation, which has lasted for15-16 years, shows the relevant level of the problem. In addition, it is virtually impossible to correlate infrastructural works (except for a few places) with efforts to rehabilitate waterfronts[5]. For many years such modernization has contributed to maintaining the current type of inaccessible embankments[6].

Local plans for riverside areas focus on defining spatial parameters and protecting views, greenery and even such details like sculptures and information boards. On the other hand however, they do not refer to social values. Regulations on functional use at best refer to whole blocks or, individual buildings, yet they do not generate a concentration of city-forming functions, such as retail trade routes or gastronomic clusters.

There is no vision of the Odra as a whole and the projects for individual segments are detached from other elements[7].

The second possibility is a fragmentary project, developed through filling up individual places and unconnected enclaves, which coincides with the applicable policy of the municipality. Although development plans dictate creation of boulevards[7], these are mostly build on private lands. This is a one-dimensional approach. Firstly, due to its gentrification nature – they bring the river closer only to a handful of "chosen ones" (in this case, flat prices make the river even more distant). Secondly, the nineteenth century idea of boulevards no longer seems sufficient as compared to growing expectations and needs of citizens, especially when clashed with the obstacles identified above (high embankments, no bonds or connections). However due to political and economic conditions[8], this pragmatic and simplified approach is most probable. In city plans the river is not a priority. It can be proved by the fact that there is no single body responsible for coordinating ideas and works on the river as a whole. In practice, these are hydrological construction engineers who decide about the river and its waterfronts instead of planners.

1.5. *Scenarios*

The inability to act on a large scale, which is a fact, regardless the reasons, shows that the city can be "stapled" with the river only through small-scale interventions. However, converting areas situated by the Odra with the approach that I described above does not really improve the situation. If this process is to be something more than merely "tidying" through filling areas with independent (self-contained) housing condominiums and creating next open spaces that although situated in the city are detached from it, it is necessary to set the priority much higher.

And the priority is to permanent bind the river to the structure of the city that is used by people. Various proposals, projects and developments that appear require clarification of objectives and needs, formulating a list of desired features, and determining what matters for life in the city by water. Therefore, it is necessary to test different proposals, different solutions that will let us go out-of-the-box and get the quality that will be attractive relevantly to new needs and requirements.

Below, I will discuss three areas of scenarios that seem important and necessary to me in the context of what I outlined in the introduction. The first will examine links and connections, the second one will touch upon issues of social activation of space, whereas in the third I will claim the need to experiment.

2. The First Area - Links and Connections

To accomplish the set priority, the key task is to investigate the possibility of "stapling" the river by merging enclaves lying by the river with the structure of the city. This means first of all building strong, active links that would be integrally connected with the system of main public spaces. Understandably, these measures should also take into account "porosity and permeability" of structures located by the river.

2.1. Shorteninig Distances / Passages across the River

The precondition to merge both sides of the city and connect systems of public spaces separated by the river is to shorten passages across it, including those that are deprived of activity to the largest extent.

Wherever we have room only for necessary activities we can hardly speak about public space – and a hole is formed. Each function that "binds" people and results in generating optional and thus resultant activities (social activities)[9] will contribute to connecting both banks, merging the city and actual absorbing the river into its structure.

Above all it concerns entrance zones to bridges - from the line of last building blocks up to bridges. Activation of these areas equals creating strong bridgeheads. The situation is hampered even more by extensive traffic, long distances to the building line, localization of entrances from the other side. Yet, there are always some options to achieve that. The simplest idea is even a small, mobile coffee bar, which has recently started to appear on Uniwersytecki Bridge, which is always surrounded by a group of people who stop there at least for a moment.

As I wrote above, the majority of historical buildings have their entrances turned the opposite way to the river. However, where the destruction of the war (and the post-war demolition) cleared the space, it is possible to create a different orientation of entrance zones. In my opinion, we have such opportunity on both sides of Grunwaldzki Bridge, especially from Społeczny Square (which was not included in the Local Plan approved in 2008[10]).

There are also missed opportunities in the area of Piaskowy Bridge, where Market Hall and the building of Wroclaw University's Polish Philology Institute open towards passages leading to the river. Other locations include the southern side of the Academy of Fine Arts building by Xawery Dunikowski Boulevard, the northern side of buildings belonging to the Faculty of Chemistry, Computer Sciences of the Wrocław University by Frederick Joliot-Curie Boulevard and the main building of the Wrocław University of Technology on Wybrzeże Wyspiańskiego.

A direction of development and a recommendation for such sites could be the diploma project for the area at Nowy Świat Street, near the Arsenal, in which the authors[11] has proposed the creation of an attractive square on the area situated at the back of the Old

Town. Today, this place is actually a dead zone, which is not animated even by the Kantor's "Chair"[12] sculpture around which nothing else happens.

2.2. Bridges

Also bridges, that at the moment are used only for transport purposes, have such potential in themselves (or rather on themselves). I believe that only by giving priority to activities occurring in traffic areas and non-utilitarian aesthetic elements we can transform bridges into living public spaces.

Obviously, relatively narrow sidewalks constitute a barrier here (specially when we expect to have bike paths running next to them). On the other hand, we certainly can and should use all existing widenings. For the time being, on Uniwersytecki Bridge such place was used to place a monument[13], which 'animates' it only esthetically (and symbolically). Another possibility could be creating a new local widenings or even extending it along the entire length, in the form of various types of cantilever structures (which certainly would not be a great challenge).

In the next step, especially on bridges running in important transport directions (Uniwersytecki Bridge, and even Grunwaldzki Bridge), the preferred solution would be to free them from vehicle traffic and designate them completely for pedestrians. Those who have experienced walking on Charles Bridge in Prague, Pont des Arts in Paris or St. Angel Bridge in Rome has to admit that the gap between one side and the other side is imperceptible there. In Wroclaw, such opportunity is offered only by the small Tumski Bridge leading to Ostrów Tumski (Cathedral Island) and footbridges, but they definitely serve only as a route to walk along.

In the future, we could consider some solutions that we can remember from of Debord's and Constant's psychogeographical proposals (New Babylon project), or historical bridges - passages (shopping streets), such as bridges Ponte Vecchio in Florence, di Rialto in Venice, or Krämerbrücke in Erfurt, which virtually disappeared from the urban landscape after the Middle Ages. However they come back in projects such as Laurie Chetwood's project, awarded in the competition for a new bridge for London[14]. This example proves that bridge-buildings may well fit into the structure of the city without any damage to the view, which was one of the reasons for which such crossings were given up.

2.3. Passages through Islands / Islands

While "stapling" the city structure of Wroclaw – the city on islands, one can not miss the way the islands are used and developed. In particular, these are the Eastern Islands and a part of Kepa Mieszczańska island that lies along Księcia Witolda Street.

The huge potential of the Eastern Islands in the existing local plans[15] has been shut in parks and recreation areas, to act as the "green lungs" for the Old Town, which in my opinion is a misunderstanding. Arguments supporting such approach are rather inadequate. The belt of high, dense greenery along the promenade by the moat surrounding the Old Town and green areas along the river banks located outside the center are, for sure, sufficient in terms of green areas for this part of the city. Hardly covered with trees, the Eastern Islands do not seem to fit this role. One should also remember that having densely developed areas does not preclude planting trees inside blocks, which growing on squares and along streets could also balance the size of buildings. However when we look at the urban fabric in the center, and even on the boulevards, we see that such opportunity is hardly ever taken.

Also, the requirement in plans to keep the view from the opposite bank to the Old Town panorama as an overriding value is not a reasonable postulate. And in case of opening the view for the Gothic church (which used to be visible in the structure of the city either in silhouette, or in a close proximity only) is even not recommended. Quite the opposite, framing views and discovering individual fragments bit by bit, which could be obtained by covering these areas with buildings, would introduce a variety of emotional tension in observers.

Clearing-up demolition of the pre-war fabric formed a hole[16] which was intended for public open spaces. Bielarska Island is used as a green square and a playground - on a weekday it

is almost unattended. Słodowa Island, that for some time was functioning as a free, vibrant place for informal meetings (mostly for young people) was pacified in the name of order, nowadays the interest in the island being much smaller.
The most important link between the two sides of the city is Piasek Island. On historical maps[17] we can see passages through the island via Świętej Jadwigi Street towards Ostrów Tumski and up to the area of the current Bema Square clearly delineated by buildings. Today, both frontages of the street have numerous gaps, and the remaining buildings hardly contain any offer intended for public (not counting a small cake shop, a glass gallery and a church). Long passageways along which nothing happens do not encourage to stay in this place. Even though they have been excluded from vehicle traffic, they cannot be fully used as a pedestrian promenade due to fast moving trams. Another reason is bypassing this rout along Piotra Włostowica Boulevard. The situation is much better while looking from the north, where Młyński Bridge opens up to the shopping frontage of Bema Square.
As for today, the north-west part of the island is a big blank area where the plan rather tends to limit any development - after the war there was one residential building left at Staromłyńska Street[18].
Leaving the island as an open area contributes to creation of attractive recreational spaces, however, for the coherence of the city, intensifying development and concentrating retail and food services is definitely preferable. Examples to follow could be inhabited islands in Paris – the existing ones (e.g. Île St. Louis, Île de la Cite, Île Saint Louis, Île Saint-Germain), and in relation to today's needs the planned ones even more (e.g. Île Seguin[19]).
The development of Kępa Mieszczańska along Księcia Witolda Street has been planned more extensively. Gradually complemented development with residential blocks, according to the proposed plan[21], provides the opportunity to establish a compact urban fabric there. However, if the street together with the boulevards that are to appear by the river will become attractive urban spaces filled with people, depends on whether the conditions for stimulating the place are created in the broader context. In my opinion, the local plan for this area (just like other plans, too) miss the aspect of generating the street life[21].
Connections and use of land on islands could be improved when a footbridge suggested by internet users and leading from Tamka Island to Słodowa Island is build, in line with the cycling exit from Uniwerstecki Bridge to Słoneczny Boulevard that is planned by the municipality.

2.4. Connections / Perpendicular Aproaches

The cases discussed above relate with the issue of biding places by the river to the whole system of urban, city-forming spaces. The main nodes of public spaces are located at a distance, and the main passages run in directions opposite to the river. This is the result of the historical formation of the city structure and as such it is difficult to change. Nevertheless, if the river is to become a real part of the city, access points to the river (on directions leading to main crossings) have to be built with focus on retail and food services that will lead to "stretching" the system and result in a better accessibility to the river. First of all, this applies to areas leading to the bridges: Pomorski, Uniwersytecki, Grunwaldzki and the passageway through Piasek Island.
The greatest potential lies in Kuźnicza Street, which leads from the Market Square to Uniwersytecki Bridge, and on the other side of the river up to the center of Nadodrze district. In its part by the Market Square and Kalambur Theatre it has become a vibrant space with numerous bars and pubs (the proximity of several departments of the Wroclaw University is not to be underestimates, since students are main customers of these places). The renovation works[22] completed in 2012 improved the condition of this area, particularly by eliminating vehicular traffic, however, more attention was paid to aestheticisation rather than to how this place could become even more vibrant.
On the other hand, Odrzańska Street leading to Pomorski Bridge is relatively inactive except for the zone close to the Market Square, even despite two shopping frontages.
Its chances lie in elimination of vehicular traffic and the development of the above mentioned area along Księcia Witolda Street.

Even though streets and squares leading to bridges through Piasek Island are spatially legible, however, they are not spaces where people would stay. On Kotlarska Street pedestrians squeeze along parked cars, shop windows along Piaskowa street work very poorly (only Market Hall at the very end of the street attracts more people, although not as many as before in 1980's). The main square on this way - Nowy Targ, was reconstructed last year[23] in an aesthetically perfect but also abstract style, so to speak, as an artificial space which does not realise its full potential. The pre-war pictures show a lively marketplace with commercial frontages. Such an active place should be a reference also today. The 20 stalls that appear 2-3 times a week arranged in well aligned rows seem to indicate the need for an aesthetic control rather than the desire to revive this place.
The worst situation is in the direction leading to Grunwaldzki Bridge. The plan for Społeczny Square[24] developed as an idea-competition commits the area by the bridge to vehicular traffic – the route planned from Grunwaldzki and Pokoju bridges leading towards Puławskiego Street completely cuts the river off. Thus, the hub of public and city-forming functions - the city square, has been planned far away from the river (area of Dobrzyńska street), in the place that is not very well merged with the system of other public spaces within the center (on the way to Dominikański Square, which is about 500 meters away, there are no commercial functions whatsoever). In this way, there is a double rupture in the connection with the river. I definitely think that the local plan should be amended, and a new model that takes into account links between public spaces that cross the river should be established.

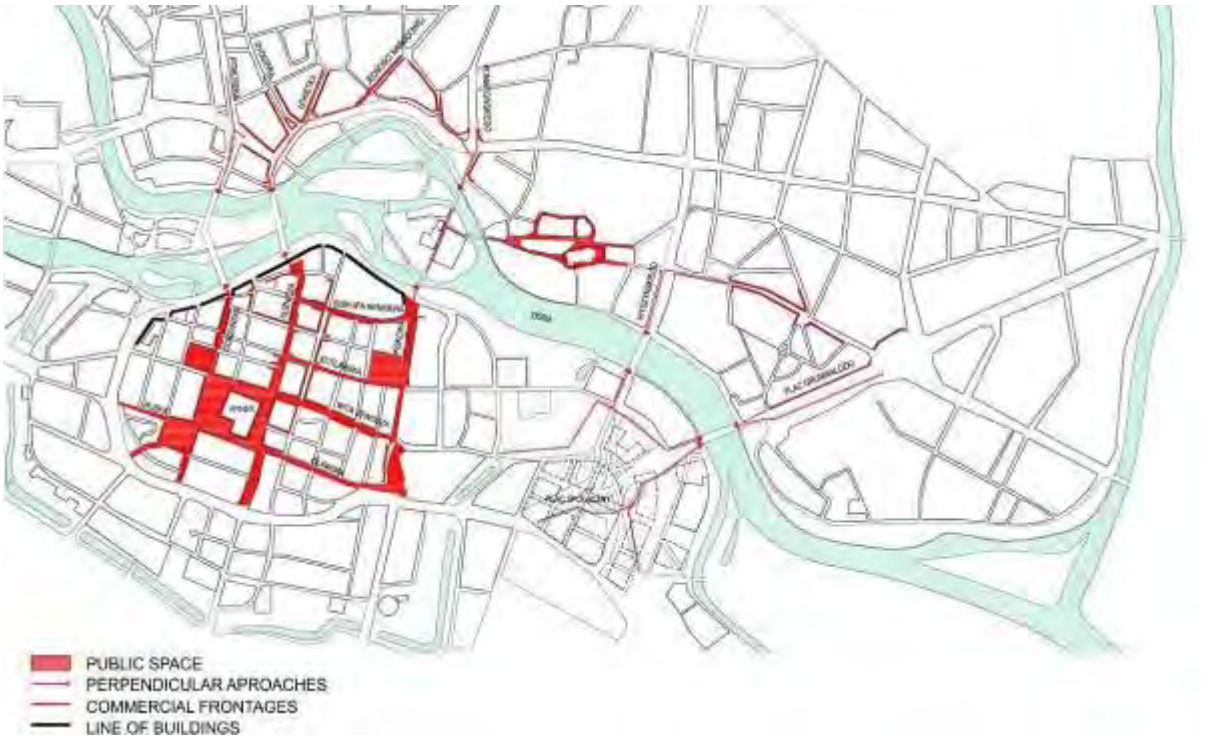


fig.5. Public spaces and perpendicular approaches. Illustration of author.

2.5. Parallel Connections

Another topic in improving connections is the issue of continuity between the areas along the river banks, which should be implemented irrespective of the strategy chosen (even only in relation to open boulevards constituting recreational and walking spaces), so that fully accessible passageways could spring up. A simple measure such as creating connections that improve movement along the river also facilitate its accessibility and thus build a richer grid of linkages.
The streets that are relatively easiest to cross are those with crossroads located directly by the bridges, where pedestrians crossings is directly aligned with the boulevard (e.g. streets

perpendicular to Grodzka Street from the south), so far there are only crossings on the north side missing, but these are planned, too.
For several years there has been a discussion running in social media and online forums, where people suggest new connections, e.g. footbridges for pedestrians and bicycles under the bridges or pedestrian crossings at the street level, directly in entry zones into bridges.
The most important places pointed out in the center are as follows: Pokoju Bridge - south and north sides, Grunwaldzki Bridge, the Warszawskie Bridges, Zwierzyniecki Bridge – its eastern side, Szczytnicki Bridge – the western side.
Local plans include relevant provisions. The city has developed a map of necessary connections, some of them have documentation and building permits[25] ready in place. However, due to the lack of funds, at the moment there is only one bicycle bridge constructed under the Warszawskie bridges on the south side, which is more a recreational connection. In the very city centre no footbridges are planned to be built. Solely during the modernization of Grodzka Street in its part situated in the vicinity of Piaskowy Bridge, there was a cantilever overhang widening the boulevard by the river constructed.
Overcoming the barriers like bridges (or routes crossing the waterfront line) is a necessary task for today, but certainly it is not enough.
In the solution for the most advanced project of the footbridge under Pokoju Bridge we can clearly see the limitation resulting from the use of the footbridge only as a route to walk or ride over. There are well known projects from many cities, such as Riverwalk & Waterplace Park in Providence, People's Park in Copenhagen or even students' projects that show the possibility of extending the function of footbridges. They can become wide piers, which in addition to being a route may also act as a public space in full contact with the water. Solutions that seek for places by the water that could be occupied by people, especially at such junctions as bridges, are for me a prerequisite in the process of biding the river with the city.

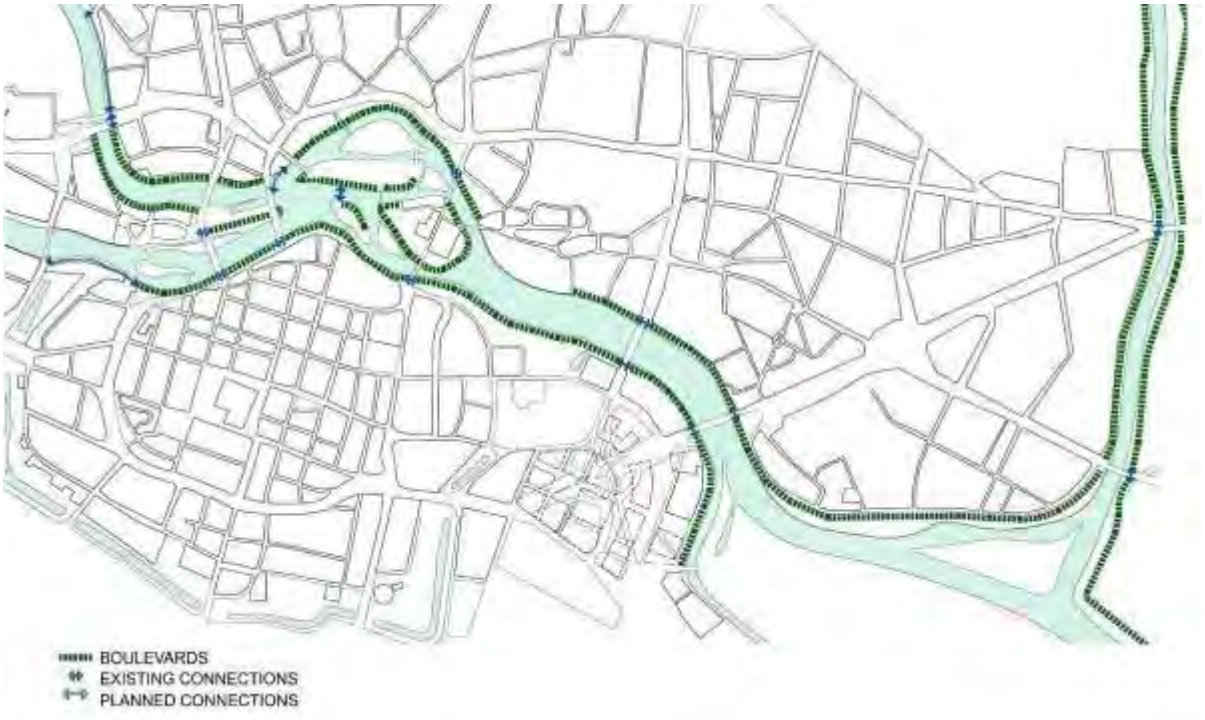


fig.6. Parallel connections. Illustration of author.

Apart from that, the river itself gives numerous opportunities to move on the water surface. Occasionally, despite difficulties (locks, water thresholds, dams, etc[26]) some enthusiasts use the river as a way to move around the city, just like my friend who has a house in Trestno (the eastern part of Wroclaw) and from time to time uses his motor boat to go shopping in the city

center. Marina Topacz I and II[27] between Uniwersytecki and Pomorski bridges, and some other new marinas planned by private developers in Popowice[28] or Osobowice[29] (north-west part of Wrocław), or a condominium planned in Babinski hospital[30], in Kleczków district[31], by the Piast Brewery[32] and Olympia Park in Swojczyce[33] offer an opportunity to strengthen this trend.
Various forms of sailing in small (20-40 passengers) and larger boats (the maximum number of passengers: 200[34]) propose different kinds of excursions on the Odra, both for sightseeing as well as for parties. Compared to other cities, the average number of passengers of around 150,000 a year[35] is not significant. Also, the base of river navigation services is scarce. Plans of harbours that would provide a rich functional program including urban functions can be found only in student diploma projects, and yet this is undoubtedly a desirable trend to follow.
Unfortunately, in Wrocław there is nothing like a water tram available. The reasons for this stem from the nature of the river and problems hindering in navigation, but also from the fact that the river is detached from the city. In 1992, at the Polish-Dutch workshop "Wroclaw on the Odra"[36], we proposed a solution in which cars would move along a rail that runs just above the surface of the water, going softly over all the places where navigation is impossible
Very similar to this slightly futuristic idea are projects involving cable cars running along the river, carried out in many cities (like Porto). In our town there was a cable car constructed across the river to connect the new campus of the Wroclaw University of Technology[37] located at Na Grobli Street. However, as one of city citizens commented after the ride, "The idea is cool, but the ride is short and the views along the way weren't so stunning"[38]. Besides its capacity (366 people per hour) is way too little.

2.6. Covering the River / Development on the River

The idea of "stapling" the river could be developed even further by introducing the urban fabric onto the water[39]. I am thinking of using the river as a place for dwelling and staying just like on land. There are many examples, from as simple ones as houses on water, hotels in old ships, residential units like Eric van Egeraat Associated Architects office's project of a floating development on the Danube in Budapest[40], and the entire structures of the kind proposed by the Japanese metabolist Kenzo Tange for the development on Tokyo Bay, and other, even more futuristic visions, such as Yona Friedman's hanging structures in Paris.
Today, in Wroclaw we can observe only feeble attempts that have arisen as a result of stubborn efforts of people who want to live closer to the water, such as Maciej Zaremba's first house on the water[41], which is anchored at Wybrzeże Słowackiego Street, or a restaurant on water at Tumski hotel on Piasek Island[42], which, despite its rather coarse appearance, can be clearly visible from Słoneczny boulevard and Bema square (direction to Cathedral Island).
This approach can be implemented in much simpler way (than the buildings on water), examples including the JDJ's and Klar's project at Kalvebod Brygge waterfront in Copenhagen[43], which emerged as a result of social criticism of this part of the city, where the construction of Nykredit office building and the Marriott Hotel hindered access to water. The designed bridge-pier at water level provides access and possibility to spend time by the water.

2.7. Access to Water / Porosity

Regulations of local plans impose the obligation to preserve the access to the river and prohibit fencing. Practices, however, happen to be just the opposite and these requirements are not enforced. This applies to the waterfront at the back of Ostrów Tumski, which stays in private hands. This is the legacy and therefore it is difficult to change. Another case is the Diocesan Curia' s plot at the end of this waterfront, at the back of Świętego Józefa Street. Maintained by the city as a public garden for years, now is going to be enclosed by a high wall, and the access from Cathedral Square is going to be virtually eliminated[44]. This is followed by giving up the idea of the river boats harbour that was planned in this place.
In turn, new housing condominiums appearing by the river comply with the imposed requirements to preservation the access by creating a variety of spaces called boulevards. These developed and designed spaces do not offer anything above well-made pavements

with few benches, and in most cases they are even almost devoid of trees (e.g. boulevards at Marina Topacz and Zyndrama Street), which besides the proximity of water makes them no different than housing estates in other parts of the city. Aesthetically developed, perforated structures with an open access to the river do not suffice to create a public space. Oddly enough, this is the way of thinking. A representative of Marina Topacz developer, in one of the statements said: "In the center we have a luxurious parking place for boats. Nobody will unfold a deckchair and walk in shorts here. In contrast, the marina in Osobowice is to bustle with life at all times ". I cannot understand why places by the river in the center cannot bustle with life.

The new approach, the prototypes of which can be traced even in PLOT's spectacular project of VM Houses in Copenhagen[45], presents the project of a housing estate at Kurkowa 14[46], where the whole area surrounding buildings is designed as a uniform surface (like a square/ boulevard). The public space here is coupled with the semi-private one, and the inhabitants' territory is situated on slabs-terraces suspended above. The proposed solution has a certain potential, and the public space mingled with the semiprivate can work well even despite the privacy conflict provided that the public offer is selected properly and the space has good governance.

Such projects could be also considered to represent new forms of living, where modern well-educated, dynamic upper-middle class appears to be like once rich burghers used to be in city gardens and parks – the scene well known from stories of Marcel Proust or Walter Benjamin. Although the Kurkowa 14 is far away from the quoted prototype – the scale is smaller, expression is less vivid (even as regards the size of flats), I think that such examples should be tested, yet they should not end up with pure aesthetics for art's sake.

However, even in such attempts one cannot ignore the fact that a large share of residential buildings acts to the detriment of public spaces that should stay vibrant at all times (meaning to attract numerous people). It is confirmed by numerous experiences[47] and I write about it further on.

2.8. *Fusion / Building the Structure of the City*

As mentioned above, housing developments emerging by the river are undoubtedly beneficial because of their city-bonding function, at least in the material sense. As obviously this also causes an inflow of people.

However, in a truly urban sense, to fuse them into the city structure – to fill up the hole, it is essential to shape the urban space so that new structures, new fabric do not create enclaves that are closed for each other.

This postulate is partially accomplished by Marina Topacz in the eastern part of Księcia Witolda Street. The place is attractive owing to two good restaurants with terraces overlooking water. In contrast, the boulevard by the marina offers nothing more than that. Marina is merely a place for mooring boats, but with a difficult access (the gate is locked due to the absence of a lifeguard).

Other housing estates, due to predominance of the residential function, rather tend to head in the same direction. None of them creates a space of a public character. The potential of the largest island - Kępa Mieszczańska, despite many attempts[48], has been wasted. Especially in its middle section the island has become a fragment of the city absorbed by the traffic system, in which individual plots are developed in a random way. The absence of any urban space made it a kind of suburb. Opportunities for Kępa Mieszczańska lie in the fragment along Księcia Witolda Street that was described above, as well as in the development of post-army sites, in the northern part.

3. The Second Area / Social Conditions

The indirect purpose of this text is to point out to the necessity to build other visions for the river, visions that would use its potentials relevantly to requirements of the modern world.

First of all, it is about taking care about the proper functioning of the public spaces situated

there. Analysis of local plans and various individual projects reveal that in Wroclaw this aspect is actually skipped, and the paramount importance is given to aesthetic issues, meaning beautifying.
There is no room here to present the wide spectrum of possibilities. Just let me quote the principles of constructing good waterfronts created by an American non-profit organization Project for Public Space (PPS). Many years of PPS' s experience, tested in a variety of conditions, bring a huge cognitive material to be widely used.

"10 Qualities of a Great Waterfront Destination:
1. Surrounding Buildings Enhance Public Space
2. Limits are Placed on Residential Development
3. Activities go on Round-the-Clock and Throughout the Year
4. Flexible Design Fosters Adaptability
5. Creative Amenities Boost Everyone' s Enjoyment
6. Access Made Easy by Boat, Bike and Foot
7. Local Identity is Showcased
8. The Water Itself Draws Attention
9. Iconic Buildings Serve a Variety of Functions
10. Good Management Maintains Community Vision"[49]

From the above PPS' s principles, for me the most important are those concerning the purpose, function of areas and buildings over the water. The authors of these principles emphasize that in order to create a high-quality space, the predominance of the residential function is unfavorable. It stands in contradiction to the attractiveness of space resulting from the diversity and grouping activities that attracting people, even around the clock. The nature of the residential function precludes a truly public use of these areas.
The authors point out to good examples such as the famous Royal Concert Hall on the south bank of the River Thames in London, which attracts people throughout the day, or City Hall in Stockholm which, despite its destination, makes the neighbourhood around a most besieged place.
Meanwhile, in Wroclaw, propositions to situate public buildings by the river appear only in student projects. An example might be the diploma project of the Cultural Center on Kępa Mieszczańska[50], well-located and very well exposed at the entrance to Księcia Witolda Street. Undoubtedly, regardless of its iconic form, an offer resulting from such function would very much contribute to making this place a more public space which would create a strong attracting point in the direction leading up to the aforementioned Odrzańska Street. We can find more proposals and scenarios similar to that in student and diploma projects.
Of course, there are no two identical situations or two identical places, and creating living places requires a proper understanding of them.
In any case, to create a space with a high social value, an evaluation is needed in order to assess the risks, barriers, advantages and potential.
Without doing that defining the destination of site and its spatial conditions does not seem to make much sense – it is just a buzzword. And the situation will not be changed by some occasionally organized events such as concerts, festivals, fairs – it is definitely not enough.
In local plans spaces along the river and islands are defined as open spaces – boulevards, parks, one could say, just for walking.
But today the expectations fed with examples coming from many other cities in the world, to mention only Sydney, Stockholm, Venice, Helsinki, Porto, or Hong Kong, grow.
For people, it is only direct ("intimate") contact with water that counts. There are not enough such places in Wroclaw (the southern stepped waterfront of Słodowa Island, green slopes at the ZOO, along Wybrzeże Wyspiańskiego Street opposite the main building of Wroclaw Technical University, around Bielarska and Słodowa Islands), but they are eagerly exploited. On private initiative there spring kayak and boat rentals, beaches and small bars and restaurants that, unfortunately, are temporary and have a rather limited offer (but for the lack

of facilities).
Boulevards, as I described, apart from the fact that they run along the water, do not remove the difference between the level of embankment and water. The exception is the section from Piaskowy Bridge to Pokoju Bridge, where the renovation of the existing Xawery Dunikowski Boulevard has been planned. Results of the competition, held in 2008[51], brought a proposal of the boulevard with stairs going down into the water, an amphitheatre above the waterline, and an underground passage (later changed to a footbridge) connecting it with Maria and Lech Kaczynski Boulevard in front of the Provincial Office, where old stairs have been preserved.
Unfortunately, during the ongoing renovation of the embankments, a number of small steps down to the water (e.g. on Frederic Joliot-Curie Street) were closed down.
Observation and behavioural analyses of the areas over the water show[52] that the fullest contact with the water is provided by lawns, and even more meadows, because it is easy to sit or lie down by the water there. In the spring and summer these areas are transformed into grassy beaches. In the afternoons and evenings, at weekends they become a Mecca for young people who meet in countless groups to barbecue and sip beer late into the night. It is not surprising that in the polls, places where you can drink beer (and it sort of creates a good atmosphere for people to be together) are most frequently mentioned as the best-working public spaces by the river. Unfortunately, this lush activity badly affects the state of cleanliness of these places. However, it is probably caused by the lack of management.
In other places, where (aesthetic) control is much wider, an increased activity appears when people go on traditional walks with family and / or when events that are only single "eruptions" of life are organized. What surprises is absence of any facilities for any activities other than walking. Research concerning participation of young people in public spaces reveal that such needs are completely omitted in the assumptions for projects of these places. Functional and operational programs focus on aesthetic and quantitative issues[54]. This approach obviously affects a limited cross-section of age, and this evidences poor social value of these places.
Thus, we have places active at specific times (of the day and weekend) for selected groups, and this is not a desired situation if we hope for creating a truly urban space of public nature, and thus including the river in the city structure. The reflect of recovery and activity is directly proportional to the degree of freedom.
An interesting case, that initially gave hope for a different approach, is the experiment with Słodowa Island. Since 2009, in a semi-formal way, a more free behaviour, which did not fit into the frames of main public city spaces, has been allowed on the island. The problem could be brought, as was done later, only to "drunkenness", or the power of informal meetings (impossible and forbidden elsewhere) could be observed, too. One could threaten with the lack of order and security[55], but one could also emphasize freedom and joyful atmosphere. It is not possible to definitely settle the dispute in an unambiguous manner. Finally, in 2013, the option for order won. Access to the island has been restricted - at night it is closed, the place is also subject of greater control. Control introduces order, but otherwise little has been done to understand this place, and the effect of vibrant activity has been significantly reduced.
In the decision-making practice, there were no comprehensive studies conducted to seek to understand the site. Research under a diploma project for Słodowa Island[56], which were conducted from spring 2013 to spring 2014, brought specific proposals that can be successfully used to develop a proposal for the island. extract from the research

4. The Third Area - Experiments

The Odra River in Wrocław is still the only vast area that enables a transformation in the scale of the whole city. In view of this, and bearing in mind the capacities indicated above, development by the river can not use clichés (that are often based on marketing). Using the old patterns is to maintain the status of the hole, in which the areas along the river will be attractive only to few people.

As I showed above, private housing developments do not contribute or contribute little to life. Thus, by the present policy towards the river, we can at best expect a practically mono-functional "theme parks". Locally considered projects, especially from the perspective of relevant actors, do not seem to be a bad solution. However, in order to seek solutions that can have an impact on the new face of the city we have to dare for more, as the goal is not only to create a new aesthetic framework for these places. And "More" means to experiment.

4.1. Hybrids / Collision of Potentials

Firstly, I would like to draw attention to programming possibilities. In a diploma thesis of 2007, dealing with the Odra River in Wroclaw, the author Iwona Borkowska in her research pointed out to the huge reserve, accumulated in the areas along the river, which could be released in collisions of potentials of the river and the city. Short and long term goals of the city can be combined with potentials of different nature, brought by the river. Parameter combinations of SWOT analyses - both strong and weak sides - can yield surprising solutions, impossible to get in other places[57]. Sample submission relate, for example to combinations of residence + flood risk retention[58], living + communication + retention[58], flood protection residence + living + energy[60] and public space + energy[61].

In view of such examples of exploration, orderly smooth residential enclaves and boulevards are still embedded in the nostalgic past. The experience shows that political decisions that reduce the vision of the river to an aesthetic viewpoint, will not contribute easily to the possibility of experimentation as regards programs on the areas by the river. However, taking these various scenarios into consideration is a prerequisite to adapt to future challenges.

4.2. Heterotopias / Negotiations

This aim can be also achieved by treating areas by the river as a different places - heterotopias, where programs which do not fall within the structure of the city because they are in-between. Heterotopias within the meaning of Foucault are places-oppositions, a kind of utopia, in which all other real places that can be found in the culture, are simultaneously represented and reversed, They represent ambiguity, bringing the desirable and undesirable impact at the same time. This alone may deter at the time when confidence and certainty are highly valued.

It is easy to get lost in philosophical deliberations, and examples of heterotopia given by Foucault are not very convincing as an invigorating potential for these areas, since they rather refer to structures such as closed enclaves. In different interpretations of the term[62], on the one hand, we have different categories of objects classified as exclusion areas strengthening segregation (as gated communities) or objects of domination (like malls). However, on the other hand, they may be a "space-time constellations (…) might harbour liberating practices"[63] and be an opposition to market-oriented developments. Obviously it means the possibility and / or the need to experiment, which allows for a more multifaceted understanding of the interaction between space, culture and society - focusing on the processes of transformation and change.

The way of thinking and acting stemming from the idea of heterotopia enables and forces the demolition of static forms, creation of non-hierarchical relationships and constant search for balance (at the risk of its loss). This involves a situation of uncertainty, but also openness and hope. I think that with all the complexity and difficulty of this concept it is still worth to try it out. The areas by the river, as the former back side of the city have the potential to absorb such experiments.

Experiments show that in practice one needs to take into account simple political rulings, in which solutions for beautification and control are selected, which is shown by the example of Słodowa Island. Just like Christiania in Copenhagen, it can be evaluated in different ways. However, the experiment in the capital of Denmark continues[64].

5. Conclussion

In a natural way, as every citizen of Wroclaw I am pleased with the results of the transformation and modernization of the city, including its fragments situated along the river. My aim in this paper was to develop a different need, the need of jump somehow to the higher level. In the policy of Municipality, there prevails the effect of the great events, huge buildings that are supposed to give publicity to the city. The city from the user level, with respect to daily life has a different dimension. It is about preserving the right proportions, as not everything can be solved through beautification and marketing.

The easiest way is to rely on "proven" solutions, define a framework within which one can move around, the easiest way is to maintain control, which is manifested in an aesthetic order. It is much more difficult to open a platform for explorations and negotiations, where the rulings are not given once and for all.

Another issue is the question of correlation between individual projects, works run along the river. Analysis of ongoing renovation projects for waterfronts shows how one-dimensional the planning is, as it is implemented as an independent task separated from other goals and needs.

The difficulty and complexity are understandable and it is hard to argue it, especially when we clash with limitations to available resources, with their use, with the number of necessary arrangements, with the need to carry out the investment process efficiently. With well-defined, individual tasks we are doing very well, with more complex ones a lot worse, but above all, we clash with a lack of vision[65].

Scenarios concerning the Odra River, which are both dreams, intentions and specific proposals are available at all times, and we can have more of them. We find them in discussions on social forums, in activities of self-governmental organizations, in the civil budget, in workshops and students and professionals projects. These are above all questions about how the future of the river might look like. Questions are discussed, and the discussion should be reflected in practice.

In the final part of the paper, I referred to the idea of heterotopia, not to talk about specific objects or developments, but just to emphasize the idea of openness, discussion, testing, and even experimentation - to recall the idea of the possibility of the clash of different forces, which signifies our agreement to uncertainty and disorder, but also opens the way to make places vibrant and unique.

This is precisely what could become part of a public discussion that should take place on the river - whether it should be a new urban lounge, which is usually the goal of transformation of city riverside areas (cited 10 Qualities of a Great Waterfront Destination) or a place for expressing diversity that takes over the role of former districts of dissent against mainstream culture, which created a new quality and were gradually absorbed in the mainstream. While the former is easier to develop, controlling or creating conditions for emergence of such diversity is difficult. In Wroclaw, Mieszczański Brewery operates slightly like this, thanks to the awareness and refinement of its owner, an architect[66]. But there are few such places along the river as a result of the cleaning-up demolition of these areas. Perhaps the most southern edge of Kępa Mieszczańska - the city's port area unless it is converted into a new residential enclave.

References:

[1] Certainly not as intensely as in the typical port cities such as London, where the street network reaching into the river resembled roots drawing water, what is visible on John Rocque's Map of London, 1746.png;
Source:http://commons.wikimedia.org/wiki/File:John_Rocque%27s_Map_of_London,_1746.png

[2] The direction of development of waterfronts in Wroclaw was outlined at the Seminar "Urbanization of Urban Waterfronts - The Face of The River, Which Connects", which was held in 25.10.2008. Source:http://wroclaw.gazeta.pl/wroclaw/1,35771,5847146,Wroclaw_zbuduje_ciag_naodrzanskich_bulwarow.html

[3] Along the southern shore of Słodowa Island there are staircase overlooking the Old City (in the spring and summer to the stairs floating terraces with tables are moored). The project of Xawery

Dunikowski Boulevard anticipates the descent into the water down the stairs. The project has received the building permission but so far has not been constructed. All other boulevards in urban areas are in the planning phase. And the mentioned places have embankments in form of slopes allowing the natural access down to the water). On Wybrzeże Wyspiańskiego Street, the University of Technology in front of the main building is planning to create an attractive public place – today, there is the museum of technology in the old ship (plans were announced in January 2014).
Sources:http://forum.investmap.pl/dolnoslaskie-sport-rekreacja/rewitalizacja-bulwaru-xawerego-dunikowskiego-t2203.html
http://www.gazetawroclawska.pl/artykul/1088108,politechnika-wroclawska-buduje-przystan-nad-odra,id,t.html.

[4] In July 2010 president Rafal Dutkiewicz presented at the press conference the vision of 3 city centers of Wroclaw: Main Market, the Centennial Hall and football Stadium. This approach does not take into account the real connections of the public spaces system throughout the city, and in relation to the river only reinforces the detachment. Source:http://www.tuwroclaw.com/wiadomosci,dutkiewicz-we-wroclawiu-beda-3-centra-miasta,wia5-3266-3535.html

[5] Apart hydrological works, the project practically excludes the realization of other elements. In a few places (including on Xawery Dunikowskiego Boulevard) it happened to correlate the scope of projects.

[6] Renovation of embankments is realized by regional authorities, the areas along the river by the city. The need to use resources in a given time is a reason for the reluctance to agree joint undertakings. More than this, the use of targeted funds for a period of five years closes the possibility of any change in the place of renovation works.

[7] All local plans for areas along the river impose green boulevards. Any developer who builds by the river must also create an appropriate open space accessible to all citizens of Wroclaw.
Source:http://wroclaw.gazeta.pl/wroclaw/1,35771,5847146,Wroclaw_zbuduje_ciag_naodrzanskich_bulwarow.html#ixzz34Sj6Mc00

[8] One of the main reasons is the tenure actions of politicians. In Wroclaw (as in other Polish cities) projects are implemented in the short term, there is no time to take into account multiple perspectives. The cause of implementation problems is also a crisis. After the realisation of large-scale projects for EURO 2012, the city indebted themselves, and now investments are limited.
Source:http://www.euroinfrastructure.eu/infrastruktura/miasta-gospodarze-szacuja-zadluzenie-po-euro-2012/

[9] Gehl Jan (1987) Life Between Buildigs, New York, Van Nostrad Reinhold, p.11.

[10] At the time of writing, on Wybrzeże Słowackiego Street close to the Grunwaldzki Bridge, a sand beach (euphemistic name for the beer garden) come to existence which, despite the noise and fumes, stimulates socially empty so far place.
Source: http://www.tuwroclaw.com/fotogaleria,tuz-przy-moscie-grunwaldzkim-powstala-miejska-plaza-przeniosla-sie-tam-spod-zoo,fot13-7-3252-3.html

[11] Authors: Anna Zięba, Malwina Teodorczyk diploma supervisor: dr inż. arch.Maciej Hawrylak

[12] The project of the sculpture was prepared in 1970, but despite promises of city authorities, was not realized. The sculpture was erected until 11 August 2011 according to the project based on an original sketch of Kantor. It was designed by architect Tomasz Myczkowski and Dorota Krakowska, who is heir to the copyright to the Kantor.
Source: http://pl.wikipedia.org/wiki/Krzes%C5%82o_%28rze%C5%BAba%29

[13]Monument "Powodzianka" by sculptor Stanislaw Wysocki, was unveiled on the first anniversary of the flood. It commemorates the efforts of Wrocław citizens in the fight against millennium flood in July 1997. Source: http://pl.wikipedia.org/wiki/Powodzianka

[14] Design competition for a new inhabited version of the London Bridge was held by Royal Institute for British Architects (RIBA) in 2011. The winner of that design competition was Laurie Chetwood with his vertical farm and public market. Source: http://inhabitat.com/vertical-farm-for-futuristic-london-bridge/chetwood-board2b/

[15] Plan No. 51, Resolution No. XIII/442/99, of 21 October 1999, on the adoption of local zoning plan area of Cathedral Island - Islands - Botanical Garden in Wroclaw, and the plan of Resolution No. XXXVII/855/13 of 17 January 2013, on the adoption of local zoning plan by the streets of Boleslawa Drobnera and Henryka Sienkiewicza in Wrocław.

[16] Inventory status of the devastation of war made in 1945 shows a considerable degree of building on the Eastern Islands, which in the draft detailed plan of 1967 (development B. Łaciorek) and phased plan of 1968 (developed under the leadership of A.Gretschel) no longer exists. Source: Małachowicz Edmunt, Wrocław na Wyspach, Zakład Narodowy im. Ossolińskich, Wrocław 1981, p.187, 226-227

[17] For example, Plan der Haupstadt Breslau 1934. Source:http://dolny-slask.org.pl/3554370,Wroclaw,Plan_der_Hauptstadt_Breslau_1934_1_10_000.html

[18] Project: Dziewoński Lukaszewicz Architects, developer: JG INVESTMENTS, completed in 2013.
[19] The closed competition on transforming areas of the Renault factory on l'Ile Sequin, client: Pinault Foundation, first prize - Tadao Ando. Jean Nouvel's current project from 2010 envisages the construction of two centers dedicated to contemporary art and music, and in the middle of the island a cinema and media center are planned. Sources:http://www.balkanassist.bg/en/regenerations/view/147 http://fr.wikipedia.org/wiki/%C3%8Ele_Seguin
[20] Plan No. 301, Resolution No. XXVIII/979/08 of 11 December 2008. Kępa Mieszczańska
[21] Not to mention the fact that the island is separated by the main street which is not limited in the planning assumptions. Rather, they sanction and basically enhance the current distribution of island introduced by the wide main streets - as it appears no boundary of two local plans.
[22] Architect: Anna Kościuk Archikon, construction: Bickhardt Bau, completed in 2012.
[23] Architect: Roman Rutkowski, construction: Mota Engil, completed in 2013.
[24] Plan No. 372 Resolution No. XLV/1366/10 of 21 January 2010, on the adoption of the local zoning plan for center in the area of Społeczny Square in Wroclaw,
[25] Information come from a conversation with the Bicycle Officer, that took place on 05.19.2014
[26] Another important issue are water steps and locks on the waterway - here again, planning takes into account the only preservation of their technical and historical nature, without reflection on the potential social and tourist service requiring larger units.
[27] Project 2nd stage: Artur Wójciak, Archipelag, developer: Topacz Investment, completed in 2013
[28] Near Wejherowska street in Wroclaw, a former Port Popowice. Rank Progress SA is planning a construction of a housing estate Marina Park.
[29] In the former port of barges there will rise a modern marina for boats. In addition, an office building is planned, and a walkway and recreational places as well. Developer: Topacz Investment;
[30] Developer: I2 developer, purchase of land in May 2014.;
[31] Housing estate Promenady Wrocławskie. Deweloper: Vantage Development
[32] Deweloper: Clairmont Global;
[33] Housing estate Olimpia Port. Deweloper: Archicom;
[34] At the turn of the century, on section of the Odra River in Wroclaw floated about ten ships, including cruise ships with a length of 46 meters and more than 500 passengers entraining!
Source: http://wroclawnadodra.pl/artykuly/633/zegluga-pasazerska-we-wroclawiu-wczoraj-i-dzis
[35] Information based on: http://www.polskatimes.pl/artykul/441469,wroclaw-ile-tracimy-na-kiepskim-lecie,id,t.html
[36] Workshop "Wroclaw over the Odra River" organized by Faculty of Architecture and Urban Planning of the Wroclaw University of Technology and the Municipal Office in Wrocław.
[37] Cable cars „Polinka". Inwestor: the Wroclaw University of Technology. Completed in 2013.
[38] Interview in Gazeta Wrocławska. Source:http://www.gazetawroclawska.pl/artykul/1009337,tlumy-chetnych-do-polinki-tysiace-osob-chcialy-jechac-kolejka-linowa-nad-odra-zdjecia,id,t.html
[39] Worth of discussion is the problem of conservative Polish water law that prevents construction of buildings on the water, off-line the waterfront (eg even slung a few meters above the water the building of Kantor's museum in Cracow, is cut on the line of the waterfront).
[40] Deweloper: B&B Holding, project: 2005. Source: http://www.architectures.nl/pdf/PDF1001.pdf
[41] Due to procedural difficulties in the Office of Inland Navigation, it was registered as a sailboat. Information based on: presentation during the festival Planete.doc in cinema "Warsaw" in Wroclaw on 18.05 2014.
[42] The restaurant is kind of float mounted on poles driven into the bed of the river.
[43] JDS, in collaboration with Klar, will redesign the harbour front Kalvebod Brygge as the result of a tender held by the City of Copenhagen, within the newly established 'Metropolzone' The Metropolzone is a major development project to upgrade a part of Copenhagen City centre, which stretches from Kalvebod Brygge to St. Jørgens Lake. The consultants consortium consists of JDS and KLAR as architects, Sloth Møller engineers, Future Experience, U-turn and WWAP.: Source:http://www.dezeen.com/2008/12/11/b%C3%B8lgen-by-jds-and-klar/
[44] Access will be possible, but the wicket in the fence at fixed hours. Also limited with respect to the current full availability of land. Information based on conversation with architect responsible for project.
[45] Deweloper: Hopfner A/S, Dansk Olie Kompagni A/S, construction: 2005.
[46] Project: Pracownia Maćków, developer: NACARAT, planned completion 2014.
[47] Just point over thirty years of experience Project for Public Space.
Source:http://www.pps.org/waterfronts/
[48] For example organised by the City in collaboration with the Faculty of Architecture and Urban Planning student competition in 2005, and organized by the SARP Wroclaw in 2007 the debate "Wrocław what will be ..." on future of the Kępa Mieszczańska Island; Sources: http://www.w-

a.pl/2004/konkurs_studencki_wroclaw.htm;
http://wroclaw.sarp.org.pl/index.php?id=100&tx_ttnews[tt_news]=176&tx_ttnews[backPid]=10&cHash=bc98831430

[49] Source: http://www.pps.org/reference/10_qualities_of_a_great_waterfront/

[50] Autors: Magdalena Orłowska, Katarzyna Poziewicz, diploma supervisor: dr inż. arch. Tomasz Myczkowski

[51] 1st prize: team Piotr Żuraw, Katarzyna Dobiecka,Angelika Juszczyk, Grzegorz Kaczmarowski, Michał Pietrzak.

[52] Research carried out under the diploma project at the Faculty of Architecture and Urban Planning University of Technology, in the years 2007-08 and 2013-2014, among other: the project of Iwona Borkowska "Urban strategies for the Odra river in Wroclaw", and project of Iwona Borkowska "Odra as a 'hole' in the City" that asked how Wroclaw may refer to the river? and project of Anna Hyrczak "Słodowa Island in Wroclaw", supervisor: dr. inż. arch Dariusz Dziubiński.

[53] It is not surprising that in the polls, places where you can drink beer (and it sort of creating a good atmosphere for people to be together) are most frequently mentioned as the best-working public spaces by the river. Unfortunately, this lush activity, badly affects the state of cleanliness of these places. However, the cause is probably in the absence of management.

[54] Conclusions from the interviews conducted in April and May in 2014 with the designers of public spaces in Wroclaw regarding research on public spaces in Wroclaw. supervisor dr inż arch. Dariusz Dziubinski.

[55] According to police statistics, which show that in the period from 1 January to 27 October 2012 on the island reported 237 incidents in the same period of 2013 years - only 166. Source:
http://wiadomosci.onet.pl/wroclaw/urzad-miejski-wroclawia-zamkniecie-wyspy-slodowej-sprawdzilo-sie/p8x24

[56] Autor: Anna Hyrczak, supervisor: dr inż. arch. Dariusz Dziubiński.

[57] An example might be a project of CHORA for Taiwan, where different innovative strategies for smart cities were tested in the context of climate change. Bunschoten Raul (2012), Taiwan Strait Atlas Manual for a Smart Region, CRC Press.
Source:https://www.youtube.com/watch?feature=player_embedded&v=oaXE6tS0dzs

[58] An example might be a project of the waterfront of the river Waal, architects: Niali Kirkwood, Review of the 2nd International Architecture Biennale Rotterdam, Deena DeNaro www.core77.com

[59] An example might be a project "Rotterdam Watercity 2035" is a comprehensive strategy for the development of the river in the city in terms of living, communication and public space 'Surviving the Flood', source as above

[60] An example might be "Surviving the Flood" that is design strategy for flood plains in Kampen, the Netherlands, project: MVRDV. Source as above

[61] An example might be a conceptual design of Yusuke Obushi is a proposal of 200-hectare garden floating on the surface of the ocean, which draws energy from the vibration of continuous water. Source as above

[62] Different interpretations of heterotopia has been shown most extensively in the collective publication edited by Dehaene Michiel, De Cauter Lieven ed. (2008) Heterotopia and the City: Public Space in a Postcivil Society, Routledge,

[63] In summarizing the text "Heterotopia Unfolded" Hilde Heynen discussing the doubleness of heteretopia indicates its emancipatory and liberating potential, particularly in perspective of the human agency. Heynen Hilde, Heterotopia Unfolded, ibid. p. 322

[64] Of course, the invigorating nature of trangresstion is often cooled by its institutionalization (see November/December 2013, Volume 83, Issue 6, Special Issue: The Architecture of Transgression).

[65] The policy of the city is included in the strategy "Wroclaw to 2020 plus" of 6 July 2006 set out the objectives very general (intentionally): "Cohesive integration of Wroclaw with the Odra river. Turning the City to face the river. The Odra river as the main walway, scene and sports arena of Wroclaw. Use of waterways for transport (not just cruise). Recreational use of the river and its tributaries, waterfronts, islands (summer lagoons). Measures to improve water purity. Purpose of the decade: swimming in the Odra river. Section 6.4. recreation space p.46.
Source:http://bip.um.wroc.pl/wps/wcm/connect/398102804280289a965bd796e258c1d9/strategia_pl.pdf?MOD=AJPERES

[66] In 2003, the former brewery buildings have been sold to Krzysztof Wojtas, who adapted them to the center of arts and cultural training.
Source:http://pl.wikipedia.org/wiki/Browar_Mieszcza%C5%84ski_we_Wroc%C5%82awiu

Riverfront Redevelopment Projects on the River Danube in Bratislava

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1. Abstract

The process of cities redevelopment is a process that contributes to better use of space at all levels of spatial organisation. Brownfield redevelopment is an integrated issue where it is necessary to deal with different aspects of spatial planning and management and take into account different phases of societal development and the reflection in spatial organisation, like transition towards the knowledge society, territorial cohesion and local/regional identity for competitiveness of regions and cities. Redevelopment of abandoned or underused sites in central parts of cities in the CEE countries is a reaction on the post-socialist approach towards resilient cities. It is a process that contributes to better use of space at all levels of territorial organization. The issue of riverfront redevelopment is of an international interest as it is on display for each visitor of cities lying on cross-national rivers.

The aim is to describe and compare two Danube riverfront projects situated in Bratislava, capital of Slovakia. Both redevelopment projects, Eurovea and River Park, are situated in the central part of the city, just a walking distance from the historical city centre, joint by the quayside walk along the river. Redevelopment projects have been developed and finished at the same period of the time on the left banks of the river Danube in the year 2010. It is interesting to follow the story of both projects, from the initial situation, throughout the vision, towards the realisation, project communication and final usage of properties by citizens and visitors.

The case study is based on the complex comparison of two riverfront development projects in Bratislava. Comparison starts with the historical analysis of project sites, their relation and connectivity to the historical city centre, land-use analysis before the project visioning, project communication and marketing analysis, services analysis with the focus on strength and weaknesses of each project. The final focus of the analysis will be on the public space, its size, quality and the usage by visitors of the site.

2. Methodology

The presented paper is mainly based on the case study analysis, including literature survey, site and print media analysis. Secondary data was reviewed and is based on the relevant information needed for the chosen topic, including survey of the online sources. The most crucial part was the print media analysis in conjunction with previous knowledge on the topic. It was necessary to study still available data (often older than 10 years) especially online and to put the emphasis on the objectivity throughout of the analysis process. Site analysis was done in diverse periods of the year and day to achieve the most complex picture of both sides. The focus was on comparison of both projects from the analysed data and the reality subdivided into six subchapters for each described project.

3. Theoretical Background

The aim of the paper is to outline the probable key behind the success and failure of described redevelopment projects. In the focus will be the importance of the public space in the redevelopment processes especially with the contact to the river. Water, as a feature of nature, should be used to its maximal extend especially if situated in central position of cities in contact with the existing build environment and living city. This can be achieved by creation of high quality public space with landscape feature and creation of a contact zone to the river.

The case study of two redevelopment projects on the river Danube in Bratislava is based on the theoretical background of two main issues; gentrification and brownfield redevelopment. Both projects are former brownfield site and throughout their redevelopment the environment have been influenced in the sense of gentrification. Theoretical background gives a very short preview on both topics and states the most important facts relevant for the case study.

3.1 Gentrification

As described in the book Gentrification by Loretta Lees (Lees, 2008), the term gentrification was for the first time defined in 1964 by the British sociologist Ruth Glass who is perceived as one of the pioneers of urban sociology in Europe. She used the term gentrification to describe distinct processes of urban change affecting the inner parts of London. Nowadays, the changes described, are known as the classical gentrification. She has investigated this process on disinvested inner-city neighbourhoods which are upgraded by pioneer gentrifiers where the indigenous residents are displaced and working-class housing becomes middle-class housing in London. Throughout the history we can follow several waves of gentrification (Figure 1).

1950s – 1973	**First-wave gentrification – Sporadic gentrification**	Prior to 1973, the process is mainly isolated in small neighbourhoods in the north eastern USA and Western Europe.
	Transition – Gentrifiers buy property	In New York and other cities, developers and investors used the downturn in property values to consume large portions of devalorised neighbourhoods, thus setting the stage for 1980s gentrification.
1970s – 1980s	**Second-wave gentrification – The anchoring of gentrification**	The process becomes implanted in hitherto disinvested central city neighbourhoods. In contrast of the pre-1973 experience of gentrification, the process becomes common in smaller, non-global cities during the 1980s. In New York City, the presence of the arts community was often a key correlate of residential gentrification, serving to smooth the flow of capital into neighbourhoods like SoHo, Tribeca, and the Lower East Side. Intense political struggles occur during this period over the displacement of the poorest residents.
	Transition – Gentrification slows	The recession constricts the flow of capital into gentrifying and gentrified neighbourhoods, prompting some to proclaim that a “degentrification” or reversal of the process was afoot.
Mid 1990s –	**Third-wave gentrification – Gentrification returns**	Prophesies of degentrification appear to have been overstated as many neighbourhoods continue to gentrify while other, further from the city centre begin to experience the process for the first time. Post-recession gentrification seems to be more linked to large-scale capital than ever, as large developers rework entire neighbourhoods, often with state support.

Figure 1: Waves of gentrification (Stage model of Gentrification according to Hackworth and Smith (Jason Hackworth and Neil Smith, 2001) Lees, 2008)

Gentrification, even 50 years later after the first definition by Ruth Glass, is still a current topic in urbanism. It is mainly perceived as a transformation of a working-class or vacant area of the central city into middle-class residential and/or commercial use. It is a process that has attracted the attention of the media, local governments, urban planner, architects and developers, businesses, city stakeholders, and political activists. In the 1990's in several works we can follow the shift from the classical gentrification to the new-build gentrification described by Neil Smith as a much broader phenomenon. He perceives it as a highly dynamic process where the reinvestment of capital at the urban centre which is designed to produce space for a more affluent class of people than currently occupies that space (Smith, 1996).

3.2 Brownfield Sites

Urban derelict sites are results of changes in functional use of the sites. The loss of main functions of the area leads to the degradation of the environment and further loss of the reputation and attraction of the sight from the point of view of users. Brownfields are predominantly perceived as a result of industrial destructuralization and wave of the recession. Brownfields regeneration is very often very complicated with respect to the strict legislation and environment protection as well as with the respect to the housing market and banking sector. Sustainable way of regeneration requires the integration of social, cultural, economic and environmental aspects (BRIBAST, 2010).

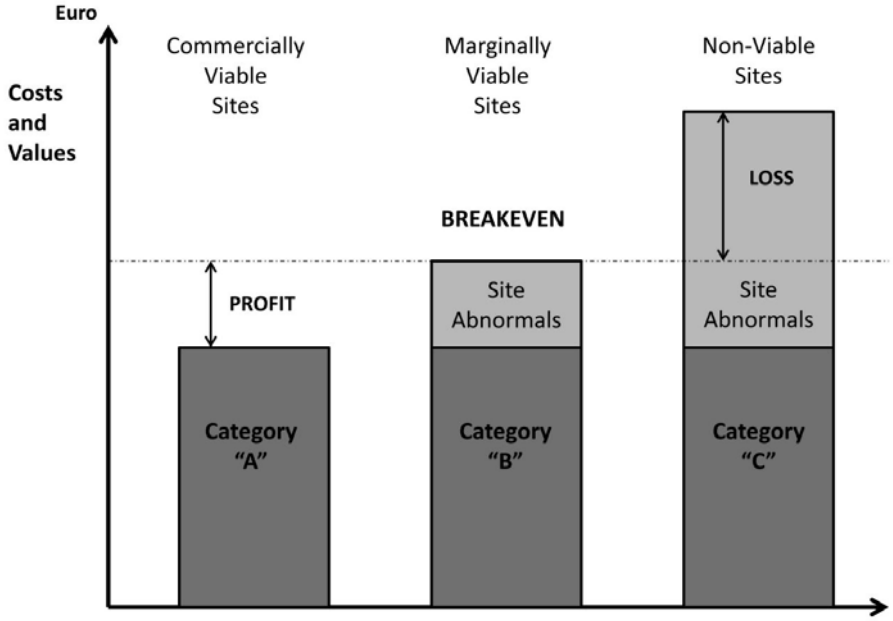


Figure 2: *A-B-C-Model for the brownfield site regeneration according to BRIBAST* (BRIBAST, 2010)

Integrative approach to regeneration lies in a sustainable way in implementation of combinations revitalization strategies based on the knowledge of mutual links among economic recession, degradation of the physical environment and social stress factors. Strategy for brownfields regeneration depends on external and internal framework conditions for the process of regeneration. One of the key factors for strategy selection is the possibility to gain the financial support for regeneration of external resources and total costs for the regeneration of the site (Figure 2). Application tools for the brownfield sites regeneration can be divided into passive (e.g. local taxes, intervention for investors) and active (e.g. improvement of the infrastructure, social infrastructure, transport, social infrastructure, environment, economic activities) financial interventions. The legal framework of the

environment, lack of trust and practical experience in majority of the sites is a limit for the private-public-partnership, but the cities should look for other forms to how to use this approach for their advantage (BRIBAST, 2010).

Brownfield sites are potential sources of pollution depending on their history. There is no official document with the number of contaminated brownfield sites in Slovakia, yet. Based on the site history, it is possible to predict what type of contamination and in what extent to expect. In urban areas, especially in larger cities, brownfields from industrial production can be found. The environmental burden of these sites is more significant as they present danger to the urban environment they are settled in. Each soil, water, air contamination must be remediated in accordance with verified processes, as well as in accordance with local laws. The most well-known example of decontamination in Slovakia is the Eurovea Project. Soil and water of the site were heavily contaminated by oil and heavy metals from the past production. Excavation of the soil into 22m depth was necessary and further disposal of the soil was inevitable. Less polluted soil and water were decontaminated in situ. Remediation and decontamination is very costly and has a direct impact on the financial part of a project. If the costs for dismantling environmental burdens are higher than the potential profit, brownfield sites are not being remediated and are left in the current state of art.

3.3 Creativity, Culture and Creative Cities as an Approach for Site Redevelopment

Creativity itself has a very long history and therefore we can find thousands different types of creativity and always from a different point of view. In general it is very difficult to define the creativity. As many authors as many definitions. Robert Weisberg perceives creativity as a work of the history´s most creative personalities and innovation (Weisberg, 1993), and John Howkins links the word with the spiritual and very personal point of view (Howkins, 2005). Culture is an important source of creativity. Creative industries foster on the rich core of the cultural heritage, gifted artists and culture professionals. This core is linked with connected innovative services bringing creativity to the market (Zlatá, 2011). Many professionals consider linkage of arts and creativity with innovation crucial for the creative potential of the place. Richard Florida, the author of “Creative Class”, sees the connection of culture with economic growth by producing incentives that promote effort, thrift and hard work. Culture according to his view motivates economic growth by focusing human energy and effort on work and away from the pull of distraction (Florida, 2005). Charles Landry describes creativity as historical evolution, while understanding a place from which culture comes from. This attitude creates a potential for a city to rethink its attitude and vision for the future. Landry, as the inventor of the idea of “creative cities”, sees a hidden potential in each city. This concept is a positive one; he assumes that ordinary people can make extraordinary happen if they receive a chance to do so (Landry, 2008).

Creative cities are spaces you want to live in, places to be visited (Hartley, 2005). Often they possess various characteristics as: vibrant arts and cultural sector, capability to produce employment, distribution of resources, etc. As summarized by Jinna Tay, “creative cities” is about how local urban spaces can be remained, rejuvenated and re-purposed within a competitive global framework. Traditionally the city has been studied from disciplines as architecture, sociology and urban planning, developing ideological concerns The concept of the creative city can be replicated but the success itself is depended on how it deals with long-term development questions, such as economic and social sustainability, gentrification and local displacement, exclusionary practices, and local identities. Creative expression may come up against conservative systems or ideological cultural bias, which may act to smother the natural diversity of creativity (Tay, 2005). This renewed focus on social identities also manifest in lifestyle and service consumption as cafes, restaurants, bars, tourism, the nigh-time economy. Cities that offer lifestyle and creative sector but at the same time they provide affordable loft spaces and heap drinks will always be greater attracter for creative workers and diverse communities. This social aspect of the creative industries links the cultural

network to economic and creative production and the city of Newcastle upon Tyne can be perceived (Ward, 2002) as an outstanding example able to compete world-wide known centres of culture.

There is a growing demand for free and affordable space mainly by artists, creatives, social initiatives, youth and sport projects. Facing the problem of derelict brownfield sites, people involved in such developments reintegrate apparently redundant spaces into the urban structures. These “space pioneers” (they discover abandoned sites and reinvent them), often perceived as temporary users, are evidence of a trend to greater social commitment (S. f. S. 2007), to more participative approach (BRIBAST, 2010). Such creativity has a chance to blossom on disused sites and in vacant buildings. The aim is to initiate a temporary use at a suitable site or premises. At the same time, the concept of many temporary use projects rests on the liberty of organizing everything oneself (S. f. S. 2007). Space pioneers, as mentioned above, apply particular criteria to their search for the right location. Alongside the characteristics of the location itself, a personal commitment to work, available networks, mutual voluntary support, creativity and a love of experimentation, all play a role at the start of a temporary use project. They re-cycle the structures for little cost trying to compensate the deficits of a peripheral location by actively networking with other temporary users. Shared locations help to create creative clusters and support the creative environment of the site.

4 Eurovea

4.1 Analaytical background

“Eurovea” is the name of a new international trading centre in Pribinova Street on the left bank of the Danube River, between the Apollo bridge and the Old bridge in Bratislava, in the vicinity of the new Slovak National Theatre building and office building Tower 115. With its location in the city centre it connects the river embankment with the old town and extends the offer of spaces for shops, entertainment and leisure. It is considered to be a successful urban extension of Bratislava´s (relatively small) historic city centre. The whole area of “Eurovea” is a former brownfield site. An oil refinery was originally located in this place, which was founded in 1885 and produced gasoline, kerosene, paraffin, candles, mineral jelly and asphalt. In 1944, during World War II the refinery was bombed and 80% of the factory was destroyed and continuously caused contamination of soil. All refinery activities were definitively shut down at this place in 1963 when the plant moved to other location in the outskirts of the city.

4.2 Visioning, planning, programming

Attractive site in the city centre has been abandoned for many years. The project was implemented thanks to the Irish developer group that respected the valid General City Plan which prescribes amenities and urban greenery for this area. However, the final project did not result in any urban or architectural competition and did not pass through large public discussion either; it was a direct contract (which is a usual procedure in Slovakia).

5.3 Implementation phase

In July 2006, the execution of the first phase of the project began. “Eurovea” (phase I) was opened in spring 2010 and in an area of 230,000 square meters it offers 60,000 m2 of shopping spaces, leisure facilities and entertainment as well as other area over 60,000 m2 of office spaces, hotel facilities and apartments. The completion was possible thanks to foreign capital of the Irish developer who cooperated also with Slovak architects on the final design. The project is situated around a new central square and includes a unique riverside park and terraces. “Eurovea” includes not only offices, apartments and a hotel but also the largest underground car park for 1,700 cars in Bratislava. Almost two thirds of its area is greenery

and public spaces. The most popular part of the project is the “Eurovea shopping place Galleria” with the area of 60,000 m2. The first phase consists of the following parts: the Danube riverside park, apartment complex, “Eurovea Galleria” - a shopping centre, a place for leisure - fitness centre, casino, 25-meter swimming-pool, multiplex cinema with 9 screens, high standard office spaces and a five-star hotel.

The second phase of the planned project would also include high-rise office buildings as well as additional hotel capacities and shops. It expects construction of modern skyscrapers, the highest one of 33 floors and the other one in the range of 13-28 floors.

4.4 Outputs and results

“Eurovea” belongs to successful urban achievements within the city. This project resulted in a new important zone that exceeds Bratislava's boundary and people started to enjoy it. The spaces among the building are proposed as traffic-free and their surroundings are formed as a pedestrian zone (the Danube promenade, several larger urban square shapes). These spaces are closely linked to public indoor spaces of shopping and entertainment mall. The interior “galleries“ serve as communication spaces as well. There are numerous socializing facilities operating inwards and outwards the structure. Thanks to this project, the river Danube "returned" back to Bratislava - well designed and implemented promenade on the left bank of the river (it also forms part of the flood-protection line) is full of people not only during weekends and it became the place for a number of various social interactions.

An important part of the project, in terms of brownfield regeneration, is the object of the Warehouse No. 7. The reinforced concrete structure was built in the 20s of the last century in a functionalist style, reminiscent of classical style. The industrial nature is enhanced by the railway track leading directly to the object, which is still preserved, and which originally connected the entire embankment of the Danube from the refinery to the contemporary port. The building was completely renovated, at present there is an exhibition related to the “Eurovea” construction and spaces where temporary exhibitions have been organized. The role of the Warehouse No. 7 should increase its importance in the near future, when it should be transformed into a city auditorium, its capacity should be increased and it should become an alternative for the malfunctioning of PKO (Bratislava's Park of Culture and Leisure). Its utilization should be mainly for social and cultural events of larger scale. Currently, the Warehouse No. 7 is located on the edge of the zone, but if the planned second phase of developing intentions would be realized it would get to the central position of the whole zone and together with the new building of the National Theatre it would have a chance to create a cultural counter-weight to the hegemony of current "consumerism" character of the urban area.

4.5 Sustainability preconditions

“Eurovea” is a successful project, which was definitely beneficial for Bratislava (often confronted with the similar “Riverpark” project located only about 2 km east from “Eurovea”, which has a superior architecture, but its contribution to "cityness" is minimal). From the commercial and urban points of view it has been the most successful brownfield transformation in Bratislava so far. The integration of the object of Warehouse No. 7 into the project can be highlighted and it is only a pity that there were no more buildings from the original site of the refinery preserved that could have been incorporated into the project (but unlike other projects we, at least, did not witness physical destruction of historic industrial structures). “Eurovea” contributes to the expansion of "pedestrian zone" of the city, it is an example of a compromise between the need of the city and the objectives of investors and, thanks to this, it are undoubtedly facing a bright future. The Danube riverside promenade and the adjacent lots were effectively taken account of in the architectural concept; there is good

permeability. Further development of the adjoining lots will integrate the complex even better into the city-scape.

4.6 Project Communication

Grounds under the “Eurovea”, former oil refinery, were bought by the Irish developer in the late 1990´s. The developer has waited several years for the ideal timing of the project begins. The site had a very strategic position with only one weakness – heavy ground pollution which did not stop the developer in future plans. Adjacent sites have undergone significant change. Originally they were used by small and medium sized enterprises, alternative groups, artists, dancers, small theatre with several pubs and alternative night scene. In the beginning of 2000´s there was a negative wave against demolition of the site and destruction of an alternative artistic scene in the city centre.

This site is situated in so called “Pribinova” zone with the final mix-used function according to the General City Plan. After long period of ground decontamination the site was ready for further development including a new flood protection incorporated into the project. The project was elaborated in cooperation of Slovak and foreign architectural offices without previous competition but fully in correspondence with the valid General City Plan. The whole project was communicated with the public and no considerable errancies have been detected. Open and freely accessible public spaces and visual connection to the river have lead to the positive acceptance by the wide public.

5 Riverpark

5.1 Analaytical background

“Riverpark” is a new multi-functional complex on the left side of the river Danube. The location is in a vicinity to the castle and the historical city centre of Bratislava with a direct view on the Danube floodplain forests called Pečniansky forest. With its location in the city centre it provides a range of services as a five star hotel, residence apartments, offices, cafes, restaurants and shops. This complex was built on a site where the main architect of the city Bratislava had its seat and partially on the grounds of the former Park of Culture and Leisure (PKO). The department of the main architect was discharged in 1990 and the building was torn down 10 years later in the year 2000. Due to the change of the system former site was not any longer used and from today’s point of view is perceived as an underused area. On the site no major contamination was detected.

5.2 Visioning, planning, programming

Attractive site in the vicinity of the city centre has been abandoned for many years. The project was implemented thanks to the domestic developer group J&T REAL ESTATE, a.s. based on the valid General City Plan which prescribes amenities and urban greenery for this area. However, the final project did not result in any urban or architectural competition and did not pass through large public discussion either; it was a direct contract to the Dutch architect Erick van Egeraat (which is a usual procedure in Slovakia) and it was finished on the site by Slovak architects.

5.3 Implementation phase

July 2006 was the execution of the first phase of the development project. “River Park” was opened in June 2010 and in an area of 32,000 square meters it offers 202 premium residence apartments, five-star Hotel River Park, wellness, fitness centre and spa, 29,000 square meters of office premises, cafés and restaurants, shops, bank, post office, Riverpark Dance School and provides underground car park for 1,100 cars out of which 400 are exclusively assigned for residents. River Park consists of four blocks, each of them with a distinct character and function. River Park 1 building is situated at the western corner of

River Park, consisting of residence apartments looking over the Danube as well as offices and shops, near the former PKO. J&T River House is the visual domain of the complex. It is located in the centre of the complex and its upper floors extend over the promenade up to the river Danube. Kempinski Hotel River Park forms a square along with J&T River House. River Park 2 is the most extensive block and the closest to the city centre. In this block are situated residence apartments with services on the ground floor.

The second phase of the planned project would also include high-rise office buildings as well as additional hotel, shop and housing capacities. It expects construction of a multifunctional hall for approximately 1000 visitors as a substitute for still existing, but not any longer in service, PKO who used to be the centre of culture and leisure (housed 2 multifunctional halls with the capacity of 3000 visitors).

5.4 Outputs and results

“River Park” belongs to new urban achievements within the city centre. This project resulted in a new zone that has gentrified the area and has a direct impact on the visiting milieu from “accessible to everyone” to “upper middle class”. The spaces between buildings and the river are traffic-free and their surroundings are formed as a pedestrian zone leading to an open space park. In the public space several statues are displayed. These spaces, depending on the year season, are used for diverse applications (e.g. in winter time there is an ice skating area for public).

5.5 Sustainability preconditions

“River Park” is only partially a successful project, containing superior architecture, but its contribution to "cityness" is minimal, in comparison to a similar project “Eurovea” located only about 2 km to the west. “River Park” contributes to the continuation of "pedestrian zone" of the city and provides a small park with playground for children. From the commercial (already two years before the completion, in 2008, developers were forced to reduce the selling prices of all premises in 40% to burst the sale) and urban points of view this project has failed to become a successful transformation in Bratislava so far. The negative perception comes from the unprofessional discussion and treatment from the site of the developer as well as ongoing comparison of the public space quality in the nearby redevelopment project “Eurovea”.

5.6 Project Communication

From the early beginning, since the grounds were bought by the developers in the early 2000´s, the development project was negatively perceived by the wide public. It has all started with not transparent sell of the grounds under the PKO under the supervision of the former administration of the city Bratislava with Andrej Ďurkovský as a mayor. The major problem was the sale of very lucrative grounds below the expected price to developers. The conflict continued when the parts of the ground had to be bought back by the city due to the necessary street and pedestrian walkways reconstruction (bought for much higher price as sold to the developer) and afterwards were given back to the developer.

Several urban studies for the zone have been elaborated, but unfortunately none of those have been adopted as the official Master Plan of the Zone. The only valid document for this area was the General City Plan with mix used function and recreational amenities. The investor has fulfilled the functional requirement even though the structure density and the height restrictions are very questionable. The development project did not undergo any national nor international competition; it was directly given to the Dutch architect Erick van Egeraat. This architect caused another negative wave with his famous quote: “Bratislava actually never liked its river”. He has developed the main idea of the River Park which was

further elaborated by Slovak architects. Many people do not agree with this quote, nor were they convinced by the new design. The access to the water is even more restricted due to the newly rebuilt flood protection on the embankment of the river Danube.

The continuation of the project causes the most negative feelings in the public. 50 years of history and culture should be torn down with no guaranty for the replacement. The grounds under the meant River Park II are grounds of the former Park of Culture and Leisure (PKO) widely used by the public for diverse occasions (concerts, exhibitions, competitions, balls, etc.). Developers had the permission to tear down the complex and start with the new development until April 2009 during the crisis. In the meantime activists started to gain signatures against the demolition and the city tried to repurchase the grounds without success. Nowadays PKO again belongs to the city even though it is not in operation (the city has received the building in very bad conditions) and the whole project continuation is not clear and convincing.

6 Conclusion

The problem of river side development is in many cases connected with the redevelopment of brownfields sides of former ports, industrial plants, storage houses. From the peripheral location they became to be parts of the city centres representing not only a barrier between city and river often with huge old environmental loads, but with potential to be very attractive functional and physical structure with valuable public spaces. The paper describes two Danube riverfront projects situated in Bratislava, capital of Slovakia. Both projects - Eurovea and River Park, are situated in the central part of the city, just a walking distance from the historical city centre, joint by the quayside walk along the river. Both project have been developed and opened in the same period of the time, both built on the left embankments of the river Danube, both creating attractive places in some specific way. Eurovea was built by the Irish developer; River Park was built by the Slovak developer. In the paper both projects are described from their initial phases, visions, planning, implementation, results and communication with public. In many respects they show similarities and some differences. Differences of both projects can be already found in the initial situation. Eurovea is situated on the former oil refinery while River Park on the former underused sites. The Irish developer had to invest much more money into the project preparation due to the heavy ground pollution. It is logical that the Eurovea project had to be oriented more towards the consumption to assure financial return of the investment. The range of services and amenities of both projects vary. The most prevalent difference is in the type of retail offers. Eurovea is focused on a shopping mall with entertainment while River Park is focused on permanent and temporal housing (both services are being provided by Eurovea too).

The most visible difference is in the offer of the open space. Both project offer open public spaces, both are situated on the main river Danube promenade; both have incorporated the new flood defence into their urban design. The difference lies in the approach. While River Park continues in the traditional way where the flood defence is in the form of a steel-concrete rail structure even closing the former balconies used for the river Danube observation, Eurovea project opens the space as close to the river as possible while making the flood defence as a part of the pavement (in case of danger mobile flood protection is raised on the site). The second approach allowed to open the space and to use by now unused river Danube embankment. Creation of the green spaces with trees, children playgrounds, relaxation areas and piers allowing a better view on the river have led to a very vivid open space accessible at any time. In comparison River Park does not provide a direct connection to the water, it is based on the display of art and architecture. The main task can be answered whether the success of one project lies in a quality, better said approach to the public space and the overall acceptance of the wide public in the case of Eurovea. The question remains in which respect negative communication towards the public has influenced

the overall perception of the project River Park. The different examples of River Park and Eurovea has shown, that interplay between private investors and public authorities can be crucial for the effects on both sides influencing attractiveness of the investment for the market and with this commercial success as well as attractiveness for citizens, visitors, retail and service providers and with this for the development of new quality of urbanity in the city. The collaboration between public and private sector can even avoid the conflict between newly developed commercial capacities in the fringe of the city core area and liveability of the historical centre harmonising functional profile of new development and providing complementary offer to the historical down town. This can lead to profitable and successful development in particular localities as well as in the city as whole.

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Ecological Urban Design Strategies Based on Water and Wind Simulation: Revival of Riverside Negative Urban Spaces

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Synopsis

This paper focuses on the urban design project of Cangzhou, one of the cities along the Grand Canal in China. The project hopes to create a harmonious relationship between the Canal and the city, to realize both revival of the Canal and improvement of urban space and living environment. So it studies the application of urban design using analysis and simulation of both the water and the wind, to propose eco design strategies on riverside urban spaces, water management and activities along waterfronts. These strategies are implemented on a real project in China to make it much more informed and data based.

Keywords:

Water and Wind Simulation, Eco Urban Design, Riverside Revival, Data-based Design

1. Background

With the nowadays urbanization, both industries and cities are in rapid development. However, the relationship between human beings and nature has not been paid enough attention to. Also the natural resources have not been efficiently used into urban design, which directly resulted in the destruction of urban environment. In addition, designers and planners always pay too much attention on building good space, but ignore that design should spatially interact with the environment.

As the result, the environment conditions failed to meet the needs of citizens' daily lives. So when doing urban design, we should take natural factors into consideration, no matter the tasks we are dealing with are high-density urban built-up optimizations or the planning and construction of a new town. In this way, we can make spaces to have good environment adaptation, and the design work can have a good basis.

The comfort of urban spaces is inseparable with both environment and the climate. Just simple water conditions, rainfall, the wind, temperature, humidity, solar radiation are closely related with the comfort of human livings. Although these conditions cannot be changed, we can do urban design under the guidance of analysis and simulation, to make the designed spaces to have better adaptability to the environment.

Cangzhou is a Chinese city located by the famous Grand Canal. In the early period, the city expansions linearly along the river. Time passed, the city center gradually shifted westward, which made the Canal finally turned into a crack separating the city into two parts. With the recession of the water, the function of transporting on the Grand Canal is gradually trailed off, and the water paths that infiltrate into city were blocked. In consequence, large number of negative urban spaces formed along the river. Ecological environment became increasingly worse, commodity trade became depressed, and cultural relics started to disappear.

So we have made the urban design along the Great Canal, trying to use analysis and simulation on both the river and the wind. We hope that we can combine natural factors together with urban design, to make designing strategies much more informed and data based. Relying on the geographical location, analysis and simulation of the designing area,

we can solve problems such as where we need to form corridors along or facing the river, where we set public spaces on riversides, how we can optimize the built areas near the river with high-density, and etc.

This paper starts from the nowadays developing background of cities and the environment, then studies the application of urban design using analysis and simulation of the river and the wind, and explores current developing stage and future directions of it. Thus the basis and methods are proposed for works like riverside urban design, public spaces application, water management as well as the consideration of activities along waterfronts.

2. Ecological Urban Design

Since it is based on the natural meteorological data and targets at the spaces, micro-environment design is after all a certain kind of space design to achieve the harmonious environment between human and nature rather than just meeting the needs of human, thus we can find a way of common development between human and the nature[1]. Climate is beyond human's resistance that we can hardly totally change the climate in a wide range, but it is possible to construct the high-quality of space's micro-climate and provide micro-environment which is suitable for living through the appropriate method of design.

In the process of design and construction of space and environment, micro-environment design is an ecological design method to make the micro-climate more comfortable according to the users' demands[2]. It can be realized by space control based on the simulation analysis of meteorological data which means we can alter the space form and surface features to adjust the micro-climate according to the laws and principles showed by the data analysis[3]. And in this process, the meteorological data of several climate elements will participate in analysis and simulation and provide crucial support to the final design of the spaces and environment.

3. Micro-Environment Design on Urban Scale

The discussion and application of urban micro-climate is not just about the small scale built environment, but also including the ecological space of macro regions. Especially in the urban areas in high density, there are a lot of things we can do according to the analysis and simulation of the climate in local area, such as how to form corridors, how to arrange the public space and how to improve the environment of the urban built-up areas. In addition, these kinds of methods are more important to apply in the construction of new city. It is beneficial to design considering the local wind environment to lead the wind and keep out the wind in different seasons consciously, and take the sunshine radiation condition, humidity, evaporation and rainfall into consideration while doing the urban design.

The application of ecological micro-environment design in urban scale has already been studied by scholars all around the world. With the thinking of wind analysis, the concept of 'The city wide ventilation' has been proposed that can save more energy and make a livable city by the wind flow to deliver the fresh air from suburb areas to urban areas, and the water and wetlands in urban areas can also produce positive effect[4]. In addition, there is an affinity between architectural layout and the wind environment formed by it and the arrangement of buildings will greatly affect the wind field in spaces[5].The water regions in urban areas are considerably conducive to the regulation of urban climate because water temperature changes slower than the land , so we can select the location of water areas in city based on wind analysis and make use of the wind flowing through the water surface to cool the city[6]. This can be proved by many built-up cases including the waterscape square in Bordeaux France.

Micro-environment design is based on the study of climate which is normally realized by data analysis and simulation. The climate data used in the designing of urban scale is relatively macroscopic, in which the most important part is the simulation of wind, water[7] and

geographical conditions and the data of sunshine and rainfall also play a supporting role. Urban scale micro-environment design can target at objects including location selection of public space aiming at constructing livable environment, reasonable urban special and building layout, the implementation of regional ecological corridor.

4. Case Practices

The case of urban scale design is based on 'the Concept Planning along the Beijing-Hangzhou Grand Canal in Cangzhou, Hebei'. Cangzhou is a prefecture-level city in Hebei province. It is located in the east of Hebei, in the north of Tianjin and south to Shandong province with a total area of 1.4 square kilometers and the total population of 7.27 million.

The Beijing-Hangzhou Grand Canal, known together with the Great Wall as the greatest project in ancient China, is the world's longest, largest and oldest canal. It is a precious alive world heritage, as well as spiritual wealth created by the ancient Chinese working ancestors. The Great Canal starts from Hangzhou in the south and ends in Beijing in the north, with a total length of 1747 km. In 2013, the Grand Canal has been officially submitted by the Chinese government to the UNESCO to apply for the World Heritage. All 8 provinces and 35 cities along the Grand Canal have worked together trying to make the Great Canal to the World Heritage List in 2014. Some of these cities have done urban planning works on spaces focused on the Great Canal, intending to disinter the value of the historical culture and develop relevant tourism.

There are two main reasons why choosing this case as the studying object. Firstly, the project focuses on the riversides of the grand Canal where the water resources is abundant, so it is significant to analyze the water and take advantages to it while designing the riverside urban spaces; Secondly, in different seasons, the predominant wind direction of Cangzhou varied with Southeast wind in spring and summer and northwest wind in autumn and winter, so it is beneficial to induce wind in spring and summer while keeping out the wind during autumn and winter, which makes the conclusion of the wind data analysis and simulation meaningful and worthy.

The project aimed at creating a harmonious relationship between the Canal and the city, to the revival of the Great Canal and improves the urban spaces and living quality along it. In detail, we make suggestions on the urban public spaces, architectural layouts and the corridors based on the data analysis and simulation of wind and water that include public space placement based on ecological analysis, eco-oriented city space layout and ecological corridors design in regional level.

4.1 Public Spaces Placement based on Ecological Analysis

When discussing where is the most suitable place for public spaces, the first work should be carried out is the analysis of nature climate factors here around the designing site. Then certain meteorological data that can be analyzed and influencing the placement are studied.

In this case, wind and water are selected as the two main meteorological elements. As for the wind, the dominant winds here in Cangzhou city change in different seasons. In spring and summer, the dominant wind comes from southeast, while in autumn and winter it comes from northwest. We hope that in summer, places that have better wind ventilation can be made as public spaces where citizens can have their activities. While in winter, the wind in this area can be efficiently weaken by architectures. As for the water, we hope that public spaces along the river can have good water quality, so that water analysis can help choosing places for citizens' public activities.

The analysis results of wind simulation in both summer and winter are showed in figure 1. According to different wind speeds on different urban spaces, the riversides can be divided into several parts according to whether it is suitable or not suitable for public space construction. This analysis is carried out only according to wind simulation.

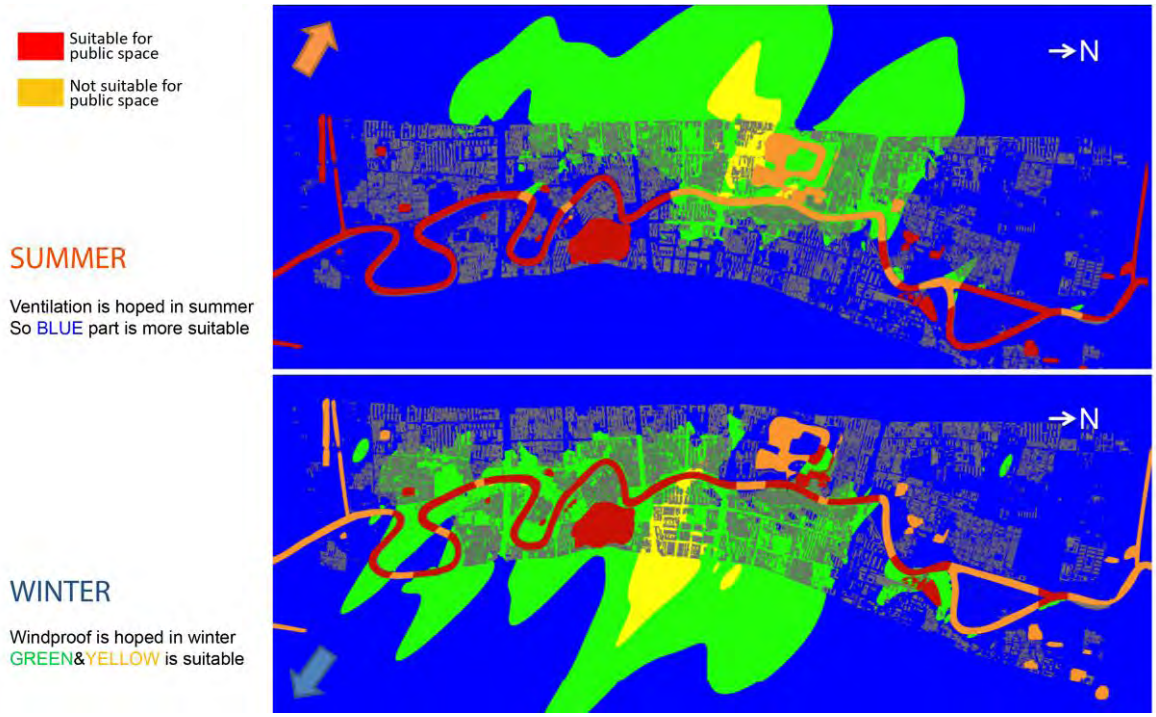


Figure 1: Wind simulation analysis and suitable construction sector for public spaces along riversides, based on prevailing wind directions in summer and winter
Source: Author's self-drawn

Spaces that have both faster wind speed in summer and lower wind speed in winter are regarded to be suitable for human activities in all seasons. Therefore, the analysis results of these two seasons are combined together, which makes comprehensive evaluation results of all seasons. (Figure 2) In the analysis results, the green parts of the riverside are places that have good public wind conditions in both summer and winter. Then where is proper or not for public activities is easy to see from the figure.

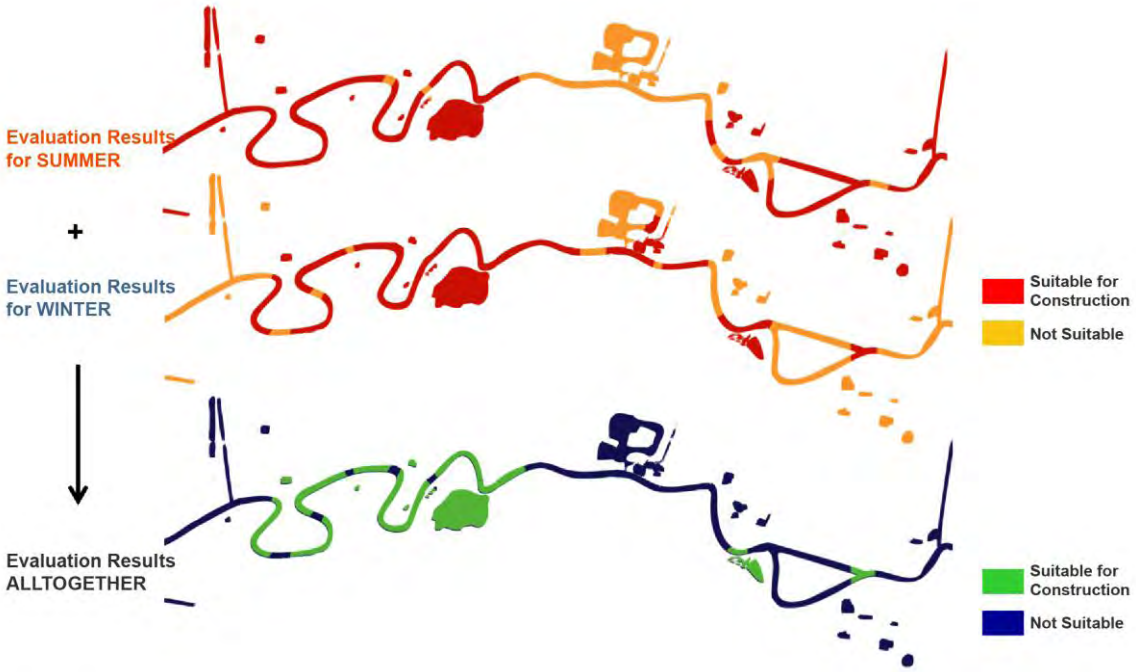


Figure 2: Suitable construction sector for public spaces along riversides Analysing results in summer and winter, and combined alltogether
Source: Author's self-drawn

Furthermore, water is added as another analyzing basis. The water quality in different parts of the Canal is of course different according to functions along the river. Public spaces are built for citizens to have activities outdoors, so once a riverside public space is decided to be settled along the river, the quality of the water near it becomes an important thing to be considered. The analysis firstly makes the data of water quality into image visualization, and then integrated it with the previous results. Therefore, both wind situation and the status of water quality for all parts of the river can be visually seen from the analysis. (Figure 3) In this way, the feeling of citizens for wind and water can be taken into consideration in designing work to help form good urban living micro environment.



Figure 3: Evaluation and analysis results from both wind and water simulation
Source: Author's self-drawn

4.2 Ecological Oriented Regional Urban Design

In order to optimize the layout of the urban spaces to improve the current living situation for citizens, current problems of the urban spaces are needed to be found firstly. The study tries using wind simulation to find the main problems that exist in the current urban situation, in order to come up with significant improvements and targeted strategies for the layouts of urban space here in current city. This is the main methods that putting the idea of micro environment design into the designing practice case. And it is also based on the study and analysis of meteorological data in Cangzhou City.

In summer, the layout of urban spaces is needed to be considered mostly to enhance ventilation. By analysis, the main problems of current urban layout are listed in Figure 4, such as buildings are in high density and open spaces are lacking, too many high-rise buildings in some certain areas leading to poor wind ventilation, ecological wind corridors are lacking and are not getting through the city. Therefore, the corresponding space design strategies are: controlling building height in order to reduce obstacles to the wind by high-rise buildings, making the angle between building orientation and the wind to proper degree (between 135 degrees to 180 degrees), constructing new buildings mainly in staggered layout, and opening wind corridor appropriately, etc.

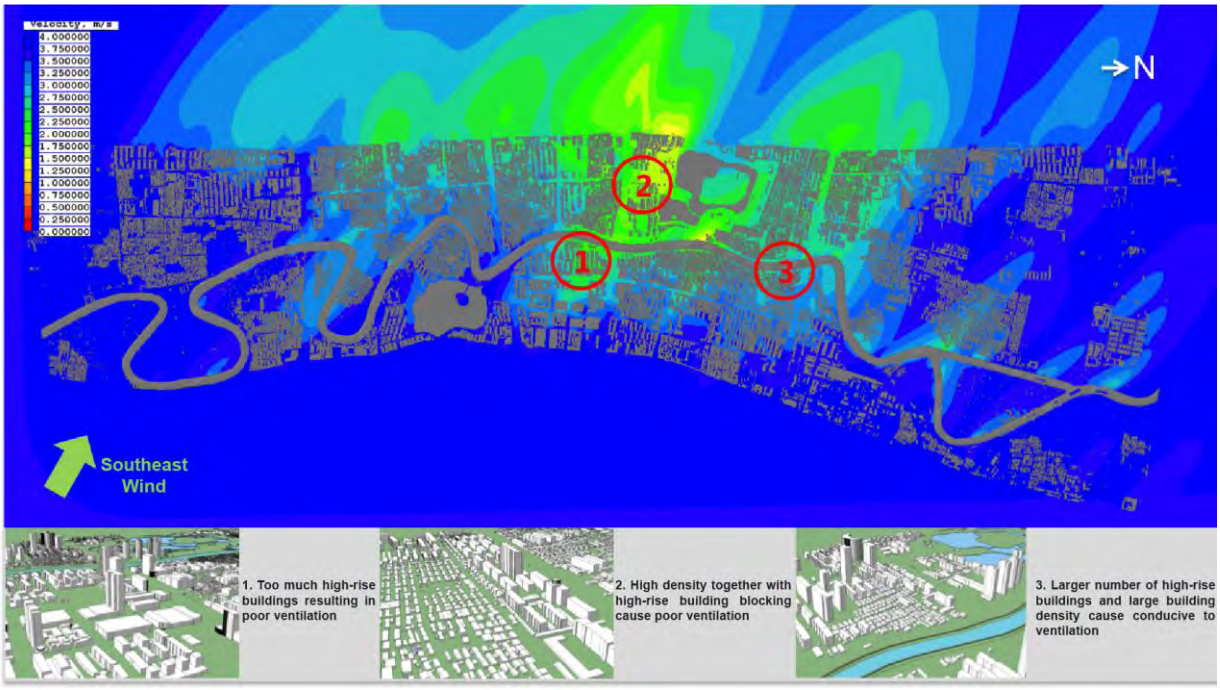


Figure 4: Current main problems on urban space layout based on simulation of wind in summer
Source: Author's self-drawn

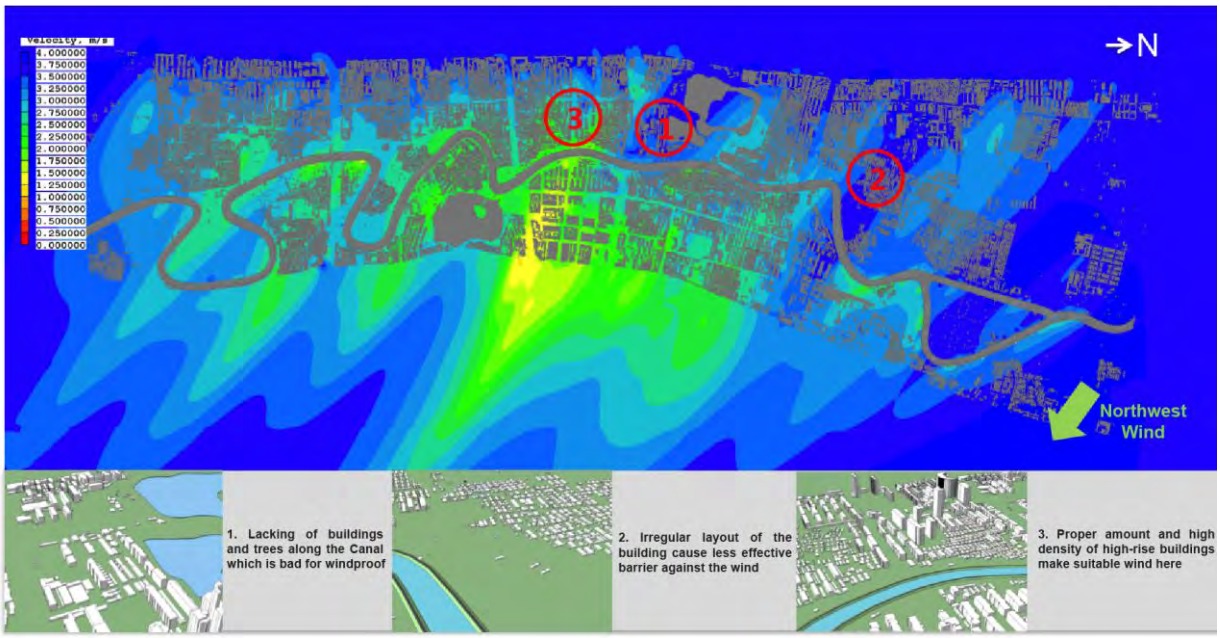


Figure 5: Current main problems on urban space layout based on simulation of wind in winter
Source: Author's self-drawn

While in winter, the layout of urban spaces is designed to be preventing the wind from blowing into urban public spaces. being quite different from the problems in summer, the main problems of current urban layout in winter are listed on Figure 5, including the buildings are arranged irregularity to have poor blocking effects to the wind, public spaces are in lack of green elements, most buildings are similar in their heights and space between them are too small to make good wind ventilation. Accordingly, strategies are proposed on several aspects, such as building high-rise buildings appropriately and a relatively controlling high degree of development, similar with strategies in summer also making the angles between

building orientation and the wind to proper degrees (between 45 degrees to 90 degrees), and make newly built building mainly in parallel layout, and etc.

4.3 Ecological Corridors on Urban Scale

As it has been mentioned, the strategies of setting up regional ecological corridors accordingly can be used to form good urban living environment in different seasons. Where and how to set the corridors specifically, can all be easily obtained from the analysis results that have already been done. (Figure 6)

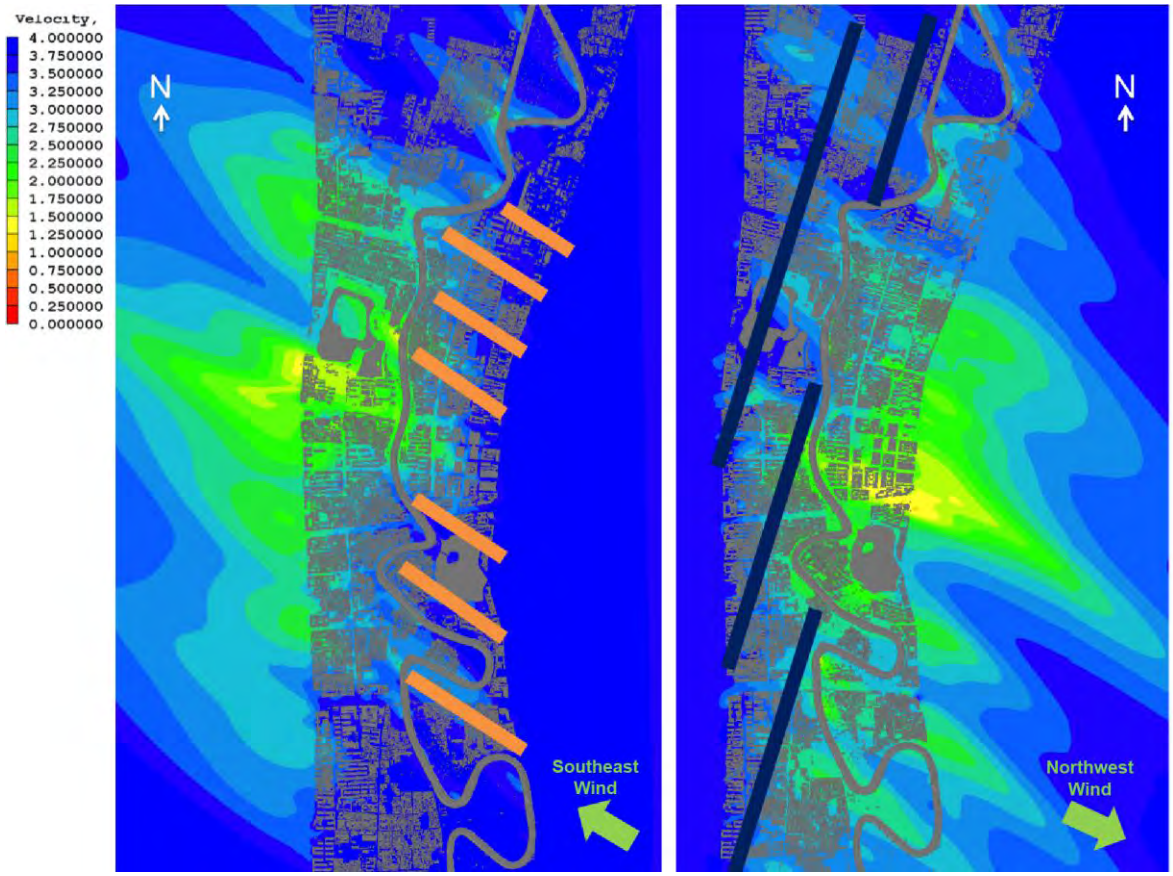


Figure 6: Guide for designing of regional ecological corridors based on analysis
Source: Author's self-drawn

According to the results of simulation and analysis, strategies are needed to be done separately on each sides of the Canal based on different seasons.

On the east side of the Canal, regional ecological corridors should be set along the dominant wind direction in summer, in order to enhance southeast winds that reach the Canal. In this way, with the help of Canal water which can speed up the wind above it, in summer the west side of the Canal can get much more wind coming through than before.

Meanwhile, for the west side of the Canal, ecological corridors should be set against the dominant wind direction in winter, in order to reduce northwest winds that reach the Canal. So that there will be less cold wind running from the west to the east part of the city then. The specific strategies for building ecological corridors on both sides of the Canal are shown in Figure 7.

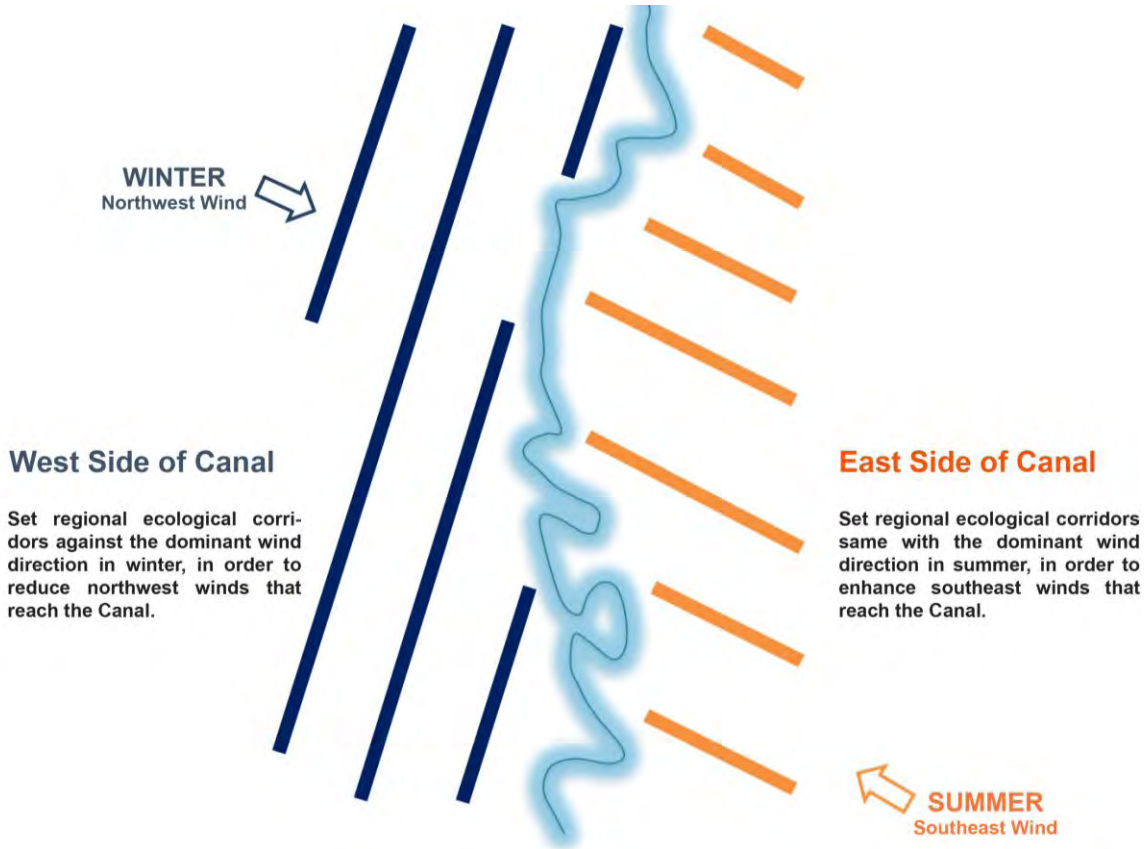


Figure 7: Specific regional eco-design strategies on both sides of the Canal
Source: Author's self-drawn

5. Summary

In the project of the concept planning, we could get the advices of the spatial design through the analysis based on different monsoon characteristics and water quality characteristics to support the urban planning and design. But only if more conditions and parameters are involved, could this kind of spatial strategy be more cogent and compelling. Thus, this calls for a comprehensive investigation and understanding of the site in the beginning of the project, based on which can we choose the proper micro environment data to do the analysis and design in an effective way.

It shows a sweet envision of the harmonious interaction of nature and the human beings through the attention thrown onto the micro environment in the design process. But in the practice it is hard to design really based on the data analysis as we wished or it supposed to be for urban planners and designer may not have a good understanding of the meteorology and meanwhile the specialists of the meteorology are likely to lack the ability to design the site or the buildings. So only through the synergy and cooperation of different majors, with more involvement of the environment analysis specialists in urban planning and designing, can we make much more cogent and compelling urban planning.

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RESTORATION OF RIVERINE WATERFRONTS THROUGH INTEGRATION OF GREENWAYS IN KENYA

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Mwangi Elijah Maina[2]

1.0 Introduction

In the world today, the issue of sustainable ecosystem management is providing humanity with one of its greatest challenges. For freshwater systems the problem is complex because human beings and the natural systems are inherently linked making rivers and wetlands to be among the most threatened ecosystems in the world. As noted by Brookkes and Shield (1996), the restoration of rivers and wetlands emerges as a global phenomenon as well as a flourishing enterprise.

Many cities in the developed countries have been able to integrate a network of habitat fragments or 'urban greenways' along their waterfronts comprising of semi-natural habitats, secondary succession, ruderal and pioneer environments and open areas. These habitats have come to be significant features for biodiversity both as stable and as transient habitats (McIntyre et al., 2001).

Unlike in the developed nations, the developing nations have struggled with environmental issues and inactions in these countries contribute negatively to the environment. While countries like the United States of America and their developed counterparts spend billions of shillings in rehabilitating the environment, especially the waterfronts, many of the third world countries have presided over the destruction of the very environment that hosts their citizens. While scientific knowledge on restoration projects increases in the first world nations, the same cannot be said of the developing nations.

In these developing countries, hundreds of millions of the urban poor have been left with very few options but to live in squalid, unsafe environments where they face multiple threats to their health and security. As much as they are faced with these challenges, they have also posed a threat to the very environment they inhabit. Development of informal settlements in the third world countries has in many ways has led to the degradation of the environment, especially the waterfronts. This is mainly because most of these developments are of linear forms along waterfronts. In Kenya, for example, most of the informal developments have been undertaken along riparian reserves creating an environment hazard and an eyesore. Where waterfronts would have been the beauty and joy of the urban form, this is not the case today and a visit to Kenya reveals a sad story.

Although researchers worldwide know a lot about restoration practices in Europe and the United States, information about the activities in sub-Saharan Africa and more so Kenya that has over one hundred rivers and streams is scanty. Here we provide an overview of the situation of riverine waterfronts in Kenya and discuss ways in which greenways can be integrated as a planning solution for conserving and protecting riverine waterfronts in Kenya. The study goes a long way in highlighting the problems that bedevil urban planners not only in Kenya but also in the third world countries as far as restoration of riverine waterfronts is concerned. We inform the global world of planners on the need of adopting greenways as necessary tool of preserving waterfronts.

1.1 Aim and Objectives of the Study

The purpose of this study is to investigate ways in which riverine waterfronts can be restored in Kenya through the integration of greenways as a concept of urban design, giving birth to the 'green-blue corridor'.

Specifically the study seeks to address the following objectives:

1. Identify the threats posed on waterfronts by the development and growth of informal settlements
2. Establish the planning issues that exacerbate the threats posed by informal settlements on waterfronts.
3. Develop a sustainable framework of integrating greenways as way of enhancing the management and protection of waterfronts.

2.0 Literature Review

2.1 Restoration of Riverine Waterfronts

The water edge, be it a seashore, a riverbank, or a lakeside is considered as a waterfront. In the recent past, waterfronts have gained a lot of public attention, especially in urban areas. The waterfronts perform a number of roles. Apart from acting as nodes for citizens activities, waterfronts give a city an image and are crucial as sightseeing places for visitors. When well taken care of, waterfront public space can give high levels of expression to city's maturity by providing the 'prime place' of urban development and redevelopment projects (Zhang, 19990). Zhang (1999) defines waterfront as the board interface between land and water where economic production, consumption and exchange processes occur at high rates. Waterfronts offer not only offer unique environmental opportunities but also provide important economic development and public entertainment besides giving a place an identity.

Today, restoration of waterfronts has gained momentum globally. Many cities around the world are seeking riverfronts that can act as place of public enjoyment and one with ample visual and physical public access. Cities also want a riverfront that serves more than one purpose: they want it to be a place to work and live as well as a place to play. In essence, many cities seek places that contribute to the quality of life in all of its aspects, be it economic, social and cultural (Arora C. M. and Gupta, T. 2012).

According to the Society for Ecological Restoration, ecological restoration is the process of intentionally altering a site to establish a defined indigenous, historical ecosystem. Therefore, the main goal for ecological restoration is to emulate the configuration, function, diversity, and dynamics of a specified ecosystem. Riley (1998) argues that unlike landscaping that is a means of creating a new environment that provides sanctuary, adventure, symbolism, recreation, entertainment and in some cases sustenance, waterfront restoration is the revegetation of waterfronts so that they don't collapse under-high velocity flows. In restoration waterfronts continue to perform as a component in the dynamic system.

Riverfronts can be classified into the following broad categories.

a) Cultural Riverfronts

These provide a sense of community, opportunity for festivity, artistic expression, recreation and commercial bustle.

b) Environmental Riverfronts

Design with nature", might include shore stabilization, wetland preservation, prairie restoration etc.

c) Historic Riverfronts

A sense of uniqueness and character" to a place. They provide a special educational experience to a person by preserving the cultural heritage of the place.

d) Mixed-use Riverfronts

The mixed-use waterfront projects include a mix of retail, housing, office, restaurant, open space etc. They can provide a dynamic space containing various activities blended to complement each other.

e) Recreational Riverfronts

These are known as the place of community gathering and provide various recreational opportunities for people such as parks, gardens, picnic areas, walking, cycling and water related activities including boating and fishing.

f) Residential Riverfronts

Housing is a very important element in riverfront development. Residential development also creates opportunities for other activities like retail, recreation, restaurants.

g) Working Riverfronts

These have some kind of river-related activity on such as fishing and boat repair.

The Value of Riverine Waterfront Restoration

According to Riley (1998), riverine waterfronts can act as industrial transportation corridors, industrial water supplies, and domestic and agricultural supplies. If well harnessed, there waters can be support marine and provide for a recreational industry of white-water rafting, kayaking, and canoeing. Riverine waterfronts inspire trails, greenbelts, and parks and can enhance the values of commercial areas and downtowns of cities by acting as tourist destinations. Riparian vegetation along riverine waterfronts also has important value for aesthetics, shade and wildlife habitat.

2.2 The Concept of Greenways

Globally, cities are building urban greenways to achieve environmental, economic, and social objectives. Greenways are recreational trails that provide functions beyond recreation, such as storm water management, economic development, community development, and aesthetic improvements (Brasier, A. 2011). Randolph (2004) posits that parks and green spaces serve as fundamental infrastructure to solve urban problems such as congestion and filth. They evolve gradually and their objectives vary in different stages. Ecological infrastructure, being continuous green space network, is increasingly recognized as a new strategy of open space planning and land conservation.

Role of corridors in the urban environment

Green corridors have become a recognised feature of urban planning and conservation in the recent past. Greenways using a drainage network as a spine can be used to buffer surface water and riparian species from influences of adjacent landscapes. They can also be used in the protection of patches of interior habitat from outside disturbances as well as offset the effects of landscape disturbances. Greenways have been known to enhance cultural resources through creating a link that forms a network that maximises interpretive and recreational value in addition to providing visible structure and legibility to a landscape (Bryant, 2006). They also poses the ability of serving as a stimulus for preservation and restoration of urban habitats, as well as a means of environmental education to visitors visiting the conserved areas.

Adoption of Greenways along Riverian Waterfronts

Restoration of streams and rivers has been done by a number of small towns and large cities interested in attracting or enhancing a tourist economy. Today, many cities have a network of habitat fragments or ‘urban greenways’ comprising areas of semi-natural habitats, secondary succession, ruderal and pioneer environments and open areas which are salient features for biodiversity both as stable and as transient habitats (McIntyre et al., 2000; 2001), and may also be valuable for their possible function as ‘corridors’ and ‘stepping stones’ to facilitate species dispersal (Kirkby, 1995).

The restoration of the San Antonio River in San Antonio, Texas and the now nationally known San Antonio River Walk has put that city on the tourist map. The river was turned into a feature of the down town with a continuous promenade following both sides of the river and shops, restaurants, and hotels facing the river. A survey done in 1973 of the citizenry of San Antonio obtained a strong positive response to the project, which was later expanded as a result to include more riverfront restoration. The survey response indicated that 96.6% of the population felt that the river restoration had created a tourist attraction, and over 80% felt that the project was an economic benefit of the city.

The River Walk originated as a flood prevention project after a flood disaster in 1921. The original plan was to put the river in a large underground culvert and pave the area into a street. A woman's conservation group defeated that plan. The plan that was adopted used a bypass channel to circumvent a downtown horseshoe bend in the river so that area would not flood. Beautification of the bend was originally accomplished by Works Progress Administration (WPA) in 1939.

The City of San Luis Obispo on the California coast has received almost as much attention as San Antonio, Texas, for its succesful downtown stream restoration project. The project is located in a relatively small town on a small creek, but the effect of the restoration has been no less important. The project was funded and sponsored by the downtown merchants' association with the purpose of improving business in the 1960s. The basic design idea was to revegetate and feature the aesthetics of the stream, to draw the public to it via walkways along it and public spaces. Store fronts and restaurants that had their back ends to the creek now face it. Down town pedestrian traffic moves along creek sidewalks. Because of the success of the concept, the city is continuing the restoration downstream.

3.0 Research Methodology

This study adopted an ethnographic survey that utilised the use of observation, interview schedules and document analysis. The researchers were able to make visits along various rivers that passed through major towns with Nairobi being the major focus of the study as it is the capital city of Kenya. Photography and field notes were used to capture important aspects that needed to be integrated into the study.

The study was also able to benefit from the participation of randomly selected residents of informal settlements and merchants who operated along various riverine waterfronts. An interview schedule played a key role in gathering data from these groups of people as well as policy makers, planners and other key informants.

In order to address the planning issues the researchers were able to undertake a comprehensive review of various documents from the government records. Planning briefs, regional master plans and policy briefs on environmental conservation among other documents provided valuable information to this study. At the same time these documents were critical in the formulation of an interview schedule for the key informants mainly the professionals, policy makers and government agents serving various jurisdictions.

The study took four weeks which ran between May 2nd and June 3rd, 2014 and was able get the indulgence of one hundred and four participants, all of whom were informed of the study purpose and participated out of their volition. Table 1 below gives a breakdown of how the respondents were drawn.

Table 1: Background of Respondents

Background of Respondents	Frequency	Percentage (%)
Residents of informal settlements	44	42.3
Merchants	26	25.0
Professionals	19	18.3
County Commissioners	3	2.9
Local Administrators	12	11.5
Total	**104**	**100**

4.0 The State of Riverine Waterfronts in Kenya

In Kenya, the neglect on rivers and lakes is at unprecedented levels. Most of the rivers are highly polluted due to lack of stict enforcement of laws. For example, River Nyando that measures about 45 metres in width and transverses a distance of 160 km, serving more than 250, 000 people, is so polluted and is now associated with increasing incidences of water borne diseases such as typhoid, tapeworm, cholera and amoeba among others. Rivers in Nakuru such as Njoro, Makalia and Nderit are also polluted by pesticides, heavy metals from industries, oils and silt. Water rivers in Central Province are also not fit for human consumption. Illegal structures and informal settlements sprout everywhere along most of the rivers, especially those that pass along urban centres.

Years back Nairobi had a cool weather, clean drinking water from four main rivers that created a created a bubbling ecosystem in which plant and animal life thrived. This ecosystem today has been destroyed by human settlement. Although the four rivers (Ngong, Nairobi, Mathare and Mbagathi) still flow within the city, they are today an eyesore. Effects of a century-long pollution have turned the one time bubbling ecosystem of the riverine waterfronts into something close to a sewer system. Ngong river runs through the Kibera slum which, despite having a large human population of over 200,000 people, has no sewage and solid waste disposal system. This is further aggravated downstream where the river passes through the city's industrial area, with some industries discharging their waste into it. It further goes to pass through Mukuru Kaiyaba and Mukuru kwa Njenga which are both populous slums, whose residents discharge their waste into the river. On the other side of the city, Nairobi river cuts through Grogan Area (the biggest garage centre in the country) into Gikomba which is a a densely populated area with both shanties and light industries on the river banks. It also meanders through the sprawling Kiambiu slums. Mathare River flows through the sprawling Mathare slum that has none existent solid waste and disposal systems (Waithanji, 2012).

The riverine waterfronts in Kenya, and more so in the city of Nairobi are a major concern for this study. While they are currently in a pathetic state, the possibility of restoring them still remains real. As urban planners we are today tasked with the duty of standing out amongst the crowd and putting our mark on this valuable ecosystem. What goes through our minds at this moment is not 'whether' the riverine waterfronts can be restored, but how can the riverine waterfronts be restored.

4.0 Findings of the Study

4.1 Threats Posed on Waterfronts by the Development and Growth of Informal Settlements

Rivers passing through urban centres in Kenya are threatened by the existence and ever increasing growth of informal settlements along the riparian reserves. All the rivers visited had informal settlements encroaching on the rivers. Within the capital city, the situation was pathetic. The growth of informal settlements along the river banks has destroyed the natural habitat of the rivers and in place are shanties and structures that are not only eyesore to planners but also a

threat to their inhabitants. Most of the residents interviewed in the informal settlements considered the rivers as their main sewerage system. Toilets within the informal settlements were constructed at very close proximity to the rivers and their sewer pipes directed into the river. Plate 1 below shows some of the toilets in Mathare Slums that discharges their sewer into Mathare River.



Plate 1: Toilet facilities located next to Mathare River
Source: Author

It is clear that the close proximity of these informal settlements along river banks have greatly contributed to the ever increasing pollution of the rivers. The rivers have become a health hazard to the inhabitants of the slums, especially the children who innocently play along the river banks and in most of the times come into contact with the polluted waters. Figure 1 below shows the state of the River as per the time of the study. It is important to note the high level of pollution of the rivers, and which are visible from the solid wastes in the river.



Figure: A Polluted Mathare River
Source Author

4.2 Planning Issues exacerbating the threats posed by informal settlements on waterfronts

Our findings from the study reveal that the waterine river fronts within the country are neglected. Discussions with various professionals within the field of urban studies and planning reveal that most of the policies on informal settlements did not put any focus on the conservation and preservation of riparian reserves. While construction along river belts are not supposed to be away from the rivers by 30 metres, this has not been enforced at all as Figure 1 reveals.

For planners within the city, the slums are not a priority. They are considered as havens of insecurity and illegal activities, thus avoided by many. A good number of the professional interviewed in this study, had found no reason to visit the riverine waterfronts along the slums. As can be seen from the figure below, the threat from flash floods is a reality within the slums that are built along the riparian reserves.

low pace of infrastructure provision in urban slums. ***4.3 Greenways as a Sustainable Framework for Conserving and Protecting Riverine Waterfronts***



Figure: Flash Floods along the Mathare

Source: Waithanji (2012)

Residents interviewed stated that the governments and its policy makers had neglected the slums and were not doing enough to improve the situation. This thus poses a threat to the riverine waterfronts, where corrupt governments administrators allocate people land on the river banks for constructing houses. Planners interviewed revealed that corruption amongst security agents within the slums had made the realisation of planning briefs meant to protect the riverine waterfronts a nightmare. At the same time most of the land that could be used to restore the riverine waterfronts had already been encroached and relocation of the residents on several occasions had been a nightmare for the government. For fear of political reprisals previous governments have shied away from enforcing measures that would greatly ehance the conservation of the riparian reserves hence restoring the riverine waterfronts.

4.3 Greenways as Solution to Restoration of Riverine Waterfronts

When informed of the concept of greenways, most of the policymakers and professionals supported it as the best form of restoration for the riverine waterfronts. They were of the view that a greenway network along the river banks, allowing for walking trails would not face much resistance from the residents, making it one of the most successful conservation effort in the country.

Nevertheless, the study was able to learn that the concept of greenways has not taken root in the country, with nearly all the county governments oblivious of its existence. This was further supported by a few senior lecturers in the department of urban planning that revealed the non existence of a greenway curriculum in the country.

5.0 Conclusion

In view of the above, this study suggest that planners can have a positive impact on urban biodiversity by slowing the pace of growth of informal settlements, more so along the riverine waterfronts. Restoration of riverine waterfronts should be done urgently. The study further emphasizes on the need of incorporation of greenways into all forms of urban planning. This is because the increase in informal settlements calls for a paradigm shift in both in development and planning. Thus there is need riverine waterfronts to be considered as forms of infrastructure no less the airports, the roads the rail system and the sewerage systems. Greenways today are a necessity, not an amenity and must therefore be preserved through public investments. Greenways should be looked at as a “green infrastructure” and its importance equated to that of grey infrastructure. It must be preserved as a connected, contiguous system, not fragmented and preserved in isolation. In essence, all planning for infrastructure interventions within the slums should respect the ecology taking into consideration the natural environment of the city. At the same time planning interventions should consider greenway as the most sustainable form of conserving and enhancing riverine waterfronts.

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High Quality Living Environment In High Density Waterfront

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1 Water and City

1.1 Introduction

There is a consensus that the waterfront areas which used to act as the hubs of commerce and industry of numerous port and riverside cities have undergone a steady decline in port activities from the 1940s to the 1960s. Consequently, considerable waterside land has deteriorated into derelict and decaying spaces. Nevertheless, the advantages of lower prices of such places have been taken by urban waterfront regeneration projects with a view to convert these areas to non-port-related uses. This has in turn accelerated the renaissance of the waterfront and exerted a further impact on the urban renewal movement across the world.

Being the capital of Wales and one of the major port cities in the UK, Cardiff has also experienced such transformation in its Bay area. However, the regeneration of Cardiff Bay is considered as a failure due to the low quality living environment represented by a great amount of vacant apartments.

From the 1990 onwards, the successful integration of the design-led approach into the regeneration process in waterfront areas has generated a number of good practices. Especially in Continental Europe, a deal of brownfield waterside land has been transformed into modern city districts where people prefer to live.

The land on the southern side of Roath Basin is the last remaining major development site in the Cardiff Bay where a high density mixed use development had been proposed by the land owner, Welsh Development Agency. It has the potential to deliver high quality built environment which attracts prospective residents and visitors, meanwhile, creates new job opportunities and promotes the reputation of the whole area. For the purpose of achieving that, the paper attempts to investigate the following research questions.

How to achieve high quality living environment in a high density waterfront site?





Figure 1: Hammarby Sjöstad, Stockholm, Sweden
Figure 2 : Borneo Sporenburg Peninsulas, Amsterdam, the Netherlands

1.2 Waterfront Regeneration

1.2.1 Lessons from Waterfront Practices of the 1980s in the UK

In the UK, during the 1980s, British urban policy development provided the framework for waterfront renewal projects (DoE, 1988). A large number of cities such as London, Bristol, Cardiff, Liverpool, had transformed their decaying docklands and wharfs significantly. Nevertheless, it was suggested that the framework was lack of clear policy directions on long term civic quality and communal benefits (Jones, 1998).

Although redevelopment of waterfront had achieved a dramatic impact on enriching a city's economy, it did not transform the waterfront area to a high quality built environment to live in (Brownill, 1990). Many waterfront projects were market-led, like Canary Wharf in London, in which design intentions were overturned by profit driven (Malone, 1996). The project's long term need for public space and mixed uses is neglected, and it failed to deliver living neighbourhoods, which unfortunately led to clear social disbenefits (Rogers, 1997).

1.2.2 Lessons from Cardiff Bay Regeneration

Cardiff Bay regeneration had the sixth largest waterfront area in the UK. The evolution has transformed the derelict coal dockland to a new city sub-center dramatically, but it did not create high-quality living environment for residents as the development was thought to be too ambitious and did not match the market capacity.

Due to many internal and external reasons, Cardiff Bay regeneration eventually failed to achieve high quality urban design for the whole area, despite a number of pieces of well designed architecture, particularly failing to create high-quality living and coherent working environments where people want to shift (Punter, 2007). Obviously, these failures can be seen in be the large gated schemes like Adventurer's Quay and Century Wharf where there are no vibrant activities at ground level and very little engagement between and massing and the waterside.

It suggests that a much more coherent and masterplanned development to the dockland sites is needed, such as housing mix like townhouses and family homes should be integrated into the overall development and a superb and attractive public realm be created to encourage more walking and cycling in future (Punter, 2007).

2. High Quality Living Environment

2.1 Attributes of good living environment

Good urban design is fundamental to deliver high quality built environment (URBAN DESIGN COMPENDIUM 2). Good schemes always have these seven characteristics as following:
(1) Well integrated with the urban context
(2) Ease of movement and legibility
(3) Housing layout and built form
(4) Mixed use
(5) Adaptability and flexibility
(6) Positive open space and thriving public realm
(7) Energy and resources efficiency

The preceding researches on the waterfront development mainly focused on political perspective and economic aspects of regeneration. Whilst, few studies have concentrated on the urban form of waterfront, especially for high density schemes.

Although the seven attributes correlated to high quality living environment have been summarized, they have neither referred to the high density waterfront development context nor give a conclusion of a proper order when implemented in the waterfront design.
Therefore, the limitation of preceding researches makes it valuable to study the urban form in high density waterfront schemes. Moreover, the exploration approach, namely, testing different urban block patterns based upon the same density is extracted from literature. This identifies that the urban block patterns formed the environment will become the main content of the exploration process and the case study. Meanwhile, the other six attributes together with the block pattern exploration will dictate the final design solution of the intervention site.

2.2 Urban form As a Significant Element of Built Environment

The urban structure of a development is fundamental to achieving high quality living environment, which is determined by the relationship of site location to surrounding movement patterns, built form, land use distribution and sequence of open space (Llewelyn-Davies, 2000). 'Many successful residential environment display a very clearly defined urban structure (BY DESIGN).' Different urban structure can generate a wide variety of urban forms (urban tissue) that matter the quality of place.

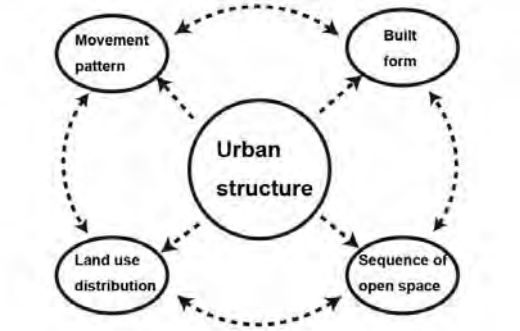


Figure 3: Aspects of urban structure

Good urban form involves conceived urban block patterns as they define the character of the space. The layout and configuration of urban block structures form the urban block patterns and they dictate the movement pattern and set design elements for subsequent development (Carmona, 2003). The relationship between block structure and street pattern, open space, density, and use is fascinating and they are interrelated intrinsically.

2.3 Urban form and Density

It should be pointed out that urban block pattern is a major consideration of creating places, whilst other attributes will also help to shape the place's social, economic, environmental and cultural life for a long time (Cowan and Adams and Chapman, 2010). In a development, many factors affect form and block structure, among which density is a key aspect as it will indicate how efficient the land is going to be used.

It is worth noting that people always have a big misconception about higher densities which they think will lead to poor quality living environment. As a matter of fact, although density plays very critical role in making places, it is only a measurement (Forsyth, 2003). 'Indeed, it is design that is responsible for creating good or bad urban fabrics (Sivam and Karuppannan, 2009).' The same density can be achieved by varied urban forms (Urban Task Force, 1999). The following two figures illustrate this approach by using two ways of measuring density (Dwellings per hectare and Square meters per hectare). Obviously, the quality of environment is extremely different from each other.

3. Cardiff Bay and Roath Basin

3.1 Site Location



Figure 4: Study area and intervention area

The study area, the core of Cardiff Bay locates in the southern part of the city. The intervention area is on the southern side of Roath Basin, which lies between the central bay and the working port.

3.2 Preceding Roath Basin Development Process

In Cardiff Bay Regeneration Strategy of 1988, Roath basin was planned to accommodate a wide mix of possible public and private sector development and uses and develop in packaged phases over time. This dramatic waterfront site was conceived to involve large scale commercial and residential development. The northern side of Roath basin acted as the first phase to test the financial and housing market, reserving the southern side for delaying development (CBDC).

The design research conceives to deliver a revised proposal for the southern side of Roath Basin, while maintaining the principles set out in the original plan. The proposal provides significant improvements to the layout, particularly in the terms of block pattern design and the design of streets and spaces.



Figure 3: Aerial view of the main part of the site from South with Bute Dry Dock in the foreground

4. Case Study and Exploration Process

4.1 Case Study

4.1.1 Overview

A number of urban waterfront projects have been successfully built across the world. Especially in the past two decades, good urban design practices have made a great transformation of the waterfront where people would like to live, work and play.

For the purpose of this thesis, however, two overseas cases from Sweden and the Netherlands respectively are chosen for further in-depth investigation and study, which are Hammarby Sjöstad, Stockholm, Sweden and Borneo Sporenburg, Amsterdam, the Netherlands.

4.1.2 Review and Evaluation of Selected Urban Waterfront Projects

Hammarby Sjöstad, Stockholm, Sweden

Hammarby Sjöstad is a new urban neighbourhood, which means 'city surrounding Hammarby Lake'. It is located to the south of the city of Stockholm, Sweden. The project was built on 200 ha former industrial brownfield land, intending to create 9,000 homes for a population of 20,000 people and 10,000 jobs by 2015 (URBAN DESIGN COMPENDIUM 2).

The scheme successfully follows the urban form of inner city by adopting the street width (18m), block sizes (70x100m), height (6 to 8 storey), density (100 people per hectare), and mix of uses (see following illustrative drawings). Meanwhile with the view of responding to its waterfront context, all orientation of blocks trends towards the water, which also largely promotes legibility.



Figure 64: Public space well overlooked by balconies, terraces, windows or front doors onto the street

In terms of block structure, a semi-open block form is applied, which can maximise views of water and sunlight. Semi-private courtyard within the block provides residents a lovely communal space to hang out. It also shows a greater variation between buildings in terms of height and form. The mutation and combination of block forms is implemented when facing specific considerations. Within a block, the building height is mainly eight storeys along the main canal and five to six storeys towards inland (see following illustrative drawings). In addition, open spaces, waterfront walkways and streets are well overlooked by balconies, terraces, large windows or front doors onto the street which contribute to creating positive outdoor spaces. Moreover, vertical mixed use is attractive in the scheme. Most ground floors along the main road and canal have been designed for adaption of non-residential uses like commercial, leisure and community uses. High density development enables this new urban

district to sustain a number of shops and other services. Besides, mix of housing types also benefit all the demands of a conventional household like different types of families and young fashions living in the community (see following illustrative drawings). A green spaces network connected by public walkways runs through the community, together with the semi-private courtyards, forming the structure of open spaces. The parking spaces are arranged underground, with the entrances at the side streets.

Hammarby Sjöstad as a new 'inner city' district successfully maintains the traditional Stockholm inner-city character and also develops its own local distinctiveness by means of innovative urban design and architectural style. It delivers quite a high quality neighbourhood for people to live in respect of variety in architecture, a fine block pattern and human scale.

Borneo Sporenburg Peninsulas, Amsterdam, the Netherlands
The peninsulas Borneo and Sporenburg are located on the Eastern harbour district of Amsterdam, the Netherlands, which were built up between 1996 and 2000. They were former dockland sites for coal exporting. The city of Amsterdam intended to develop the two peninsulas as one planning area, dictating a high density housing development with 2,500 dwellings within the district.

100 dwellings per hectare was the compulsory density to be built. The designers sought to achieve this density through a new approach,
rather than follow the medium-size high rise block structures done in JavaIsland. It was then certified that ‘by organising the dwellings in a compact system of plots and small streets, higher densities could be achieved (CABE).’

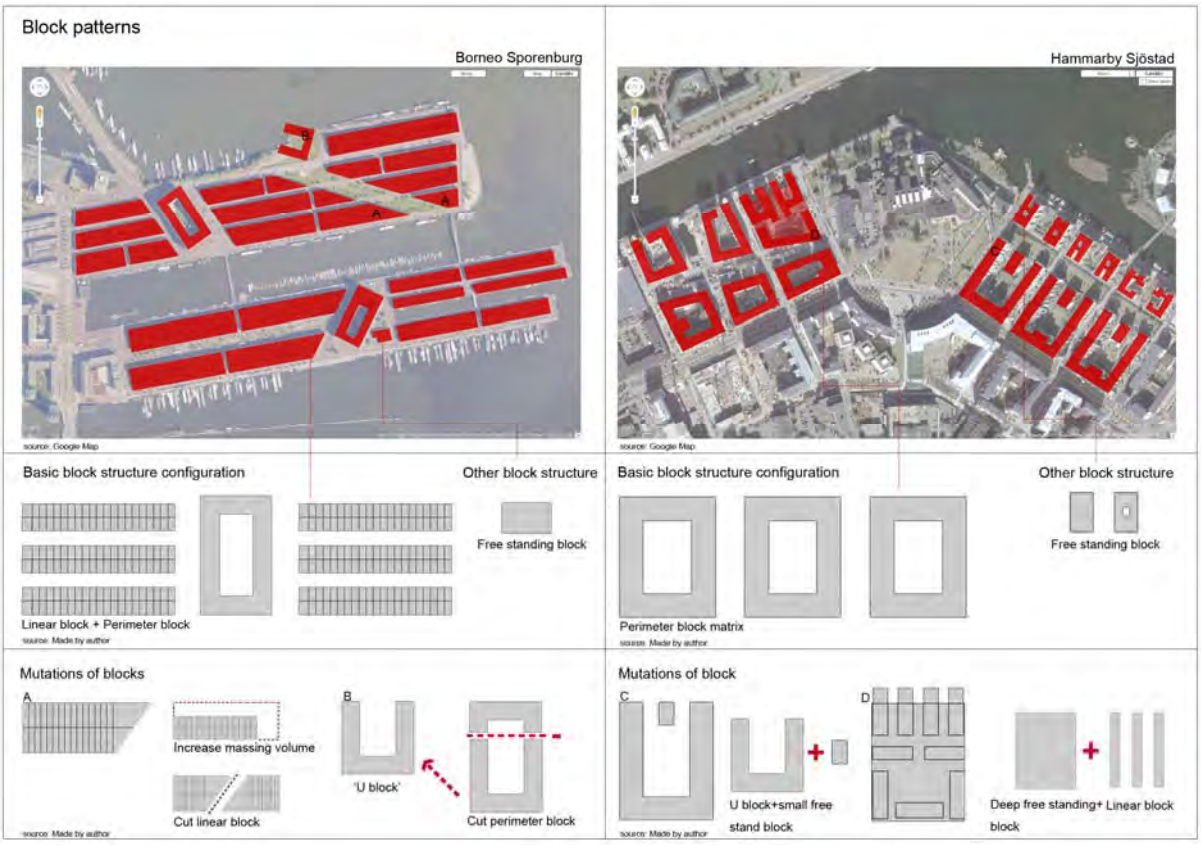
West 8 was appointed to design the Masterplan for Borneo Sporenburg. They successfully brought diversity to urban block pattern within a fine matrix of streets. The variety of block structures includes three storey linear blocks and large sculptural perimeter blocks or free standing block of apartments. The low-rise terraced houses retain the character of the inner city Amsterdam canal house typologies (URBAN DESIGN COMPENDIUM 2). Each of them has a front entrance facing the street and its own outdoor space, which promotes the sense of communal safety by overlooking the public realm. Within the plot, private parking places as well as generous patios and gardens are provided to meet the demands of single families.

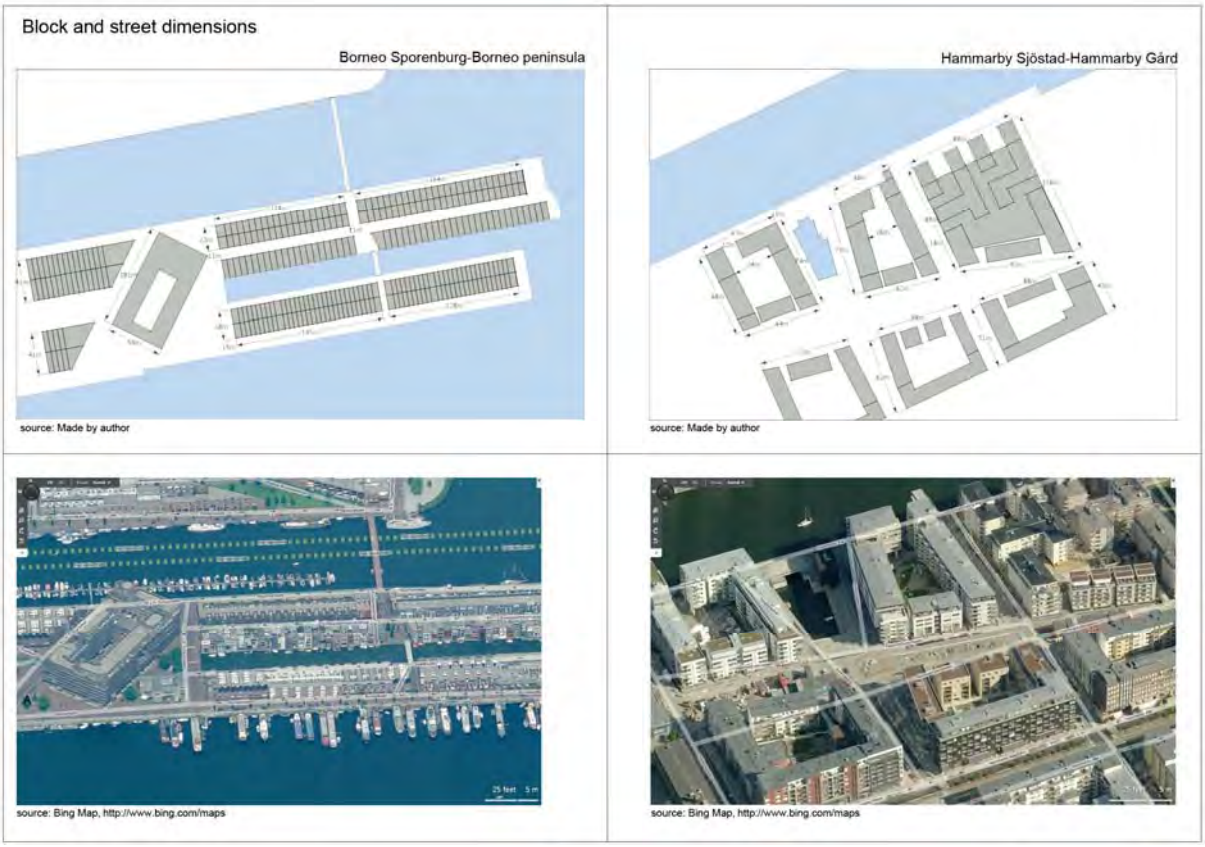
On the other hand, the distinctive apartment blocks which stem from 19th century city block of inner city Amsterdam, acted as landmark buildings help to bring up the average density of the whole area (the 600 dwellings in the three large housing blocks). They are aiming for apartment living comparing to the family-oriented houses, together creating mixed housing types and people of different ages and incomes.

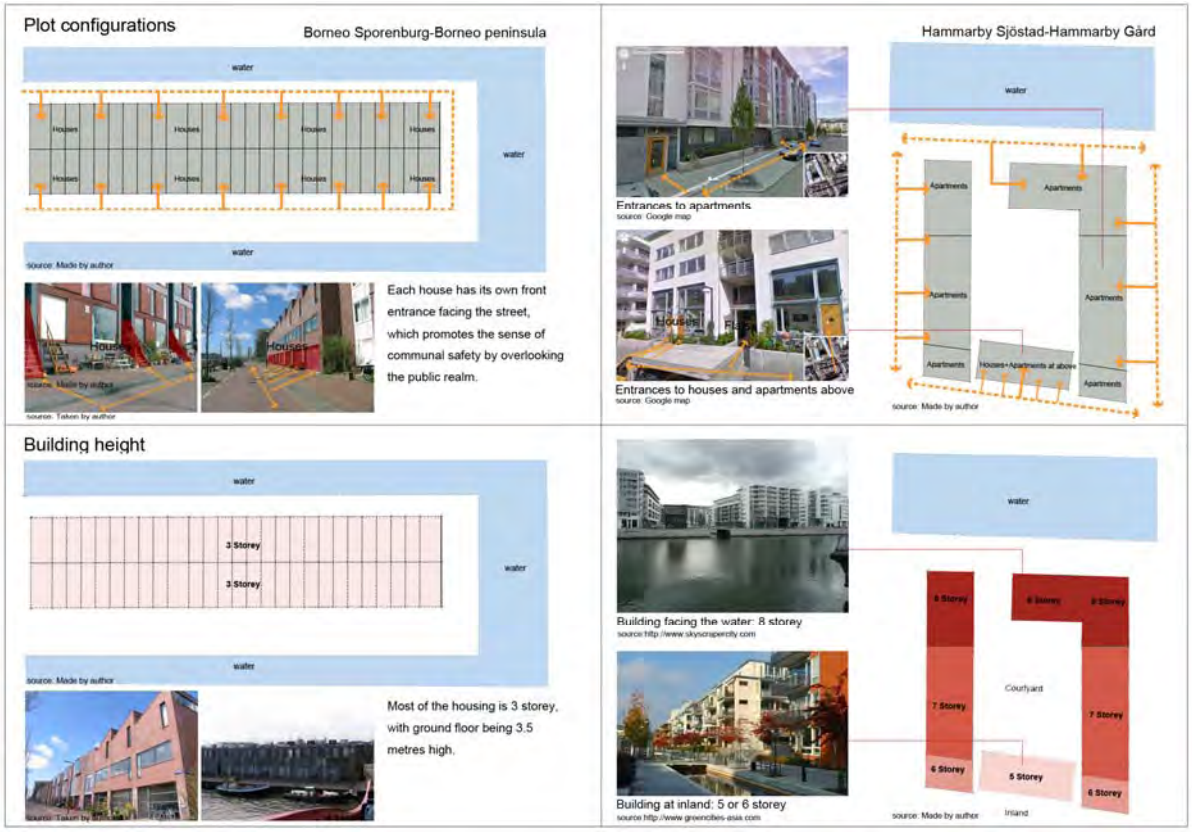
The public green space in the overall scheme is little, only two linear green spaces in the middle of each island. But the water surrounding the peninsulas can be treated as public space which adds character of the area. Apart from residential uses, some small scale business and retail units as well as educational and community uses are provided within the scheme.

Borneo Sporenburg is a crucial paradigm that demonstrates that family housing can be integrated into dense urban areas. It offers a different approach of waterfront living environment that people like.

The following two pages show the illustrative drawings for two cases.


Block patterns
Borneo Sporenburg
Hammarby Sjöstad
source: Google Map
source: Google Map
Basic block structure configuration
Other block structure
Free standing block
Linear block + Perimeter block
source: Made by author
Basic block structure configuration
Other block structure
Free standing block
Perimeter block matrix
source: Made by author
Mutations of blocks
A
Increase massing volume
Cut linear block
B
'U block'
Cut perimeter block
source: Made by author
Mutations of block
C
U block+small free stand block
D
Deep free standing+ Linear block block
source: Made by author


Block and street dimensions
Borneo Sporenburg-Borneo peninsula
source: Made by author
Hammarby Sjöstad-Hammarby Gård
source: Made by author
source: Bing Map, http://www.bing.com/maps
source: Bing Map, http://www.bing.com/maps


Plot configurations
Borneo Sporenburg-Borneo peninsula
water
Houses
water
source: Made by author
Each house has its own front entrance facing the street, which promotes the sense of communal safety by overlooking the public realm.
Hammarby Sjöstad-Hammarby Gård
Entrances to apartments
source: Google map
Entrances to houses and apartments above
source: Google map
Apartments
Houses+Apartments at above
source: Made by author
Building height
3 Storey
Most of the housing is 3 storey, with ground floor being 3.5 metres high.
Building facing the water: 8 storey
source:http://www.skyscrapercity.com
Building at inland: 5 or 6 storey
source:http://www.greencities-asia.com
8 Storey
7 Storey
6 Storey
5 Storey
Courtyard
Inland
source: Made by author


Types of urban spaces, Mixed-use
Borneo Sporenburg-Borneo peninsula
Houses
Retial or Offices
Mixed-use
Water
Quay walkway
Vegetation +parking
Street
Frontage
5m
2m
5m
3m
Public
Semi-Private
Private
source: Taken by author
source: Made by author
Hammarby Sjöstad-Hammarby Gård
source:http://picasaweb.google.com
source:http://www.hammarby-sjostad.info/
Apartments
Retial or Offices
Water
Quay walkway
Vegetation
Street
Walkway
Mixed-use
Courtyard
3m
6m
3m
14m
Public
Private
Semi-Private
source: Made by author
Legibility and accessibility of water
Each houses have easy access to the water front Some building could be entered directly from water. Meanwhile, the intercross street layout ensures permeability.
source: Taken by author
source: Made by author
N
The courtyards have entrances towards the water front. The main streets are arranged towards the waterside which encourages people to approach there.
source: Made by author
source: Taken by author
source:http://farm3.static.flickr.com
source:http://www.skyscrapercity.com
source:http://www.sustainablebusgood.com

4.2 Exploration process

4.2.1 Overview

Roath Basin Development Schedule (17 September 2009) documented in the Design and access statement for Roath Basin 2009, illustrates the proposed floor space for the site including mainly three land uses and the parking provision.

	Area			Office		Residential			Leisure retail		Parking requirement			
	m2	ha	acres	GFA		GFA		units	GFA		office	res	other	total
				m2	sqft	m2	sqft	78m2	m2	sqft	1:100	1:1	400	
Total		10.41	25.71	**111,933**	1,204,858	**78,984**	850,192	1,010	**11,104**	119,525	1,069	1,010	28	**2,107**

Site Summary	**ha**	**acres**	**%**	**Gross plot ratio**	1.37	**Total GFA**	
Development plots	10.41	25.71	70.45%	**Net plot ratio**	1.94	GFA	
Roads and open space served wider areas	4.36	10.78	29.55%			m2	sqft
Total	**14.77**	**36.5**	**100%**			**202,021**	2,174,574

Table1: Roath Basin development intensity

Testing urban block patterns based on this schedule is reasonable in terms of economic feasibility as the survey on financial and housing market background has been taken at the earlier stage. Paradigms analysed in the last section contribute to the subsequent exploration and design process with respect to block structure selections, block sizes, plot configurations, vertical mixed uses, legibility and accessibility of water, etc. It is worth noting that these elements should be adapted and revised in the intervention site-Roath Basin on the score of respecting site constrains and conditions.

The exploration process comprises four stages:

(1)Initial abstract testing the density on 1 hectare
(2)Testing the block configuration on the site
(3)Adding other design layers
(4)Presenting the proposed optimum block pattern for the site

4.2.2 Initial Abstract Testing on 1 Hectare

The information of the table is transformed into the following charts.

- **Built vs unbuilt** 70.45% vs 29.55% 10.41ha vs 4.36ha

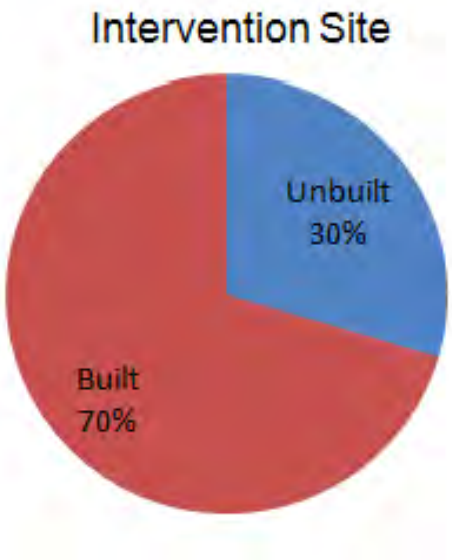
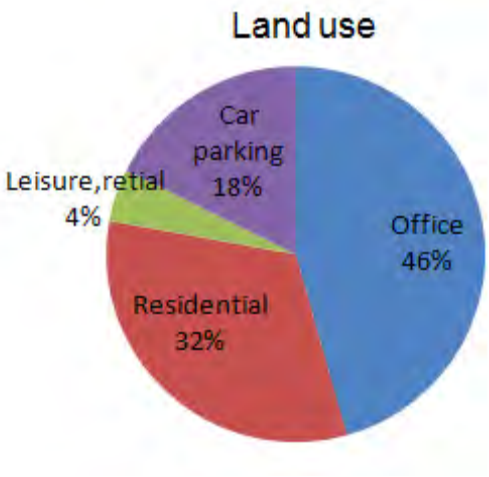


Chart 1:Built vs unbuilt

- **Land use floor space proportion**



- Office: 111,933 m²
- Residential: 78,984 m²
- Leisure, retail: 11,104 m²
- Parking: 43,194 m², 2107 space
- on 10.41ha built area

Chart 2: Land use floor space proportion

- **Land use floor space put onto the site area**

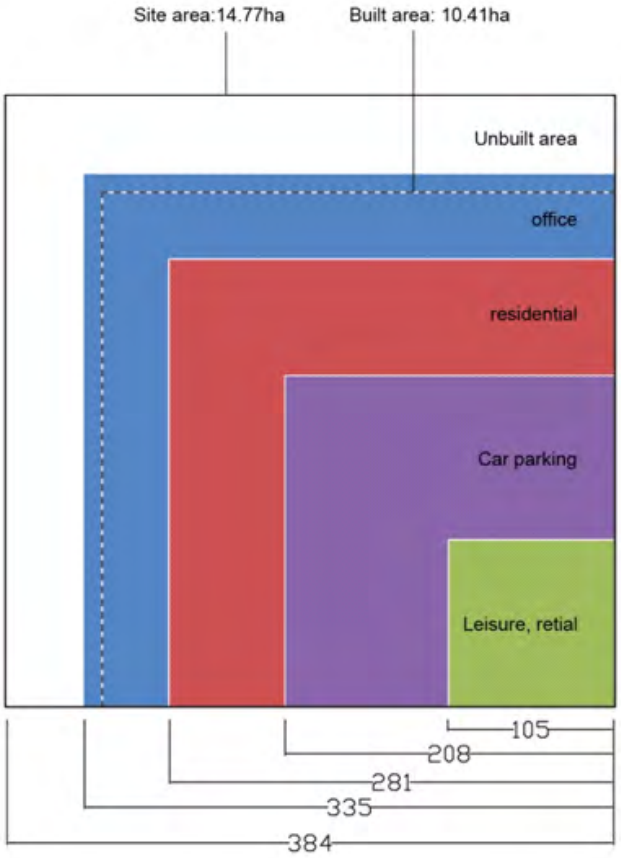


Chart 3: Land use floor space put onto the site area

This chart demonstrates that the car parking provision will take too much floor space and ground space if it is all arranged in parking structures and on surface parking. In order to avoid that and substantially save floor space for other uses, most parking spaces will be put underground, leaving some on street parking space for visitors use. Then the land use percentage will change to the following chart.

- **Adjusted land use floor space proportion**

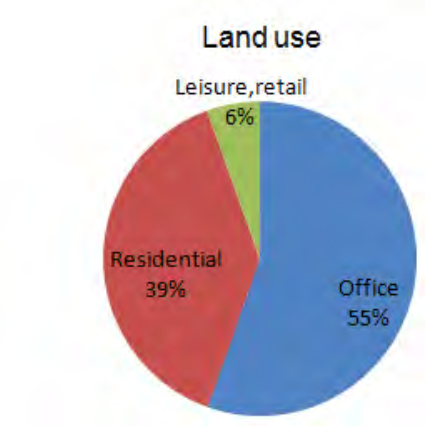


Chart 4:Adjusted land use floor space proportion

On 1 hectare, the floor space for the three uses is Office: 10,752 m²; Residential: 7,587 m²; Leisure and retail: 1,067 m². Using the approach set out in the methodology, three typical block structures: perimeter block, linear block and free standing block are tested for each use. The sizes of blocks are adapted from the precedents: 70m x 70m (perimeter); 80m x 40m (linear); 50m x 50m (free standing). It is north notice that there is no unified size for the block, but this stage is still worthwhile because it tries to demonstrate an abstract view of the proposed development density.

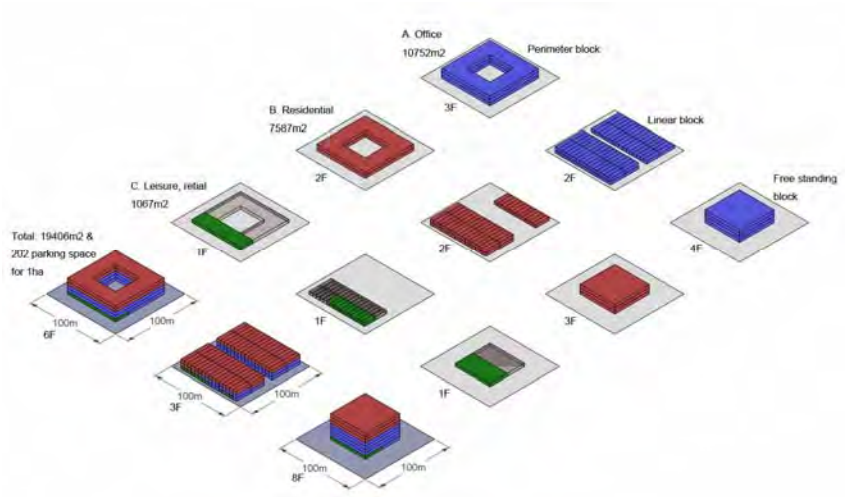


Figure 7: Block testing on 1 hectare

4.2.3 Testing the Block Configurations On the Intervention Site

The infrastructure-mandatory vehicular routes for the site should be fixed at first.
Then the subdivision of the site can be generated based on the infrastructure. The block patterns can be tested within the subdivided areas.

This stage is to find out the possible block patterns specifically fit in the site. The procedure is to test the three block structures in the site, respectively, compromising on block shapes and building heights so as to meet the development intensity-the overall floor space index and site physical dimensions. After that, an initial block pattern for the site is beginning to take shape.

The perimeter block should be tested first comparing to the other two as it has been proved to be the most robust one. The linear block and free standing block can also be used to provide good uses.

The initial block pattern involves three basic block structures, making perimeter block the prior type. This pattern is not the final form, remaining some thorny blocks to be solved in next stage and some modifications to the blocks. This drawing also indicates large public open spaces serving wider areas.

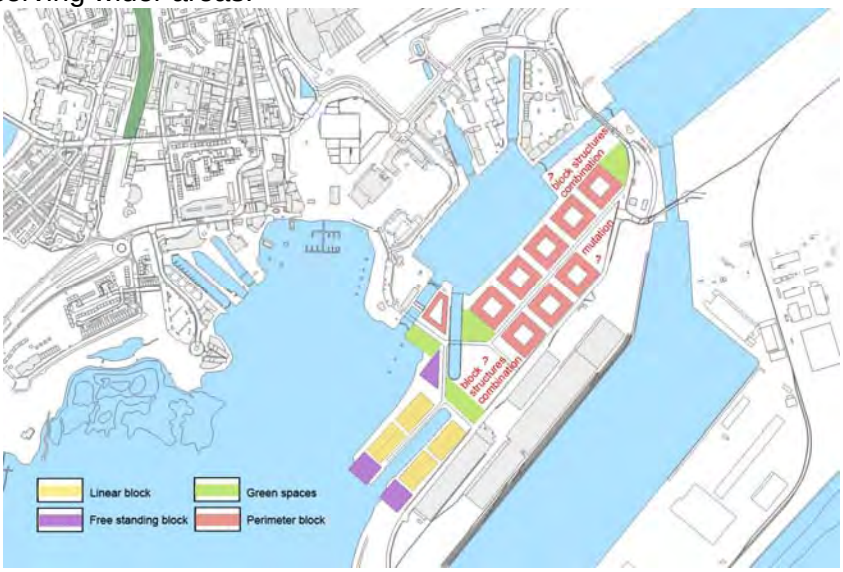


Figure 8: Initial block pattern

4.2.4 Adding Other Design Layers

This stage is to refine and adjust the initial block pattern by overlapping other important design issues. The procedure is to integrate wider urban context to the intervention site, introducing contextual layers to distribute land uses and land value areas and adjust block sizes and shapes slightly. Afterwards, the proposed optimum block pattern can emerge.



Figure 9: Urban form framework

5. Design

5.1 Design Proposal

Flowed from the case study and exploration process, this chapter contains the new masterplan and analysis of design. The proposal covers two scales: medium and small. Medium scale presents the overall scheme and subsequent analysis of design in terms of built form, movement patterns, sequence of open space, and land use distribution, whilst small scale illustrates cross sections demonstrating the scale of massing, streets and open space, the sun path, vertical mixed uses, etc. Furthermore, a parcel of land of the scheme is designed in detail, showing what the neighbourhood will be like.

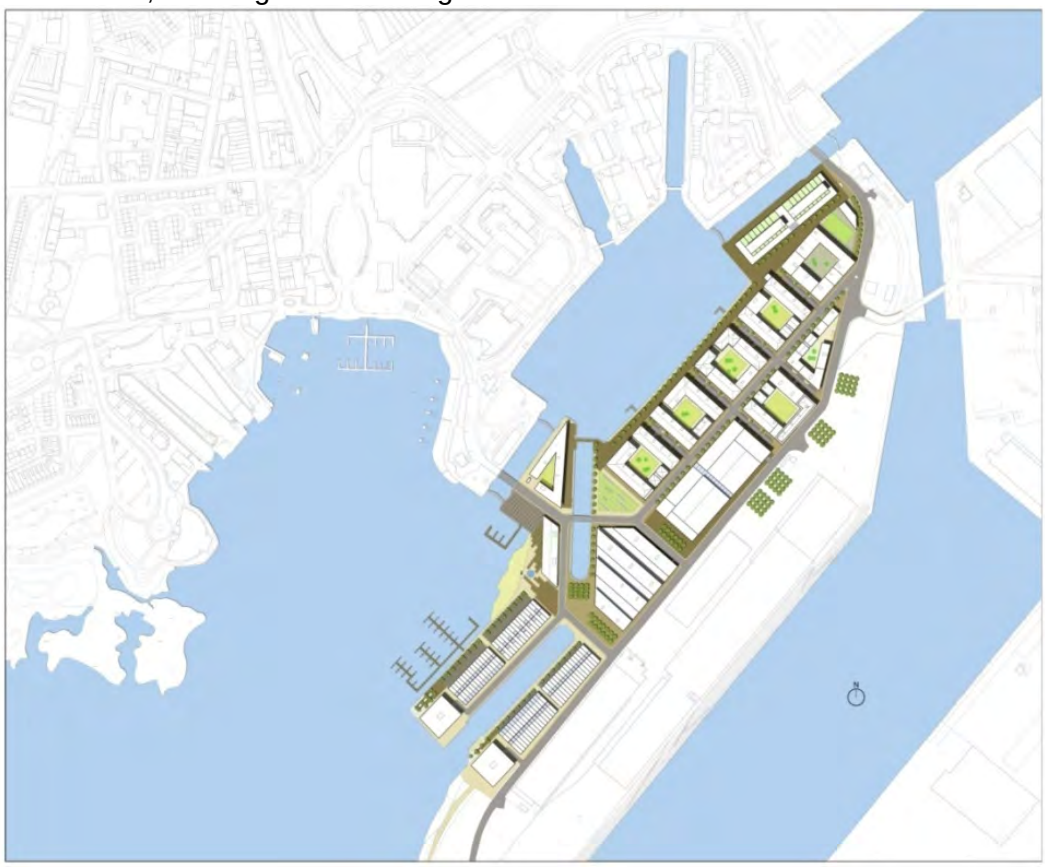


Figure 10: Masterplan

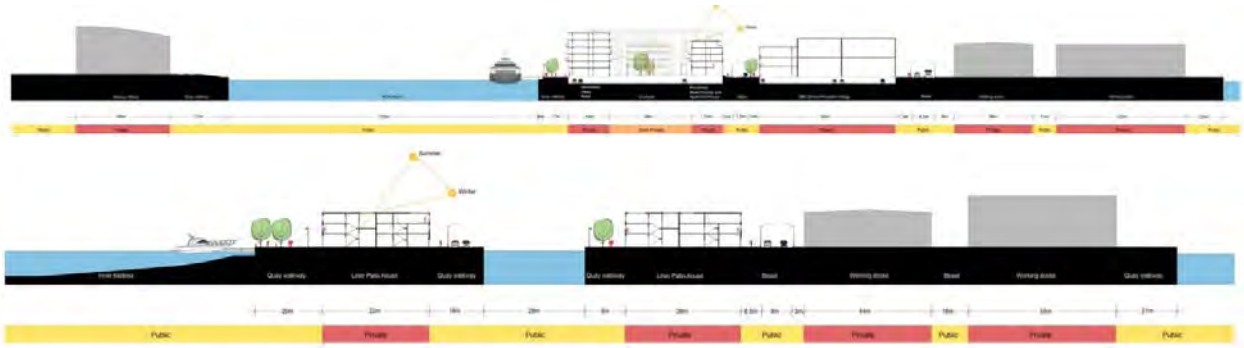


Figure 11: Cross sections

5.2 Adaptation and modification of the approved density

Comparing the GFA in the new masterplan with the approved density set out in the previous brief, an additional 38% floor space has been provided. The increment has been all distributed to residential use as it gives money for the development. The new plan will introduce an additional 515 units to the site. In that case, the land use proportion is changed .

In addition, the increased amount can be fulfilled in many other ways. So the adaptations of it can be recommended.

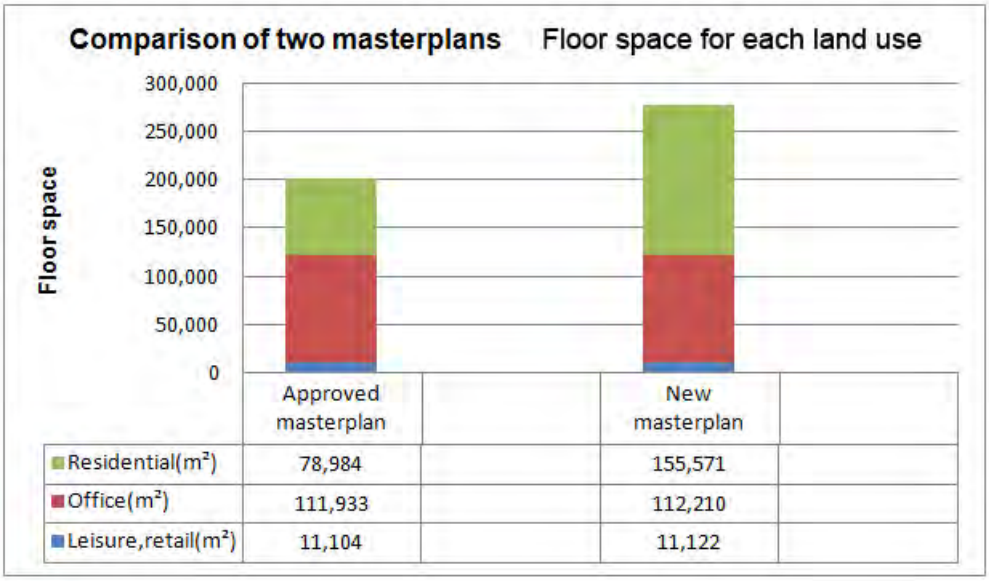


Chart 5: Comparison of two masterplans Floor space for each land use

6. Conclusion

It is noteworthy that there is no single appropriate design solution for the site. Quality comes in many forms. The proposed design in the study does not attempt to diminish the previous masterplans, but to give an indication of possible urban form and to show how the development can work in different aspects by manipulating urban block patterns and how the high quality living environment can be fulfilled.

6.1 The Contribution of the New Roath Basin Masterplan

The new proposal for Roath Basin South is in line with the local authority's aspiration for an attractive and superb urban waterfront development in Cardiff Bay. It is worth remembering that the density advocated in the proposal merely reflects and increases the aspiration of the developers. The proposal enhances the approved density by approximately 38 percent while not compromising the quality of environment. Moreover, the increment has been allocated to residential use as it offers more profits than other uses for the developers. This in turn contributes to the quality of public space, the facility and amenity provision. The design also reflects flexibility in land use proposal since the increased capacity can be distributed to other non-residential uses, which has been stated in section 6.3.

Besides, it also presents attractions which are unique to Roath Basin development. The new reconfigured BBC Drama Village development seeks to bring a new life to this derelict dockland, which will promote tourism, generate new jobs, enrich the quality of urban living in this unique setting and strategic location of Roath Basin site and ultimately reinforce the image of Cardiff Bay as a whole.

6.2 Assessment of Seven Attributes of High Quality Living Environment for the New Proposal

The study highlights the potentials to achieve high quality living environment based upon the proposed density. The author greatly believes that the proposal demonstrated in this study is one of the most responsive and preferable approaches in creating better places for people. The quality of living environment has been reflected in the following seven attributes:

(1) Well integrated with the urban context

The design well responds to its urban context in terms of movement connection, open space sequence, the scale and use of adjacent developments.

(2) Ease of movement and legibility

The movement network properly links the existing two enter points of Roath Basin to the north and connects the Barrage and Penearth to the south-west, which reinforces the pedestrian flows and promotes the usage of bicycles. Moreover, the internal movement strategy is focused on creating high quality pedestrian environments that provide permeability to the water and clarity to the sequence of public open spaces.

(3) Housing layout and built form

It forms a coherent and diverse block pattern within a fine grid of streets, which largely promotes the accessibility and legibility to the water. The perimeter blocks make more efficient use of land in the core of the site, whilst other block structures including block mutation and combination also contribute to the diversity of built form.

(4) Mixed use

The scheme substantially advocates mixed use, mixed housing types and social mix. Namely, leisure and retail are distributed in the spots of major pedestrian flows whilst most offices and apartments are located in the core of the site with some large 3-4 bedroom houses around Channel Dry Dock and northern gateway. Social houses have been arranged in the superblocks with convenient access to facilities and shops.

(5) Adaptability and flexibility

A certain degree of flexibility has been taken in consideration, which demonstrated in building width and ground floor height. Building depth of perimeter block within 16-18m and ground floor height within 3.5-4m can accommodate further adaptation of uses and lifestyle changes and subsequent architecture design, evaluation and refinement.

(6) Positive open space and thriving public realm

The scheme provides ground floor active frontages, public walkways and large open spaces along the southern side of the basin, Bute Dry Dock and Bay waterfront, in which visitors and residents can sit, meet and socialize. Whilst the courtyards of the perimeter blocks offer peaceful and safe play areas and communal spaces for the local residents. Besides, proposed buildings are mainly medium rise to generate a clear sense of enclosure to public spaces and to create a sheltered environment for pedestrians. The ratios of building height to street width for primary road and secondary road create enclosure public realm, but the ratios just fulfill the minimum for comfortable urban street (1:1).

(7) Energy and resources efficiency

The orientations of the blocks mainly face towards the water rather than due south facing. The orthogonal grid of urban blocks aligned to the waterfront overweighs the maximum solar access. As stated in ‘Urban Design Compendium’, ‘strict adherence to solar access can serve to space buildings further and further apart-lowering densities and weakening street enclosure.’

Although it is considered that “the more sun the better” (URBAN DESIGN COMPENDIUM), the constraints imposed by the local settings to some extent, are the factors that should be given more priority, particularly in waterfront context. In addition, due to the geographical position of the site (51°N 3°W), the solar altitude in winter is about 17 degrees which dictates the form of vertical mixed use that ground floor and first floor need to be commercial (retail or offices) and upper floors could be residential (see cross sections drawings). So that the rooms at above storey are high enough to allow sufficient natural daylight to reach all

windows. Some blocks may be stepped back on the top storey to allow light into the shared garden. For these homes, it is possible to create a roof garden or terraces.

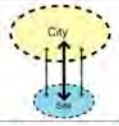
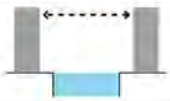
6.3 Implication of Seven Attributes of High Quality Living Environment for Future Waterfront Development in the UK Scene

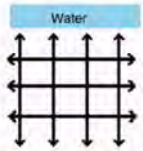
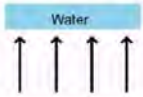
It is concluded that the seven attributes dictate the urban form in high density waterfront development, which in turn exerts a great impact on the quality of living environment and residents' lifestyle. Nevertheless, it is recommended that these important factors should be arranged in a logic and coherent way when proposing design solutions. Hence, considering the above assessment of the new proposal for Roath Basin, proper design guidelines for waterfront, particularly for the dockland sites in the UK scene, can be suggested.

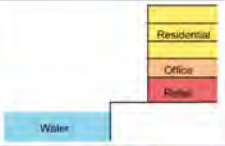
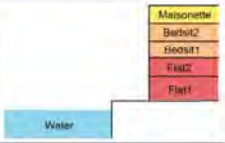
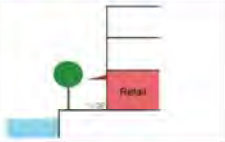
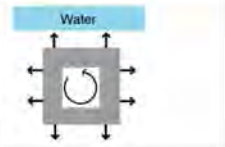
The guidelines are formulated in a prescriptive order to guide the future redevelopment in waterfront in the UK. Meanwhile, it also allows a certain degree of flexibility in the exploration of a specific design as the guidelines themselves are not the final solutions and are not site-specific. Furthermore, based upon the guidelines, subsequent detailed urban design of street level and architecture design could be conducted.

But this study also recognises that the high quality living environment in high density waterfront could be achieved by a number of approaches. Therefore, it is suggested that in further studies, the guidelines need continuous refinement to meet the changes in the UK's waterfront development.

Design Guidelines for future high density waterfront development in the UK

Category	Design Attributes	Design Criteria	Design Guidelines	Schematic Diagram
1	Well integrated with the urban context	Accessibility and connectivity with adjacent areas	- Dockland site is usually separated from the city's road network. The priority should be given to pedestrians, cyclists and public transport movement linkages.	
			- Reinforce the existing pedestrian routes along the water and complete the pedestrian circuit around the water.	
			- Provide waterbus if possible to introduce all modes of transportation to access the waterfront.	
		Built form to adjacent areas	- Respect surrounding buildings in terms of height, massing and scale. Allocate high rise buildings with response to existing horizontal landmark structure across the water.	
		Land use proposal	- Introduce desired facilities and amenities complimentary to adjacent development.	
		Sequence of open space	- Create a legible network of pedestrian walkways and open spaces around the water.	

2	Housing layout and built form	Efficient use of land	- Use perimeter block where possible as it has many advantages. This block structure is also applicable in waterfront.	
		Block pattern	- Use matrix of perimeter blocks if the site dimension is allowable, nevertheless, other block structures including block mutation and combination can still attribute to coherent block patterns. - Manipulating block patterns is the key to achieve high quality living environment in high density waterfront scheme.	
3	Ease of movement and legibility	Permeability	- Make places connected with each other and easy to move through.	
		Legibility	- Provide recognisable routes and landmarks. - Move towards water.	

3	Mixed-use	Mixed land use	- Convenient access to the facility within the neighbourhood is achieved by the arrangement of different uses vertically and horizontally in the urban blocks.	
		Mixed housing types and social mix	- Introducing different housing types rather than one type can promote social mix in the community.	
3	Positive open space and thriving public realm	Continuity and Enclosure	- Ground floor active frontage facing onto the water encourages diverse water related activities.	
			- Perimeter block creates a strong distinction between the public and private, namely, the frontage defining the public and inner courtyard serving the local residents.	

			- Appropriate ratio of building height to street width enhances the sense of enclosure (between 1:2 and 1:2.5 providing a good sense of enclosure and 1:1 considered the minimum).	
		Types of open space	- Providing a mix of hard and soft landscape relating to water can enhance the richness.	
4	Adaptability and flexibility	Multi-purpose housing rather than a fixed single use	- Block depth of perimeter block should be long enough to accommodate future adaptation of uses (normally more than 10m). Ground floor is high enough to expand non-residential use (normally over 3.5m).	
4	Energy and resource efficiency	Efficient use of natural resource, especially day lighting	- Orientate the blocks within 30° of due south to obtain optimum solar access. But the local settings should also be taken into consideration. Usually facing the blocks towards the water offers more advantages.	

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Rio de Janeiro´s waterfront: Will it be good?

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Abstract:

The city of Rio de Janeiro (Brazil) is currently seeing the implementation of a large-scale waterfront revitalization project of its central port area. The project is an initiative of the Government of the City of Rio de Janeiro, that created the *Operação Urbana Consorciada da Área de Especial Interesse Urbanístico da Região Portuária do Rio de Janeiro* (Urban Operation Consortium for the Special Urban Interest Area of the Port of Rio De Janeiro), in collaboration with the State and Federal Governments. This extensive and largely idle area of 5 million square meters on the Guanabara Bay waterside is undergoing a process that has been seen in many cities around the world since the second half of the 20th century, which objective is (or should be) to create a significant urban centrality near the city's financial center.

Many successive past administrations do not seem to have given due importance to the sea and the Guanabara Bay, the area around the place of the first settlement that gave origin to the city. Thus, to improve the water quality and recover the numerous polluted beaches ought to be the first measure to be taken upon the implementation an urban project of this magnitude.

In addition, urban planners should consider other uses for a region that seems over-reliant on commercial and recreational buildings for its success. Stimulating residential use can also ensure wider occupation and use of the region. The recovery of the decaying São Cristovão neighborhood could also be among the primary targets of the project's actions.

In reality, the lack of a rigorous planning tradition leads to initiatives that contribute very little to improve the infrastructure of a typical developing country city that is plagued by serious transportation, sanitation, housing and other problems. Nevertheless, there are positive aspects that deserve consideration.

1. Development

1.1 *A brief historical background*

The origin of the city is closely linked to the Guanabara Bay. In general lines, the physical structuring of the city occurred mainly as a consequence of the economic, military and harbor aspects determined by the geographic situation of a stretch of land confined between the mountains and the sea, but protected by the bay.

The initial settling of its inhabitants took place during the Portuguese colonial period (between the 15th and 19th centuries), in a quadrangle close to the Bay, delimited by the the Castelo, Santo Antônio, São Bento and Conceição hills. On the hills, the exuberant view of the Guanabara Bay was already sought after, and good housing slowly began to be appear in the region.

Later, in the 19th century, the arrival of the Portuguese Royal Family[i] in Brazil — who, incidentally, disembarked in this area — gave a strong boost to the development of this central area, where large farms were gradually subdivided and several streets were built. That is how the neighborhoods of Saúde, Gamboa and Santo Cristo were created. The

houses were built on narrow, but very deep plots, and the colonial model was maintained. Gradually, many alleys and hillside accesses, stairs and winding streets were built, according to the topography.

At the same time, the disorganized growth of the city led to the emergence of many slums, in very insalubrious conditions. There was housing deficit, and disease was rife due to lack of sanitation, overcrowding, yellow fever epidemics, flooding, etc., which were local characteristics.

The administration of Mayor Pereira Passos, in the beginning of the 20th century, is responsible for the features that the port region came to acquire. The aim of the intervention was to organize mass transportation, build sewer grids, roads, etc., on the many areas reclaimed from the sea in order to create land for expansion and eliminate mangroves and sewage disposal areas. Many warehouses, markets, metal workshops, factories, etc. were built due to the area's characteristic as a trading post. In addition, the railways that connected productive regions in the countryside with the coast contributed to configure the local urban landscape.

In recent times, the region has been under absolute decay. Numerous warehouses that were used as storehouses or factories connected with the port's activities have been derelict for decades, as is the case of plots of land that served as backyards for commercial warehouses or as parking lots. There is a growing and relentless process of degradation, particularly in the peripheral areas, which has resulted in underused buildings, vacant land and many families living in rooms in abandoned houses. The local population is decreasing, while there are many attractions for visitors. Important scenery and historical buildings are hidden by degradation, lack of interest and neglect, not least by the state. It is relevant to admit that the *Perimetral* overpass greatly compromises the visual relationship between the built environment and the natural landscape. The neglect — for different reasons — of the group of colonial houses, which have historical value, has resulted in their physical de-characterization and in spontaneous collapse. It should be also mentioned that the first favela of Rio de Janeiro appeared in a location very close to these areas of intervention.



Figure 1: Central Port Area, Rio de Janeiro, RJ
http://www.portomaravilha.com.br/web/sup/OperUrbanaApresent.aspx

1.2 *Present and Future*:

Rio de Janeiro is Brazil's iconic city, perhaps the greatest symbol of "brazilianess". In the interstices of its original and unique landscape, a city springs up, occupying uneven surfaces, in a succession of "styles" that define the different periods of its history. This mixture of utopia and reality, beauty and ugliness, poverty and wealth, are the ingredients that attract the world's interest for Rio de Janeiro.

As in other examples around the world, the aim of this regeneration project is, in theory, to renew the area through the implementation of an urban waterfront project (figure 1), particularly through the renovation of large lots and vacant warehouses, the creation of cultural and recreational infrastructure, appreciation of the architectural heritage, re-study of the road network system in order to create efficient urban mobility tools, landscape study to restore the relationship with the Guanabara Bay and create more livable environments, etc. All these measures are desirable and vital for this part of the city, which, for decades, had been nearly forgotten. Nevertheless, it is important to conduct a more detailed analysis in order to be able to understand the possible benefits and problems that this large-scale intervention can generate.



Figure 2: Central Port Area, Rio de Janeiro, RJ
http://www.portomaravilha.com.br/web/sup/OperUrbanaApresent.aspx

First of all, we should point out that the city of Rio de Janeiro will not only be one of the host cities of the 2014 FIFA World Cup, but it will also be the host city of the 2016 Summer Olympic Games. There is great concern about measures that may benefit almost exclusively sports interests, without proper consideration given to the possible legacies to the city and its residents.

The role of the public administration as a driver of proposals and as manager is crucial, as is its role as regulating agent. Its role as regulator is irreplaceable and should guarantee the continuity and the persistence of the public interests. Thus, the entire process is being undertaken through a Public-Private Partnership, in the shape an administrative concession of the services of revitalization, operation and maintenance of the *Área de Especial Interesse Urbanístico da Região Portuária do Rio de Janeiro — AEIU Portuária* (Special Urban Interest Area of the Port of Rio de Janeiro) — which aims to invest approximately BR$ 8 billion in the area and involves the following disciplines: Urban Planning, Landscape Design, Engineering, Transit System and Urban Infrastructure (Water Supply and Sewage System, Drainage System, Electricity Network, Telecommunications and Street Lighting).

But, before we go any further, we should stress that, here, it could be hastily concluded that there is, necessarily, an intrinsic and unambiguous relationship between the spatial form and the social process. However, when establishing assumptions about the urban spatial

specificity inherent to every urban center, this equation should not be taken as a strict rule. It is also important to be aware of the fact that the care of the physical-environmental qualities is being conducted in a fairly balanced way, in spite of the omnipresent temptation to make concessions to the excessive and unrealistic demands of certain sectors in this globalized information era.

From another perspective, which correlates local strategies and the catalyst factor, Del Rio summarized some ideas in an article titled “In search of lost time: The rebirth of city centers.” When citing examples from Baltimore, Bilbao, Boston, Curitiba, Salvador, and others, which anchored urban revitalization processes on public and private equipment, recreation areas, museums, marinas, aquaria, shops, markets, hotels, housing, etc., Del Rio highlights that “although these catalysts evidently cannot ensure the success of the revitalization process as a whole, they have proven to be essential in sparking off and often sustaining the whole process.”

The author also states that “the study of successful experiences points to five fundamental aspects of the projects: a) complex planning, monitoring, management and marketing processes; b) a well-researched mix of different land uses, with the presence of solid ‘anchors’; c) respect for the collective memory and the pre-existing context (physical-spatial and sociocultural); d) focus on the power of images and design quality; e) implementation through collaborative processes between the groups involved (government, community and businesses/investors).”



Figure 3: Museu de Arte do Rio, Rio de Janeiro, RJ
http://www.jacobsenarquitetura.com/projetos/?CodProjeto=12



Figure 4: Museu de Arte do Rio, Rio de Janeiro, RJ
http://www.colegiodearquitetos.com.br/wp-content/uploads/2014/03/museu-do-amanh%C3%A3-no-porto-do-rio.jpeg

From another viewpoint, in the context of initiatives focused on promoting the attractiveness of cities, new techniques and strategies to deal with the urban environment have incorporated initiatives that can be loosely inscribed in five main areas (Borja, 2003; Lacaze, 1997; Hall, 2001): 1) Architecture and Urban Design; 2) Infrastructure; 3) Basic Services; 4) Environment and Ecology; 5) Attractions.

Ultimately, all these approaches to the urban environment are seeking to rebuild the image of the city. Particularly in the case of big cities in developing countries, with typical problems in the quality of their urban forms, this new image should be anchored on a consistent foundation that tackles the most visceral, long-term structural issues of the city.

As mentioned previously, also it is inadmissible — and especially because it purports to be a waterfront project — that its initiatives are set against a background of a totally degraded and polluted bay. There are serious social, economic and environmental costs that can significantly compromise the possibility of success of a project that has taken so many years to be implemented and is proving to be questionable from the point of view of sustainability.

Another serious mistake in the implementation of the urban design seems to be a type of planning — or lack of planning — that disregards (or deliberately neglects to inform the public): a) a greater variety of urban uses, with clearer incentives for residential occupation; b) the need for an in-depth study of urban morphology; c) greater socioeconomic and cultural diversity of the region's participants; d) the original idea behind the project and solutions concerning the urban design etc. Some urban planners and part of the city's population have opposed a project that claims to be an urban revitalization project, which seemingly forecasts a future consisting almost exclusively of corporate or recreational buildings (aquarium, museums, etc.) surrounded by open areas with little urban vitality in its day-to-day use. The coexistence among different uses could foster a richer, more intense and diverse use of the region. It is common knowledge that adequately established groups of residents can play a role as anchors for urban revitalization projects and foster the existence of open public spaces with which the community can more easily identify. The balance required for a pragmatic formulation, concerned primarily with public spatiality, should also be structured around procedures that ensure the possibility of diversity of coexistence (socioeconomic, racial, age, etc.) and also maximize the quality and quantity of usages. Different demographic groups should be considered when defining the urban space, making it more democratic in its conception and existence.

In any case, there has been an increase in the construction potential of the region with the sale of *Certificados de Potencial Adicional de Construção* (*CEPACs* — Certificates for Potential Additional Construction), for an approximate value of BR$ 3 billion. That should allow the construction and provision of the services planned in the Operação Urbana Porto Maravilha in the next 15 years.

When proposing a more socially inclusive policy, especially in the context of the physical-spatial urban configuration, the local peculiarities must be acknowledged and the necessary actions to mitigate poverty and promote social justice must be designed, as in Amartya Sem's thinking: "human development as an expansion of freedom." The actions should be targeted at democratizing benefits, tackling social-spatial segregation, and ensuring access to public services.

The adoption of a large sports event as a stimulus for the regeneration of the urban environment is but one approach that deals with a limited area of the city and its urban infrastructure, even though its goals have a systemic character. It is essential to situate this mega-event within the wider context of a host-city that has all the typical characteristics of a developing country's metropolis, where socioeconomic inequities are reflected in the

physical-spatial configuration of the city. That is a complex issue especially because of the multidimensional character of the poverty that exists there. Hence the exercise of citizenship needs to be assertive. The city, understood as a space of coexistence, should be the dynamic setting for the rights and duties of its citizens to be played out.

One contribution to environmental quality that is highlighted in the project is the planting of 15,000 trees, expanding the green area from 2.4% to 10.9% and increasing soil permeability. In addition, according to the concessionary, the project promotes the renovation of 70Km of roads, 650,000m2 of sidewalks, 700Km of infrastructure network (water, sewage and drainage), the construction of three new wastewater treatment plants, etc.

Several other measures can be cited as relevant, but, unfortunately, some are innocuous at the moment, such as the demolition of the almost 5km long elevated expressway (figure 2), known as *Perimetral*. A more comprehensive study of the possible building masses and types of occupation of the area, for example, could lead to considerable optimization of resources through the partial removal of the expressway and its partial maintenance for transit use. Or, also, through using a stretch of the expressway to establish a large public recreational area (belvedere) on the expressway, offering sweeping views of the Guanabara Bay (as in New York's High Line).



Figure 5: Demolition of the elevated expressway (Perimetral)
Photo: James Miyamoto

A relevant measure for the city of Rio de Janeiro would be to establish a new intermodal urban mobility matrix. The modernization of the urban mobility equipment is actually taking place, with the use of light rail vehicles (LRV) (figure 3) and the construction of an underground road tunnel in order to free the ground level from car traffic. However, these are relatively timid measures in face of the chaotic state of the city's transportation system. Integrating and modernizing mass transportation through rational and creative connections with the near and peripheral regions through the use of, for example, cable cars, train lines, metro lines, bike paths or even water transport over the Guanabara Bay would significantly change the pattern of occupation of the city, improving the quality of life of the population.



Figure 6: New light rail vehicles
http://www.portomaravilha.com.br/web/sup/OperUrbanaApresent.aspx

Incorporating the historic, but degraded, neighborhood of São Cristovão would be a significant way to recover the centrality of a neighborhood with a considerable urban infrastructure (road network, water and sewage services, electricity, etc.) that is underused in relation to its residential, commercial and touristic potential.

Not veering away from the objectives of this study, the aim of a critical review of the social and urban question is to ensure a conceptual framework that values projects that stimulate the identification of users with the space they inhabit, giving that place meaning: the "conceptual impulse method" (Argan, 2000). At the same time, that framework must be clearly connected with the stimuli generated by a large sports event. The intention is, first and foremost, to allocate resources for the promotion of social justice and the common good based on the stimulus given by this "isolated fact".

There is evidently space for a balance between what Castels and Borja call "the constitution of an urban hub of advanced organized services management", the attracting techniques and formalisms (currently in evidence in international urban environments) and specific design actions.

When recognizing the new "economic globalization processes", we propose a polysemic response that includes a framework that articulates "local" and "global" concepts in formulations, contemplating the imbrications between the disciplines of urban planning and design, taking into account the specificities of each city. Hence, the positive aspects of the urban intervention currently underway must be acknowledged. They include, among others, the removal of the *Perimetral* expressway, which, although it could have been partial, restores the connection with the Guanabara Bay and creates a more open environment, favoring pedestrian circulation and recreation in open public spaces.



Figure 7: Demolition of the elevated expressway (Perimetral)
http://www.portomaravilha.com.br/web/sup/OperUrbanaApresent.aspx

The initiative and incentives to build museums, aquaria, hotels, a pier for transatlantic cruise ships, bicycle lanes, etc., for good or ill, are all in the menu of urban revitalization projects, including waterfront projects, and they are all contemplated in this project. The famous Praça Mauá (Mauá square) (figure 4), for example, is upgraded through new uses around it, special landscape treatment, removal of vehicle transit, etc.



Figure 8: Mauá square
http://www.portomaravilha.com.br/web/sup/OperUrbanaApresent.aspx

As previously mentioned, the urban design is not shown to the public. It is not known for certain how the landscape designs will be carried out, where the commercial areas will be located, what the street furniture and the visual communication design will be like, whether there will be sustainable tools for the use solar energy and rainwater, or waste water treatment, waste management, etc.

A no-nonsense thoughtful proposition for implementing the urbanization of that waterfront should take into account a consistent development study, considering the gradual adjustment of population density and feasible economical steps, not only considering environmental and cultural issues but mostly the flow and circulation trough open and free spaces. Different housing typologies, hotels, commercial and office buildings, among other uses, should have been considered. Likewise, it should be proposed a variety of recreational and contemplative areas, defined by a landscape design that could encourage a balanced occupation of permeable green areas. Lastly, just after an extensive work to mitigate Guanabara Bay pollution, it would be possible to support boating, sailing and other water sports activities. Only high quality environments can improve the delicate balance of a waterfront condition.

It is also important to highlight that the centrality of this location could entail the establishment of a broad and rational urban transportation system.

The preservation of the historical heritage should be one of the local tourist attractions. However; considering the need create a strong connection to sea, several warehouses should be demolished — challenging some conventional trends — to clear out the view, upholding just a few of them to recall the historical tradition of the area.

Ultimately, it is important to underline that rather than merely and exclusively playing the role of manager or mediator, the public administration should take a proactive stance, focusing on the adoption of programs that are adequate for each place, particularly those that can promote a positive regeneration of the urban space, with consequences for image building, the attractive restructuring and the generation of financial resources, while, at the same time mitigating present problems: “The best product a city can offer is itself and its urban quality” (Borja, 2003).

Conclusion

Rio de Janeiro's present and near future are connected with the fact that it will be hosting two important mega events: the FIFA World Cup (2014) and the Olympic Games (2016). It is claimed that the revitalization of the Port area will be one of the Olympic legacies.

Despite its importance, the so-called catalyst effect of the Olympic Games should not be the only motivation, nor the most important reason for the social and urban integration of a city. At the same time, evoking exaggerated Olympic urgencies can only lead to poorly conducted (or opportunistic) bidding processes.

The basic assumption is that the "permanence of urban facts" can be seen as an inductive legacy for the urban development process: the "pathogenic and propelling elements" considered by Rossi. Hence, certain facts or actions can prove to be catalysts (positive or negative) or restrictive (positive and negative) of the physical-spatial configuration of the city and the making of its image. To intervene in an area under such decay seems in itself to be a positive development for the city and its participants. Nevertheless, it remains to be seen whether the outcome is, in fact, positive.

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[i] Brazil was a Portuguese colony from the 16th until the beginning of the 19th century.

West Africa's Urban Coast Revitalization: Potentials and Challenges

Edouard MOREAU, founder of Off-The-Grid Studio, France

The potentials of waterfront revitalization in developing countries, and in West Africa in particular, are largely under-studied. Whilst the African context provides radically different conditions on the ground from the pre-regeneration ones in Europe or North America, waterfronts share common strategic characteristics as essential structuring backbones of coastal cities. Already major projects are emerging in the region and waterfronts are already under huge development pressure. West Africa is engaged in profound and rapid urban mutations and it seems crucial to better anticipate the planning challenges and better understand specificities involved in order to avoid copy-pasting western models. More than any urban territories, waterfronts are lands of local identities; deeply rooted in its cultural context and highly sensitive to economic transitions and environmental challenges.

The author participated as a lead urban planner and designer at the regeneration planning framework of Mainland Central area of Lagos, an area of more than 70 square kilometers with strategic waterfronts, between 2010 and 2013.

1. Coastal West Africa: a territory in mutation

The growth projections shown in the latest 2014 UN-Habitat report give us a clear picture. In the next 100 years, the World's global economy will be largely remodeled by Africa's urban development.

Western Africa, the most rapidly urbanizing African sub-region after Eastern Africa shows impressive growth projections and urbanization rates, such as World's upcoming powerhouse Lagos, with an estimated twelve millions inhabitants by 2025, but also maturing regional urban hubs such as Dakar and Abidjan with over 5 millions by the same timeframe.

Whilst projected growths should be taken with precaution given the lack of solid data on the ground, it is nonetheless clear that West Africa has entered a profound urban mutation, especially "along the Western African coastline, which has been increasing in density of urban settlements and urban interconnectedness" (UN-Habitat, 2014).

These coastal areas concentrates economic activities, in particular rapidly expanding port-related businesses, but also various industries and tourism, and are a destination of choice for rural immigration (Quensiere et al., 2006).

Whilst Peter Hall describes waterfront revitalisation as one of the major event in urban planning in the 1980s in the developed world (Hall, 1993), this has clearly still not yet materialised in Sub-Saharan Africa. Urban Waterfront Redevelopment is still largely restricted to developed countries (Hoyle, 2002) and little literature has been produced on Africa's coastal conditions and on case studies of waterfront revitalizations.

Among notable exceptions in the African Continent, it is worth noting the cases of the tourism led regeneration of Zanzibar's Stone Town supported by UNESCO, Aga Khan Foundation and various urban planning and conservation initiatives (Hoyle 2002) and the developer-led redevelopment of Victoria and Alfred waterfront in South Africa (Kilian, Dodson 1996), which both have attracted notable attentions and may well represent the first signs of future "success stories" (Breen and Rigby, 1994). None of them are in West Africa, which still largely stays under the radar, despite the fundamental role the region will play in the next few decades on the continent and on the World.

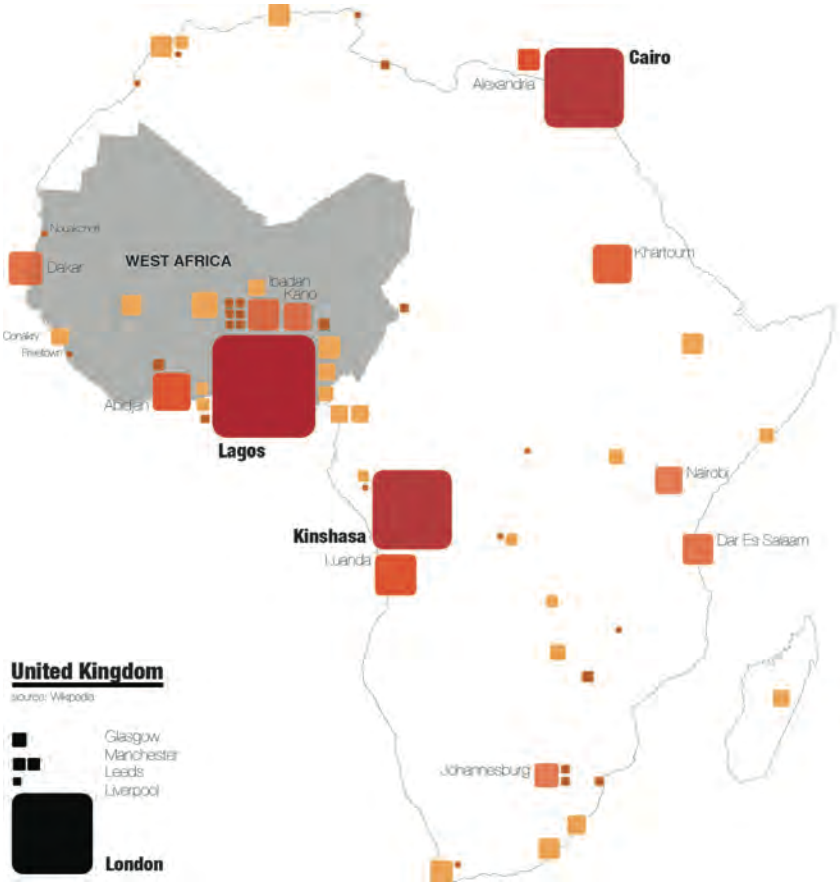


Figure 1: African Cities Population by 2025 according to UN-Habitat 2014 State of African Cities
Source: Off-The-Grid Studio

2. Are waterfront revitalization projects irrelevant in a Western African context ?

Africa's urban development has attracted a lot of attention, fostered by extensive researches and work on the ground of major institutions such as UN-Habitat, on various subjects from slum renewal to water access and basic infrastructure provision. However, no major focus has yet been given to coastal conditions and their development potentials as specific territories of strategic importance.

The explanation might lay in the apparent hiatus between the fundamental issues facing current urbanization of Africa with chaotic and largely informal urban sprawl unsupported by crumbling infrastructure on one hand, and the image of coastal regeneration projects in the developed world on the other hand (Hoyle, 2000). These projects are often targeting middle-class and the higher end residential market, with attractive restaurants, high-quality public spaces and tourist facilities and appear at first sight "out of place". To put it simply, would a Barcelona-type of urban coastal regeneration be a complete non-sense in the West-African context which would have for only consequence of widening inequality gaps?

The risk of developer-led and "extreme gentrification" is real but the need for change in these particularly under-utilized areas equally cannot be ignored under the argument that West Africa "has not yet fully entered history" as Mr Sarkozy once famously declared in Dakar, in a sort neo-colonialism mindset. This article argues that coastal developments within city agglomerations have equal regeneration potentials than their European and North American counterparts as potential kick-start projects of wider positive effects.

3. Conditions and Opportunities along West Africa's urban coast

It would be an impossible task to develop a rigorous "coastal typologies" covering the mere 4,400 km stretch of the West African coast, from the desert conditions of the North of Mauritania to the immense Niger Delta in Nigeria, through the environmentally rich humid zones of Senegal. This article will therefore "narrow" its attention down to major coastal city agglomerations, with equally drastically varied conditions within each city.

Whilst the conditions on the ground largely differ from the pre-regeneration ones in the developed world, it is important to understand first to what extent urban waterfronts in the region share similar core characteristics of strategic importance with their European or North American counterparts.

They are first and foremost by nature equally important city image makers as physical and symbolic windows to the world, with their own distinct physical character and identity. They are crossroads of intense interactions, often with strong historical assets and a vital economic and cultural role within the whole city (Schubert, 2012).

More importantly, they are often "paradigmatical territories" where the effects of regional and global economic restructuring are the most evident; territories where the contradictions of "fixity and flow" (Harvey, 1996) representing the fundamental tensions within cities between dynamic components and static elements, is the most critical (Desfor, Laidley, 2008). They are agents of change, potential catalyst of wider city-scale regeneration strategies.

Beyond these fundamental common characteristics, it is crucial to develop a better understanding of their unique aspects. It is worth noting that no major coastal cities existed in Western Africa before the colonial period. As a result of the maritime-based logistics of colonialism, cities rapidly developed within a very short time frame and few sites of historical importance remain nowadays.

This rapid and often chaotic development created an immense "heterogeneity in close proximity" characterizing Africa's urban development (Pieterse, 2013), and does not help to draw macro-urbanization conclusions. Furthermore, despite important efforts from institutions such as the African Centre for Cities and other institutions, we have to acknowledge vast gaps in our understanding about african cities, which is a result of two main issues: the lack of reliable data on the ground, as underlined for example by the Lagos Mainland Central Planning Framework (Moreau, 2013), and our over-reliance on western-based theoretical mindsets and framework.

We can therefore only modestly identify current main macro-level analytical elements which characterize West urban coast versus the pre-revitalization conditions in the West:

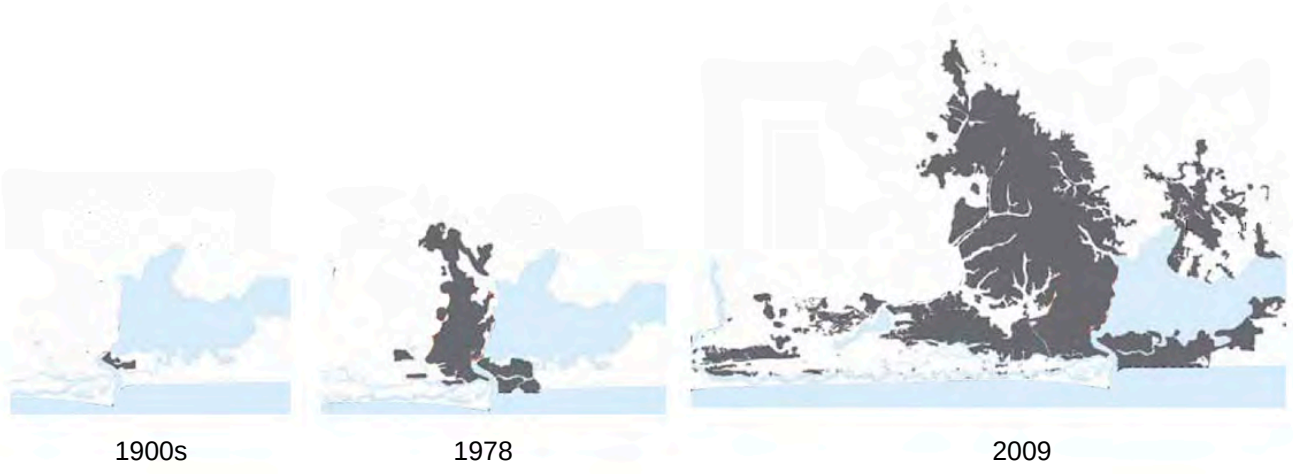


Figure 2: Spatial Growth of Lagos from the 1900s based on historical maps and current satellite imagery
Source: Off-The-Grid Studio

- the **fast growing urbanization** and the availability of land on the cities outskirts; which creates a "construction race" or sprawl with little consideration on improving the existing waterfronts or quality developments. In a very broad estimate, Lagos went from less than 10km of urbanized waterfront in early 1900, to more than 70km in the beginning of the 2000s before doubling to 140km in a mere decade.

- the **on-going modernization of port-related activities**; despite a doubling capacity of cargo fret between 1995 and 2005, the existing ports in the region are fairly small in international standards, with low productivity level and lack of modern equipment, creating "economic bottlenecks" (Ocean Shipping Consultants, 2008). The pressure is high to restructure and modernize ports, resulting in major impact on existing port territories and adjacent lands, located in the heart of most West African cities. Abidjan is for example launching a $2.5 billions expansion project, due to be completed in 2020 and Lagos has two new "mega-port" project in construction in Badagry, a village with colonial heritage, 50 km west of the city and in Lekki Free Trade Zone, closer to the city. These new port facilities which are popping up will have radical consequences for the city's waterfronts, beyond the mere borders of the ports.



Figure 3: Aerial photo of the port of Abidjan (source: www.lacotedivoiredenhaut.com)

- the **expanding industrialization** in a largely chaotic and uncontrolled manner; whilst waterfront revitalizations in developed countries were largely fostered by the availability of post-industrial land in city centers, West Africa's economy is largely based on light and heavy industries, still operating on their waterfronts and elsewhere.

  The relocation of the saw mill district of Okobaba on Lagos's central waterfront is one of many examples of the inevitable relocation issues and development constraint linked to such operating activities. It is perhaps best to offer a snapshot on the ground and transcribe here an extract one of the many reports done on the relocation of Okobaba's activities for a new development in this prime waterfront areas (thisdaylive, 2012):

  " For sometime now, Israel Duruaku, a wood carver in Okobaba, a slum in the waterfront area of Lagos had never been as happy as he was last Tuesday. Emerging from the make-shift structure from where he plies his trade in the shanty,

he leapt forward as he welcomed this reporter with a warm embrace. But that was where the joy of the wood carver ended.

Duruaku expressed fears over what the future holds for him. "Now, the government says they are demolishing this place and resettling the saw-millers at Agbowa. What plans do they have for the residents who live here?," he asked rhetorically, as he added, "We are not saying we are opposed to the demolition but where do they want us to go?" [...]
"I have been living here since 1970 and this place now filled with sawdust was full of water before. We did all that ourselves and live here with our children with virtually no input from government, yet we pay our taxes and vote during elections," he said, asking, "Now that the government said they want to use this place,where do they want us to go."

Elsewhere in the blighted settlement of about 350,000 people, life went on as usual that sunny afternoon. But the fear of an uncertain future loomed large as the residents await their fate in view of the plan by the Lagos State Government to demolish the structures, which, indeed, are really unfit for human habitation. Lagos State Governor Babatunde Fashola recently unfolded the government's plan to demolish the settlement and replace the shanties with modern structures.

The governor also disclosed that the saw-millers who do their business in Okobaba had agreed to move to Agbowa-Ikosi on the outskirt of Ikorodu to continue their work. But the silence of the governor on the fate of the 350,000 residents who live in Okobaba community in the wake of the planned movement has triggered off fresh anxiety in the community.

Chrio Foundation [a christian foundation operating in the area] maintained that "any forceful demolition and subsequent development of Okobaba into a Venice of Africa may be done at the expense of sacrificing the lives, destiny, career,well-being and the future of the over 350,000 already impoverished adults and children of Okobaba. The well-being of the people and children of Okobaba is a higher incentive than Venice of Africa."



Figure 4: Photo of the Saw Mills activity of Okobaba, Lagos, before the relocation by Edouard Moreau

- the **urban heterogeneity**; the tight coexistence of numerous coastal typologies, sometimes mixed, further complexifies any integrated revitalization strategy and represent a major development constraint. Establishing an extensive list of these typologies would be a major task in itself, but we can broadly differentiate macro-scale typologies.

The first typology is the traditional urban corniche, a dense mixed-use fabric of multiple land ownerships, usually characterized by important transport infrastructure, such as urban highways, and lack of quality public spaces. These urban corniches are attracting pieces of land for real-estate developers and hospitality groups who operate by nature in a piece-meal approach within limited development guidelines constraints by the public sector and little overall coherence.

The second type is informal housing, or slums. With an estimated 40 to 80% of urban inhabitants in West Africa living in slums (UN-Habitat, 2014), waterfronts are no exceptions. Makoko in Lagos, the Slum Venice, is one of the most well studied example of slums progressing onto the water (Funsho et al., 2013). Low-income residents are forced to live at the periphery or in ecologically sensitive natural habitats such as wetlands and estuaries or in swampy areas with the associated increases health risks, food insecurity and susceptibility to extreme events, such as flooding.

The third type are ports and port-related activities which still occupy an important section of the waterfront of coastal cities and are expanding, as well as various operating industrial lands as previously mentioned. This typology represents a great potential of re-development in the short term, without the complex issues of residents relocation.

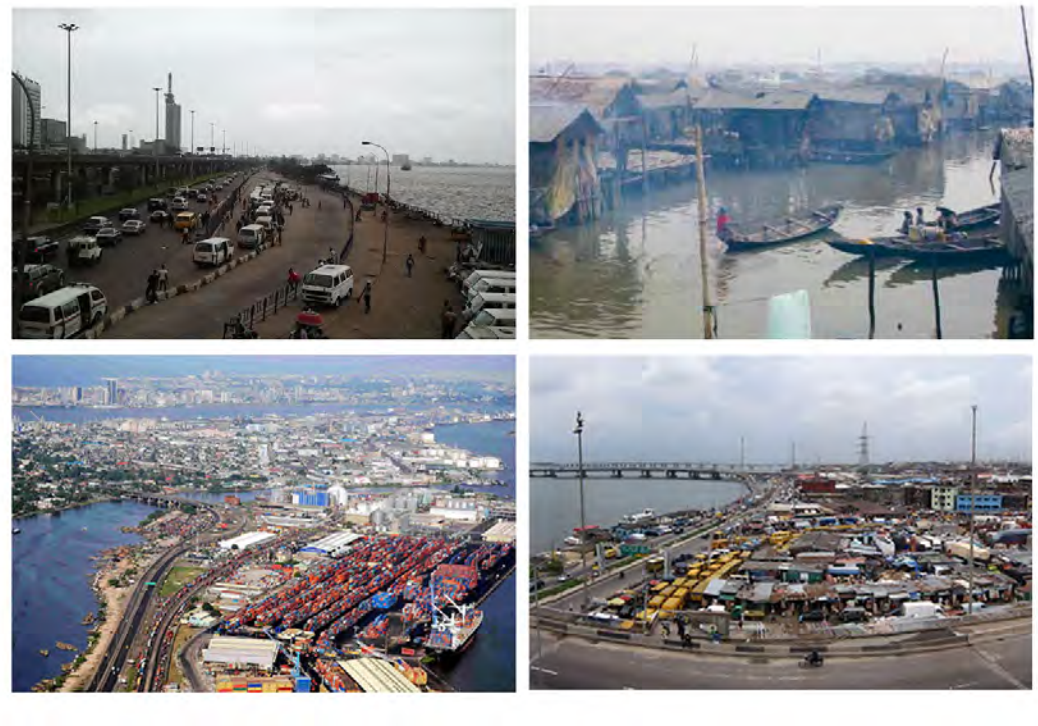


Figure 5: Photos of 4 coastal typologies within Lagos centre: urban corniche (top left), informal housing (top right), port activities (bottom left), small industries (bottom right) source: unknown (Internet)

A fourth type includes historical towns/heritage sites; most heritage sites are well identified UNESCO protected sites such as the islands of Goree and St Louis in Senegal or the colonial town of Grand Bassam in Ivory Coast. Timid efforts have been made to restore the past glory, but success stories of these heritage sites are rare. Additional physical places have also important cultural and symbolic assets, such as the Point of No Return in

Badagry, an important gateway of atlantic slavery, but also smaller and more modest places such as local fish markets are largely neglected and under-threat by real-estate development pressure (AIMF Report, Unspecified).

Finally, a fifth macro-scale typology would be represented by natural landscape, beaches, estuaries and other natural habitats, at the doorsteps of coastal cities. They represent an "endangered specie", threatened by environmental degradation, chaotic urban sprawl and privatization for large recreational and touristic projects. Lagos has for example over 150 kilometers of relatively untouched beach front, with rich cultural assets including Badagry's historical Slave Route.

In the 2000s, several developer-led tourism projects emerged but never materialized, including a large scale resort financed by the Mickael Jackson's family around music and slavery memorials. These projects, which had little to do with sustainable development and local integration, perhaps thankfully never materialized. However, it is clear that the tourism potentials of natural landscape in the vicinity of cities is high and development will inevitably occur. The rhetorical question is therefore the following: are local authorities ready to support and most importantly control this development pressure?

- **aging infrastructure and inappropriate provision**; the rapid urban population expansion has outrun the ability of city and local governments to cope with the infrastructure basic needs. A gap often filled by the informal and private sector. Major public investment is needed to upgrade the current infrastructure network to enable revitalization projects to occur. An estimated 15% of GDP investment in infrastructure would be require to cope with the basic needs, against the current 2% (Foster, 2009). Public-Private-Partnerships, once seen as the prime strategy to combine redevelopment projects and infrastructure upgrade in African countries, have yet to deliver its promises and have raises number of concerns, including rising cost, lack transparency and increase risks of corruption (Oyedele, 2012).

- extensive **water pollution**; due to the contamination of existing operating local industries and aging infrastructure, in particular poorly maintained stormwater drainage systems and waste management. The city contaminates the sea in a vicious circle of poor maintenance and slow degradation. Heavy industries, port activities and off-shore pollution are also important factors of water and coastal pollution which create unattractive waterfront, decrease its attractiveness and hinder development potential through high investment cost for the de-pollution.



Figure 6: photo of signs of pollution at Baie de Hann, Senegal (source: www.caseeworld.com

- **environmental risks,** in particular related to climate change; the vulnerability of dense linear agglomerations along the coast to "climate change-related pressures such as flooding, storm surges, sea-level rise, saline intrusion and coastal erosion is projected to increase" (UN-Habitat 2014). It is time for national and local authorities, at their different levels, to integrate climate change related issues in their development strategies.

- **weak existing urban governance and financial capacities;** whilst national legislations make provisions for environmental management and urban planning, local authorities are at the city level, "over-bureaucratized and tedious to negotiate for most people, opening up opportunities for corruption and exploitation" (UN-Habitat, 2014). Informal settlements and related issues further create tension in the urban governance system. Financial capacities are low and inadequate to meet primary infrastructure needs. Local authorities tends to have a limited role in urban development planning and implementation, creating further difficulties in planning effectively for the future and integrate efforts at the metropolitan level.

- **lack of planning framework, absence of strategic visions** at the scale of each coastal cities for their waterfront, which could guide revitalization projects and ensure quality and coherence with wider benefits for the city. Initiatives from local authorities such as the Mainland Central Model City in Lagos (Moreau 2013) or the "Grand Dakar" scheme are first steps in the right direction to anticipate the current urban mutations at the scale of the city or even the region and support future development projects. Furthermore, specific planning framework for waterfronts should be developed with appropriate guidelines and implementation mechanisms to guide, control and support private-led initiatives.

It seems clear with this short panorama that these characteristics are largely interlinked as pieces of the same puzzle. An integrated approach is therefore an absolute necessity to tackle these complex waterfront issues and conditions.

4. Portraits of current urban waterfront revitalization trends in West Africa

The intention of the following is not to give a complete picture of the waterfront revitalization trends in West Africa, but to broadly portray the current complex multi-facetted reality through three chosen case studies of different nature, each with their own motives, objectives, positive effects and shortcomings.

The first type of waterfront revitalization projects currently emerging could be called the "mega projects" for their scale and ambitions. One example of such type is Eko Atlantic City in Lagos, a brand new 10 square kilometers of reclaimed land hosting an expected 250,000 inhabitants in a mixed-use commercial and business environment.

Designed officially to "stop the erosion on Lagos coastline", the project received the Clinton Global Initative award. Eko Atlantic City represents in reality the model of the privately led large-scale development project, a completely isolated enclave for the rich (Lukacs, 2014) with limited socio-economic benefits for the rest of the city, eventually widening the inequality gap within the city. The generic architecture of the marketing material shows the absence of finesse and cultural grounds, designed first and foremost as an investment product by foreign investments and local banks. Located on the edge of the city, with its own planned modern infrastructure, it seems physically and culturally separated from the rest of the city.

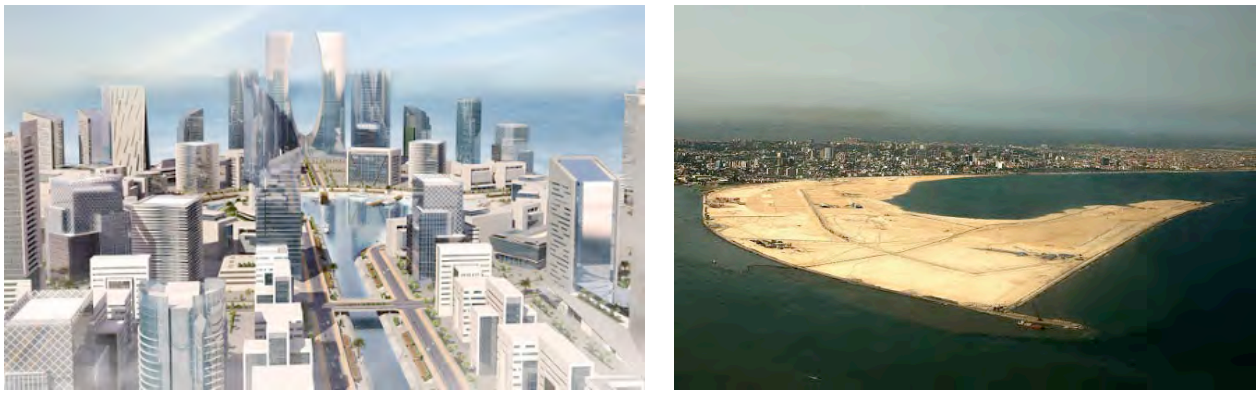


Figure 6: concept of the Eko Atlantic City and aerial view of the reclaimed land (source: www.ekoatlantic.com)

In sharp contrast, the second type are micro-scale interventions, largely bottom-up and at the community level. Makoko School by Nigerian architect Kunle Adeyemi in the floating slum is a prime example of such projects, and has recently attracted media attention. The floating structure is made of low-cost wood and buoyed by recycled plastic barrels to adapt to rising water levels, have sloped roofs to harvest rainwater, and compost toilets to solve sanitary needs.



Figure 7: new Makoko school, photograph by Ewan Baan

It is indisputable that these micro-scale interventions are not the only solution to the immense task of waterfront revitalization. It however raises important aspects, too often neglected in large-scale regeneration projects in African context, such as community engagement, local cultural identity, climate change adaptation or affordability. Only an integrated and inclusive combination of top-down planning framework which ensure the necessary district scale infrastructure investment and micro-scale bottom-up initiatives which creates, to quote Wouter Vanstiphout, "irreversible facts on the ground", really bring long-term change.

The third case study is an environmental and infrastructure led project. The Baie de Hann in Dakar used to be one of most stunning bay in the world and the favored beach of the Senegalese capital, but has slowly degraded to one of the most polluted areas of the country, due to industrial pollution

and domestic wastewater leakages. This situation resulted in important health related issues for nearby population as well as economic consequences for local fishermen and for tourism activties. In 2009, Dakar municipality, with the help of international funds, engaged the de-pollution process which integrated four major aspects: an substantial infrastructure project to improve wasterwater networks within the surrounding districts through a collector, an urban regeneration strategy of the surrounding towns, a revised urban governance ensuring the financial viability of the operational cost through, among other initiatives, a new tax on the surrounding polluting industries based on the level of pollution, and community engagement throughout the process. Once de-polluted, the Baie de Hann could represent a major potential of further waterfront revitalization for Dakar.

The above case studies are only a short selection and represent the tip of the iceberg of number of planned revitalization projects. They show that very development angles, motives and processes are possible and it is time for public authorities and planners to take position on what types of waterfront revitalization should be encouraged and develop a more in-depth knowledge of the process and know-how in the local urban context highlighted previously.

5. Conclusion: Towards an integrated and inclusive approach to West Africa's urban coast revitalization

In conclusion, this overview of the macro urbanisation characteristics of waterfronts in West Africa shows that the urban coast is of strategic importance in the future social, economical and environmental development of the region, which is currently experiencing a rapid and profound urban mutation. For too long, waterfront revitalization in developing countries have not been the subject of dedicated research and focus, appearing at best as a luxury, far from the urgency of the chaotic urbanization and infrastructure needs of the city as a whole. It is time for decision makers and planners to look ahead and understand that waterfronts, like their European and North American counterparts, can be the structuring backbone of wider regeneration initiatives, crystalizing private led investment and improving the image of the city.

These revitalization projects should not be a copy paste of our western models. It requires first and foremost to develop a better understanding of the specific tangible and intangible conditions on the ground and its immense challenges.

Current development trends in coastal areas are both worrying, such as the Eko Atlantic mega project, and promising such as the community based Makoko School or the Baie de Hann de-pollution project. The latter are signs of hope in integrated and inclusive approach to develop a "deep-rooted reunion between the city and the sea" (Hoyle, 2000). A reunion rooted in the cultural assets and inclusive of local communities; rooted in the economic reality of an emerging economy; rooted in the environmental and infrastructural challenges of african cities in transition.

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Water dialogue: the influence of the Tagus estuary on the development of metropolitan Lisbon

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The main goal of the paper is to explore the role of the Tagus estuary in metropolitan Lisbon, its influence on the location and morphology of the industrial areas and the changing nature of their relationship (for energy and food production, access to raw materials, transport or leisure).

1. The presence of the water in Metropolitan Lisbon

The paper explores the role of the water in metropolitan Lisbon, its influence on the location and morphology of the specialized areas and the changing nature of their relationship (for energy and food production, access to raw materials, transport or leisure).

The communication with the Atlantic Ocean and the calms and navigable waters of the Tagus estuary offered the ideal place for shipyards and trade activities, present in the history of Lisbon until nowadays. In the first half of the twentieth century, keeping pace with the industrialization of the territory, the Tagus estuary played an important role as the centre of the metropolitan area, allowing for harbour activities, transport and communication between its banks. Several large scale industrial clusters were located in direct contact with the water, contributing to rapid urban expansion processes and the increase of functional complexity in their surroundings.

From the 1990s onwards, there was pressure to adapt to the new demands of the emergent knowledge society, including the supporting mobility network, the motorization of the population and changes in the way of inhabiting the city. The global changes in the industrial production processes and the restructuring of the economic system had consequences in the obsolescence of the vast peripheral industrial areas created until the 1960s, originating a wasteland landscape around the estuary. The identification of the potential of the abandoned areas resulted in several plans and (built) waterfront projects in metropolitan Lisbon that aim at creating multifunctional areas and at establishing a direct contact with the river by promoting leisure and sports.

The re-colonization and the re-mixing of uses are the key-elements in the current planning discussion, in order to regenerate the abandoned industrial layer and to protect and define areas of environmental quality, contributing to a cohesive development. In this scenario, the main question addressed by the paper is the role of the water in the development of metropolitan Lisbon and the different nature of their relationship over time.

2. Between the Atlantic ocean and the Mediterranean sea

Lisbon's metropolitan territory is part of an advanced promontory on the Atlantic coast (Ramos Pereira, 2003). In spite of the symmetrical composition of its biophysical support – consisting of two peninsulas (Lisbon and Setúbal), two estuaries (Tagus and Sado), two cables (Roca and Espichel) and two dominant mountains (Sintra and Arrábida) – it is a place of great diversity, with areas of distinct characteristics that originated different forms of urban settlement and various human activities over time.

The landscape of this region gathers characteristics from *the Atlantic ocean and the Mediterranean* sea (Ribeiro, 1945). The lithography, the physiography, the climate, the solar and wind exposures feature a landscape divided between the rugged western and southern coasts contrasting with the plain estuaries, recreating similar conditions to the Mediterranean sea, allowing for the first settlements of ancient civilizations (Gaspar, 1994).

The rivers, the estuaries, the streams, the river branches and also the aquifers assumed a determinant role for the urban development of the region, as well as for the settlement and location of agricultural and industrial activities. These water elements were central for the transportation; for the access to potable water and its utilization for power generation through windmills and river dams; for industrial production as feedstock and as the suplier for fishing and salt production.

The Tagus estuary is the feature with the strongest physical presence as well as in the metropolitan imaginary, developing from Azambuja to the Atlantic, and originating an extensive flatland area. The Tagus floodplain results from the dialogue between land and water, extending over a large area, along a narrow strip with northeast-southwest orientation that gathers several islets, sandy islands and the fertile banks exposed the rhythmic variation of the tides and to the occasional floods.

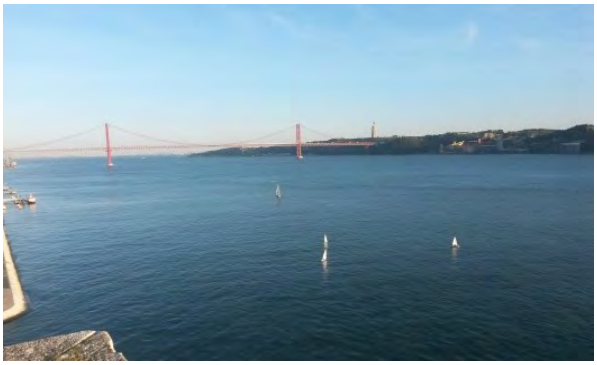



Figure 1 and 2: The Tagus estuary: view form the south bank and view from the north bank. Source: I.M., 2013.

The estuary is the joint between the peninsulas of Lisbon and Setúbal, allowing for the communication and transportation between the two, but also dividing both sides of very different characteristics and landscapes. The northern bank is characterized by an older geological formation, with higher mountains and stable margins. In contrast, the southern bank is flatter and linked to the floodplain, influenced by tides. This close relationship with the river and the constant change of the tides originates areas of marsh, river sandbanks and dunes that support agricultural activities dominated by the presence of water (rice, salt, etc.). The influence of the estuary on the south bank extends to the deep river branches that penetrate the land as arms of water, furrowing the plain and conditioning the human activities and providing the conditions for the emergence of the first urban settlements, which economy depended on the relationship with water – initially related to fishing and agricultural activities, and later on with the introduction of the heavy industry, linked to the siderurgy and naval activities.

The historically important waterway of Tagus is, therefore, the most dominant landscape structure of this region. This *liquid territory*[i] has dynamically allowed for urban settlements, port and industry (Dias and Alves, 2010) and the current activities related to sports, culture and leisure. The estuary is a protected natural area between land and water which holds a wide ecological diversity and constitute as interface between the water and land transportation, with easy access to essential raw-materials for industrial production.

3. The water and the production spaces

From early on, the hydrographical and the physiographic features determined the history of Lisbon and from its metropolitan territory. Lisbon polarized the development of the region, dating back to the Phoenicians and to the Roman and Arab occupations (Ferrão, 2004). The contrast between the ocean and the Tagus' estuary was an opportunity for the settlement and the urban development, offering calm waters in contrast to the Atlantic, and allowing for the control of the river entrance, transport, port activities and the availability of marine and river resources. This characteristic led the future of this port city developed on the northern bank of the estuary, by boosting the activities associated with water and keeping the interior space free for agricultural activities.

The privileged location in relation to the water played a fundamental role for the genesis of the city, allowing for the defence and the integration in the (land and maritime) commercial routes. The commercial and productive activities were constant in the history of the city since its origins, supporting its subsistence and growth. During the nineteenth century, the first industries established a direct relationship the estuary, rivers and stream shores in search of water access. Besides this aspect, the combination between the physiographic conditions and the access to the mobility network through the railways and ports was the strongest determinant factor for the emergence of the first industrial layer.

Thus, the first industrial layer emerged in the immediate periphery of the centre, concentrated in the valleys of Alcântara and Chelas, associated with their streams, which provided access to water and transportation (facilitated by the inner railway belt and harbour structures). Afterwards, in the twentieth century, with the growth of the city and the need for industrial space introduced by the mass production methods, the industries were displaced to the periphery, associated to the hygienist policies present in *General Urbanization and Expansion Plan of Lisbon*[ii] from 1948. These policies initiated a centrifugal movement from the centre, which replicates the previous relationships in relation to the biophysical support.

The logics behind the location of these industries were based by the conditions related to the characteristics of the site that allowed for land and river transportation, as well as direct access to the hydraulic and energy networks and raw-materials such as salt, stone or agricultural products. Besides these aspects, the industrial clusters that initiated the first peripheral anchorage in the metropolitan territory and started the displacement movement away from the centre, had as major guidelines for their location areas close to the city which could offer for large vacant spaces, with flat terrains and protected from floods or landslides, in combination with the dominant winds in order to protect the city from the industrial pollution.




Figure 3 and 4: Industries at the waterfront – Rice mill factory in Vila Franca de Xira and Quimiparque in Barreiro. Source: I.M., 2013.

The mechanistic concepts applied to the territory were very much present up to the 1970s, targeting the efficiency at various aspects, also in the relationship with the biophysical support, which presented itself as a powerful element for the building and transformation of the urban areas, rural areas and their functioning. In the case of the rural production, the

territorial efficiency was present in the land use distribution, where the most fertile areas were reserved for agriculture, and their productivity was boosted by the use of fertilizers[iii] and hydraulic improvements. However, this required the transformation of the original topographic and hydrographical situation, through the construction of infrastructures, the design of the flood areas and the shaping of the shores in order to accommodate harbour facilities, through the building of embankments and of industrial units at the waterfront – on both banks of the Tagus estuary and on the north bank of the Sado estuary.

In this sense, along with the industrialization, the intensive agricultural production was targeted for infrastructure renovations, framed in a progressive vision, where agricultural hydraulics became an instrument of productivity (Morgado, 2005). Thus, several works were undertaken for the rationalization of the water, through the drying of moist areas[iv] or channelling for irrigation in the floodplain of the Tagus estuary, and through the capture and storage in dams, for urban and industrial supply and hydropower production.

During this industrialization period and the consequent relocation of the industries towards peripheral areas at the waterfront of the Tagus, the water played an important role for the spatial planning, associated to the agricultural production, to the urban production and the installation of the industries, by influencing its location, density and morphology. In terms of production, the water fed the industrial machines, the agricultural soils and produced hydroelectric power. In order to increase the productivity and efficiency of its supply across the country (with special emphasis in metropolitan Lisbon) during this period, the hydric network was adapted in order to become as efficient as possible.

On the other hand, the port activity was established as one of the economic foundations of the country, driving the shaping of the Tagus and its waterfront, which were subject to a succession of projects and improvement plans[v], with the goal of maximizing its potential and leading to a harbour and industry specialization at the waterfront. The river accessibility was decisive for the industrial expansion, establishing *a priori* relationships (Custódio, 1994) with the factories by ensuring the cargo transport – in this way, for the establishment of this peripheral productive layer, was formed by the industries were first located along the riverfront, ensuring the accessibility to the estuary, complemented by the railway access.

In 1946, the *Port of Lisbon Improvement Plan*[vi] set the beginning of a phase of programmed growth of Lisbon's riverfront, with the definition of functional zoning, relocation of several industrial units to peripheral areas in the north or in the south bank and the improvement of road, rail and port infrastructures. If in the first stage the port was the catalyst for the industrial growth, and later on, this has become an interdependent relationship. The business turnover from the industries increased the transportation demands and justified for the construction and extension of the port structures (Ochoa, 2005).

The relationship between the water and the production spaces was, therefore, very dependent on the natural conditions of the estuary and the availability of land at the waterfront, which allowed for the industrial location and the construction of port structures associated to large industrial clusters. The industrialization of the waterfront of Tagus contributed to accentuate the dependence between its two banks. At the same time, it has also influenced the articulation of the ports of Lisbon, Setubal and the private port terminals connected to the southern bank industries.

4. The water and the abandoned spaces

From the 1980s onwards, the global changes in the industrial production processes and the restructuring of the economic system had evident consequences for the vast peripheral industrial clusters which became obsolete, having started processes of abandonment, transformation or adaptation. The industrial production model of concentration in large areas with high territorial presence was gradually altered to a *post-Fordist* model, characterized by

the segmentation of the production cycle and its consequent relocation to distant places, inducing the growth of processing and distribution activities (Castells, 2009 [1999]). So, while the industrial activity slowed down, the service sector showed an increasing dynamism.

Moreover, the impact of the *europeanization*[vii] of the national policies with the adoption of macro-economic and cohesion European Union (EU) policies, through the opening of the market and the introduction of the EU common currency, attracted foreign investors and allowed for the growth of the logistics activity, with the division of industrial production phases, supported by extension of the infrastructure networks. With the intention of reducing regional disparities in order to support the single market and the movement of people and goods, the main aims of the common transport and European cohesion policies were the creation of a trans-European transport network, encouraging sustainable mobility as well as the construction of telecommunications and energy infrastructures within the EU.

At national level, assisted by the Community Support Frameworks[viii], the transport policy invested in the improvement of the circulation, through the construction of a network of highways between the different parts of the country in addition to the international connections. The establishment of this network had a strong impact on the country, and specifically in the development of Lisbon's metropolitan area (Domingues, 2006, George and Morgado, 2007) by improving the connectivity of areas on the periphery of urban centres, which consequently attracted activities related to the processing, storage and distribution of goods – supported by the growth of trucking. The multinational companies installed in metropolitan Lisbon have adopted the production model of the geographically separated production phases, leading to the growth of new industrial and logistics structures in locations of high connectivity.

These changes allowed for the consolidation of the business service sector and, despite the efforts of the industrial update programs, led to the decline of the large industries. By losing the function which they were originally designed for, these spaces were destined to expect a new activity or transformation, their soil decontamination or to host a set of marginal activities associated with parking or recreation (such as sporadic trade shows, flea markets, *graffiti* or skateboarding). These locations were part of the industrial fabric that settled in the territory until the 1970s, composed by the industrial clusters, the port structures and railway lines. Nowadays, these abandoned areas occupy the waterfront of the estuary and are, therefore, sites of great environmental and ecological interest, with great potential for functional and economic (re) integration.




Figure 5 and 6: Abandoned industrial structures – Lisnave shipyard in Almada and Mill production factory in Póvoa de Santa Iria. Source: I.M., 2013.

While the opportunity for metropolitan reconfiguration presented by these vast brownfields has become broadly evident, the comprehensive reading of the landscape and of the vacant open spaces at the waterfront has contributed with a new approach without preconceptions of the abandoned areas, present in the production of plans and strategies for their integration in the metropolitan dynamics. The design of qualified spaces at the riverfront and the definition of areas of ecological interest are present in recent projects for the metropolitan

territory, having contributed to the spatial redefinition of the open space of the Tagus estuary. On the other hand, these projects provide recreational areas and interweave the residential fabric, the abandoned industrial and port areas and the river, confirming a general awareness of the potential of these areas to the cities (Alemany and Bruttomesso, 2011).

5. The water and the public spaces

In parallel to the loss of importance of the heavy industry and its inability to adapt to new technologies, there was a general awakening of interest in ecological and urban quality, expressed in public policies[ix], leading to the increasing importance of the tertiary and quaternary sectors, as well as the emergence of a widespread awareness of biophysical and environmental aspects. On another hand, the strengthening of the metropolitan identity, associated to the enhancement of the cultural and environmental aspects of the territory, reflects the specific characteristics of the place, where the Tagus estuary landscape plays a central role.

The identification of the riverfront brownfields as potential landscape projects, with the articulation between economic, environmental and social aspects, justified the production of a number of plans for these specific areas around the estuary. In 1998, the redevelopment plans for Parque das Nações[x] introduced the discussion about the environmental dimension in the territorial plans. This project expressed landscape policies that were later reinforced by the implementation of the *European Landscape Convention*[xi], which includes the sectors of culture, environment, agriculture, forestry, rural development and spatial planning.

The identification of this other type of *opportunity spaces* is present in the regional strategies, (expressed in the *Plano Regional de Ordenamento do Território da Área Metropolitana de Lisboa-PROTAML)* and in the Municipal Masterplans, leading to discussions about the obsolete industrial areas on the north axis along the Tagus from Lisbon to Vila Franca de Xira and on the south bank, were large industrial areas became obsolete.

In order to deal with this issue, a management company *ARS (Arco Ribeirinho Sul)* was created and, in partnership with the municipalities, proposed a set of actions for the regeneration and urban revitalization of these areas[xii] – Almada[xiii] (where *Lisnave*'s shipyard was located), Barreiro[xiv] (where *CUF* was located) and Seixal[xv] (where *Siderurgia Nacional* was located). The main goal was the recentralization of the metropolitan area, promoting a social, economic and environmental balance between the two banks of the Tagus. However, reflecting the current financial and economic crisis, the management company was disbanded[xvi] and the implementation of both these projects and the transport infrastructure projects planned for the region were stopped indefinitely.





Figure 7: Parque das Nações in Lisbon. Source: I.M., 2013. Figure 8: Arco ribeirinho Sul location. Source: www. parqueexpo.pt [acessed 2014.07.09].

At the municipal level, there have been varied efforts to return the riverfront to the public use, re-establishing the contact between the river and the city. The recent projects have

supported the transformation of the functional relationship between the industrial areas and the water, by the introducing open public spaces which enable community interaction and activities such as culture, sports or leisure.

Metropolitan Lisbon gathers several examples of urban regeneration and of reestablishment of the contact between the city and the Tagus, through the use of different strategies. The intervention forms and the creation of public spaces reflect their location and the relationship with the surroundings, taking advantage of the biophysical potential or of the built support, as landfills, piers, docks or surrounding buildings. In this sense, much differentiated urban spaces and ecological parks were created, having in common the physical and visual connection to the estuary as its strongest symbolic and identity character.

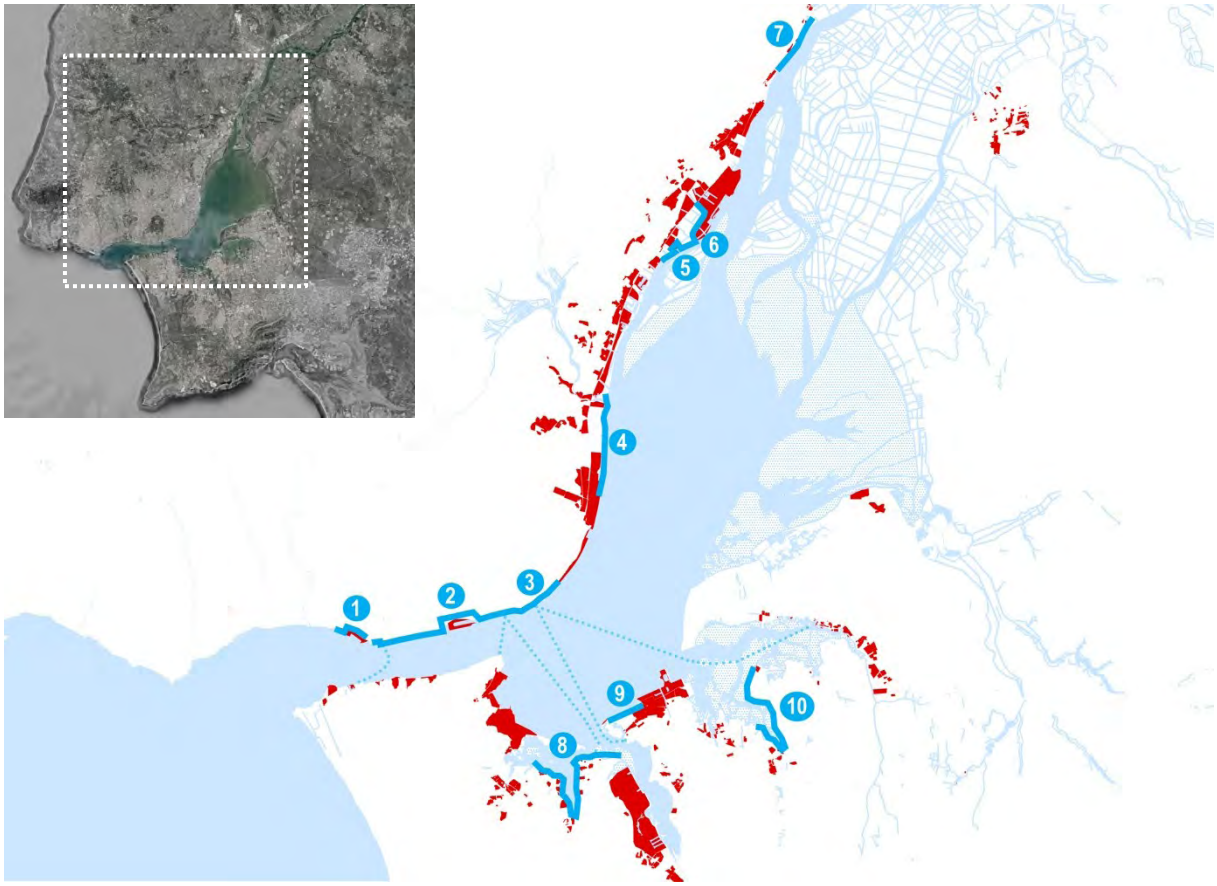


Figure 9: Waterfront of theTagus estuary (red: industrial spaces at the waterfront; blue: public spaces at the waterfront). Source: I.M. over Googlemaps and militar charts (sc. 1:25000), 2014.
(1) Riverfront spaces of Algés; (2) Riverfront spaces of Alcântara; (3) Riverfront from Cais do Sodré, Ribeira das Naus to Santa Apolónia; (4) Riverfront of Parque das Nações and Parque do Tejo e do Trancão; (5) Urban Park of Póvoa de Santa Iria; (6) Linear waterfront park of Tagus estuary; (7) Pedestrian riverfront path between Alhandra and Vila Franca de Xira and urban harbour of Vila Franca de Xira; (8) Riverfront path of Seixal; (9) Riverfront path of Augusto Gomes, Barreiro; (10) Riverfront and ecological mobility path of Moita.

In 2008, Lisbon's municipality established a protocol with the *Port of Lisbon' Administration (Administração do porto de Lisboa – APL)* for the transformation of several unused port areas into public spaces, with a shared management[xvii]. As the result of this agreement, the *General Plan for interventions in Lisbon's riverfront*[xviii] was produced, consisting in a set of interventions for Lisbon's riverfront with the goal of removing the physical and visual barriers and the creation of an urban river path that assumes different characters in relation to the surroundings (Salgado, 2013). The plan extends from Belém to Parque das Nações and establishes a dialogue with the port structures, the urban fabrics and hosts various types of activities, with a strong tourism oriented vision.

The same strategy may be found in the other municipalities around the estuary, as the rehabilitation of the riverfront path of Seixal or the urban harbour regeneration of Vila Franca de Xira. These projects reveal the intention of introducing leisure spaces of urban character and the enhancement of the visual presence of the estuary as an urban composition element.




Figure 10 and 11: (2) Riverfront spaces of Alcantâra and (3) Ribeira das Naus, in Lisbon. Source: I.M. 2014.

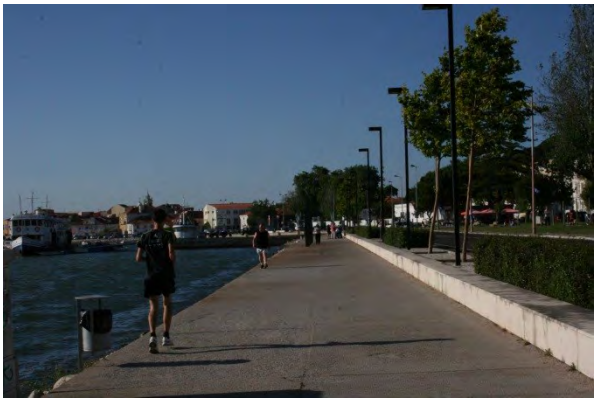



Figure 12 and 13: (7) Urban harbour of Vila Franca de Xira and (8) Riverfront path of Seixal. Source: I.M., 2014.

On the other hand, the waterfront interventions in Moita, in the area between Póvoa de Santa Iria and Alverca and in the area between Alhandra and Vila Franca de Xira explore the environmental dimension and induce a new dialogue from the coexistence of the industrial spaces and the ecological parks at the riverfront, contributing to improve the metropolitan metabolism. In the last two cases, the waterfront area is set along a strip of land between the railway line and the river shore, which concentrates a wide range of industrial and logistic activities of great economic importance. The maintenance of these activities is therefore essential and requires a strategy for their balance with the public spaces and the interaction with the waterfront.

In this sense, even though the renovation is very recent, the new waterfront defined by the urban park of Póvoa de Santa Iria, the Linear waterfront park of Tagus estuary and the pedestrian riverside path Pedestrian riverfront path between Alhandra and Vila Franca de Xira have strongly contributed to harmonize the functional use of the riverfront and to create singular spaces in the metropolitan territory.

This functional mixture on the riverfront of the Tagus estuary contributes to enrich the spatial, social and environmental experience, and helps to strengthen the regional identity associated with the presence of water, by allowing the dialogue between the industrial and port facilities, public recreational areas and natural parks.



Figure 14: (5) Urban Park of Póvoa de Santa Iria. Source: I.M., 2014.



Figure 15: (6) Linear waterfront park of Tagus estuary, Forte da Casa. Source: I.M., 2014.





Figure 16 and 17: (7) Pedestrian riverfront path between Alhandra and Vila Franca de Xira and (10) Waterfront of Moita. Source: I.M., 2014.

6. Towards a multifunctional waterfront

In conclusion, it is important to strengthen the central role of water in development of the metropolitan territory of Lisbon and the transformation of its relationship with the urban settlement. Transversely over time and the urban transformations, the identity character of the region remained associated to the Tagus estuary, present in the collective imaginary and constant in artistic expressions (literature, painting, photography, films, etc.).

With industrialization, the original functional relationship with the water – associated to the extraction of raw-materials, fishing, salt production, energy or transport – was replaced by the use of the riverfront exclusively for industrial and port activities. Later, along with the process of the deindustrialization, this relationship has evolved, through the awakening of ecological concerns and the demand for the restoration of the visual and physical connection

with the river. The result have been the recent interventions on the riverfront of the Tagus estuary, substantiating the need for greater contact with the water through quality public spaces, as well as the reintegration of obsolete port and industrial spaces.

The current deindustrialized areas occupy prime locations at the riverfront and in the surroundings of urban centres that resulted from the employment provided by the former structures. Today, these spaces constitute an (a) environmental opportunity in terms of the decontamination of industrial soils and response to the rising of the sea level, (b) a symbolic opportunity in terms of the contact with the river and (c) an economic opportunity in terms of the urbanization of these vacant areas.

However, the radical transformation and the total removal of industrial and port activities across the estuary is not desirable scenario, while they are still active and necessary for the economic dynamics. The coexistence of public spaces and industrial areas should be considered in order to create a functional mixture in the use of waterfront, as part of a broader regional system, with the estuary in the center of the metropolitan territory creating the *metropolis of the two banks* (CCDRLVT, 2002, CCDRLVT, 2010). Moreover, introducing residential areas in strategic points of the riverfront, in balance with the port, industries and leisure areas would contribute to introduce different functions and to reach the desired multifunctional waterfront for all.

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[i] In his lectures' cycle *Lisboa:a espessura do Tempo*, in *Culturgest* in 2013, João Gomes da Silva refred to the Tagus estuary as the *liquid territory* of metropolitan Lisbon.

[ii] In 1948, the *General Urbanization and Expansion Plan of Lisbon* (*Plano Geral de Urbanização e Expansão de Lisboa)* by Étienne Groër, defined areas of the city with specific functions. In this plan, the industrial area assumed a previously non-existent scale and urban leading role, driving towards a specialized concentration that would be later on replicated and intensified. It resumed the research produced between 1932 and 1938 for the city of Lisbon and presented as guiding principles the limitation of the urban development Lisbon, establishing a protection rural belt in order to restrict the territorial and demographic size of the city, as well as the decentralization of services and industries and the implementation of regulations on land use through zoning.

[iiiiii] The relationship between rural Alentejo and the industrial complex of CUF in Barreiro is an example of the synergies established between the agriculture and the industrial production, with the mediation of the railway. In a very simplified fashion, the transport of the agricultural production was carried out by the South railway line to Barreiro to be transformed by the CUF, and in the reverse direction the train transported the fertilizers produced in Barreiro, with the aim of increasing the agricultural productivity of Alentejo. For more information: Espírito Santo, P. & Saiote, V. 2002. A química de base e os adubos: o fim do século XIX e a primeira metade do século XX. *In:* Brito, J. M., Heitor, M. & Rollo, M. F. C. (eds.) *Engenho e Obra - Uma abordagem à história da Engenharia em Portugal no século XX.* Lisboa: Publicações Dom Quixote. P. 144-50.

[iv] Such as the drying of Loures' basin during the 1930s and 1940s, or the floodplain of Coina's river stream, where later in the 1960s the National Steel Factory was built.

[v] Between 1823 and 1884, several plans were proposed for the riverfront of Lisbon. In 1886 was approved the final project for the improvements to the Port of Lisbon, designed by engineers João Joaquim de Matos e Adolfo Loureiro, replaced later on in 1946 by the *Port of Lisbon Improvement Plan (Plano de Melhoramentos do Porto de Lisboa*). For more information: http://www.portodelisboa.pt/portal/page/portal/ PORTAL_PORTO_LISBOA/ AUTORIDADE_PORTUARIA/MEMORIA_INSTITUCIONAL

[vi] *Port of Lisbon Improvement Plan (Plano de Melhoramentos do Porto de Lisboa*) was approved by the Decree-Law no. 35.716, of 24th July, 1946, and consisted in the transformation of the waterfront of Lisbon, from Pedrouços to Sacavém.

[vii] *Europeanization* is understood as a process of construction, diffusion and institutionalization of formal and informal rules, procedures, policies, styles, shared beliefs and norms first defined and consolidated in the policy making of the UE and then incorporated into the discourse, identity, political structures and public policies of the member state. *Europeanization* is structured from policies, resources and transnational cooperation. For more information: Waterhout B, Mourato JM and Böhme K. (2009) The Impact of Europeanisation on Planning Cultures. In: Knieling J and Othengrafen Fe (eds) *Planning cultures in Europe: decoding cultural phenomena in urban and regional planning.* England: Ashgate Publishing Limited, 240-254.

[viii] Since EU integration, the community support for Portugal was divided into five phases: between 1986 and 1988 (Previous Regulation), between 1989 and 1993 (First Community Support Framework - IQCA) between 1994 and 1999 (Second Community Support Framework - IIQCA), between 2000 and 2006 (Third Community Support Framework - IIIQCA) and between 2007 and 2013 (National Strategic Reference Framework - QREN).

[ix] In Portugal, the environmental policies have an autonomous status since 1974, through the creation of the *Infrastructure and the Environment Ministry (Ministério do Equipamento Social e Ambiente),* which integrated the *National Environment Commission (Comissão Nacional do Ambiente*), created earlier in 1971. Since then, the environmental and spatial planning have been present in separate or integrated ministries, as currently – since 2013, they are associated to the *Ministry of Environment, spatial Planning and Energy (Ministério do Ambiente, Ordenamento do Território e Energia)*.

In 1987 the *Law on Environment policies (Lei de Bases do Ambiente)* was published, and later amended in 2002, including explicit references to landscape, understood as the geographical, ecological and aesthetic unit resulting from human action and the nature's reaction. The presence of this dimension of comprehensive landscape is as well expressed in the *National Program on Spatial Planning Policies (Programa Nacional de Políticas de ordenamento do Território)* through its strategic objectives of conserving and valuing biodiversity, the resources, and the natural heritage, by resorting to a sustainable use of energy and geological resources, and by monitoring, preventing and minimizing the risks.

[x] The process started in 1993 with the creation of a private company with public funding (*Parque Expo*) that would be responsible for the development and implementation of the plan for the area that hosted the international exhibition *Expo'98*. In 1994 were approved the master plan of the area as well as six detail plans. The urban design presented as goals the creation of a new urban area of environmental quality, in line with the strategy of reinforcement of the image and competitiveness of the city. The requalification brought improvements in the infrastructures (the construction of the bridge Vasco da Gama, the extension of the metro line, etc.) that allowed for the creation of a new centrality in the metropolitan area, with 340 hectares (from which the exhibition occupied 60 hectares). After the exhibition some of the key buildings remained, creating the functional mixture aimed by the plan, as well as hotels, offices, housing and public spaces in the form of urban park, squares and a river promenade. The program of the operation proposed 638.000 m^2 of housing, 240.000 m^2 of mixed-use (offices, shopping and others), 85.000 m^2 of industry and 467,000 m^2 of public facilities. Housing and mixed-use/public facilities are the dominant functions, corresponding to 45% and to 50% (respectively 17% + 33%) of the total 1.430.000 m^2 of construction.

[xi] *European Landscape Convention (Convenção Europeia da Paisagem)* promotes the protection, management and planning of European landscapes and organises European co-operation on landscape issues. The convention was adopted on 20th October 2000 and came into force on 1st March 2004 (Council of Europe Treaty Series no. 176). The convention was ratified by Portugal in 2005 (Decree-Law no. 4/2005, of 14th February). Available at http://www.coe.int/t/dg4/cultureheritage/heritage/Landscape/Publications/Convention-Txt-Ref_en.pdf [acessed at 2014.06.01].

[xii] Resolution of the Ministers' Council no.137/2008, of 12th September, amended by the Resolution of the Ministers' Council no. 66/2009, of 7th August. The consortium *Arco Ribeirinho Sul S.A.* produced a provisional strategic document in 2008, available at https://dspace.ist.utl.pt/bitstream/2295/707455/1/Relatorio%20resumido_Projecto%20Arco%20Ribeirinho%20Sul_RCM.pdf

[xiii] The Urban Development Plan *Almada Nascente (*Notice 1098/2009, of November 10th) was developed for an area with 115 ha at the city's riverfront and extends from Cacilhas to Arsenal do Alfeite, including the area of the former *Lisnave's* shipyards. After the shipyard was closed down in 2000 an international competition was held to select the design team (Consortium *ATKINS, Santa-Rita Arqºs, Richard Rogers Partnership*) for an urban regeneration project promoting the connection between the city and the river. The plan proposed a close relationship with the riverfront through the construction of a marina and cruise terminal and eco-park, occupied by diverse functions and cultural facilities whilst maintaining the industrial memory that characterizes the local identity.

[xiv] After a large number of initiatives that have emerged from the identification of the declining activities of *Quimiparque* (former premises of *CUF*), a preliminary proposal for the Urban Development Plan *for the territory of Quimiparque and surrounding area* was presented in 2008. The plan is the result of a consensus between the owners and the Municipality of Barreiro over the need for a planning instrument to guide the land use change, the soil decontamination and the project for a third Tagus bridge. The regeneration of this brownfield site plays an equally critical role in the metropolitan development, indicated in the PROTAML as an area capable of generating new economic dynamics and improving environmental quality for the region by contributing to the strategic vision which classifies Lisbon as a city-region and development centre of the country. The provisional version of the Urban Development Plan *of the territory of Quimiparque and surrounding areas,* developed by RISCO was published in 2010 for public consultation, available at http://www.cm-barreiro.pt/NR/rdonlyres/DAABFA40-3825-4E8F-B08B-F61F5FE88752/55960/Relatori odaPropostadePU12.pdf

[xv] The *Detailed Plan for the ex- Siderurgia Nacional*, from 2008, was developed for the largest of these three areas, where the national siderurgy (iron and steel works) operated until 2001. This document sets the guidelines for the conversion process of this brownfield site, with 535 ha and a significant environmental liability that arises from the steel production. The vision aims to combine both urban and environmental aspects through soil decontamination, creation of a new port terminal and recreational facilities. The industries currently operating in the Industrial Park of Seixal, after the siderurgy ceased activities are integrated in the plan, as well as a new multifunctional area in the north and a business area in the south, connected by green corridors in order to integrate the urban centre, the productive areas and the riverfront. A provisional version of the *Detailed Plan for the ex- Siderurgia Nacional,* developed by the consortium CISED, CVB, Sulplano and CM Seixal/SNESGES is available at http://www.Baia dotejo.pt/cache_bin/ XPQRZUAXX2004hmO8ErNX4OZKU.pdf

[xvi] Decree-Law no. 57/2012, March 12th.

[xvii] Resolution of the Ministers' Council no.87/2009, of 18th September.

[xviii] *General Plan for interventions in Lisbon's riverfront* (*Plano Geral de Intervenções na Frente Ribeirinha de Lisboa)*, available at http://www.cm-lisboa.pt/viver/urbanismo/planeamento-urbano/documentos-prospetivos/plano-geral-de-intervencoes-da-frente-ribeirinha-de-lisboa [acessed at 2014.07.09].

Envisioning support for a green and livable delta in the Netherlands

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Synopsis

The Dutch want more space for natural processes, but without losing the safety and economic possibilities. We developed the Delta Envisioning Support System to bridge differences and identify synergies. So we can find new opportunities for more natural dynamics, greener technology, sustainable agriculture and waterfronts related to port channels.

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Paper

The Delta Envisioning Support is a serious design game in which we present the knowledge of the area in maps in order to support stakeholders in understanding each other's interests and stimulate them to develop new design solutions.

Holland is made a lot safer after a flood in 1953 (with 1835 deaths). This is done by building dams and flood barriers in former sea arms and increment of dikes: the Dutch subjugated the estuary with the guiding motive "Dredge! Drain! Reclaim!". Today the Netherlands have a perfect flood safety system. The economic yield of this safe delta nowadays is large: ports and agriculture flourish.

But this comes at a price. The natural sedimentation is disturbed by the barriers between sea and rivers. Tidal movements were marginalized. Flood safety and economic development goes at the expense of landscape, biodiversity and quality of life. Currently the Netherlands found a new way: 'Building with Nature'. It seems much smarter and more effective to use the forces of nature, instead of working against them. So, the Dutch want more space for natural processes, but without losing this safety and economic possibilities. This should be possible. But many interests in the delta are opposed: economics and safety do not mix easily with ambitions for ecology and quality of life.

Governance processes that can deal with these contradictions are difficult. To overcome these contradictions The Netherlands Environmental Assessment Agency developed a tool that supports these governance processes. We call this the *Delta Envisioning Support System* (DENVIS), which is set up as a serious design game with the use of decision support techniques. It has a 'market-like' set up in which information and knowledge are linked to ideas and interests. In DENVIS characteristics of the long-term delta issues are confronted with the actual interests and positions. With DENVIS we can bridge differences and identify synergies.

In this envisioning support system we bring the representatives of governance, science and design literally together in one room and we guide them to a solution. These participants are put in a structure where the regular steps of analysis and visioning are summarized. We bring all geo information and possible design solutions in a MapTable (a kind of large interactive iPad) where we will find good spatial solutions for all sectors in an interactive negotiation.

DENVIS is a unique tool for planning complex spatial problems. We are working on new plans for improved environmental sustainability with participants from recreation, industry, water management, agriculture, municipalities, the government and nature organizations.

On the congress we can show the methodology, best practices and new plans. Such as a flexible long-term strategy to allow more tidal dynamics in the Haringvliet, a water basin where the River Rhine previously had free range to the sea, but where now a dam with a sluice gate holds back the sea.

Particularly promising are the edges of the islands. Around the islands in the estuary are usually several levees in succession, due to the gradual reclamation. Between those levees we find areas where various new forms of land/water transitions seems possible. We discovered that most of the participants in DENVIS see opportunities for more natural dynamics with greener technology (tidal power), sustainable agriculture and waterfronts & parks related to port channels. The approach can also work well in other urbanized delta areas such as Hamburg, Greater New Orleans and the Mekong delta.

Munich and the River Isar: Opportunities and Challenges for Sustainable Urban Design

Stephan REISS-SCHMIDT, Germany

Abstract

The Isar and its riverfronts are crucial for the identity and urban quality of Munich, the capital of the German state of Bavaria with more than 1.4 Mio. inhabitants. While the southern part of the river within city boundaries has been successfully naturally restored during the last 15 years, the function and design of the inner city segment of the Isar are still discussed, a master-plan is under way. The case study analyses the process to integrate contradictory objectives of the stakeholders. It presents lessons learnt about changing social and cultural behaviour leading to contradictory aims for use and design of public urban spaces and about strategies for the integration of different activities in a valuable and sensible waterfront environment. In many respects, the Munich experience with the river Isar as an important urban quality is transferable to other dense populated cities with inner city riverfronts.

1. Introduction: Green and water - important resources in a fast growing city

Munich Metropolitan Region still retains its leading edge in Germany as the economic power-house of the knowledge economy, thus constantly attracting people, firms and purchasing power into the area: re-urbanisation has a new show case. According to a recent forecast the population of the city of Munich will grow by a further 13 percent by the year 2030, mainly on account of immigration from other parts of Europe and Germany. Over the same period, the population of the region is expected to grow by more than 10 percent. Increasing pressure on the housing market, a growing demand for technical an social infrastructures and not at least an enormous need for public spaces, be it green or urban, are the consequence of a growing population.



1: Aerial view of the inner city of Munich with river Isar from south (source: City of Munich)

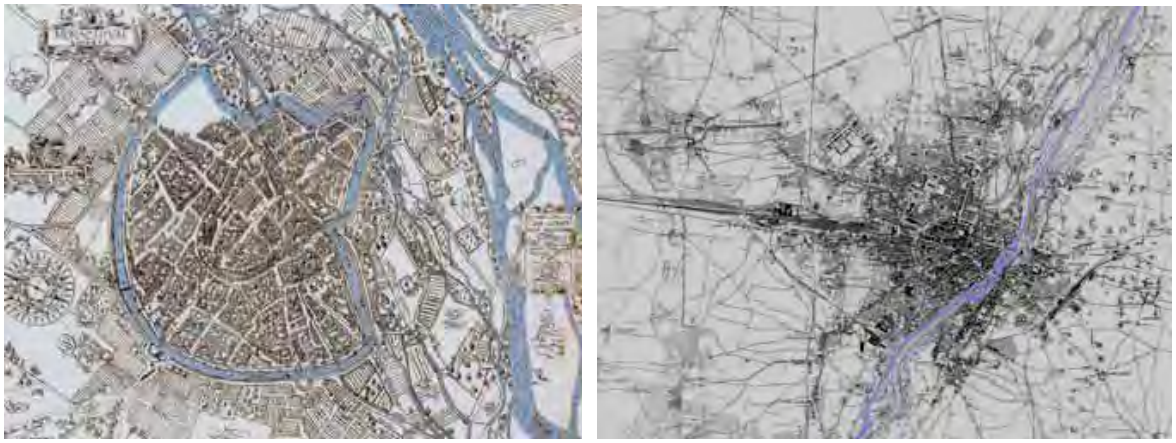
Open space, old trees, fast running, clear water and a relatively natural landscape is a great advantage for the citizens – and creates a visible connection with the impressive alpine landscape south of the city. Crossing Munich from south to north over approximately 14 kilometers, the Isar is a main cultural and natural identifying feature for Munich - and an important green and blue public open space in the very heart of the city. Besides the role as an attractive place for recreation the Isar-valley is an extended nature protection area of European importance (Flora-Fauna-Habitat). Since the 1960ies people have spontaneously taken more and more possession of the river embankments and gravel beaches. The relatively unregulated open space, the clean water and nice places for private parties make the Isar a wonderful natural leisure area just around the corner, easy to reach by metro, tram and bicycle (CITY OF MUNICH 2005). By new purification plants upstream the water quality has been improved in the last 20 years. Today the water of the river in most time of the year meets the EU-quality standards for swimming water.

Munich is the most densely populated in Germany with 4'500 inhabitants per km². For the inner city districts where approximately half of the population of Munich lives, urban densities are much higher and reach up to 15'000 inhabitants per km². Concerning the urban climate (reducing heat, bringing fresh air into the densely built up quarters) the river valley and its vegetation is of great and not replaceable value. Under the perspective of a rapid growth of population in Munich (+ 200'000 inhab. till 2030) and an ongoing densification of the city fabric, the central open space of the Isar valley is of a special importance for the quality of life (REISS-SCHMIDT 2012; CITY OF MUNICH 2012b).

2. City and river - three phases of a relationship

The relationship between city and river in Munich can be described in three different phases (CITY OF MUNICH 2012):

- Juxtaposition of city and river - the medieval city within its walls holding a free space to the unpredictable and wild river.
- Expansion of the City crossing the river - freed of the medieval walls, effective storm water protection allows a leap the growing city over the river with technical infrastructures, manufacturing and housing.
- Integration of the river into the city – with the change from industrial- to leisure-society, since the 1970ies became a favorite recreation- and party-area for citizens, first the southern Isar, since 2006 more and more also the inner city part.



2, 3: Munich and the wild Isar, 1613, left – Munich leaps over the canalized Isar, 1883, right (source: City of Munich)

Floods, Rafts and Water-Power

The Isar, the name means “the wild,” is the cradle of the foundation of Munich and its urban development. More than 850 years ago Duke Henry the Lion built there a new bridge and toll station on the important salt trade road from Salzburg to Augsburg. The former bridge some 25 kilometers downstream near the traditional bishop’s seat of Freising had been destroyed by the Duke to bring the toll income into his hands. A little fortified settlement developed on the left (western) side of the river: Munich, which means “ad munichem/at the monks”. For the new city the river with its natural dynamic became an important water way for rafting heavy goods like wood and stone from the Alps downstream and a severe thread for the citizens with inundations every spring after snow melting. The settlement area remained in safe distance from the river. Important for the economic development of the city was also the rich offer of water-power by the Isar and many smaller creeks. Hundreds of water mills were built during the middle ages to drive machines in the craftsmen’s shops in Munich (CITY OF MUNICH 2004).

After the de-fortification of the city at the beginning of the 19th century first river regulations and flood protections became possible. The city could dare to approach the river and started to develop an urbanized riverfront. With a comprehensive building and design program the city of Munich started 1901 the adaptation of the wild and dangerous river Isar to the needs of a modern city. Storm water protection, embankments, attractive public promenades and parks and six new bridges were parts of this program. A great part of the water was led into a parallel canal to gain electricity by water power. Embankments of stone, avenues and several new bridges were built and gave better access to the river for trade and leisure and not at least to the enlargements of the city on the right side of the Isar. Since 1959 with the Sylvenstein-Reservoir 60 kilometers upstream near Lenggries not only the flood-risk for Munich was significantly reduced, but also the amount of water and its dynamic (BAIV 1984). The characteristics of a wild mountainous river disappeared nevertheless more and more.

Inner city Isar: a carefully designed and striking urban space

Today we can distinguish three different spatial characters of the inner city river and its valley as it was shaped in the early 20th century (CITY OF MUNICH 2005):

- *“The flood hollow”* in the southern area shows extended grasslands on the eastern bank, used by people for sun bathing, playing and walking. Beyond the dike a public open air swimming pool, sports grounds and public parks with the embedded city’s nursery create a green and leisure image. From here you have nice views to the city panorama in the north and to the Alps in the south. On the western bank manufacturing areas are followed by a 19th century dense urban structure with a promenade with three parallel rows of trees.
- *“The canal”* begins north of Reichenbach-Bridge, where the river divides into two arms, the “big Isar” on the western side facing the inner city and the “little Isar” on the eastern side facing the quarter of Haidhausen. Three islands remain between both arms, giving spectacular locations for special uses and activities. On the southern one, the former “Coal-Island”, after 1903 the famous “Deutsches Museum” (German Technical Museum), one of the biggest technical museums worldwide was built in several steps. With 1.2 Mio. visitors per year it is the most visited museum in Germany and actually in a longer lasting refurbishment process. Since the 19th century, alongside the western bank of the “big Isar” embankments and promenades with urban character, planted as avenues give access to the river 3 to 5 meters below. The “little Isar” with less and different amounts of water is not canalized and has a more natural characteristic. Today it is a protected biotope for animals and plants. The gravel beaches here are also an attractive place for bathing, sunbathing and picnics. North of Ludwigs-Bridge the impressive ensemble of Muffathalle – built 1893 as power station and today a concert hall - and Müller’sches Volksbad, an impressive Art Nouveau swimming bath – give this part of the inner city Isar its special quality and atmosphere.

- North of Prater-Island the both arms reunify in a technical designed, very tight river bed. The embankments, twelve meters above the Isar ground sole, formed by huge walls are used as a main car traffic artery with 30 to 40'000 cars/24 hrs. in south-north (and partly also north-south) direction. The river is accessible only by few steep stairs. On the eastern high bank the topography of the naturally deeply engraved river bed can be experienced by walking through the Maximilians-Park with impressive old trees to Maximilianeum, the seat of the Bavarian parliament.

Very typical and important for the shape of the inner city Isar are the thirteen bridges for railway, car traffic, tram, bicycles and pedestrians (BAIV 1984). Bicycle- and foot-paths follow the river on both sides nearly completely. But due to the increasing car traffic, the inner city Isar valley today is rather noisy.





4, 5: Big Isar: Defence-bridge north of Museum-Island, left - Maximilians' Bridge during Isar Bridges Festival 2008, right (source: Keller&Damm, Illing/City of Munich)

3. PERSPECTIVE MUNICH: Strategic guidelines for urban development

Munich has a highly elaborated strategic and proactive urban development concept, namely "PERSPECTIVE MUNICH" (CITY OF MUNICH 1998/2001), which is based on the principles of "sustainability and urbanity". In line with its integrated, long-term-approach, which has a tradition of 45 years of development planning, the guiding principles and strategies of PERSPECTIVE MUNICH focus on the city as a whole, as well as its surrounding region. Some of its guidelines include economic prosperity, regional co-operation, social balance and equity, inner city development instead of sprawl, and sustainable mobility for all citizens. Within this framework the guiding principles are given concrete form by means of lighthouse-projects, local and sectorial concepts, as well as action programmes. An innovative external evaluation process of the PERSPECTIVE MUNICH in 2006/07 (CITY OF MUNICH 2007) allows transferable methodological and strategic conclusions.

The recently adopted four new strategic guidelines focus on:

1. Urban performance: open minded and attractive city.
2. Urban spaces: identity and qualities of public space.
3. Urban society: solidarity and engagement for a peaceful living together.
4. Urban policies: future oriented city management and cooperative governance.

Concerning the public green open spaces, the guideline 2 focusses on usability for different groups, good design and the local identity given by public open spaces. They shall allow flexible and different uses, sports as well as contemplation and they shall give people the opportunity for participation and co-production. Munich aims at a sustainable development in cooperation with neighboring counties and tries to connect green open spaces even beyond city boundaries. Building activities shall be aware of valuable landscapes and keep unbuilt areas for climate protection and exchange of fresh air.

The city's strategic guideline for spatial development is summarised as the sustainable settlement strategy of inner development, following the key words "compact, urban, green". This strategy combines dense urban land use for all purposes with the promotion of mixed use developments whenever possible, instead of mono-functional commercial or housing areas. Together with the polycentric system of district-centres that spread over the entire city, the mixed use approach will also secure a diversity of social life and short distances for many citizens to get to their jobs, schools and shops. This will help to encourage walking and cycling and using public transport instead of private cars for the every-day mobility. The focus of internal expansion is on re-use and re-structuring existing built-up areas of redundant land use, for instance former industrial or railway land or military barracks (REISS-SCHMIDT 2012). As a result of the privatisation of the federal railway, postal and telecommunication services as well as the reduction of military force (both of the German and the allied forces) at the beginning of the 1990s, Munich experienced a 'windfall' gain in the form of a huge amount of inner city development resources, without reducing scarce open space.

More than 60'000 housing units could be realised on these internal expansion sites. The existing urban context offers the chance to ameliorate neighbouring areas by new housing, more open space and a better social infrastructure. One of the city's top housing priorities is to complete at least 7'000 units annually. This objective can first be achieved by internal expansion as just described and second by additional options like densification of existing housing areas by filling gaps, adding further floors etc. A third option is building up some areas at the periphery of the city-limits designated since long in the land use plan for development. But a clear priority lies on the internal expansion and additional densification of existing housing areas.

The notion of "green" in this context implies that parks and green open spaces in the city must not only be safeguarded and enhanced, but also significantly augmented. This is a very important part of the low carbon city strategy and especially of the adaptation to climate change, since the number of very hot days will significantly increase in future. Green open spaces, trees and lakes are important to avoid bio-climatic stress especially for elder people and to guarantee good living conditions even in densely built up, compact inner city areas. According the rule in Munich for every inhabitant in newly built residential areas 17 m² of green open space in new public parks has to be provided. An important element of the strategy is the knitting together of a network of green open spaces. It constitutes regional green belts, big parks, green river banks, inner-city green belts or district parks and sport facilities like the world famous Olympic Park (1972 Olympic Games), which is still one of the most frequented parks in Munich for sports, leisure and entertainment.



6: General strategy for urban landscape network. The middle one of the blue corridors is the Isar-valley (source: City of Munich)

4. Isar-Plan 1984-2011: giving the southern Isar back to people

Since 1984 the discussion about functions and design of the Isar within city boundaries started with different initiatives from city councilors. A conference called “Isar-Colloquium” was held in 1987, where objectives and methods of a nearly natural design of the Isar within the city were discussed with experts from several disciplines. In the following year city council approved the initiative to develop a program under the title Isar-Plan in partnership with the State Water Authority to enhance flood protection and at the same time to naturally rebuild the bed of the Isar for a better quality as habitat and for recreation. Next milestones after a broad public debate were the inauguration of an integrated state/city working group and an agreement for a joint financing of the project. Experts for flood protection, water quality and dynamics, landscape architects and environmental engineers were committed with alternative studies for the project. In an artificial water stream of an institute of the Technical University of Munich models of the planed design for the river bed were tested to foresee the transportation of gravel by the natural dynamics of the flowing water and the changes of the topography of the river bed during times of low, middle and high water.

In the autumn of the year 2000 the building works started at the southern city boundary. Six kilometers up to the edge of the inner city Isar at the Braunauer Railway Bridge had been completed until 2004.







7, 8, 9: Isar-Plan for the natural restoration of the southern Isar between Grosshesseloher Bridge and Reichenbach Bridge, above; aspects during, left, and after natural conversion, right (source: Rädlinger (8), City of Munich).

Since then the new southern Isar valley is a very well accepted and intense used recreation area with a nearly natural appeal and a good water quality which nearly reaches the EU standards for bathing-water. Following this international remarkable best practice example, since some years also the northern part of the Isar, crossing the English Garden up to the city boundary at Ismaning is intensively discussed (CITY OF MUNICH 2005).

2003: Isar-Plan reached the inner city

Final part of the Isar-Plan of 1988 has been the two kilometers from the Braunauer Railway Bridge to the Museum Island, which started 2003 with an engineers and landscape-planners competition. The challenge here was a much higher water capacity than southwards, were

the main water flow goes through the parallel artificial canal to produce electricity. The task was to enlarge the flood capacity up to a maximum of 1'100 m³/s and at the same time to meet the needs for better accessibility, recreational areas and a better landscape design. The very clear architectonic concept of the first price winner (Irene Burkhardt Landscape Architects, Munich) with an artificial stone-island as a barrier between the "big Isar" and a less deep and slower flowing bathing area on the eastern side would have taken away the traditional lawns of the former flood-bed. Citizens of the adjacent quarters opposed this concept and city hall committed the first and second prize winners with a revised version of their concepts. After intensive discussions a majority of the citizens and of the district councils preferred the more natural paradigm of the second prize winning team (Winfried Jerney Landscape Architects, Munich). 2005 a compromise was approved by city council, following the first prize winner in the southern part, the second prize winner in the middle area and creating a compromise of both concepts for the northern part up to Museum Island. As an additional access for pedestrians and cyclists, the "Klenze-Foot-Bridge" between Wittelsbacher- and Reichenbach-Bridges is planned. Despite this project, the works in this part of the Isar-Plan had been completed in summer 2011.



10: Final design for the inner city Isar up to Museum-Island, 2005 (source: City of Munich).

5. "The Inner City Isar 2.0": public space for a diverse urban society

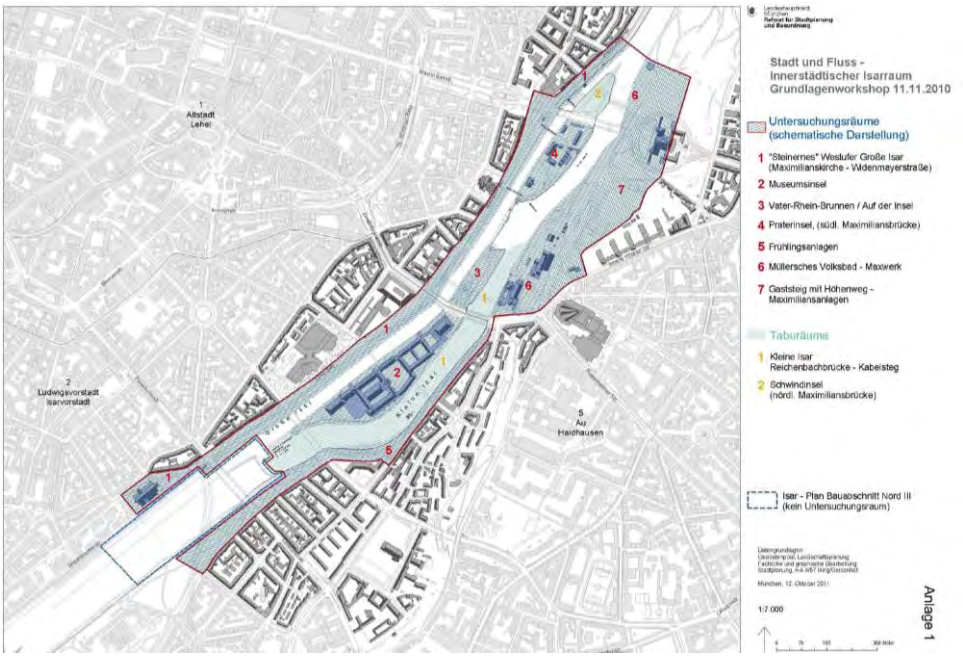
Nature, urbanity and recreation are the poles of the ongoing debate about the inner city Isar even after completion of the Isar-Plan. Even more controversial than the before mentioned southern part of inner city Isar up to Museum Island is the northwards following area up to Maximilians' Bridge. In the year 2008 a series of open air events on the banks and bridges of the Isar during the 850th anniversary of Munich gave new public and professional attention for the potentials and values of this very urban part of the Isar. Since then, citizens and stakeholders discuss different intentions and rise initiatives for traffic-calming during summer weekends and a better accessibility of the river to create an urban beach („Stadtstrand") like in Vienna, Berlin or Paris. Others want more beer gardens, cafes, clubs and evening events alongside the river, whereas a third group claims for preserving the valuable natural environment, the monuments and the hidden and relatively quiet places and hidden beauties.

Master-plan process

Following an intensive public debate and several initiatives from city councilors, 2010 the Department of City Planning and Building Regulations of the City of Munich started an intensive research and planning process with studies, workshops and public debates to create an integrated vision for the 1.7 kilometers of the inner urban Isar. First step was an internal workshop to discuss the task with representatives of all involved departments and of the political parties in the city council. All participants agreed about the high qualities and the historical and ecological value of the inner city Isar, but some deficits and challenges for further development were also discussed:

- Lack of gastronomy.
- More temporary events – concerts, theater, festivals.
- More opportunities for recreation and leisure.

- Reconstruction of visual perspectives and panoramas.
- More attention for nature preservation.
- Complete network of foot and bicycle tracks, better connections into adjacent neighborhoods
- Less car traffic along western bank, alternatives for car-parking.



11: Area for Inner City Isar Workshop 2010 (source: City of Munich).

For a better spatial differentiation, a zoning concept was suggested: spaces with deficits and predominantly tasks of qualifying and spaces with existing high qualities and mainly preservation tasks. As such “taboo-areas” were designated the “little Isar” and the Schwind Island. As main areas for improvements the western bank of the “big Isar” had been identified: the Museum Island with the surroundings of Deutsches Museum, the “Father Rhine-Park”, the Prater island, the eastern bank of “little Isar” and some parts of the Gasteig hill. Also concerning the water body and its quality some important projects were discussed.

As a result of the first workshop all participants realized the different intentions and priorities and not at last the conflicts and concurrences of different functions and development aims. The participants agreed to commission a master plan for the inner city Isar as a next step, following nine important guidelines:

- Strengthen and save the inner city Isar area.
- Develop and strengthen opportunities for recreation and events.
- Keep open spaces for experimental uses and daring designs.
- Save building culture with all changes.
- Improve culture.
- Save the visual quality of the landscape.
- Save and restore visibility and perspectives.
- Guarantee protection of habitats and biotopes.
- Enhance and improve slow mobility.
- Installation of a “River Round-Table” to accompany the further planning process.

First ideas and concepts for refitting the inner city Isar

As a main outcome of the Isar-Workshop in November 2010, the studies for a comprehensive" Master-Plan City and River" had been commissioned in 2012 to the team of landscape architects and urban designers mahl gebhard konzepte, Munich and yellow z, Zurich. The results of an in depth analysis and first conceptual ideas were presented in a second workshop in summer 2013. The discussion of these first ideas will be integrated in the draft for a master plan which will be presented in autumn 2014.

Some of the first ideas:

- Promenade at the west bank: traffic calming, separation of slow and fast cyclists, footpath directly at the waterfront; widening of the linear promenade by balconies at significant places; probably sitting terraces/stairs facing the river; improvement of visual relations to the other side and important monuments; eventually greening and opening of roof-terraces on public buildings nearby.
- Islands: Promenades alongside both sides of museums island; probably cafés and beer gardens on the islands with direct relation to the water, cultural summer beach in the "Father-Rhine-Park" on the northern museum island and/or near Müller'sches Volksbad.
- Natural and silent east bank: mainly nature preservation, improvement of existing foot paths; better visual relations to the water by cutting back trees and bushes; widening of some narrow passes for (slow) cyclists and hikers.
- Connections: better connections and orientation for cycling and walking from the nearby dense populated quarters to the river; more lively and attractive uses for the ground floors of public buildings; opening of the internal court of Deutsches Museum for crossing the island by bicycle or by foot.
- Gastronomy, public toilets: feasibility-study for different possible places on the island and at the river banks, probably create places by artificial platforms over the water.

For the main areas project-sheets had been elaborated out to show existing situation and future potentials. Main intention of the master-plan concept is to improve accessibility and to develop the individual characters and identities of different places. Objective is to preserve the uniqueness and qualities of the inner city Isar but also to improve quality for different needs of old and young citizens and visitors. Conflicts between different groups of users should be regulated by a consequent zoning concept with more artificial and busy places on the one hand and more natural and silent on the other. The direct relationship to the water shall be intensified despite the height-differences and restrictions by nature preservation.

Implementation of the master-plan

The master-plan will be presented to city council for approval early in 2015. After approval, the Implementation should start with a set of short term initial actions to make the intended change of the inner city Isar visible. Short term actions may be planting and redesign of the green open spaces or temporary uses and events at the river banks and on some of the bridges or developing nature preservation combined with nature education in selected areas which are under special pressure or overused.



12, 13: First ideas for projects from the master-plan process: seat-steps facing the river opposite Deutsches Museum, left – platforms for sitting and sun-bathing at the defence-bridge, right (source: mahl-gebhard/yellow z, City of Munich).

6. Conclusions and lessons learnt

Rivers and urban riverfronts are important infrastructures and important places of history and identity for a city. As an infrastructure, the river may be a traffic corridor, a source for electricity, a reservoir for drinking water or a main sewer, a climate buffer and habitat and not at least a place for recreation and leisure in the inner city. Infrastructures are important collective goods. Access to riverfronts should be free for the public and may not be privatized. Infrastructures should be able to fulfill their tasks, but they also should be designed carefully to integrate them into the urban tissue and into the landscape. Infrastructures are not only technical elements, but also cultural creations. The embankments, bridges and parks of the inner city Isar from the beginning of the 20th century are good examples for the integration of cultural aspects into the design of big technical infrastructures. The transformation of the southern part of the Isar in Munich from a mere technical building to a natural landscape for recreation and leisure shows the importance of long term planning and of the cooperation with citizens in a permanent dialogue from planning to implementation.

For cities with a big navigable stream (like Cologne, Hamburg, London, Vienna or Budapest) or at the sea shore (like Amsterdam, Copenhagen, Stockholm, Lisbon or New York), waterfront locations are a main potential for urban renewal. Vacant land from old harbors or industries at the waterfront could be recycled for housing and recreation. For cities with smaller, sometimes wild inland rivers like Munich, Zurich, Milano or Madrid the riverfront has

a different meaning. Open space is often very scarce in the dense built up and populated cities like Munich, where land prices and rents are at the top in Germany.

The river Isar is an important element for Munich's identity and beloved by its citizens. Even more facing a high rate of immigration and the densification of the urban fabric, not at least the river and its valley are of increasing importance for urban climate, nature preservation and recreation. The needs and intentions of a socially more and more diverse and relatively young urban society, where sports plays an important role cannot be fulfilled with the strict and stony design of the inner city river banks and with strict rules of nature preservation in the green parts of the riverfront.

The ongoing improvement of the river Isar in Munich has nevertheless five important lessons for other similar cities with inner city river fronts:

1. Water and river banks - even in smaller format - are important elements of urban identity and urban history. They are of high emotional value for many citizens. Therefore planning and realizing improvements at the river front is not possible in a top-down-process. Different values, intentions and objectives for the river front have to be explored, discussed and decided in an open dialogue and a cooperative planning process.
2. In dense and growing cities despite a wide and beautiful surrounding landscape inner city river banks are of a not replaceable and high value for the recreation and various leisure activities. Usable space at the very water front, shady trees, noise protection, safe and beautiful places to sit near the water, a good water quality and opportunities to bath and to play at the water front, but also gastronomy and sports facilities are searched also in inner city river situations. Solution for the car traffic (driving and parking) alongside the river is an important precondition for reaching more quality for being at the river front.
3. A great risk of the growing interest in inner city water fronts is the overuse and over-functionalizing of these areas. As seen in Munich, one of the important values of inner city Isar is the contrast between urban embankments and more natural shaped banks in short distance. This contrast and spatial difference should be preserved as well as the contrast of rather busy, lively areas and party locations at the river front and more silent, contemplative areas and hidden paths and lawns to recreate from inner city business and activities. Overall the same intensity of functionality, design and accessibility is the wrong concept for a very precious inner city river landscape. Also worth to preserve is the feeling of different atmosphere of the Isar in winter, spring, autumn or summer.
4. The complex and differentiated functions of the inner city Isar cannot be answered with "one fits all" design standards and traditional recipes. New solutions should be experienced as for instance temporary and limited activities in certain areas, taboo- and silence-areas and other experimental methods.
5. Strictly to avoid is any form of monopolization and privatization of parts of the public river space, be it by certain groups of users, be it by private businesses like surfing schools, cafes and beer gardens. The increasing real estate value along the river, which will even more accelerate with a rising quality ant attractiveness of the inner city Isar is a social and cultural problem of great relevance - also in the actual public debate about gentrification and displacement by increasing housing costs in the inner city districts of Munich.
6. Munich and the river Isar is a success- and love story. That is a challenge for planners and politicians to develop the right concepts and to take decisions which fit the different needs and wishes of citizens and visitors of the city. By the ongoing open debate and a cooperative planning process this will be reached in the next five years.

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Water in Cities: To Whose Benefit?

Judith RYSER, CityScope Europe, UK

Synopsis

Waterfront developments have been all the rage and still are. Arguably, they form part of the globalisation process, as they accommodate footloose investment and contribute to the internationalisation of urban design. They have matured, undergone further transformations, and possibly changed cities for the better. However, assessments have mainly been carried out by their protagonists. Questions remain about waterfront developments and their assumed betterments: from whose standpoint? In whose interest? To whose benefit? With what short-term effects: displacement, demolition of assets, elimination of existing values? With what long-term effects: improvement of the local economy, renewal of derelict sites and buildings, production of gated premises with restrictive access, or revalorisation of the 'liquid asset' – water - in material as well as symbolic terms? Some examples address these issues with emphasis on the impact of large scale, long timeframe of waterfront developments on validity, legitimacy and resilience of masterplans.

Preamble

Water is intrinsically linked to cities. For those who live, work, learn and play in cities water is essential for their survival. In this sense, water is socially unifying and needs to be guaranteed as a human right, a duty shared by planners. "Water in cities" is an enormous topic and the paper focuses on waterfront developments, owing to their attraction of mobile capital which is contributing to the globalisation process and arguably to the internationalisation of urban design relevant to planners. Yet, it is important not to omit the emotions that rivers, lakes, seashores, even fountains, rain and snow arouse in cities. A little detour explores this wider meaning and purpose of water. The symbolic character of water remains paramount. It is seen, heard, felt, experienced by all human senses. It remains an inspiration for poets, painters, musicians, a fascination for children, and has sacred significance in religions.

Roles of water

Since time immemorial water has been simultaneously a lifeline and a threat to life. Water has been the object of human domination over nature. Settlers chose water for survival and as defensible space and water shaped cities ever since. Industry used its motive power, while polluting it with its waste. Water served to transport goods, to conduct wars. It has become a tourist attraction, and is being turned into a marketable asset with great opportunities for the development industry. Water continues to play an important role in the human economy. It contributes to the gap between poor and rich: hard and expensive to access for the poor, and often squandered by the rich.



fig 1
power shower
heatforce



fig 2
water carriers Africa
Tichaona Jorofani

Technology and water

Technology is helping to tackle both overabundance and scarcity of water. It has been transported over long distances already by the Romans, used for irrigation by farmers all over the world, extracted deep down from the water table in arid climates, collected as rainwater from roofs and in wells, made drinkable at desalination plants. At present, water is remotely captured, cleansed, recycled and preserved in most cities. Water supply and disposal is an essential part of planning.

Water and cities

These roles of water exist throughout the world in very diverse forms. Most cities were located near a water source - rivers, lakes, seafronts - until recently, when other locational criteria prevailed. A few snapshots illustrate this: archetypical examples of defensible cities are Constantine in Algeria created by an emperor in Roman times; Freiburg im Breisgau and in Switzerland founded by the Zaehringer in the Middle Ages; colonial forts surrounded by water erected by colonialists to defend their territorial conquests in the 17th century;[1] settlements on rivers in the United States created by religious minorities expelled from Europe in the 18th century.[2] Water was the main medium of transport reaching ports built on rivers and seafronts until rail, later roads for motor transport and finally aviation overtook its importance. During the industrial era in the 18th and 19th centuries cities were created near raw materials (iron ore, etc),[3] but often using rivers for motive power[4] and disposal.[5] New towns were built in the 20th century in the Old World after the second world war[6] and after independence all over the New World,[7] all in need of water, whether in proximity or imported.



Fig 3
Constantine Algeria
Medina above Gorge of Rhummel river
Photo Judith Ryser

Water in cities

Although cities just tended to settle near water, they later used water for development and change, by taming natural rivers, beaches and banks or by adding new watercourses and water features. The geography of water in cities is dynamic. Water, rivers, as well as seashores are not static. Their courses and shapes vary over time, by nature as well as by the hand of humankind. Water may be tamed into canals to alleviate flooding or enrich urban development. When rivers are pushed under ground their presence is no longer visible albeit real, changing micro-climates without memory on the surface. Rivers can be silent tributaries below ground, used to supply drinking water under culverts, receive storm water or contribute to sewage networks. Although rail, road and air traffic tend to dominate, many cities are returning to their rivers, canals and waterfronts to transport both commuters and leisure passengers. Ports remain active and continue to characterise their cities, even if their industrial functions are shifting their location and liberating land for waterfront development discussed below.

Water is also a social divide. Initially, cities tended to be built only on one side of a river using it as a barrier against outside enemies. The space on the other side was gradually populated by other functions before the city itself expanded over the river. Markets supplied food for the

city, inns accommodated travellers before entering the city requiring a pass. Cities also offloaded the 'bad life' there, waste disposal, polluting trades, quarantines, prisons. These residue activities attracted illicit pursuits. Prostitution and destitution were rife, but also fun like theatre and other naughty pleasures.[8] This created a social divide between those who lived on the good and the bad side of the river, often perpetuated long after activities had changed.

Water embodies danger. With climate change, extreme weather conditions have become more frequent. They have led to flooding, as cities with their sealed surfaces are ill prepared for these changes. Although many had embanked their rivers, built relief canals and erected barriers in the past, they had also converted greenery and natural soil into hard surfaces, increased the density of the built up area and lost open spaces to development. In recent times, these hard engineering methods were contested and softer solutions sought, such as creating overspills for flood waters and respecting wet lands used as temporary recreational spaces depending on the water flows, thus bringing nature back into the city.[9] Instead of filling in docks and canals, some cities are taking off the culverts over their canals, uncovering their natural rivers and, where possible, letting water find its natural course again.[10]

In cities water reaches far beyond its utilitarian function. Water has a ludic side and brings pleasure to everyone. Cities have used water to great effect to embellish their public realm and raise their status. Fountains and ornamental water features are making cities like Rome world famous, but drinking fountains are also bringing delight and artists, just like children enjoy playing with water in the public realm. Water was used creatively to cool the streets of the Sevilla Expo 1992[11] and along facades at the Zaragoza Expo 2008[12] and cities have installed sandy beaches on their riverbanks during the summer to the delight of locals and tourists.[13] In London, activists are lobbying for a new green bridge over the Thames where people can meander, dwell and experience the river from a close up at leisure.[14] Individuals ornate their gardens with ponds and their houses with small water features. Even the bespoke goldfish bowl brings delight.



fig 4 Drinking fountain Rome Italy



fig 5 fountain Logrono Spain



fig 6 Abandoned canal Aviles Spainphotos: Judith Ryser

More than other urban features water fascinates even when it is neglected, silted in, cut off from thoroughfares. Abandoned water courses tend to be recuperated by nature and casual users alike. Wildlife is taking hold of such remote places, discovered gradually by people who use them now and then, to observe them, fish in them, or simply enjoy their soothing effect.

Water has meaning and affects identity. People tend to identify with both their cities and their rivers, including the symbolic effects of their names. Why are 'La Tamise' and 'La Seine' feminine and 'Le Rhone' and 'Le Danube' masculine? When Transport for London tried to take the symbolic Thames off its Underground Maps, people protested and demanded it

back. Rivers feature in novels and poets write about the mysteriousness of rivers and their love for them. People spend days walking along their river, from one end of their city to the other, to experience the many facets of the water. [15] "Water in the City" matters, the question remains: for whose benefit?

Rivers in cities

Before turning to urban waterfront development, it is opportune to dwell a little on rivers, how they affect their cities and how planners and politicians are turning them into assets. The fate of rivers in cities varies all the time and perhaps symbolises the imponderables of urban growth and change. A few examples (Madrid, Paris, London and Wroclaw) illustrate this diversity, aware that they share the importance of the river for their city.

El Manzanares

In Madrid the river Manzanares was curiously absent. Madrid appeared as a city of stone. Only by penetrating deeply into the park Casa de Campo and peering down the steep overgrown banks was it possible to discover the river. Until it was dug up, first in timid steps for fishing and ambling alongside. Later it was uncovered in earnest, regenerated and beautified as a ploy of city marketing, to sell Madrid's global city status. This may not have been possible without the repeated bids for the Olympic games on reclaimed land over the inner Motorway ring which without winning the bid was tunnelled for that purpose in most parts, also along the river. The city went ahead with this mega-project regardless, a legacy of the development industry and enormous investor gains before the property crash, a last grand gesture of expansion at a mega-scale, too large for intimacy. However, in present times no other city has produced such a uniquely generous river-scape of new public open space from which the city and the citizens will benefit for a very long time.



fig 7
Manzanares
Madrid
Plan West8



fig 8 Seine
Paris
Pont des Arts

http://misadventureswithandi.com/2013/02/french-friday-the-best-romantic-strolls-in-paris.html

La Seine

Perhaps the most romanticised river is the Seine in Paris. It figures endlessly in novels and films and its beauty has been captured by painters, photographers, poets and musicians over centuries. Couples on the Pont des Arts enjoyed the openness of the river and the sunset on its horizon. Its beauty embellished even the more industrial parts in the east and west of the city, long since gentrified. Paris has been regenerating its riverfronts for a long time. Besides prestigious buildings like the national library with its wooden steps forming a new public realm with a great view over the Seine, an interesting example of riverfront regeneration has taken place near the Austerlitz railway station, where Christian de Portzamparc has created a new quarter by instating the Paris grid on this brown field site to extend the Parisian urban grain and integrate the new quarter into the existing fabric.

The Thames

In London, the Thames remains an as yet commercially underexploited asset in the eyes of current neo-liberal planners. A historic divide remains between the north and the south bank of the Thames, conquered in Victorian times by rigid embankments to tame the tidal river.[16]

Prime Minister Thatcher envisaged to reinstate the 'Pool of London', the oldest historic tidal port on the river, but this time with locks to prevent the unruly tide disfiguring the walls of the embankment. Yet, the tidal dynamic of the Thames draws nature into the heart of the city and moderates its micro-climate. The Thames remains the last generous open space, the only significant public realm which really belongs to all.

How long for though? Not surprisingly, like the greenbelt the Thames is undergoing constant development pressures. A recent offensive to colonise the Thames was hatched by the City of London which proposed artificial islands in its plan for 2035 to make space for more and ever more skyscrapers, transforming London into an ubiquitous global banking CBD. Meanwhile, some 250 skyscrapers, essentially financed by Middle East petro-dollars, Russian energy money or Asian hyper-accumulated capital have planning permission for investment into commodity rather than use. Located mainly on the south side of the river, they are creating a wall of steel and glass, overshadowing the areas behind them most of the day. It could be argued that such projects correspond to the uniqueness of London, its messy, disorganised, contradictory spaces always ruled by mercantilism of one type or another. Nevertheless, some of these riparian spaces have been recuperated by culture, the London Eye, the South Bank Arts Centre, the National Theatre, the Tate Modern gallery, the reconstructed Shakespearian Globe theatre, Borough market, London´s oldest food wholesale place turned into a global tourist hub. Together they are attracting many more informal creative activities and crowds the whole year round.



fig 9
Thames near Tate Modern ,London
photo Judith Ryser



fig 10 Bar25 on Spree Berlin,
Wikimedia commons

Die Spree

In Berlin, the Spree has gained a central role since reunification. Different forces of recuperation were at work there, busy eradicating the traces of some 40 years of communism and opening the city to liberal speculative development. The Spree, abandoned during the war when plates of steel were stored to feed the war machine and abandoned during the post war enclave time is now enhancing the Museum Island and accommodating tourist boats. The waterfronts are under pressure from various regeneration projects, but local activists were busy colonising abandoned stretches of land along the river and managed to recuperate at least some of the spaces as public realm and for leisure pursuits for all on the waterfront. [17]

Odra

Lastly, in Wroclaw Poland the Odra remains a wild river whose several arms are meandering through the city and overflowing without warning from time to time. The 1997 floods were fast and drastic and covered about a third of the city. Newly instated retention ponds have attenuated flooding in 2010. This ecological approach to taming the river has implications for the configuration and use of the city. Planners as well as citizens were keen to keep close access to the river wherever possible while preserving its natural freedom, albeit with safety nets which spring into action during high rainfalls.



fig 11 Odra Wroclaw Poland temporary uses,
photo Judith Ryser

Urban waterfront regeneration

Urban waterfront regeneration occurs along rivers and seashores. Very large schemes driven by footloose investment are contributing to the globalisation process and arguably the internationalisation of urban design.

Many such developments continue to be planned and built throughout the world. Many others have matured, undergone further transformations, and may have changed the city for the better. However, their longer term impacts have mainly been assessed by their protagonists with particular objectives in mind and there is scant critique of their achievements and drawbacks.

Numerous questions remain unanswered about waterfront developments and their assumed betterments: from whose standpoint? in whose interest? to whose benefit? Most importantly, what are their social, environmental and cultural short-term effects in the form of displacement, demolition of assets, eradication of existing values? In the medium term how do gentrification and urban change fare, with what newcomers and what benefits for the city as a whole? What are the long-term effects? How do they improve the local economy? What is the economic contribution of the renewal of derelict sites and buildings in comparison with new build on green field sites? How does the production of gated premises impact on urban quality of life?

The time dimension is an essential factor of such large scale regeneration projects. They often straggle over several business cycles, during which the city itself may undergo economic and socio-cultural transformations driven by new aspirations of younger generations, but also by structural and technological changes, such as for maritime transport. This raises the issue of resilience and legitimacy of master plans for such areas.

Waterfronts and the city

Goods from marine trade arrived by water and were stored along the waterfront, often protected by high walls from the city and its thieves. Ports, warehouses, factories to transform the raw materials were gated spaces controlled by public or private owners. This includes free-ports and container ports from where a part of the goods are re-exported without reaching the cities. Such waterfronts provided work, generated related activities in the cities, contributed to their economy. However, for most inhabitants what happened on the waterfront was not visible from the city. In reality, such industrial and commercial waterfronts turned their back on the city.

With technological innovation, internationalisation of production, new global division of labour, many of these waterfronts became redundant. Often, they fell into disrepair and remained unused over long periods while structural changes were resisted or not acknowledged by the cities. Reinforcing this was heavily contaminated land with In effect negative value. What triggered regeneration varied but always required long range vision and strong political will to mobilise large amounts of tax payers' money, justified by expectation values of rehabilitated land for large scale high density development. Cities have also used international events such as world expos or Olympic games to start the regeneration process.

A selling point for the local electorate was that regeneration was opening up their cities to their waterfronts. Meanwhile, regeneration enabled policy makers to introduce economic restructuring into their cities from industrial manual jobs to services alongside large scale property development yielding property taxes.

Characteristics of waterfront transformations

Large port activities are displaced as maritime transportation technology requires deep water ports. This frees up large tracks of land but at a price. There is a need for decontamination of land for future use (usually with public funding), as well as of water often polluted by industrial and port activities. These preconditions are usually met with externalised costs[18] to attract developers. Local politicians justify public subsidies and (public) land transfer below market value as trigger for local economic recovery, (re-)connecting and expanding the city to its waterfront, substituting higher value added urban uses to industry, kick-starting urban restructuring and modernisation by adding transportation networks and other infrastructure provisions and, most importantly, increasing hope value for real estate development expected to co-finance regeneration.

The institutional arrangements necessary for this urban restructuring are often public development corporations, consisting of state, region, city, sometimes supra national agencies. More recently public-private development structures have sometimes replaced or succeeded public corporations to accelerate private investment on public land. Under neo-liberal economic conditions, statutory planning is suspended for such large scale developments and planning powers are vested in often non-democratically accountable corporations, quasi-governmental organisations, public private partnerships, or entirely private sector agencies.

Large scale urban waterfront regeneration demands a very long timeframe for political decision making (sometimes requiring parliamentary legislation to allocate public funding), land acquisition (sometimes by means of compulsory purchase powers), setting up new institutional structures to negotiate with outside agencies, devising physical and economic plans and programmes, managing the development process, lobbying (foreign, inward) investors, issuing tenders, preparing contacts and letting them, marketing and selling land and real estate, and sometimes managing the public realm. Sadly interacting with the public - existing residents and businesses, surrounding neighbourhoods, the local authority, the trade unions, sectoral interest groups, even some existing land owners, etc. - is often wanting.

In diverse guises these characteristics apply to most waterfront developments regardless of their geography, including those briefly mentioned below, although planning and implementation of such spatial transformation vary from place to place.[19]

The waterfront site of Lisbon Expo revisited

Lisbon located the 1998 World Expo on a 5 km strip along the Tajus river, east of the city on industrial wasteland. Realised with private domestic and foreign investment this new quarter on 330 ha is accessed by a new railway station, underground public transport and a new bridge over the Tajus. The project was managed by a public company Parque Expo98 with expropriation powers across municipal boundaries. Within 10 years, the area was completely regenerated in three phases.[20] Plot sales for mixed development were ahead of schedule. Success is attributed to the political will to establish a new centrality with state of the art infrastructure, including central heating and cooling, waste disposal and technical galleries, fast track licensing and intense marketing. The masterplan included a generous public realm, open access cultural and leisure activities along the riverfront, mixed uses and tenures. Subsequently, the public development company obtained contracts worldwide for managing other waterfront regeneration projects.

Regarding the gentrification process care was taken to facilitate relocation of existing businesses which contributed to improvements in other locations. The most problematic part of displacement were as usual existing residents, unskilled and poor. Some remained on the fringe of the area but unable to benefit from the new job offers while others just seemed to disappear. Despite the economic crisis, the area is viable with new businesses and higher

income residents and the diverse waterfront activities attract the wider Lisbon population as well as tourists. Lisbon can rightly claim that it has created a new centrality and shifted its centre of gravity towards the poorer areas in the east.





fig 12, 13
Parque des Nacoes, Lisbon Portugal
http://www.parqueexpo.pt/conteudo.aspx?l
http://www.marinaparquedasnacoes.pt/map

Marseille´s transformation into a Euro-mediterranean metropolis

The waterfront development of Marseille formed part of many other efforts to restructure and expand the second city of France.[21] Marseille, one of the most ancient ports in the Mediterranean is a cosmopolitan city with immigrants coming from the sea. With the arrival of the high speed train it diversified to high tech services and research in cooperation with top universities while still enduring large unskilled unemployment. Although it forms part of a polycentric city region of some 2 million inhabitants, it remained more connected to other ports in the Mediterranean and the ex-colonies than to its hinterland. This may explain Marseille's effort to reinstate a cross-Mediterranean network to share experiences with other waterfront developments.

State intervention triggered the regeneration of 310 ha along the waterfront abandoned by the industrial port.[22] The focus was on international business, hotels, convention centres and luxury housing in 'starchitect' designed tall buildings, later expanding to another 160 ha of run down city centre. The municipality was able to built a tram on the main axis of a socially and spatially divided city and refurbish the centre. Although intended to generate unifying mobility this de facto gentrification displaced the poorer population from the Haussmanian area like that driven out from the historic part above the ancient harbour which had become a tourist attraction, and the chances for regeneration to reach the outer poorer areas remain slim.

Not mentioned by the protagonists of the state agency Euromediterranee is the neighbourhood of Belle de Mai, where artists occupied derelict warehouses along the main rail-tracks in the city centre. Their staying power, their closeness to the local population and their ability to negotiate secure tenure and a semi-independent management position with the city are all factors which have strengthened their position. They were instrumental in bottom-up regeneration attracting synergetic ICT and media start-ups and later established companies while benefiting from the public sector stability of managing its archives which guarantees their long term innovative and creative role in the city.



fig 14
Euromediterranee II
Marseille France
http://www.euromediterranee.fr/



fig 15
Belle de Mai, Marseille
Photo: Judith Ryser

Transformative drives in London Docklands

The physical enclosure and the dominance of the Port of London Authority masked the decay of London Docklands which were exposed to the same transformative geo-political and technological changes as many other ports. No local public plan could transform this enormous polluted area, criss-crossed by heavy transport infrastructure, surrounded by smoke stack industry, energy storage, refineries, power stations, warehousing, working class housing and poverty. It required a number of statutory acts and the determination of the Thatcher government to induce change. In 1981, endowed with planning powers and subsidies, the London Docklands Development Corporation took over 3800 ha Thames waterfront and docks to initiate 1.9 million m2 speculative office space and 30.000 dwellings for incoming knowledge workers, displacing the existing 40,000 inhabitants and 27,000 businesses. After several boom and bust cycles this area is still far from completed but the second financial centre at Canary Wharf has transformed it beyond recognition. Social costs had been systematically externalised to the cash strapped local authorities who needed to relinquish their land reserves while this neo-liberal development strategy has expanded through the whole of the Thames estuary.[23]



fig 16 London Docklands extension Canary Wharf OMS *http://www.baltimorewharf.com/index.html*



fig 17 Argenzuela Bridge over Manzanares Perrault, photo Judith Ryser

Endowing future generations with public realm

Uncovering the Manzanares river in Madrid and turning it into an enormous public waterfront playground follows a somewhat different motivation of urban change. Akin to Victorian appetites, Madrid undertook to bury the inner motorway ring with the support of a State confident in continuous exponential growth. The aim was to connect the city centre with the urban fabric around it and to allocate a large proportion of this reclaimed land to public use. Many generations will benefit from this exceptionally daring project which has already become a popular playground of Madrilenians.

Outcomes?

These experiences show that land ownership is the key to profitable development, that private investment leverage can only materialise through incentives, enormous de facto public subsidies and guarantees, the latter ironically requiring some form of public sector controlled planning. Most critically, they demonstrate that regeneration entails destruction not just of physical but also of social and cultural fabric. Any evaluation is predetermined by the criteria applied. It appears that there cannot be any common ground between a neo-liberal and a social-spatial justice scenario. The timeframe of such large scale regeneration schemes is shaping the debate over the right to the city, keeping in mind that a succession of contradictory factions can change their standpoints, ideological and rational, over generations.

What are the lessons for the Gdynia waterfront?

Circumstances are unique to each place. Nevertheless, cities and their designers are influenced by international models. This is no different in Gdynia which has faced similar problems from the displacement of the port and got inspired by a global design approach for its own waterfront transformation. Opening up the harbour space as public realm and

creating a continuous path along the sea required investment outside the reach of the local public sector. Finance needed to be found from other parts of the waterfront development process and real estate which would increase land value was the international answer. Without wanting to enter the controversy over skyscrapers, there may be a design as well as an ecological argument which may weigh against such a lone vertical structure, interrupting the coast line, obstructing the view from far away and changing not only the skyline but the strong and pure character of this CIAM inspired modernist 'new town'.

fig 18 Gdynia waterfront, photo Judith Ryser



This raises the issue of the validity, legitimacy and resilience of masterplans for large areas and, with it, the role of planners and planning more generally at such broad scales and with such long time horizons. When thinking of its next fifty years at its fiftieth anniversary, Isocarp may do well to address these challenges.

Judith Ryser, London July 2014, judith@urbanthinker.com, www.urbanthinker.com

[1] e.g. Fort Zeelandia,Formosa, Taioan, 17th century, situated on an island in the sea.
[2] e.g. German and Austrian protestants created settlements in 18th century, Ebenezer in Georgia in the USA situated on the river.
[3] e.g. Bleanavon in South Wales, now a Unesco heritage site.
[4] Pohja in Finland is an extreme example, to where the Swedish masters exported their iron ore to take advantage of Finland's rivers for motive power and timber to heat the smelter furnaces, to finally re-export iron to Sweden.
[5] e.g. the Escher in the Ruhr during coal mining and steel production.
[6] e.g. New Towns beyond green belts outside existing congested cities like London, Manchester, etc.
[7] e.g. New Towns in the Pearl Delta in China, and all over Asia.
[8] A footbridge requiring a penny linked the 'good side' of London to naughty Battersea park with fun fairs and other popular amusements.
[9] In Wroclaw, after the floods of the Odra, the city has redesigned the river banks to leave large areas to overflow which are used for recreation during low water levels.
[10] Initiated by the Urban Design Alliance, the ICE (Institution of Civil Engineers) and the Landscape Institute had commissioned research to find solution to return watercourses to more natural movements. ICE/ Landscape Institute/UDAL. 1998. Liquid Assets. Making the Most of our Urban Watercourses. This was truly innovative work, also from a professional-political point of view.
[11] The pergolas with plant ceilings from where water was spraying created a difference of 2º on the paths below, enough to make people feel cooler.
[12] MIT had cooperated with the city of Zaragoza to create water curtains, and many pavilions, including the British one used running water along the facades to cool the paths along them.
[13] The mayor of Paris, Bertrand Delanoe was the first to convert a busy urban route into a beach on the Seine during the month of August.
[14] The actress Joana Lumley, a formidable activist initiated this project designed by Thomas Heatherwick of 2012 Olympic cauldron fame.
[15] E.. Patrick Kellner's walks and reflections along the Thames.

[16] More formidable projects of the Victorian era along the Thames remain unbuilt but figure in paintings and etchings.
[17] e.g the story of bar25 is typical for such creative resistance.
[18] For impacts of neo-liberalism on cities, see David Harvey.2005. A brief history of Neo-Liberalism. OUP
[19] The examples of waterfront developments and their critical evaluations presented here are drawing in part on studies towards 'Building the European Diagonal' in cooperation with city mayors at the Fundacion Metropoli Spain, in part on other research and observations by Judith Ryser.
[20] For a detailed account of the Expo 98 and regeneration process, see Julia Lourenco. 2013. Parque de Nacoes, Lisbon, a new centrality in ten years. EUSS 2013 AESOP.
[21] See chapter on Marseille by Judith Ryser in: Judith Ryser (ed). The European Diagonal. 2008. Fundacion Metropoli.
[22] Jean-Claude Tourret was CEO of EPA Euromediterranee for phase 1. He became Director of "Institut de la Mediterranee, Marseille" and directeur general of Avitem, Agence des villes et territoires mediterraneens durables. See also: Jean-Clade Tourret. 2008. La Mediterranee au temps du monde. Editions Parantheses.
[23] For a more detailed analysis see: Judith Ryser. 2011. Regeneration: Gentrification or Local Gain? Spatial Development under Austerity: the Case of East London. EUSS12 (European Urban Summer School). AESOP.

River related urban design and regeneration concepts for Polish towns

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Synopsis

While several Polish towns develop visions of urban regeneration, rivers are often key elements of the strategies. Neglected areas along the rivers are rediscovered, cities are being “turned back towards the water", and the leitmotif of water emerges in theming public space and urban (re)branding. The article discusses a context of the issue, and three cases from the authors design practice: the historic centre of the town of Bogatynia, a linear park along the river in Kościerzyna and a riverside development in the town of Oświęcim (internationally known as Auschwitz).

Introduction

Since the change of the political system in 1989, several cities and towns in Poland have pursued comprehensive regeneration. Urban development generally concentrated in larger cities and included infrastructure works, greenfield development new housing estates, as well as downtown revitalization. In smaller cities and towns these processes had less momentum, and in many cases are still subject to debates, strategic visioning and conceptual planning. However, joining the EU in 2005 and the possibility of acquiring funding for urban regeneration has mobilized their attempts. In line of current favored regeneration trends, projects generally seek the synergy between spatial, economic and social development. An extra value – and potential for acquiring funding - comes from environmental, cultural and heritage aspects of the projects.

Several projects envision improving the attractiveness and competitiveness of towns by capitalizing on local amenities and heritage. Neglected rivers and lakes are rediscovered and used for enhancing recreation and tourist activities. Spatially and functionally, the cities are being “turned towards the water". This includes the development of waterfront places and creating new activities. Another aspect is branding and theming elements of the public space along the leitmotif of water. Such a process has happened in several Polish cities, and many other have developed regeneration strategies, which have not been implemented yet.

The paper will present case studies of projects from the authors recent design experiences, including awarded competition projects. The *research by design* methods used were based on a thorough site analysis and identifying local conditions, amenities and potential. This method is generally in line with the notion of *design thinking* (Brown, 2009), which advocates understanding and identifying the potential of a place for establishing the most adequate design solutions. In a broader context, it can be positioned in the trend of *sustainable urbanism*, understood as searching optimal ways to use all sort of local resources.

Theoretical framework

Urban regeneration is a broad issue at the intersection of spatial, economic, social and environmental issues. The regeneration strategies usually have an urban design component, and visualizing the desired physical improvement of a place plays an important role not only as a project, but for marketing and political purposes. For the discussed cases, the context can be defined in the broad notion of sustainable urbanism - which advocates optimal use of resources; a more specific postulate of creating a vibrant system of public spaces as a canvas for urban development, with a specific notion of creating *narrative places*, which *tell a specific story*, related to local heritage and the *genius loci.*

Sustainable urbanism

Contemporary urban design is profoundly related to the idea of sustainable development. The essence of sustainable development is the rational use of resources and maximizing social, economic and environmental benefits from human activities. As most of those activities take place in cities and towns, naturally the idea of sustainable development has several implications for urban environments.

The principles of shaping the built environment within the paradigm of sustainable urbanism, postulates a holistic approach in three scales: polycentric cities; shaping the urban structure of districts and neighborhoods with a grid of street and public spaces; and the micro scale of an urban block, with active frontages, amenities and public space. It implies the rediscovery of the value of traditional, compact and multifunctional urban form, with local access to services, green space and amenities. However, sustainable urban regeneration is not only about reducing the use of resources, but also maximizing social, economic and environmental benefits. Within the paradigm of sustainable urbanism, this would also mean of an optimal use of amenities such as cultural heritage, landscape beauty and location advantages – such, as a location near the river. In this perspective. A river in a city gives an opportunity to catalyze development and provide unique spatial identity.

The significance of public space in the process of urban regeneration

Public spaces play a vital role in contemporary cities. They are one of the most important elements in creating an image of an attractive city, both for the work and life of the residents, as well as for tourists. Public space can be a *trademark* confirming the city's identity, position and aspirations. The concept of public space may be understood in a variety of different ways – seen as non-private spaces, belonging to everyone; or as spaces accessible to the public, notwithstanding their ownership. In fact, the most adequate definition of public space seems to be that of the place of social interaction; a place of meeting, available to all. In the scale of the city, all its spaces form a kind of system of places for interaction – squares, streets, green areas and city parks – which together contribute to the city's attractiveness.

A well-organised public space is essential in its significance for the city and the standard of life of its inhabitants. It is a physical space which creates a cohesive whole, saturated with social definition. It is a site accessible to all, possessing one of the most important advantages in the city – the ability to integrate the local community. Public space also has a major influence on the city's identity, being; on the one hand, open to the future, and on the other emphasising the link to its historical past. The appearance and character of a given public space decide how the whole city is portrayed, which has additional value in the time of growing regional and global competition between municipal areas. Each city has its own sites which can either be the subject of pride or a reason to feel ashamed.

The current, popular view on shaping public spaces is well summarized in the works of Jan Gehl, and Project for Public Spaces (PPS). Gehl notes, the activity of the residents in public spaces may be divided into three categories: Necessary activity such as shopping, travel to school and work, waiting for the bus or tram, etc. Optional activity (municipal recreation) – walks, resting on a bench, sitting in the 'garden area' of cafes and restaurants, urban sports – rollerblading, cycling, and generally watching local events unfold. Social activity which means active and passive interaction with other people – conversations, meetings, watching, listening and chance contact. He emphasizes, that good urban space requires a fresh approach: firstly fostering public life and activities, then designing spaces for it, and in the end designing buildings which would enclose the space.

Fred Kent, the founder and president of Project for Public Spaces summarizes similar way of thinking in the words: *when you focus on place, you do everything differently.* The PPS idea of "triangulating" activities in a public space can be summarized by Kents *rule of thumb to* get public spaces to work called *the power of 10,* which says that *you should have at least 10 good places in a district, and 10 things to do in each of them.*

Narrative places

While basic spatial improvements can meet community needs and improve usability, innovative design can provide additional value, such as beauty, sense of place, pleasurable experiences, building local identity and pride, etc. The additional value of public space can include transmitting local heritage in spatial forms. Dennis Frenchman proposed the concept of *narrative places - spaces which transmit the multiplicity of stories – heritage, culture, history - of people and events that inhabit the city*, and noted that *heritage development is an aspect of the information economy* (Frenchman, 2001). He claims that *the growth of interest in heritage is not being pushed by a yearning for the past, but pulled by forces that are creating the future*. Designing interpretative places is raising challenges not only in terms of how to physically construct them, but also choosing what messages they should carry. Spaces which transmit the multiplicity of stories of people and events that inhabit the city play an important role in cities in the so called “experience economy”. Cities devote much of their energies to the management of information and transmitting their qualities and heritage, to present a unique spatial form and experience, relating to heritage and culture. This has also happened Poland in the last decade. The themes range from historic heritage and “serious cultural issues”, to interpretations of popular culture, folk stories, fairy tales, etc. It shows that water - and river-related themes can provide attractive elements of public space landscaping.

Bogatynia – town centre regeneration study

Bogatynia (approx. 19 000 inhabitants) is a town on the tripoint of the Czech, German and Polish borders, lying in the so called "panhandle" between the Czech town of Frydlant in the east and the German town of Zittau in the west. The settlement in the historical region of Upper Lusatia was first mentioned in 1262, and prospered from its location on an important trade route. Today Bogatynia is one of the richest towns per capita in Poland, due to its two principal enterprises: the open-pit Turów Coal Mine, and the associated thermal power station. The town is known for a specific regional local wooden craft building style. The Upper Lusatian house (pol. *dom przysłupowy*; germ. *Umgebindehaus*) combines log house, timber-framing and building stone methods of construction. Its main characteristic is *a wooden support system, which runs around the living area of the house made of logs or boards, which has the job of freeing the frame of the living area from the weight of the roof or the roof and upper storey* (Hammer, 2009).

The river Miedzianka running through the centre is both an amenity and a thread. It gives the city an unique, picturesque feel (resembling places like Bruge in Belgium, etc.). On the other hand, in 2000 a massive flood caused by extremely heavy rain flooded the entire central part of the town. It killed two people, caused heavy damage, destroyed several historic buildings and left its inhabitants with a traumatic experience.

The project concerned a 15 ha area of the centre of Bogatynia, along the river. In order to determine the needs and proposals of residents a public consultation was held, in the form of individual surveys and a participatory workshops for residents. The workshop enabled the identification of strengths, opportunities and constraints of the site at hand in the minds of the inhabitants, as well as their expectations. Among the biggest assets of the town the people declared the Upper Lusatian houses, tourist attractors such as the yearly Karbonalia festival, local sport facilities and the river. The river was in turn also counted among the biggest problems and threads with a negative impact on the place, as well as economic constraints and lack of prospects and activities for the inhabitants, especially the young ones.

The inhabitants suggested several things that are missing in the center, and could improve its comfort, functionality, image and attractiveness in the short- and long term. Some of the suggestions included urban style retail, dining and entertainment, spa, florists, pastry shops, open air markets, club, disco, playgrounds, public spaces, etc. – in general, they feel a lack of high quality services and meeting places, especially in comparison with the nearby Czech and German towns which they well know. During the workshop the citizens engaged in a lively discussion about their visions and desires for particular places in the town.

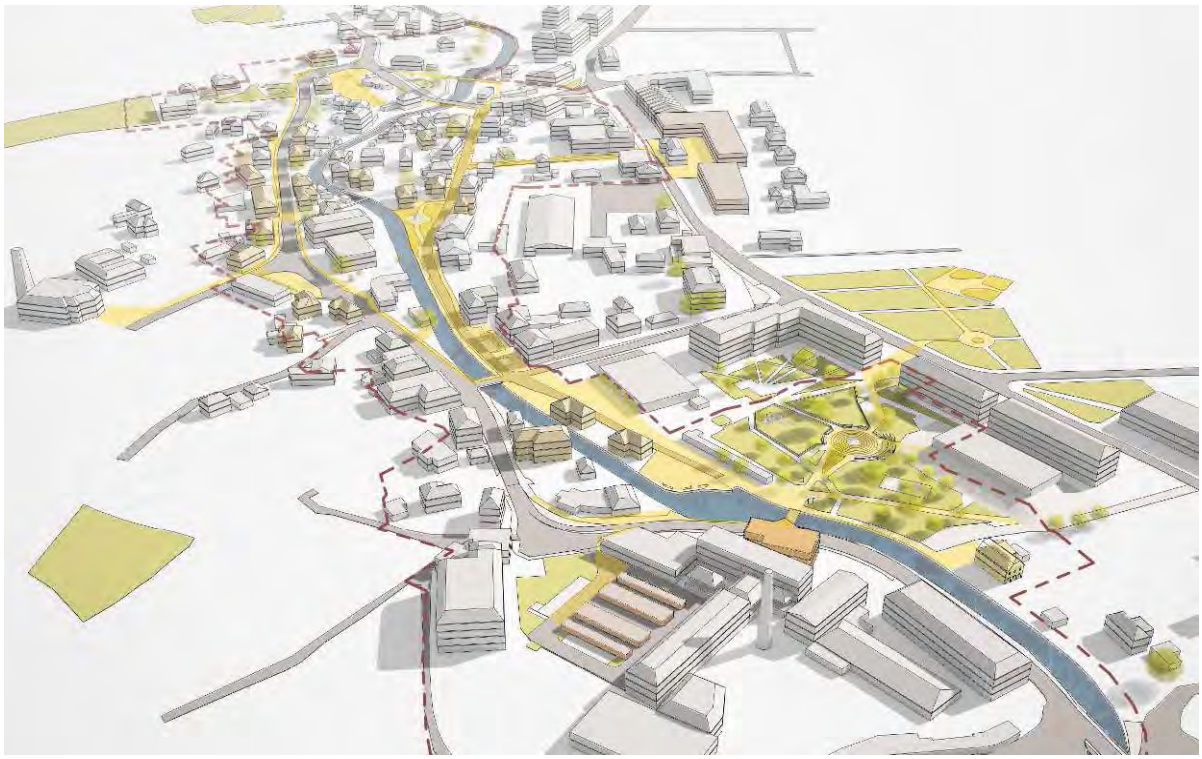


Fig. 1. Bogatynia regeneration strategy – overall schematic site visualization
Source: ARCA Michał Stangel, 2013

This gave the basis for formulating the vision and the program for key places, many of which have a direct link to the river. For Preibisch Park (named after local 19th century entrepreneur, who set up a local textile factory - Concordia) the proposed list included general improvement of paths, seating, planting and recreation facilities; connection with the terrace of the local library, a themed playground with elements reminiscencent of local industry and street-art elements. The second space was a to-be pedestrianized boulevard by the river – a sequence of public spaces including the linear boulevard along the river and several openings in the form of small squares and pocket parks – a square between historic buildings with a fountain, a small open air market with stalls, and a connection to a park. The listed buildings along the boulevard are in a bad shape, but may gradually be re-used for guesthouses, restaurants, etc. The study also included several minor amendments and improvements to the public realm, such as facilitating pedestrian movement by widening the pavements, adding street crossings, adding places to sit, public greenery, lighting, elements of visual information, etc.

The project also gave some guidelines as to how the municipally owned buildings could be used for new functions, such as: a centre for vocational training and education, shared conference facilities to support local guest houses, a centre for arts education for children and youth, University of the third age, an art gallery and seats of local NGOs. A scenario was formulated for creating a local technical museum in the former house of Carl August Preibisch. It may present local technical heritage (textile mills, mining and the power plant) in an interactive and attractive way - such as the industry museum in Lowell, MA, or recent Polish examples of the Copernicus Science Centre in Warsaw, Hewelianum in Gdańsk or Experiment in Gdynia). most of these functions may expand in one way or another to the riverside spaces in front the buildings, in form of outdoor activities, exhibitions, etc.

Since the elaboration of the project, the town has gradually implemented the modernization of its public spaces along the river. The projects were elaborated independently to the study, but with an overall reference to its assumptions and recommendations. Meanwhile, several private owners of plots adjacent to water have been renovating the buildings and their surroundings, improving the places along the river – gardens and hotels, café terraces, etc.

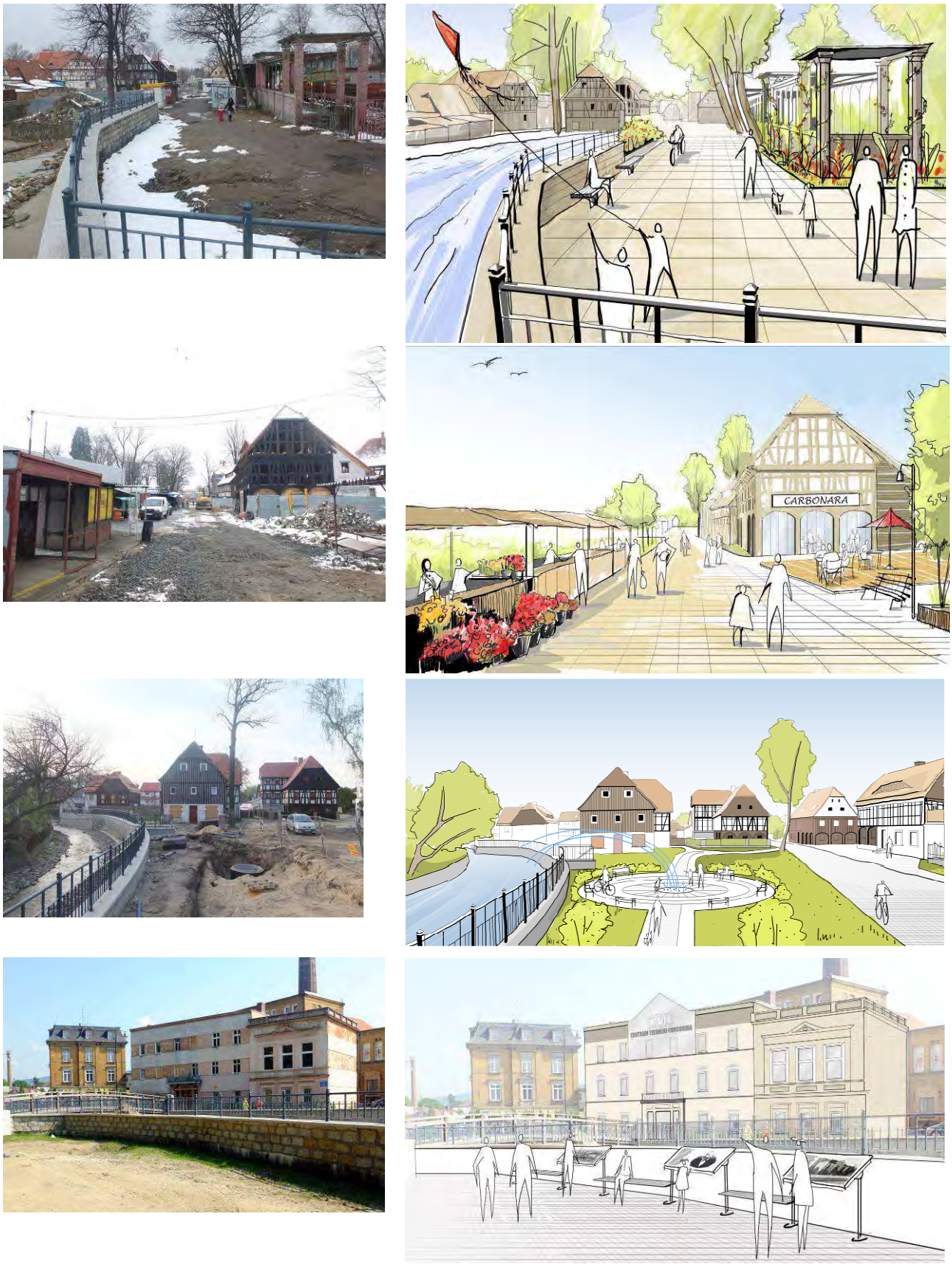


Fig. 2. Bogatynia regeneration strategy – before and after artist impressions of key spaces by the river Miedzianka
Source: ARCA Michał Stangel, 2013. Foto: M. Stangel; visualization: M. Ulfik

Kościerzyna Culture Park

Kościerzyna (approx. 24,000 inhabitants) is a picturesque town and an economic and tourist centre of the region of Kashubia (a part of Pomerania region, northern Poland). It is located approximately 50 km south-west of Gdańsk and well connected to the Tricity. The history of the town dates back to the year 1284 and up to this day it has preserved its medieval urban layout – the restored town market square with historic architectural structure, neo-Gothic town hall and a beautiful fountain. The town is literally located on water – it sits in the basin of Wierzyca river, surrounded by three lakes – Gałęźne, Kapliczne and Wierzysko. Moreover, two small rivers – Bibrowa and Kamionka run through the town.

The subject of the urban design competition held in 2013 was to envision the so called Kościerzyna Culture Park – a linear park along the ecological corridor in the river valley. The town already has several tourist attractions (e.g. recently renewed market square, a railway museum, an accordion museum), but they are spread allover the area. Water-related recreation zones are in quite bad shape and require modernization. The *culture park* may thus give an opportunity to "connect all the dots" by spatial and functional means, and improve the overall attractiveness and access to the amenities.

The authors concept (team included M. Stangel, R. Schurma, M. Wezykowski and M. Ulfik) were awarded the second prize. The first prize was not awarded, as the jury was not fully satisfied with any solution. The essence of the proposed design strategy was to create a sequence of activity nodes, related to existing and new attractions. The most important of these places also constitute transportation hubs. These strategic locations would also be preferable for new buildings and new functions, which would act as flagship projects for creating functional and spatial synergy and improving the quality of life and tourist experience.



Fig. 3. Kościerzyna Culture Park design strategy – urban plan
Source: ARCA Michał Stangel, 2013. Foto: M. Stangel; graphics: M. Ulfik and M. Wezykowski

The main activity hub was strategically located on the river bank and near the main street. The space was enclosed by the facades of two new buildings – the tourist information centre and a youth activity centre. This setting was aimed at providing opportunities for an

interaction between tourist and locals. The three lakes were linked by tourist trails spanning the entire area of the park – a water canoeing trail, a pedestrian and bicycle hiking trail, and a motorized trail named after Hans Kloss – a popular, fictional film character, supposedly born in Kościerzyna. The trail could act as a unique transportation system and a tourist attraction, using stylized World War II amphibious vehicles for trips on land and water. Other rental vehicles would include, off-road cars, motorbikes with trailers, antique bicycles, etc.

Other designed water-related attractions included a swimming area at Gałęźne lake (pool, water equipment rental, beach volleyball courts, dining facilities), and a recreation zone including a small amphitheater with a floating stage at Kapliczne lake, and tourist attractions at Wierzysko lake (canoe landing spot, marina, camping, a trail around the lake with resting places, and a wakeboard trail in a cove of the lake). Some proposed elements of the urban landscape were based on local heritage and identity, such as Kashubian sculptures, engravings in paving, outdoor exhibitions, a map of the region, etc..

The broad scope of the competition challenge and the proposed design solution provided material for further elaboration. Shortly after the competition outcome, two detailed contests were organized for detailed design of smaller spaces: a new urban square and its surroundings, and a park on a hill where the city hall is located. However, the subject of the areas by the river was not developed further.

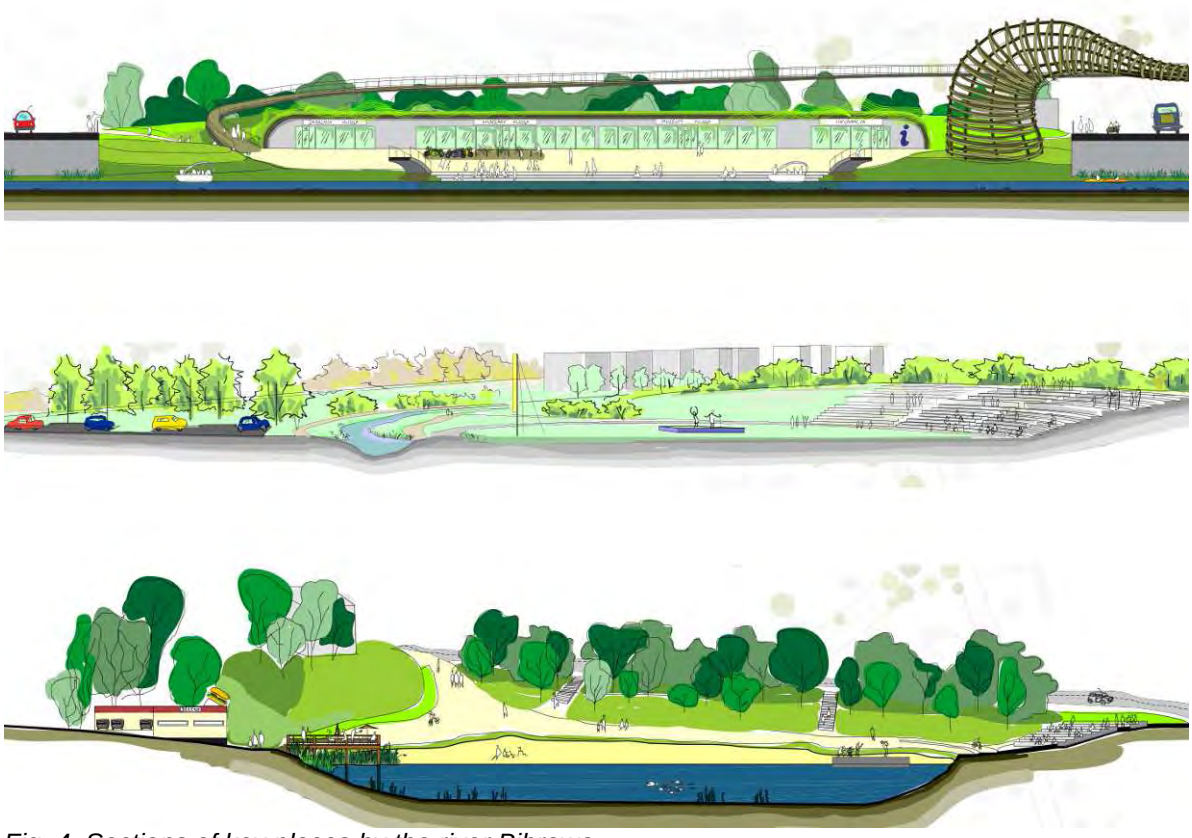


Fig. 4. Sections of key places by the river Bibrowa
Source: ARCA Michał Stangel, 2013. Foto: M. Stangel; visualization: M. Ulfik, M. Wężykowski



Fig. 5. Kościerzyna Culture Park amphibious vehicles trail conceptual drawings
Source: ARCA Michał Stangel, 2013. Visualization: M. Ulfik

Oświęcim - "Green Terraces"

The town of Oświęcim (population approx. 40 000) is located in south of Poland, some 50 km west of Krakow. The town is better known by its German name – Auschwitz. This name become the symbol of terror, genocide, and the Holocaust, due to the Nazi Germany concentration and extermination camp, where according to historical research, 1.5 million people were systematically tortured and murdered. The death camp, situated near the Soła River, is currently a 191 hectare State Museum, listed as a UNESCO World Heritage Site, with over 1 million visitors annually. For the city Oswiecim, the former death camp, with a surrounding monument protection zone has been a stigma on its heritage, image and development prospects. Despite the city's rich history going back as far as the 13th century, it is currently associated mainly with Auschwitz. The number of death camp visitors hardly translates to any tourist activities in the city. In the recent years, the city has attempted to find ways – including spatial development concepts – to revitalize its image and develop beyond the genocide stigma, along the themes of reconciliation, hope, etc.

Oświęcim is located close to where the river Soła flows into the Vistula River. The river flows across the city, close to the old town, and within metres of the concentration camp. According to the Auschwitz-Birkenau State Museum human ashes and bones of those murdered there were sometimes dumped into the river. The newest, complex municipal program is to develop the spaces along the river - as a green link between the camp and downtown. The strategic municipal project *Oświęcim – the meeting space* envisioned the development of public spaces along the river, which shall create opportunities for the city to attract investment and tourist attention. The project includes several places by the river: a boulevard linking the concentration camp and historic downtown, The Park of Reconciliation – "Gardens of Europe" – opposite the camp, across the river, as well as a new, iconic pedestrian bridge. The design from 2010 is by a renowned artist and landscape architect Jarosław Kozakiewicz, but the idea of creating a "bridge of ghosts" across the river is disputable, by focusing on the traumatic past, rather than hope for the future.

A neglected area near the Soła river, on the edge of the old town was subject to an urban design competition in 2012. The aim was stated as creating a new urban space, suitable for various civic functions. The first prize was awarded to a team of two firms from Gliwice ARCA office for architecture and urban design, and VISIO Architects and Consultants (composed of. M. Stangel, R. Schurma, A. Witeczek, M. Wężykowski and M. Ulfik). The project was acclaimed as the best solution for shaping the new urban space. The main ideas included shaping an urban square by the active frontages of new buildings, and enhancing connectivity to the river by extending the square onto the current parking lot. Instead, a covered parking was designed near the existing slope, and covered by planted recreational terraces for recreation and an occasional outdoor amphitheatre.



Fig. 7. Photos of the site by the river Soła – current state (2014)
Source: Foto by M. Stangel

In the project, a new north frontage of the square was formed by creating an urban block adjacent to the backyard of a nearby planned hotel. Ground floors and part of the volume are

accessible from the level of terraces of the frontage, and house commercial activity - cafés, restaurants, shops - as well as tourist information office, etc. Higher floors would get a perspective view of the river. The terraced slope was formed as terraces, dropping towards the river with planting, stairs, seats, ramps and smaller activity cubicles. A contemporary interpretation of an amphitheatre form would serve as an audience area during outdoor events, and as observation point of the everyday urban life-performance in the square, with the river in the background.

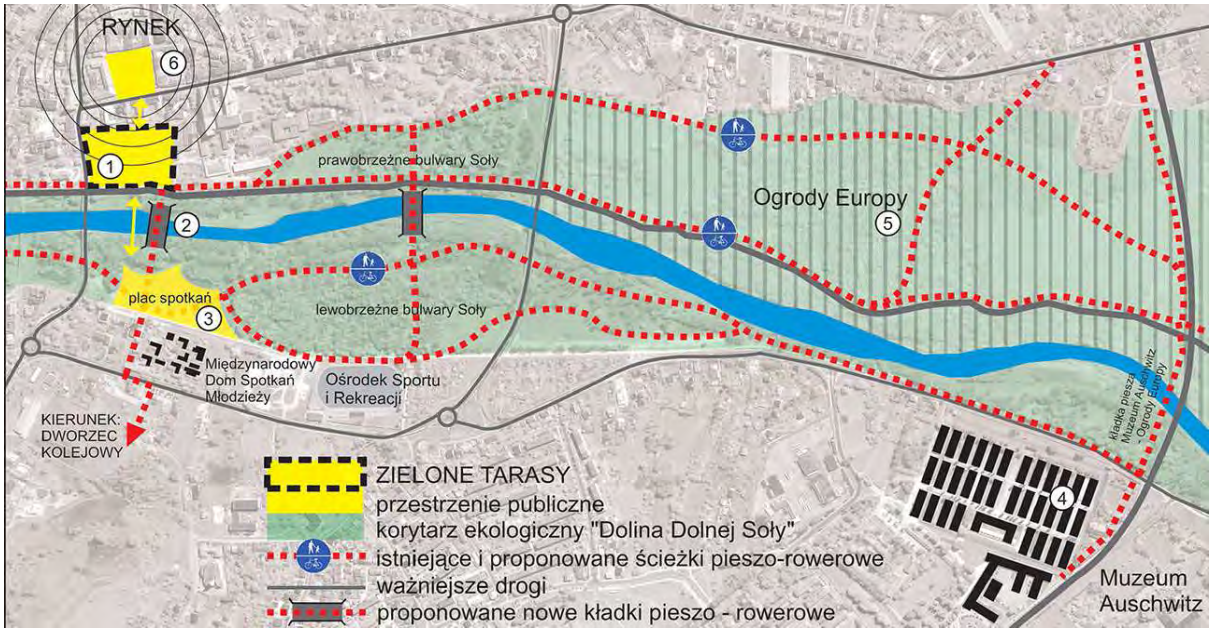


Fig. 6. Scheme of assumptions of the concept and functional connections along the river
Source: ARCA Michał Stangel, VISO Rafał Schurma. Graphics: M. Ulfik and M. Wezykowski



Fig. 8. Urban design birds eye view visualization
Source: ARCA Michał Stangel, VISO Rafał Schurma. Graphics: M. Ulfik and M. Wezykowski

In the wider context, the area of the competition is crucial not only for organizing this part of the city, but also as the beginning of broader development vision which assumes creating the sequence of the public spaces from the Market, through planned Gardens of Europe and the walking footbridge to the National Museum Auschwitz - Birkenau. In this sense, the place would constitute a kind of a gateway, which would be the first point of the walk in Oświęcim. The development of the area in conjunction with the riverside space shall contribute to increasing the attractiveness of the riverside zone. The aesthetic distinction shall upgrade the riverfront to a recognizable place, affecting the image of Oświęcim, encouraging tourists to visit the centre and thus contributing to its economic vitality. It will be a space of activity for residents and tourists, linked to the natural landscape park "Valley of the Lower Soła River".

A key element of the "Green Terraces" concept was to create a new place, understood as a public space, along with utility functions in frontages and developing the square for all sorts of activity. In accordance with both the theory of urban composition (Gehl, 2009), as well as contemporary sustainable urban planning, such an approach may seem pretty obvious to realize the full potential of the place. However, this approach was proposed only by two competition teams, while others focused on paving, street furniture etc.

Proposals acquired as a result of the competition were used in formulating Oświęcim's spatial development plan. Creating the new urban square is among six strategic projects, which are currently being developed by the city authorities within the project "Oświęcim – a meeting space". The project has been included within in the Strategic Program "Heritage and Leisure Time Industries" of the Malopolskie Region, which gives it prospects of achieving EU funding. The project is currently being elaborated to be incorporated in municipal development plans. The authors team was commissioned for a post competition refinement of the project, which acted as a basis for further project tender, currently underway.

Conclusions

In several Polish cities and towns a public debate on urban regeneration is underway. Key sites, including those close to rivers are subject to urban design competitions, workshops, consultations, research projects, etc. The perspectives of EU funding calls for seeking innovative solutions, including ways to transmit historic and cultural heritage in architecture and landscaping forms. The discussed cases show several similarities in the ways waterfront spaces can be treated in small cities as part of regeneration strategies. For instance, riverside boulevards are commonly renovated as sequences of new public spaces. A waterfront place with an amphitheatrical enclosure providing a view on the river may often be a desired place for recreation and cultural activities. And the activities generally work better when interconnected and concentrated in nodes and hubs, rather than randomly or evenly distributed. On the other hand, an analysis of specific conditions and layers of heritage can lead to site-specific proposals. These can be routed in various local narratives and themes: from local heritage and history, through pop culture, to dealing with traumatic pasts.

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Globalizing the Belgrade Waterfront: Mega-projects for a Sustainable Development?

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The industrial zone along the Danube's riverfront in Belgrade, which was a key element of urban identity during the end of the 19th and the beginning of the 20th century, is now abandoned. Meanwhile, the Sava Amphitheatre, which was marshland a century ago, has become the most important and most valuable construction area in Belgrade, although still underused. However, both sites have been a focus of interest for generations of planners, architects and politicians, which is visible from numerous urban plans, projects, research studies and several national and international competitions for specific locations. The main aim of all these efforts was to achieve and realize a full potential of anticipated regeneration.
Considering the complexity of waterfront areas, as well as the history of their decline conditioned by political, economic and social changes, the paper presents two recent mega-projects for these sites. Targeting regeneration and revitalization of the Belgrade's waterfronts, they offered a globalized model of urban morphing which was again (mis)used by politicians, developers, investors, local government and practitioners - as a tool for promotion and a burning issue for debates and speculations. Therefore, this paper provides a critical analysis of positive and negative impacts which these regeneration projects could have on the development of the city.

1. Introduction

The city of the 21st century has further developed a globalization setting based upon increasing urban competitiveness and multiplying imperatives of attractiveness, efficiency and hyper-connectivity. The recently introduced environmental agenda represents a new test for already reinvented modern cities (Giddens, 2009), but its global importance remains overshadowed by corporative or governmental interests, aspiration and manipulations. The position of a city in a global hierarchy of urban centers also conditions a scale of undertaken and planned actions, which transform its physical, social, economic and environmental features, leaving behind debatable and often unsustainable results. Targeting abandoned, devastated or neglected areas, underdeveloped sections of urban tissue or waterfront areas, the contemporary cities tend to increase the intensity of valuable urban activities and remake their identity in accordance with the latest architectural and environmental trends.
The well-known globalization recipe, which included establishment of the spaces emphasizing global initiation, recreated urban identity and a preferred excitation and inhibition logic (Stupar, 2009), has been gradually upgraded by new tools, visions and ideas implemented on different levels and scales. Consequently, the recent transformations follow two simultaneous, but very diverse paths including both official and unofficial initiatives. Tackling the issues of small and large-scale developments, alterations and improvements, these activities shape a new image of urban world, exposed to upcoming influences, fears (De Cauter, 2004) and power (im)balance.
The problem of mega-projects, reflecting the ambiguities of a contemporary megalomania, could be especially controversial and damaging for space, economy, society and environment. However, these initiatives, allegedly driven by the idea of absolute connectivity/efficiency/mobility (Flybjerg at al., 2003), have became a new leitmotif, a symbol and a sign of anticipated progress, which often ignores usual planning procedures in order to

produce a glamorous image typically created by star-architects. Although supported by national or supra-national governments, private investors and/or banks, these projects frequently remain in a domain of political propaganda (especially in countries with developing economies) but even when materialized they usually fail to fulfill expectations, in spite of large cost overruns.
The case of Belgrade and its two important development areas represent an interesting contribution to this practice, positioning the idea of mega-project(s) into a specific socio-economic and ideological framework which has been exploited for decades. Although the circumstances have changed, as well as the development imperatives and planning paradigms, the initial pattern of wishful activation has remained, focusing on two attractive, yet very challenging sites along the river banks of Sava and Danube - the Sava Amphitheatre and the Port of Belgrade.

2. The scale of aspirations

The phenomenon of mega-projects is not a recent one, although its contemporary emanation has certain uniqueness. Since scale and importance of architecture have always mirrored power and ambitions of a society (or its ruler), it is not surprising that modern cities continue this ancient thread which is especially manifested in edifices important for the functioning of a system - from institutional buildings and nodes of capital to major infrastructural complexes.
According to some definitions, megaprojects represent large investment projects which cost more than 1 billion of US dollars, but the financial limits could vary due to a level and size of a city. Their popularity, in spite of significant risks and recorded failures, is usually backed by an increasing interest of politicians who exploit the idea of Zero-Friction Society, which is supposed to eliminate or maximally decrease our dependence on spatial and temporal distances. Consequently, in order to enable fast and efficient flow of people, information, goods, energy and money the majority of megaprojects are focused on a production of complex infrastructural spaces incorporating transport, telecommunications and energy flows (Flybjerg at al., 2003).
However, the increasing number and size of similar projects does not correspond to their actual success related to economic, social and environmental sphere. Many projects have caused severe problems in private and public sector, frequently shaking a general economy of a country. Furthermore, these projects are not usually supported by a community or professionals because they avoid regular planning and decision-making procedures, ignore environmental issues and lack the transparency of process (and project) even though the effects of these mega-initiatives could be extensive and long-lasting.
Due to a specific socio-economic situation of Serbia, the anticipated mega-projects in Belgrade still represent just a testimony of turbulent political reality and an image of preferred global identity. Nevertheless, the history of elaborated ideas, controversies and paradoxes represents a good foundation for the analysis of this phenomenon offering a unique insight into numerous urban and social processes which directly and indirectly shape the city.

3. Belgrade: 'On the water'?

Belgrade has more than 153 km of riverbanks and their most attractive part is positioned in close proximity to the historical core. Although the confluence of Sava and Danube is perceived as the main element of urban identity, the waterfronts were never considered as an integral part of the urban tissue because both rivers represented a great natural danger for built environment, especially until the beginning of the 20th century. Consequently, the major part of the centrally located contact zone is nowadays devastated and neglected. Reasons for this condition are not just environmental and morphological, but also caused by

previous planning decisions which imposed infrastructural elements (railroad) and industrial zone along Danube.
The first half of the 20th century marked the beginning of the industrial development in Belgrade, which was the result of several factors, including those related to demography, political and technological changes, legislation and increased investments (Petrovic, 2006). The number of industrial facilities significantly increased between 1900 and 1941 (from 29 to 206), and their distribution, mainly in the central zone and along riverbanks, was conditioned by the efficiency of transport infrastructure.
However, the period after the WW II introduced some changes to already shaken state economy with destroyed industrial facilities. The planned economy became a major driving force, while the process of nationalization homogenized production facilities causing the enlargement of production. Spatial distribution did not change, but the intensity of activities increased along the central part of riverbanks.
During the 1960s, the industrial production had annual growth of approximately 14% and certain efforts were made in order to reposition industrial activities to suburban areas or to create specialized (homogenized) zones (Petrovic, 2006). This process continued during the 1970s and 1980s, but it was never fully conducted since some new facilities appeared in the central areas, although without necessary modernization and application of latest innovative solutions. The industrial decline started during the 1980s, but a radical decrease marked the period of international sanctions (during the 1990s) and NATO bombing, which was also focused on industrial facilities in Belgrade.
The urban development of Belgrade, also targeting waterfronts and their industrial burden, was directed by planning documents and strategies (master plans, spatial plans) which gave their visions of future transformations. Oriented toward urban growth, the Master plan of Belgrade 2021 and the Spatial Plan of Belgrade anticipated transformation and modernization of industrial sector, a dislocation of industrial facilities from central urban areas and a minimal growth of employment. In the Master plan of Belgrade 2021 (2003), the issues of culture and identity are emphasized, as well as the imperatives of well-balanced ecological and economic development. Simultaneously, the development of industrial zones is guided by several objectives - revitalization and modernization of existing capacities with the development of new capacities, minimal increase of employment, transformation of industrial facilities into business and housing, removal of industrial buildings from central zones and establishment of sites suitable for sustainable industrial development. However, during the last few years, there have been a few successful implementations of plans and projects aiming at rehabilitation and regeneration of industrial areas in the central Belgrade municipalities (e.g. the area of Beton Hala, which was regenerated from warehouses to a mixed–use facility). Unfortunately, the main obstacle represents a problem of ownership which usually delays or completely cancels the process.
The Sava Amphitheatre, which was a marshland a century ago, has become the most important and valuable construction site in Belgrade, although still underused. Simultaneously, the industrial zone along the Danube's riverfront, which was a key element of urban identity during the end of the 19th and the beginning of the 20th century, is now abandoned. The projects related to the left bank of Danube (Marina Dorćol and the Port Belgrade/'Luka Beograd') tend to close down industrial facilities and introduce housing and commercial activities. However, the site of the Port is currently a focus of a conflict between city authorities and the owner of the private company 'Luka Beograd', which questions land ownership and delays rehabilitation of the site.
Due to their strategic importance for the further development of Belgrade, both sites have been in the public eye for several decades which resulted in a number of plans, projects, national and international competitions, studies and workshops. However, the thorough analyses and evaluations, as well as the created visions and documents, have not been implemented, keeping the ambitious images of foreseen megaprojects in a domain of paper-architecture.

4. The Port of Belgrade

Located on the right bank of the river Danube, the site of the Port of Belgrade covers approximately 200 ha. The port was founded in 1961 and sold in 2002, remaining a part of an abandoned industrial area. In 2008, Daniel Liebeskind designed a project of regeneration of the industrial area declaratively based upon the principles of sustainability (Figure 1). Conceived as a mixed-use zone, the proposal anticipated a high level of urbanization, including a new urban area for 100.000 inhabitants and a number of multi-purpose venues which should improve an overall quality of life and insure a higher attractiveness of space (e.g. library, the Performing Arts Centre and a marina with service facilities). The environmental features could be recognized in a large public park along the riverfront and in the anticipation of a 'Green roof district'. The project also includes a new landmark - a tower of 60-70 floors, positioned at the end of Plaza, which should upgrade the identity of the city and the waterfront. The general layout allows a high level of implementation flexibility, since every neighborhood acts as an independent unit which could be adjusted to various requirements regarding the size, purpose and height of buildings.
The owner of the site, 'Luka Beograd' group, has initiated a number of professional activities dealing with the rehabilitation of this area and invited a number of experts from Belgrade and abroad to propose their solutions. Studio Liebeskind (NY), was in charge of the Master plan of Belgrade's waterfront, while Gehl Architects (Copenhagen) focused on the level of public spaces. One of the members of a team was the Town Planning Institute of Belgrade, a public institution founded by the City of Belgrade in order to elaborate planning documents related to the development of the capital. Another member of the team was Smart Futures, an international consultancy specialized in sustainable development and corporate social responsibility, which was in charge of the study related to the strategic options regarding the development of the Master plan in accordance with the requirements of investors and all other interested parties. Smart Futures also organized workshops in Milan and Belgrade (2007) dealing with the critical issues of further development and revitalization of industrial heritage of the Port of Belgrade, while together with another company - Colliers and Scott Wilson, they conducted analyses which were later used for the process of master planning.

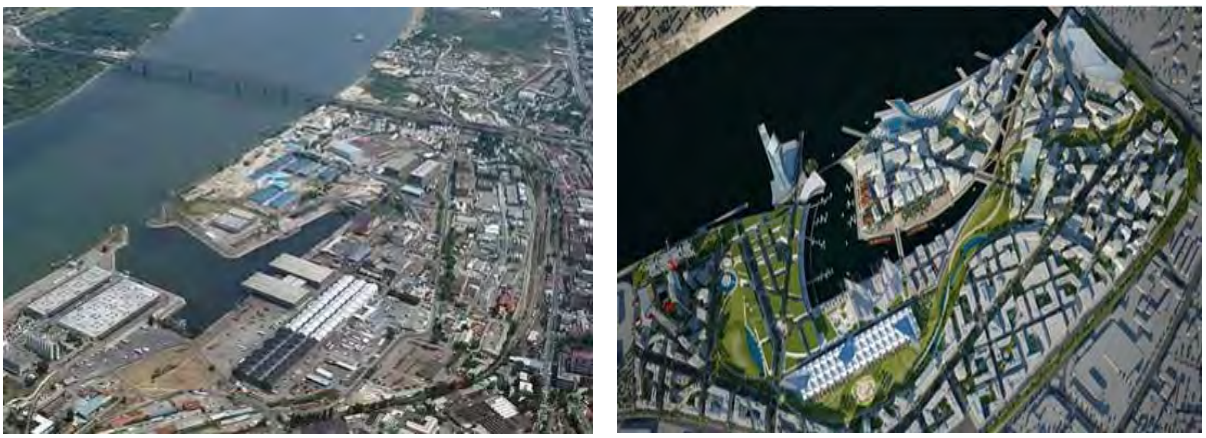


Figure 1. Present situation of Danube`s waterfront and Liebeskind's project for future development.

Considering the position, role and size of this megaproject, it was important to take into consideration a number of stakeholders - public institutions, citizens, planners, advisers, investors and land-owners, but the Municipality represents one of the key participants in the process, especially concerning a necessary infrastructural upgrading/investments which should back up the development of the area.
Due to the ongoing dispute between city authorities and the owner of Luka Beograd, the issues of land ownership are still unsolved and the whole project is on hold. However, the

idea which was promoted by this initiative, had an impact to a general perception of problems related to re-activation, regeneration and recycling of ex-industrial sites, especially those integrated into central urban areas. Unfortunately, the gap between grand ideas of politicians and professionals and current reality (legal and economic) still prevails, disabling possible activities and initiatives which would lead to a reinvented urban identity of the Belgrade's waterfront.

5. The Sava amphitheatre

The centrally located site along the river Sava has represented an important urban resource and experimental (theoretical) ground for generations of architects since 1923, when this area between the river and the main train station was considered as a possible mixture of housing and business activities (Figure 2a). Although never implemented, the visions of the Sava amphitheatre were included in all major documents concerning the development of the city. After the WW II, the Master plan of Belgrade of 1950 proposed a modified vision of urban matrix adjusted to urban expansion, separation of urban activities and improvement of traffic (Figure 2b). The relocation of the main train station was also planned, while the space along the right bank of Sava was anticipated as an area for housing and production. The Master plan of 1972 reconfirmed a new position for the central station, while the Sava amphitheater again incorporated the idea of high-rise housing, with business and commercial activities (Figure 2c).

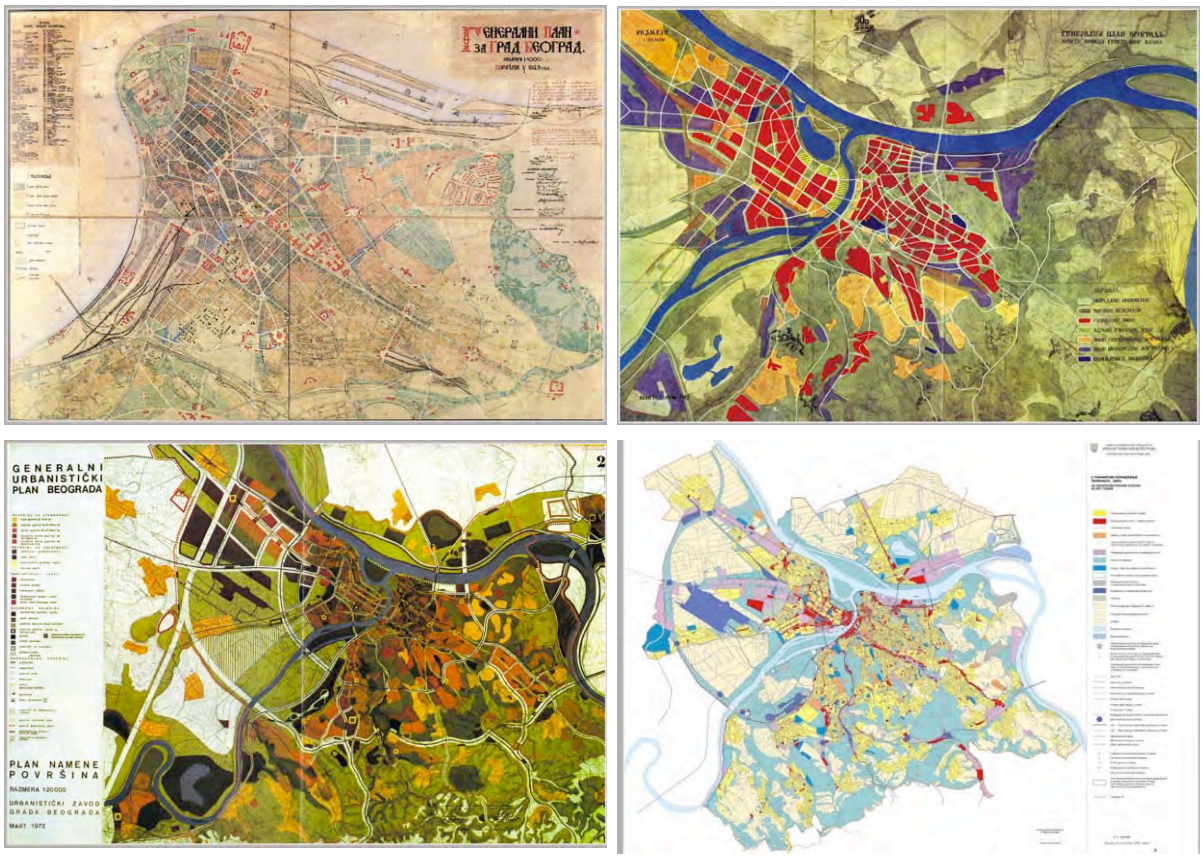


Figure 2. Evolution of the idea - a) Master plan 1923, b) Master plan 1950, c) Master plan 1972, d) Master plan 2021.

Few years after the approval of the Master plan, the Study of the central zone of Belgrade (1976) re-emphasized the role of the area as an important urban connector between old and New Belgrade, which was supposed to facilitate activation of both riverbanks.

The end of the 1990s was marked by another proposal for the Amphitheater - the study 'City on water', made by the Town Planning Institute. The study re-lunched the idea of closer connectedness between urban tissue and waterfronts, focusing on both sides of Sava, as an integral functional and architectural entity. However, the special importance was given to the space of the Sava amphitheater and its connection with Terazije terrace, a significant morphological feature of the urban core. The proposal included networks of canals and artificial islands which were supposed to link New Belgrade and the traditional centre, while housing, commercial activities, business, services and tourism were integrated into compact urban blocks.

The project 'Europolis' (1995) envisioned a 'New Manhattan' along the riverbanks of Sava, but the whole idea actually represented a part of political propaganda which further developed the idea of spatial activation, proposing high densities on the New Belgrade's side and mixed-use development on the other side of the river (Djukic at al., 2014). The urban matrix followed already existing patterns - a modernist, open blocks on New Belgrade, and traditional, compact forms in the historical area.

Finally, the Master plan of 2003, which anticipates the development until 2021, proposed a form of a linear commercial-business centre for the Sava amphitheater, increasing the intensity and variety of activities and physical structures on both sides of the river (Figure 2d). The main station (still on the same position) got a new role - as a regional metro station, the existing industrial facilities were dislocated and the recycling of the site was also planned.

Beside these official documents, the Sava amphitheater was analyzed or tested by numerous projects (e.g. interdisciplinary graduation 'Project Belgrade' presented at the Venice Biennial in 2006) and two international competitions (1985, 1991). The first one was mainly focused on the area of New Belgrade, targeting the left bank of Sava, while the second one, organized by the Serbian Academy of Science and Art ('The competition for the 3rd millennium') invited seven teams which proposed solutions for eight major development issues - The city on water, Ecological approach - New Ada, Futuristic vision, Sava boulevard, Urban matrix, Sava city, Border zones and Initial places.

During 2007, there was a number of planning activities which intended to activate the area. The potentials of the Sava amphitheater were re-evaluated, as a part of new development trends and aspirations. The Town Planning Institute was in charge for all these activities, collaborating with other professional institutions. During the process, which was perceived as a preparatory phase for a new competition, the Institute analyzed previous competition entries, underlining their visionary approach and proposed elements. The list of elements which were taken into consideration included the compositional qualities, the relation toward the existing structure of New Belgrade, the relation toward the physical structure of Kneza Milosa street, visual links, environmental aspect, visual qualities, a connection with the river, the treatment of the protected area of the Old Fairground and the temporal dimension of the solutions. The evaluation also included issues of land ownership, already existing spatial elements, traffic, bordering areas etc. (Djukic at al., 2014)

However, all these professional efforts, embedded in studies, competitions, documents, workshops and student projects have not generated the anticipated results. One of possible reasons could be found in a continuous discrepancy between ideologically colored ambitions and actual financial limitations, but also in a prevailing idea that a solution has to be implemented at once, following one vision and applying total design of the site which would confirm the value and strategic importance of the position, investment and its political reflections (Djukic at al., 2014).

In spite of the obvious failures of this method, the similar pattern is applied once again in the latest initiative (2013) with already exploited name 'Belgrade on the water'. The new city government has launched this idea as a national priority in order to finally initiate and implement transformation, but the presented draft does not correspond with surrounding displaying a number of illogical solutions considering the basic morphological and functional characteristics of the area, a scale of open public spaces, environmental requirements and limitations, as well as the visual preferences and hierarchy. Certainly, there is a possibility that this draft could be improved and further elaborated in accordance with the guidelines

from the Master plan and/or recommendations from previous proposals, although the communication between the city authorities and professionals almost does not exist in this moment. Furthermore, the scale of the project might cause serious difficulties during implementation and after the completion, because the lack of participation of all interested parties always has very negative effects on new spaces and their acceptance by the public.

6. Conclusion

Driven by the “frictionless capitalism” the contemporary megaprojects reflect all the paradoxes of modern, globalized world. Embraced as a confirmation of the latest stage in capitalist evolution, they avoid usual planning procedures and public participation in order to implement a radical large-scale transformation as a symbol of grandeur and power of a state or transnational corporations. However, the results of these extremely expensive actions frequently fail to fulfill the anticipated expectations creating a monument to the un-sustainability of these visions.

The situation is especially confusing in the countries with severe economic limitations and the example of Belgrade's mega-projects describes several side effects of mega-undertakings. Declaratively aiming to improve a general competitiveness of the city, increase the attractiveness of neglected urban areas, redefine urban identity and improve global and local connectivity, the projects for the Belgrade's waterfront are still waiting for a solution of numerous legal and financial problems.

Due to an attractive and highly valuable position of the waterfront which stretches along the historical city core, the cases of the Port of Belgrade and the Sava Amphitheatre clearly demonstrate a disturbed balance between ambitions and reality, which is further magnified by a sensitive relation between the power of capital and the role of professionals and community. Although the future of proposed solutions is still vague, it is obvious that some changes are necessary in order to provide more sustainable spatial outcomes, which would increase the general quality of environment and provide a higher financial stability. Furthermore, the whole processes of land-use transition should be transparent and conducted within an advanced institutional framework.

Considering the current socio-economic context of the country, it is obvious that small-scale initiatives could achieve more than large-scale investments. They would ensure continuous iterations and higher flexibility of spaces and activities, but also provide an interactive relation between all interested parties. Following this path, Belgrade could avoid the consequences of numerous megaprojects which are, nowadays, perceived as the mega-failures of globalized aspirations and greed.

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Heritage Value Evaluation and Its Preservation of the Beijing-Hangzhou Grand Canal (Wuxi section)

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Abstract: The Wuxi section is one of the oldest stream segments open to navigation of the Beijing-Hangzhou Grand Canal (BHGC). Its advanced water network system, as well as the urban settlements closely connected with the Canal, lasts long over one thousand years. These urban settlements developed due to the Canal still play an important role in the Yangtze River Delta Economic Zone, producing crucial impacts on Wuxi's social and economic development. This paper analyzes its geographical and cultural features, and studies the types and components of heritages of the Wuxi Section of BHGC. Based on the Outstanding Universal Value (OUV) and other evaluation factors, it also makes general assessment on the value, current status and management of the canal. Finally, it puts forward some protection methods and strategies of the Wuxi Section of BHGC.
Keywords: Beijing-Hangzhou Grand Canal, historic preservation, heritage value evaluation, Wuxi

1. Introduction

The Grand Canal in China, also known as the Beijing-Hangzhou Grand Canal (BHGC), is the most complicated, systematical, and comprehensive ultra-large scale water conservancy project in the agricultural civilization, which is regarded as the greatest project in ancient China together with the Great Wall, witnessing and representing China's civilization and becoming the symbolism project in highly organized society. 1797-kilometer BHGC is a national water conservancy project which was canalized, maintained, and utilized by seven dynasties (total nine dynasties in total in the history of China) for 1779 years (canalized in 486 B.C, entirely open to navigation in 1293 AD). The Wuxi section is one of the oldest stream segments open to navigation of the BHGC (Fig. 1) with a total length of 40.14 kilometers. Its advanced water network system which is said to reach every river and lake, as well as the urban settlements closely connected with the Canal, lasts long over one thousand years. These urban settlements developed due to the Canal still play an important role in the Yangtze River Delta Economic Zone in which the level of urbanization and economic development is highest and cities and towns are most intensively distributed, producing crucial impacts on Wuxi's social and economic development.



Figure 1: Location Illustration of Wuxi Section of BHGC
Data source: "History of the Grand Canal"

2. Geographical Features and Cultural Value of the Wuxi Section of BHGC

2.1 Geographical Features of the Canal

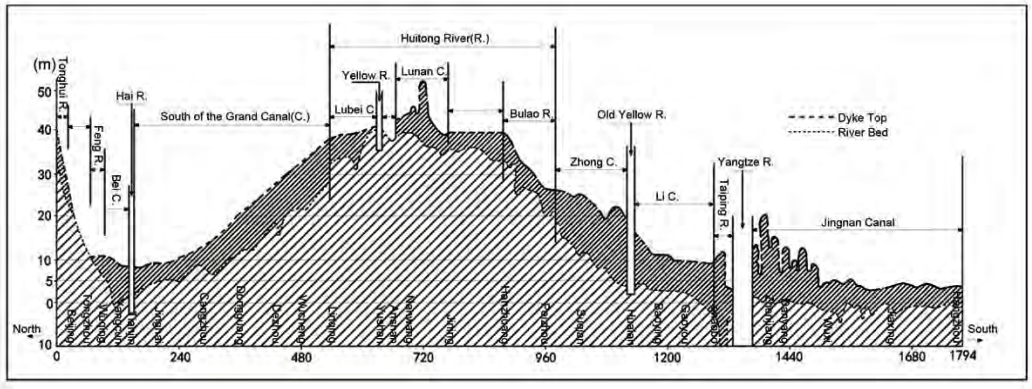


Figure 2: Profile Illustration of the Terrain along the Grand Canal
Data source: Repainted according to" History of the Grand Canal"

Not only is the Grand Canal in China the earliest created, largest scale, and longest canal in the world, but it is also the first canal that overcomes variations of elevation. The canal slopes upward and downward six times from north to south (Fig. 2). Located at the junction of the 3rd descending part and 3rd ascending part of the BHGC, the Wuxi section's function of water conservancy is to take advantage of unique hydrological characteristics of tides of rivers and lakes to regulate and store water volume and to assure security of canal shipping, farmlands, and towns and villages, making the Wuxi section free of drying river-way dry up and floods from Taihu Lake for over thousands of years after it has been formed. Its excellent conditions of water conservancy supports continuous function of valley shipping under different social backgrounds (use of natural forces and less artificial control) and its well-developed shipping network which reaches "all rivers and lakes" until today is still busy.

(1) Geographical environment and characteristics of the Jiangnan region

The drainage basin of the Wuxi section of BHGC is an area of plains, diked marshes, and swales, which is a typical lake marsh water network plain located in the corridor part between the Yangtze River and Taihu Lake(Fig. 3). The Wuxi section slopes from northeast to

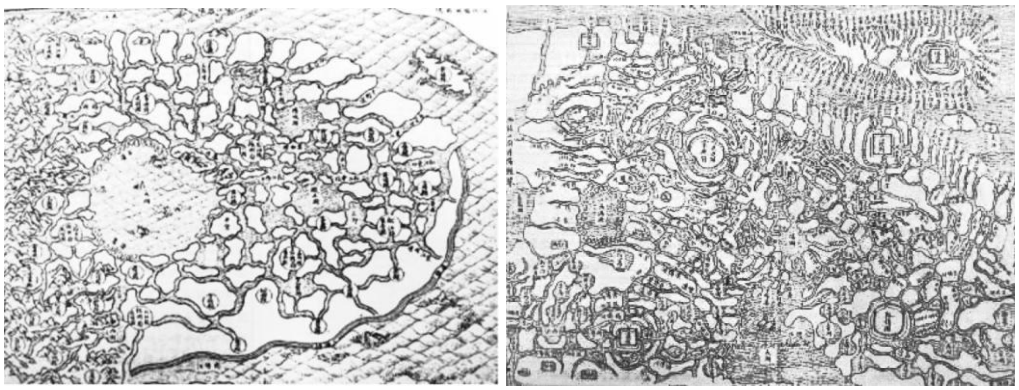


Figure 3: Water Net Illustration of Taihu Lake Valley during Ming and Qing Dynasties
Data source: "County Annal of Jinkui"

southwest with a general ground elevation of 3.0-6.0 meters. The ground elevation of the part from the northeast to Jiangyin is a little higher, while the elevation of the part from the southwest to Taihu Lake and Xicheng Canal is a little lower. The ground elevation of some low-lying plains is 1-2.3 meters, and these plains are located west of the Grand Canal and

Xicheng Canal, which evolved from ancient lakes such as Ancient Furong Lake, Wubu Lake, Yanghu Lake, etc. Along the Canal are converging basins, which have flat topography and advanced water net. There were many inland lakes and marshes which were too large for human beings to live in ancient times.

(2) Geographical Environment Change by Canal Drainage

The establishment of the Canal has changed geomorphic features of development of lakes and marshes in the drainage area, creating the possibility of formation and the rise of settlements in the drainage area. The drainage, with the BHGC as its east-west main axis, connects many north-south key river-channels, as well as controlling and storing water flow of the Yangtze River and Taihu Lake, letting the settlements along the canal access water resources when droughts occur and release waters when floods hit to avoid water disasters as much as they can through the waterhead of Taihu Lake and the Yangtze River. Plus, reclamation management of generations, lakes, and marshes in the drainage area decline gradually and develop into wide plains and swales suitable for human settlement.

Stable shipping network of the Grand Canal further assures development and prosperity of basin settlements. River and lake association is the general vein of Wuxi water conservancy. The canal system of which the main axis is the Grand Canal (Wuxi section) adjusts reciprocating water flows between rivers and lakes, and it makes full use of water resources to satisfy the needs of the depth and volume of water in the canal shipping during the contact between rivers and lakes, which is relatively stable.

2.2 Canal Drainage's Interaction with Development and Evolution of Settlements

Canals are organic components of basins' development and evolution. Prosperity of the basin is led and influenced by changes in status and role of the Jiangnan Canal in the whole Grand Canal system; otherwise, function extension and status reversal of the Jiangnan Canal is determined by the prosperity degree of the basin. (Fig. 4)

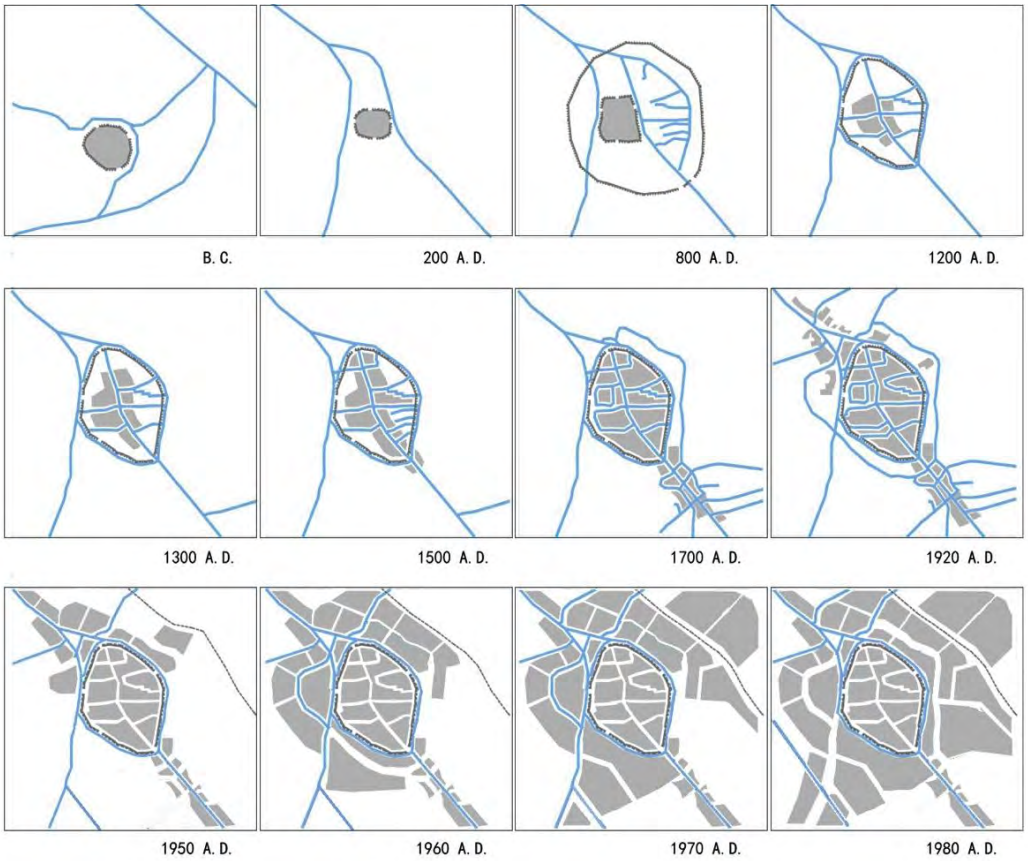


Figure 4: Evolution Illustration of the Canal Drainage's Interaction with Wuxi Settlements

(1) Influence of Canal Drainage on Formation of Settlements

Development of settlements along the canal and formation of towns and villages are promoted by improved natural environmental conditions of the region due to the Grand Canal drainage.

At the end of the Spring and Autumn period (5th century B.C), after the earliest formed stream segments, namely the Wugugu Channel and Changzhoufu River, were canalized and open to navigation, and channels like the Liangxi River and Wuxieshui Channel were dredged, the earliest Wuxi settlements were bred in the area from the junction of higher-lying eastern foot of Huishan and the canal and Bodu Harbor to Meili. These areas were brought into the national urban system and became an established county−Wuxi County—in 202 B.C.

After the establishment of the Sui Dynasty (9th century A.D), the Jiangnan region gradually became one of two basic economic zones of the country and the canal water network was more developed, which led to a busier navigation in the canal. Settlement system started to form since more and more regional settlements sprang up after the long-term reclamation management. In the year of 960 A.D, besides Wuxi County, the Xi'an Township was also established, forming village streets and bazaars such as Luoshe, Yuqi, Fangqiao, and Lishe, etc..

As the administrative, economic, and cultural center of the settlement system of the Grand Canal's Wuxi section, Wuxi County includes the Grand Canal outside of the city, making the Canal the "river in the city." All the navigation channels are completely open and continuous without defensive measures within the entire basin.

After being completed in the Yuan Dynasty (12th century A.D), the Grand Canal's water conservancy system was further developed, and thus the middle and lower reaches of the Yangtze River became a national economic center. Its rapidly developing economy cultivated a batch of prosperous commercial towns. Wuxi became the transit center of materials in the region, forming many wharfs for characteristic materials' gathering and distributing among which there were four famous wharfs for "cloth, rice, silk and currency."

In modern times, the Canal still plays a critical role in the spatial expansion of Wuxi City. Wuxi has entered into an axial development period since the early years of the Republic of China (1920s). Railways built during this period were parallel to the canal, and it could be concluded that the Canal remained to be the leading force of the controlling city's development. During this period, the city's northwest and northeast oriented axial development trend was more obvious, inducing Wuxi City to transform its original turtleback shape into spindle shape. The city broke through the limits of the city wall and developed into a size of 323 hectares.

(2) Influence of Settlement Formation on the Canal's Drainage

Development of settlements and excavation of the Canal are complementary. With the continuous expansion of settlements, maintenance, and widening of the Canal, excavation of new channels and abandoning of old channels are under uninterrupted process. This kind of situation is more obvious in modern times.

Canal transportation was stopped in 1905. Many reaches of the Canal were abandoned in the north, while the Wuxi section, relying on stable and prosperous basin settlements, maintained its inland river navigation function in the Suzhou, Wuxi, Changzhou, and Hangjiahu area.

Wuxi City's rise after the 1930s assured the continuous use of canal channels. Wuxi became an industry-centered city second only to Shanghai in the Yangtze River Delta, developing an industrial group under the leadership of six main national capital groups resulting in the appearance of a batch of businessmen. The rise of national industries in modern times drove the rise of the inland river navigation industry of Taihu Lake with the Canal as its main body and Suzhou, Wuxi, Changzhou, and Hangjiahu areas as its center. The Xihu, Xili, and Xicheng Line were busy all day, products of spinning, wheat flour, rice milling, and silk reeling were transported to northern Jiangsu, and opening ports and raw materials from various regions were transported to Wuxi for process through inland river channels with the Canal as its main body.

After the 1950s, Wuxi began to change the historical pattern of canal channels as it developed and grew. Changes included: Channel oblivion, “one bow and nine arrows” water network pattern disappeared, and rivers in the city were buried to be main arterials in the city; External detour of river channels. The Wuxi section of the Grand Channel was improved and regulated in 1965 and 1983 and no channels went through the city. With the rapid economic development of the region, entry volume of resources continuously increased, and that promoted total regulation of the Grand Canal in accordance with the four-level channel standard after 1983. A large scale improvement and regulation according to the three-level channel standard was conducted after 2000.

3. Types and components of heritages of the Wuxi Section of BHGC

Due to the long history and large scale of the Grand Canal, there are quite obvious features of its relevant heritages which are: many fields, wide scopes, various properties, and long existence. There are more than one thousand heritages just related to the Wuxi section of the Grand Canal. From the perspective of heritage type, national water conservancy projects in the agrarian age break through the heritage component system of production, mining, and trade network, whose value basis is the industrial revolution in *Information Document on Heritage Canals*. The projects also cover all types of cultural heritages, such as heritage canals, historic landscapes, historic cities and towns, and historic monuments with many characteristics of heritage types, including linear heritages, cultural routes, and serial heritages. From the perspective of heritage age, multi-level iterative construction over one thousand years essentially changed the original habitat system of the Canal several times, and the Canal in the new habitat system and its surrounding areas have formed s symbiotic environment, crossing space-time boundaries of historic monuments.

Aiming at macrosystem characteristics of the Grand Canal’s heritages and focusing on the value theme of cultural heritages, a general framework has been determined to protect body projects of the Canal, drainages for regulation, storage, guide, and discharge, trading ports, towns, bazaars along the Canal, and heritages of national industry and commerce in modern times.

3.1 Canal Body, Water System, and Hydraulic Projects

The Canal body and channels for guide and discharge linking to the river are two main parts of the engineering system of the natural guide, discharge, regulation, and storage of the Wuxi section of the Grand Canal.

(1) Canal Body

Canal body refers to the main channels for shipping projects, including rivers in the city and the Yangyao Bay Ring Canal, the new canal in the Wuxi section, as well as the part of the Grand Canal outside of the city. It also includes sub-rivers linking to the Yangtze River and channels for guide and discharge within Wuxi City. Sub-rivers mainly refer to Xicheng Canal and its drainage. Historical records indicate that from the end of the Southern Song Dynasty to the beginning of the Yuan Dynasty (1264 A.D to 1294 A.D), Xicheng Canal replaced Jingkou in Zhenjiang as the channel entering the Yangtze River for transporting rice from the Jiangnan region, taking the north-south transporting function of the section of the Grand Canal from previous Zhenjiang to Changzhou. Channels for guiding lakes mainly refer to the Liangxi River, whose earliest water conservancy project can be traced back to the redredging of Liangxi River during the Liang Dynasty (502 A.D to 557 A.D).

(2) Network System

Network system in Wuxi Section of Grand Canal refers to the channels for guide and discharge that link the Grand Canal to the Yangtze River and their engineering systems. Drainage for linking the river and guiding lakes was formally accomplished after the formation of “Wuxieshui” from the successful reclamation of Furong Lake during the Song Dynasty. The Beijing-Hangzhou Grand Canal was utilized based on this water network system in the Sui Dynasty, and the system was further improved and maintained by subsequent dynasties

to assure the shipment in the Beijing-Hangzhou Grand Canal. Nowadays this water network system still integrally maintains and continues its responsibility of guaranteeing the Canal's water conservancy function. This water network system takes the place of the totally natural system of regulation, storage, guide, and discharge through lakes and marshes, witnesses Chinese traditional thoughts of water conservancy reflecting natural dialectics, and is regarded to be an example of human beings' transforming and harmoniously coexisting with nature.

(3) Hydraulic Projects

Hydraulic Projects refer to ancient, modern, and contemporary water conservancy engineering facilities, shipping engineering facilities, ancient facilities built for the Canal, and remains of management institutes. These facilities with a long history faithfully reflect the construction and utilization of the Canal. Moreover, they are the mirrors of historical developments and changes of the Canal since its construction due to their historical uniqueness and representativeness.

Wharfs connect the channels and the land, transform waterway and land transportation mutually, and allow residents to get water for daily life. Wharfs in Wuxi enjoy all kinds of forms due to their different locations, landscapes, purposes, structures, and sizes, and they are regarded as a major characteristic scene. For example, production wharfs comprise that of passenger terminal, cargo berth, and shipyard; life wharfs are built in shapes of constant slope, cross slope, and others which are built along straight lanes and stilted buildings.

As a common tool of water control, sluice gates play a vital role in people's communication with water. During the development of water conservancy, especially modern water conservancy, Wuxi creatively designed and applied many high-tech and new sluice gates which, in the order of development history, are gates horizontal pulled gate, vertical-lift gate, upper-lied gate, down-lied tainter gate, down-lied plane gate. These gates have made significant contributions to flood prevention, water conservancy, and modern urban construction.

Drainage and irrigation facilities are of great importance to water collection and water resources regulation. Wuxi is the domestic forerunner to utilize mechanical facilities of drainage and irrigation as well as the leader in earliest and fastest imitation, manufacture, research and development of mechanical facilities of drainage and irrigation. Wuxi plays an important role in study, utilization, and development of water collection tools.

3.2 Trading Ports, Towns, and Bazaars along the Canal

Trading ports and towns were developed on both sides of channels along with the Canal and its water network for regulation and storage, witnessing the influence of lake and marsh patterns' transforming into water network patterns on basins' construction and development. The earliest Wuxi settlements were bred in the area from the junction of higher-lying eastern foot of Huishan and the canal and Bodu Harbor to Meili, including three larger settlements, which were Wuxi County, Meili, and Dangkou. Towns and bazaars kept developing and further grew in number along the Canal and newly formed channels, forming village streets and bazaars such as Luoshe, Yuqi, Fangqiao, and Lishe. Up to now, the canal townscape of Ming& Qing dynasties is still remained.

(1) Wuxi Ancient City

Wuxi is a city with a history of three thousand years. The Beijing-Hangzhou Grand Canal goes through Wuxi Ancient City and is named the "river in the city" as a result. Formed by the Canal and its branches, the "one bow and nine arrows" shape established the basic pattern of Wuxi Ancient City. Roads in the city are winding, and almost all the streets and lanes in the ancient city are extended along the riverbank. As the saying goes, "the ancient canal appeared first and then Wuxi City was built." Defined by the ring canal, "rivers in the city" and the canal's branches formed the ancient city's shape of a turtleback together. (Fig. 5)

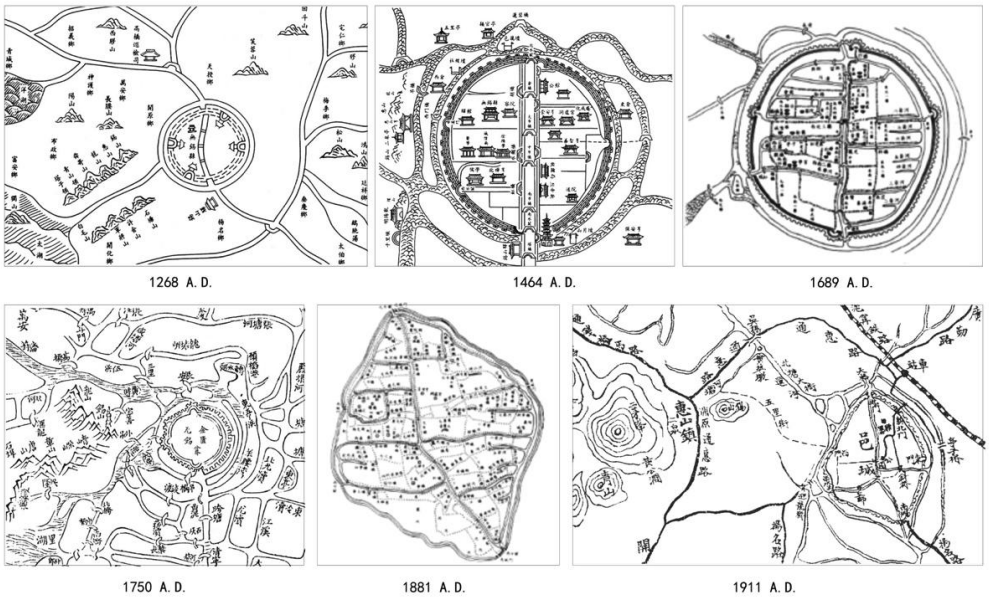


Figure 5: Historical Map of Wuxi Ancient City
Data source: "County Annal of Jinkui, Wuxi" & "Historical Record of Wuxi"

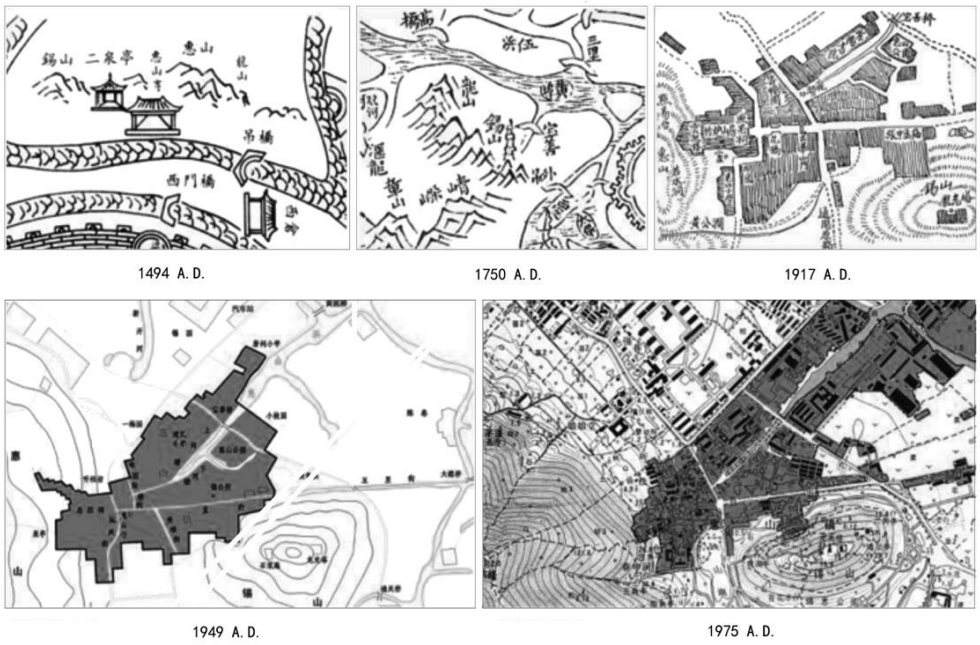


Figure 6: Historical Map of Huishan Ancient Town
Data source: "County Annal of Jinkui, Wuxi", & "Historical Record of Wuxi"

(2) Huishan Ancient Town

Huishan Ancient Town is located in the southern side of the Wuxi Beitang section of BHGC, five miles to the west of the city. Huishan Creek, a branch of the Grand Canal, flows directly past the ancient town's hinterland since the bottom is at the foot of the Hui Mountain. There are not many classical buildings during the Ming Dynasty and middle term of the Qing Dynasty preserved in Huishan Ancient Town, but modern buildings at the end of the Qing Dynasty and the Republic of China are of a large amount. However, the ancient town's "rivers and streets interlaced" pattern formed in the Yuan and Ming Dynasties continues up to now. Longchuan Creek and Huishan Zhijie constitute Huishan Ancient Town's double axes framework system, forming streets interlaced in rivers with obvious local characteristics.

Gathered at both sides of these streets are ancestral halls and temples while the ancestral halls are comparatively more flourishing. (Fig. 6)

(3) Traditional Settlements

Traditional settlements along the Canal basically keep the traditional style of the Yangtze River Deltas with the similarity that "rivers" are regarded as their veins. Meanwhile, the traditional settlements reserve historical spatial texture of old villages, traditional pattern and scale of alleys, building structures with rich local features, social living conditions of living together, unique folk arts, and particular cultural deposits. Among the settlements, Dangkou Ancient Town is famous for its location in Wuxi's southeastern Goose Lake and Nanqing Marsh as one of the earliest settlements within Wuxi City. With interlaced river networks and a forest of wharfs, Dangkou Ancient Town was a famous commercial distributing centre in the Jiangnan region during the Ming and Qing Dynasties. Yuqi Laojie is a famous wine township in the Jiangnan Region in which there are a lot of wine shops and tea houses, being a typical old town street in the Yangtze River Deltas.

3.3 National Industry and Commerce In Modern Times

National industry and commerce in modern times developed and thrived on the economic basis of basic economic zones. Raw material transportation and product export of national industry and commerce's four main industries which were spinning, flour, rice milling and silk reeling were both through the Canal, so the heritages of national industry and commerce in Wuxi are distributed on the sides of the ancient canal, old canal, and the Liangxi River in the old urban area. Up to the 1930s, an industrial group developed under the leadership of six main national capital groups, and Wuxi became one of the origins of national industries in modern China.

The Canal is the axis of industrial heritages in Wuxi. Preserved asset entities represented by six main national capital groups include Zhou's Yuchang Silk Mill, Yang's Yeqin and Guangqin Cotton Spinning Mill, Maoxin Flour Mill, Rong's Shenxin and Zhenxin Cotton Spinning Mills, Tangcai's Jiufeng Flour Mill and Qingfeng Textile Mill, Tangcheng's Lixin Spinning Mill, and Xue's Yongtai Silk Mill. Industrial and commercial remains include the former site of the Chamber of Commerce of Wuxi County, Xijinqiansi Commerce Association, Dingchang Silk Mill, Savings Business Association, Wangyuanji Pot Mill, and the former site of Bank of China, the former site of Huiyuan Flour Mill, Jiufeng Flour Mill, and Paper Association.

4. General Assessment and Analysis of the Wuxi Section of BHGC

The World Heritage Organization advocates a protection system with the Outstanding Universal Value (OUV) as its core and emphasizes the highlighting of value theme, realness and integrity, and management assurance of heritages. In this planning assessment, "value characteristics" evaluation is the core, and a quantitative and qualitative scientific cultural heritage protection system is built to focus on protecting the dynamic balance system consisting of the Grand Canal's heritages and drainages and preserve the overall spatial environment and human landscape consisting of heritages of the Grand Canal and its basins.

4.1 Value assessment

The assessment system is built on the basis of science, art, and historical values. Classification assessment was performed of the water conservancy heritages' time degree, the volume of kept historical information, project adaptability and technology advancement, etc; tangible cultural heritages' historical representativeness, structure, material, and scientific nature of craft, etc; settlements heritages' hydraulic technologies, planning technologies, construction technologies, etc. Also, a comprehensive analysis was conducted of the values of history, culture, science, society, emotion, etc. Finally, 4 sections of water conservancy heritages and 2 historic areas were determined to achieve assessment level A, and 10 other tangible cultural heritages were determined to achieve assessment level B.

4.2 Preservation assessment

Using realness, integrity, and continuity as assessment standards, a preservation assessment was performed of water conservancy heritages' location, function, material, structure, style, etc; tangible cultural heritages' body structure, form, material, and environmental factors such as surrounding terrain and landform, hydrologic vegetation, and climate; settlement heritages' spatial pattern, historical style and features, remains' conditions, etc. As a result, a two-stage evaluation factor was established. Finally, the current condition of 1 water conservancy and hydraulic heritage, and the current conditions of 2 settlement cultural heritages were determined to achieve assessment level A; the current conditions of 3 water conservancy and hydraulic heritage, and the current conditions of 10 other tangible cultural heritages were determined to achieve assessment level B.

4.3 Use and management assessment

This assessment is aimed at the roles in which current management organizations of canal heritages, administrative provisions, and all kinds of managements play in the protection of heritages. A secondary assessment system focus on different types of heritages was established from the perspective of management, exhibition, research, etc. Finally, current conditions of 4 water conservancy and hydraulic heritages, 2 settlement cultural heritages, and 4 other tangible cultural heritages of the Grand Canal were determined to achieve assessment level A; 5 were determined to achieve assessment level B and 1 was determined to achieve assessment level D.

4.4 Assessment Result and Classification

After the OUV assessment, three categories of canal heritages were planned and determined, and protection methods and strategies were proposed according to different types of heritages. A system for protection, exhibition, and management of heritages was established with drainages of the Canal as its core, ancient towns' streets as its node, and modern industries as its extension.

Four levels of A, B, C, and D were classified in a qualitative way depending on the features of evaluation factors. The body section of the Canal is recommended as the world heritage, and other recommended heritages include 14 important canal heritages, of which there are 2 water conservancy and hydraulic heritages, 10 other tangible cultural heritages, and 2 canal settlement heritages.

5. Protection Methods and Strategies of the Wuxi Section of BHGC

As an inter-basin and large-scale water transportation system, the Grand Canal's protection involves many departments of cultural relic's preservation, water conservancy, transportation, environmental protection, urban planning, and shares intimate connection with urban and rural areas along the Canal. Therefore, the Canal's protection is quite a complicated social system project which is different from the mere preservation of cultural relics in the last. The traditional ideas of relying on relevant units for cultural relic's preservation is not applicable any more, after a specific framework of relics value directly related to this completed system is determined, a series of overall planning systems and guarantee mechanisms which guide the long-term protection of the Grand Canal shall be established based on the Canal's overall spatial environment and dynamic balance system as well as in compliance with the principles of effective protection and harmonious development.

5.1 Protection of Drainages of the Grand Canal and its Body

(1) Defining objects of protection and delimiting the protection zone

Body projects of the Canal and drainages of branches linking to the river and guiding lakes should be both included in the list of objects of protection, and protection borders should be defined. Important protection sections and common protection sections are classified according to specific conditions at the same time. (Fig. 7)

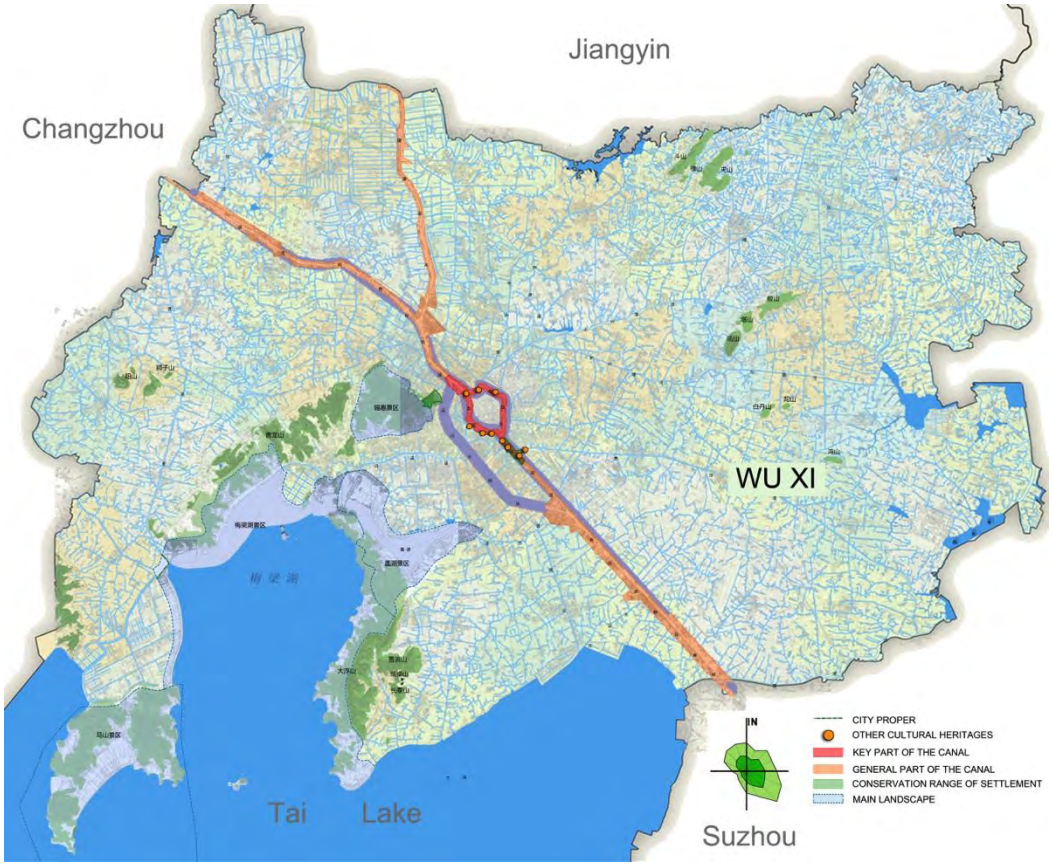


Figure 7: Illustration of the protection zone of the Wuxi section of the Grand Canal

(2) Determining contents of protection and reaching a cooperation agreement
Besides relevant functional requirements of water conservancy and transport such as flood control, drainage channel, and navigation, channels and surrounding areas within the scope of significant protection of channels should be protected in accordance with the requirements of Cultural Relics Protection Law of People's Republic of China.
(3) Dividing management jurisdiction and establishing system safeguards
Supreme examination and approval authority systems should be insisted in the construction activities along the Grand Canal. Regional systematical water pollution control projects should be carried out, ecological remediation projects for water environment should be commenced, and supervision and monitoring network of city's water environment should be established.

5.2 Protection of Traditional Towns and Historic areas along the Canal

(1) Historic area of Qingming Bridge
Located in the junction of the ancient canal and Bodu Harbor, out of the southern gate of old Wuxi, Qingming Bridge maintains the "parallel roads and rivers" double-chessboard city pattern up to now. It retains the waterside town's features in the Jiangnan region, which is reflected by small bridges, flowing water, people, and deep and serene ancient alleys, and it preserves hundreds of historical buildings, nine ancient bridges, and so on. The preservation plan is to combine the Chinese Silk Museum, the Kilns' Relics Museum, and the Canal Museum with the daily street life of people living beside the Zhen River to make them constitute core contents of the culture of historic area together. Meanwhile, through the protection, improvement, and rejuvenation of historical streets of Qingming Bridge, historical context can be continued, cultural characteristics can be shaped, and general environment

can be optimized so that the streets can be developed into a cultural scenic region with Jiangnan cultural characteristics and the ancient feel of the Canal. (Fig. 8)



Figure 8: Protection zone of historic area of Qingming Bridge

(2) Huishan Ancient Town

Protection of the ancient town depends on the unique landscape framework of Xi Mountain, Hui Mountain, and the Canal. Historical factors such as ancestral halls, streets and alleys, bridges, river quays, ancient wells, and ancient trees should be reintegrated simultaneously to inherit agriculture civilization's evolution process to industry and commerce civilization, Chinese traditional culture, and the development path of ancestral halls, folk craft culture of clay figurines, and the culture of traditional gardens at the foot of Xihui Mountain, as well as control requirements of size, height, and color of buildings in the historical streets. (Fig. 9)

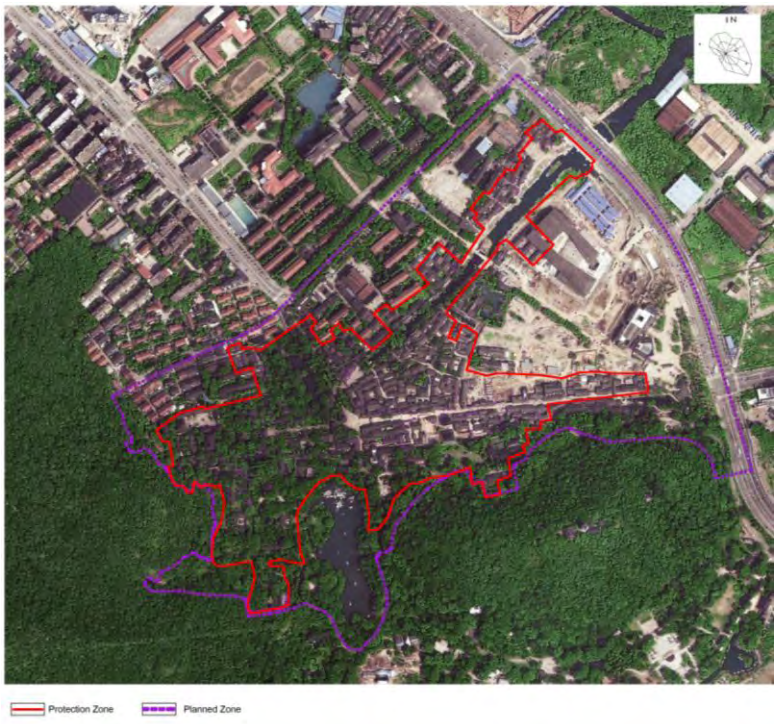


Figure 9: Protection Zone of Huishan Ancient Town

(3)Protection of traditional settlements along the Canal

Traditional settlements along the Canal mainly include ancient towns, ancient villages, bazaars, etc. Key protection lies in historical spatial patterns with settlements and drainages

as the features and trend, scale, and floor decoration of historical streets and alleys and the style of buildings along them. Appropriate development and use in different forms including tourism and culture industry is encouraged on the basis of maintaining the original main functions of ancient towns and villages.

5.3 Protection and Use of Industry Heritages in Modern Times

In light of relevant provisions of *Cultural Relics Protection Law of People's Republic of China*, the body of industry heritages and their monitoring zone are under protection. Meanwhile, spatial historical information of heritages of national industry and commerce in modern times should be protected and be utilized reasonably combined with the environment of canal's landscape. Specific methods are as follows:

(1) Protecting and utilizing industry heritages combining structural adjustment of industry

Use the opportunities such as product switch, transformation, and conversion to activate traditional space to be construction arts, industrial design parks, and culture industry parks, realizing the functional reconstruction of industry heritages and development of emerging industries. For example, the Compressor Mill is substituted for the 1955 Creative Industry Park and the Beicangmeng Silk Warehouse is transformed into the Living Art Creation Park.

(2) Protecting and utilizing industry heritages combining cultural development

The Maoxin Flour Mill of Rong's Group has been built to become the China National Industry and Commerce Museum; Chunlei Dockyard has been rebuilt to be the China Township Enterprise Museum. Combined with the construction of Canal Park, rice barns in 1970s and plants and Associations in 1940s have been built to become the He Zhenliang and Olympics Memorial Hall, China Folk Music Museum, Wuxi Painting, and Calligraphy Art Museum.

(3) Protecting and utilizing industry heritages combining urban renewal

The former site of Bank of China, the former site of Wuxi County Chamber of Commerce, industrial remains such as Paper Association, Zhenxin Cotton Mill, Shenxin No. 3 Factory, Tianyuan Jute Mill, and Kaiyuan Machine Factory were reserved and renovated and thus became highlights of improving the plot's status and building cultural environment of residential areas.

(4) Protecting and utilizing industry heritages combining development of tourism

A series of important industry heritages in the Qingming Bridge section of the ancient canal have been renovated to serve as museums and memorial halls. The important industry heritages include Zhu Dachun's Former Residence, Yongtai Silk Mill, Xue Nanming's Former Residence, relics of kilns, etc.

5.4 Establishment of Comprehensive Management and Coordination Mechanism

Aiming at the current situation where the Canal's management is involved in many departments while a specific administrative authority is in lack, it is suggested that a mechanism for coordination and communication among departments shall be established as soon as possible. Platforms of protecting the Canal's heritages shall be built through seminars on the Canal's development and protection and corresponding action plans. Coordination and function division among administrative authorities can be achieved by establishing service organizations facilitating coordination and cooperation as well as collaborative network of the Canal's development and protection. Measures can be taken such as inviting relevant departments and experts to participate in studies of the Canal's development; establishing a database of the Canal's management which serves departments related to the Canal's construction and maintenance by providing the projects under construction with information, consultation, intermediary service, initiatives and seeking cooperative partners, financial aids, and market development for these projects; setting up a collaborative network, which consists of principal leaders of different departments, to solve internal problems among all the departments instead of within one single department or development of certain section.

6. Conclusion and Discussion

Changes of the Canal and development of settlements in Wuxi interact with each other and together make up the culture and landscape of the Yangtze River Delta with unique charm. From north to south, the Canal flows past the edges of many cities like Yangzhou, Suzhou, and Hangzhou in the Jiangnan region. But Wuxi is the only city where the Canal flows through the city. The Canal and water network systems constructed by natural drainages settles the city's unique pattern, fully reflecting the organic relationship between the Grand Canal and settlements. Canal settlements in Wuxi appeared because of the Canal, from agricultural towns, trading ports and wharfs, industry and commerce central city, to deputy central city in the most developed Yangtze River Delta Economic Zone, witnessing the crucial role the Canal with continuous operational play in cultivation of settlements for commerce and trade along the Canal. Furthermore, the sharp rise of the Yangtze River Delta based on the Grand Canal and economy of southern regions of Jiangsu with Wu Culture as its link witnesses the deposited economic and cultural capitals promoting prosperity of the Grand Canal's basins.

In the aspect of the protection of heritages in the Wuxi section of the Grand Canal, owing to the obvious "active state" feature, relatively clear "system" structure, and clear difference of the traditional city's cultural heritages, the previous idea of a protection plan relying on a single cultural relics unit was broken through, and theme framework of heritage value directly related to systematical and cultural landscape was established, which increased indexes of evaluating system properties of factors and built a systematical constructive model of large-scale cultural heritages.

However, this protection practice is just a trial both theoretically and practically. With respect to some specific aspects such as evaluation of core value, selection of protection mode, and establishment of coordination and cooperation mechanism, further research and explorations shall be implemented based on local practical situations as protection work moves forward.

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Can research by design on regional level help to introduce new concepts in spatial planning?

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1. Abstract

In this paper, we want to explain our findings from recent research by design on regional level, that is initiated or realised by the Flemish spatial development department.

As experience in research by design on regional scale is growing in the last 10 years, there is an evolution in the working process towards more focused and more defined research topics and towards an international collaboration. Research by design on regional level is a recent discipline and has her roots in the research by design on urban level and in future explorations (toekomstverkenningen) (Schreurs J, Kuhk A. 2011) . It has an extra explorative dimension and a new vision on forecasting and backcasting.(Dreborg K.H. 1996). Most research by design is done to explore, spatialise and visualise new concepts, to make new transitions in urban planning matters understandable. On a regional planning level, spatial form is directly linked to the functional aspects of the society. This means that some kind of transition path will be incorporated in the research by design process.

2. Challenge for Research by design on a regional scale

Spatial planning on a regional scale struggles with keeping up with the ever faster changes in society. As the former dominant planning paradigm, based on central places theory combined with modernist functionalism is no longer up to the task, planners need to find a new way of creating appealing future visions that will in the end lead to a new spatial reality. Françoise Choay (Choay, 1965) wrote on this point *"Il est vrai que l'existence même d'un langage urbanistique coherent est rendue aujourd'hui problématique par la mutation inachevée de certains systèmes référentiels, tells les secteurs du travail et des loisirs"*. From our point of view this is clearly illustrated by planning processes like the Limmattal UPAT, where the very strong Swiss planning tradition apparently is not able to deliver a good living environment. According to the introduction on the UPAT website *"The Limmat Valley has been faced with powerful development pressure from Zurich, transforming it into an increasingly urbanized part of the Zurich Metropolitan Region in the last decades. This development, however, poses growing threats to the valley's functional and ecological capacities and to the local quality of life."* Other regions in Europe face the same difficulty of combining *'powerful development pressure'* with the *'ecological capacities and the local quality of life'*. Initiatives like *'Le grand Paris'* or *'le petit manuel de la conception durable'* show the difficulty contemporary spatial planning still has finding a (new) way of handling societal problems on different planning levels and scales.

In the Flemish regional spatial planning administration, a small group of designers[i] and spatial planners started in 2004 to test a design-based approach to regional planning. These tests can be seen as first steps towards Janssens' *"Design based approach to reconceptualise the human-environment relation"*. (Janssens N, 2012).

In this paper we will present and discuss some of our work of the last 10 years, following three paths of inquiry: (1) Application of pre-existing spatial concepts to the Flemish territory, (2) graphic representation, and (3) construction of region specific spatial concepts and

strategies. From the vast number of examples we will focus on ecological and landscape issues to show the continuity of our work.

3. Application of pre-existing spatial concepts to the Flemish territory

In 2004 the team, then called 'Ontwerptank', was created from both the frustration of the lack of contemporary design in regional planning processes, and the opportunity and willingness to design by ourselves to redefine questions. Therefor we introduce research by design on a regional scale to visualize wicked problems (Rittel 1973, Dehaene 2013), to envision future thinking. The main hypothesis was that other European regions were facing similar problems as Flanders, and thus the transposition of their spatial policy to our territory might show us instantly what contemporary regional planning would suggest. In 1997 the ministry of VROM published a study on 4 spatial perspectives for the Netherlands in 2030 (VROM 1997). These perspectives start from regional policy potential and are unlike the SRES science based carbon dioxide emission scenarios from IPCC. From 6 territorial assignments, four different groups of experts constructed each one policy framework, leading to 4 spatial perspectives. The main question was: *How can we react as spatial planners to new future challenges?* As the construction of a new possible future was at the core of this research, we thought it fit for our purpose.

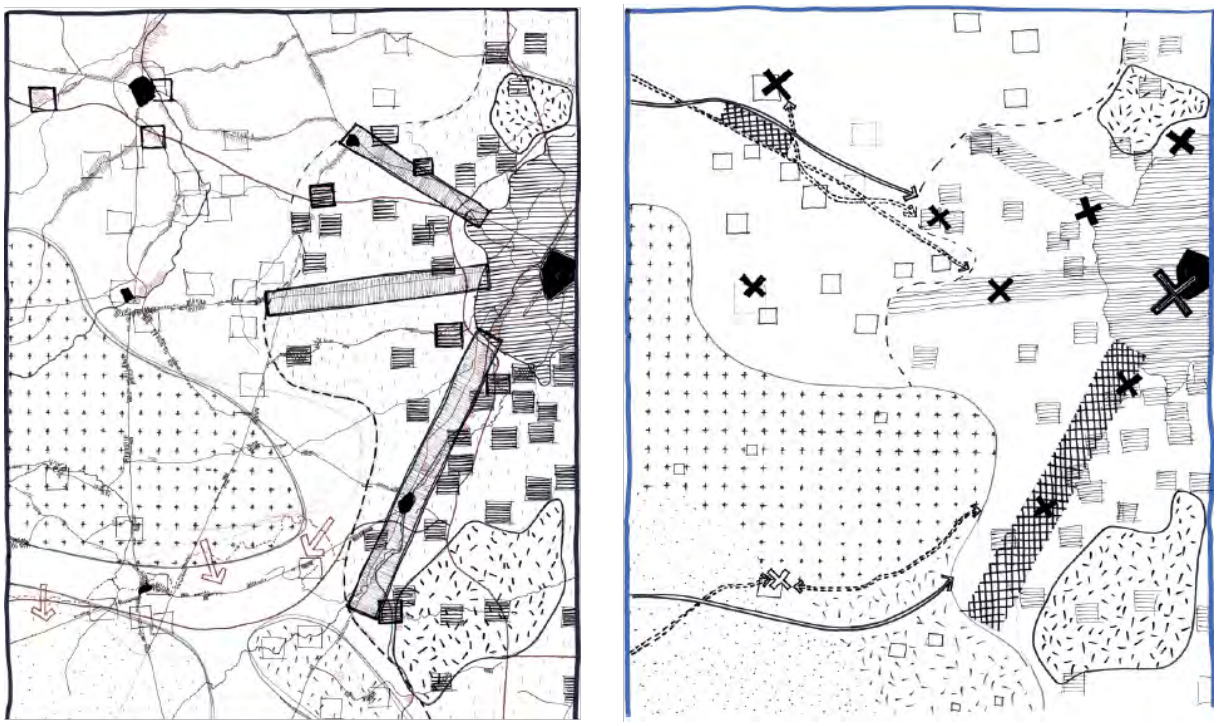


Figure 1: spatial dynamics on focus area: existing and Parklandschap perspective (Geldof et al 2005)

After mapping the 'Existing Spatial Dynamics map of Flanders in 2004' and translating it to a local level (figure 1) and exploring possible future spatial perspectives 2030 on Flanders and on that local specific area. We started to work on a future vision exploration of Flanders as a whole and of the outskirts of Brussels to understand better future spatial dynamics. We used 4 future scenario's families developed for 'Nederland 2030' such as 'landscape of parks', 'palette', 'land of streams', 'land of cities' (parklandschap, palet, stromenland, stedenland) and applied it to area of Flanders and to the area Ninove – Aalst – Brussels, a semi-rural area cross-border of the Flemish and Brussels territories. On figure 2 you find the future perspective 'landscape of parks' with an alternation of green regions (green horizontal lines) and city regions (red diagonal lines) laying in the big green regions of France, Germany and the Delta of the Netherlands. Today those green regions are still threatened by fragmentation due to economic developments and local dynamics.

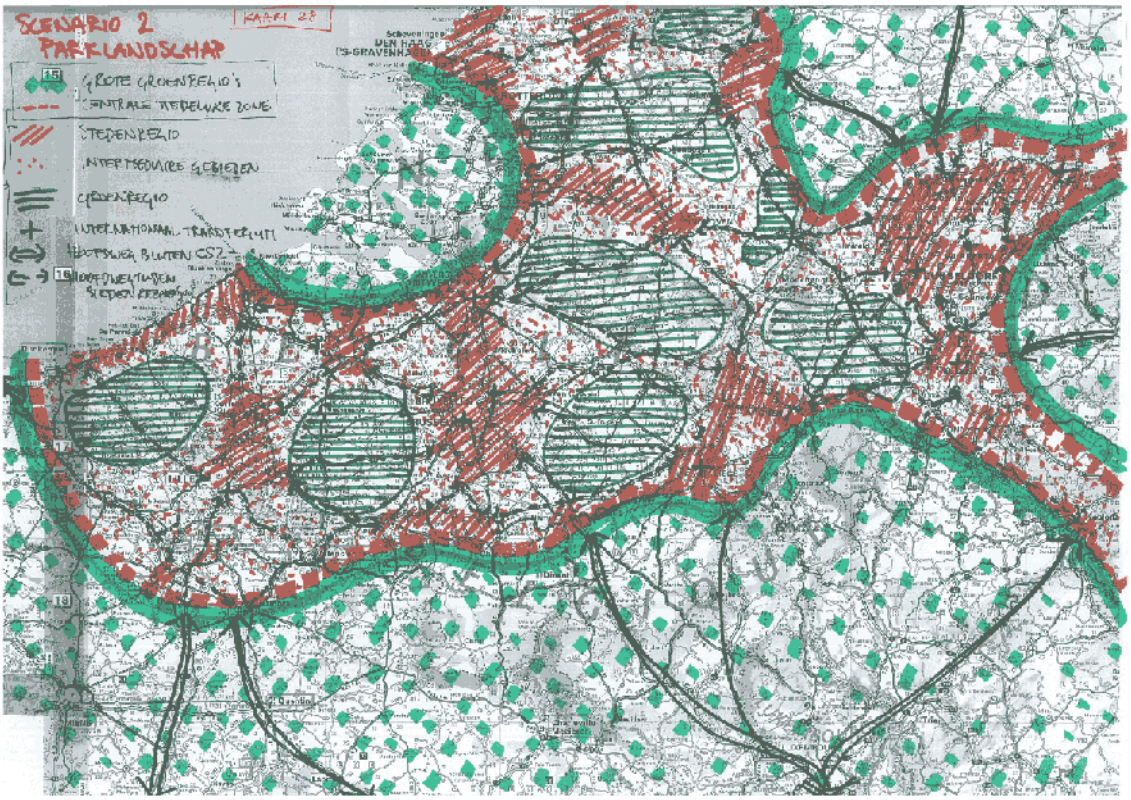


Figure 2: : perspective 2030 on flanders : scenario 2 "parklandschap" (Geldof et al 2005)

As this application gave us new insights on design on a regional scale, transferring the outcome to spatial policy development was extremely difficult. The four perspectives are very complex and comprehensive, and thus only those who understand the dutch perspectives and our transposition can work further on it. By consequence this hermetic work remains unused by others in our office, even if it worked out perfect for the team.

This general, comprehensive approach was never repeated by the team. It took until early 2012 that the application of pre-existing concepts was the main aim of an external research project 'Visions and concepts for the new Spatial Policy Plan Flanders' (AWB 2013).

When the new Flemish government took office in 2009, it meant a fresh start for the renewal of the Spatial Structure Plan. The new plan, *Spatial Policy Plan Flanders (SPPF)* had also the ambition of being more strategic and focused on the essential territorial topics on the regional level. This went hand in hand with a new communication strategy, with a press campaign, online questionnaires and a one day working group with 'normal' people. From this we stated that this type of strategic plan should also have a new type of contemporary graphic language and ditto maps.

In the 'Visions and concepts for SPPF' project (AWB, 2013) the research team was asked to find international experts in Urban Design, Regional Planning or Landscape Planning, and bring them together around three themes. The experts got the assignment to apply their experience and knowledge of planning practice to Flanders. Francis Cuillier applied the Swiss S-Bahn concept to the area between Antwerp and Brussels, Thomas Sieverts focused on a strategy of 'radical decentralisation', Paola Viganò applied the 'horizontal metropolis',… In the thematic workshop on the *productive Landscape*, Sven Stremke showed how to construct an energy-landscape from the existing patterns and functions in Western and Central Flanders (Fig 3).

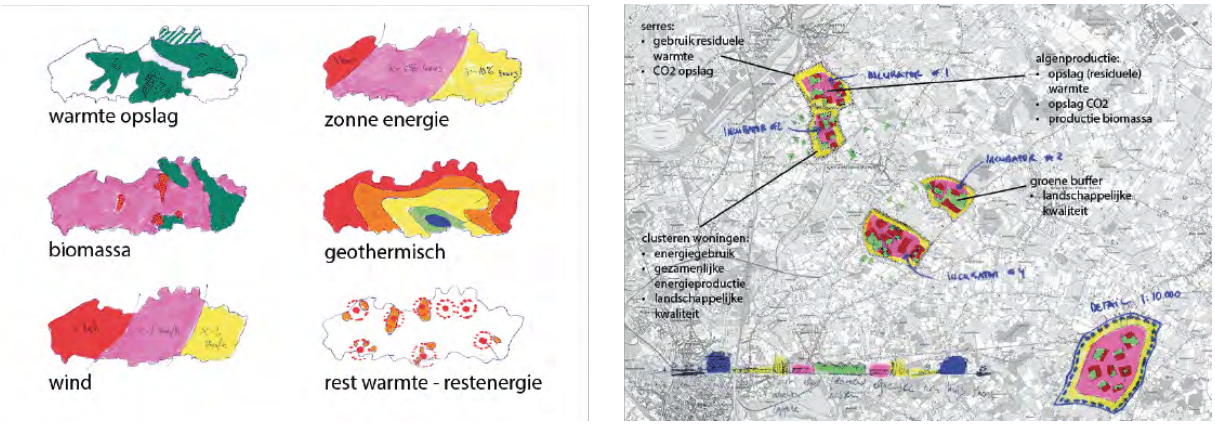


Figure 3: Flanders Energy Landscape by Sven Stremke: Left: Energy potential; Right: application on Sint-Katelijne-Waver (AWB 2013)

As the visions and concepts project was developed at the same time of the green paper and preparation of the white paper for the spatial policy plan, expectations on the influence of the project on the policy were very high. During this project a large number of people were involved, that were writing and discussing the draft White paper for SPPF. Usually, only a smart portion (10-20%) of research by design work gets a place in a final project or decision. In reality, very little of the concepts was used in the final proposal, even if most people involved think that it should have been possible to use most of the visions and concepts. In depth research is needed to find out why nothing is used in the final draft white paper of march 2014.

4. Graphic representation

From 2009, after the disappointment with the spatial perspectives 2030, we discovered that 'learning by drawing' was crucial for our further development. We added a new path to our work. To work on innovative maps and representation of spatial strategies was the aim. If it proved to be difficult to influence the overall quality of concepts, maybe the right graphic representation would raise awareness of the inherent conflicts inside the proposed concepts and could at least start a discussion?



Figure 4: Flanders Today (Ruimte Vlaanderen 2012)

For the first major document towards the SPPF, the green paper 'Flanders 2050 – human scale in a metropolis?' we produced four maps: 'Flanders today', 'metropolitan Flanders', 'Flanders in daily life' and 'resilient Flanders'. We based the maps on text that were largely discussed in a working group. By drawing them, multiple new disputes and discussions arose, mostly due to the fact that a map allows less freedom of interpretation. Even the most vague maps are always clearly identifying cities, regions, areas, rivers…especially for those who know the territory by heart. For the published green paper, only a small sample of each map was used, exept for 'Flanders today'.

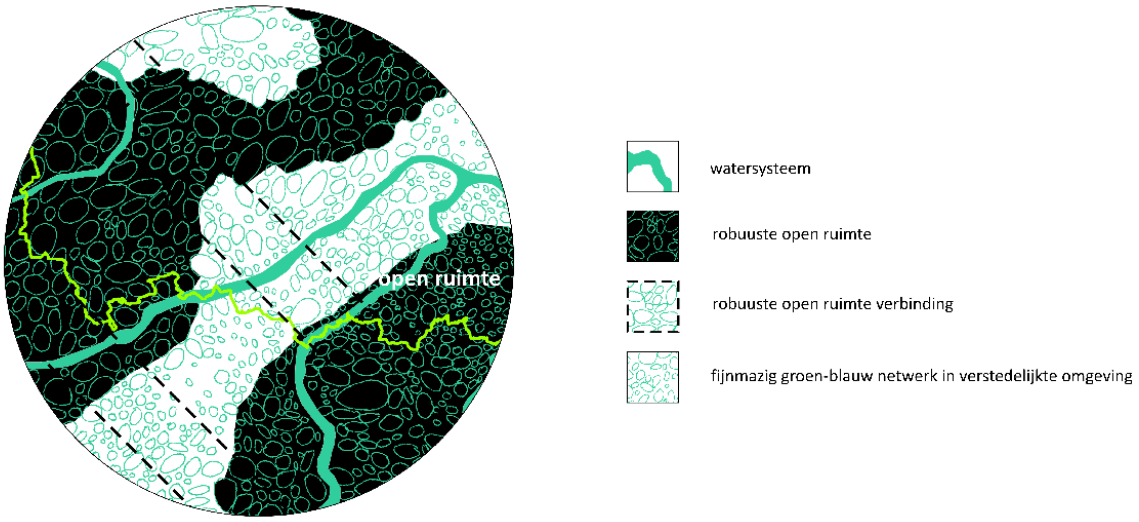


Figure 5: Flanders 2050 – Resilient Territory. The figure shows the small excerpt that was used from the 'resilient Flanders' map. (Ruimte Vlaanderen 2012)

A few months after the publication of the SPPF green paper in 2011, the preparation of a SPPF white paper started. Three thematic groups, correspondent to the three thematic maps of the green paper were formed, and worked (mostly) on texts. The 'resilient Flanders' group followed a more graphic approach, and put all the challenges on an axonometric map. We wanted to present the vast number of changes that a specific territory should undergo to become resilient (according to the working group) by 2050. This was meant to be a first step into a research by design exercise with the working group, where we tried to imagine how this vast number of actions could be carried out in reality. Unfortunately, this led to a reduction of the challenges, and the working group chose to elaborate only some easier to understand aspects (eg greenblue networks on figure 6).



Figure 6: Green-Blue network as part of resilient Flanders in 2050

After the first draft SPPF white paper in May 2012, our group produced (in collaboration with URA) maps, wallpapers, illustrations,…(URA 2013). Again we set out humbly to serve the existing texts. A recurring problem with this humble attitude towards providing maps (or other graphic material) to illustrate spatial strategies consists in the unclearness or different interpretations of the same text. In all examples, the graphic translation reduced the number of possible interpretations, and forced the author of the text to be more specific. In the URA catalogue this becomes clear, as at some point it proved to be impossible for the policymaker to choose one of the possible illustrations accompanying a specific text.

This type of 'graphic research' was again very fruitful for our team, as we are preparing a small publication on the lessons learned from this graphic research.

5. Construction of region specific spatial concepts and strategies

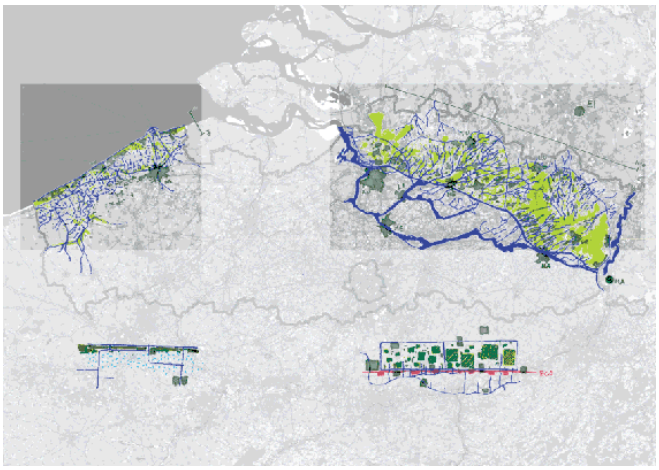


Figure 7: Three meta-parks for Flanders designed by Paola Viganò (AWB 2013)

Off course, we also made specific concepts rooted in our own Belgian territory. One of the experts in the "Visions and concepts for the Spatial policy plan Flanders', was Paola Viganò

from the Studio Bernardo Secchi Paolo Vigano. She knows the Belgian territory very well from previous work in Antwerp, Mechelen and Brussels (Studio Associato Bernardo Secchi Paola Vigano, 2012). In the 'productive landscape workshop, she set out with the statement that, in a territory with a fertile soil, no extra square metre should be lost to settlement. Based on the existing soil type and settlement pattern she moved to the concept of the 'meta-park'. (fig 7) The 'water'parks in the West (coastal area) and the East (Kempen from Antwerp to Maastricht NL) are complemented by a central park that is more dominated by cities and dispersed settlement. The central park's specificity is the linear of contact between settlement and open areas. (fig 8)



Figure 8: Central Belgian typical asset 'linear of contact' (in green) between built areas and open space (Paola Viganò in AWB 2013)

In another research project (Royal Haskoning 2012) on resilient territories, the meta-park concept was further elaborated for a sample area in each of the three meta-parks designated by Vigano. The coastal water-park is designed as a dynamic coastal zone, which can evolve at the same pace of sea level rise (due to climate change). The waterpark is divided in a salt water part and a freshwater part, along a new inland dike (fig 9 & 10). The productivity of the saline land is however maintained, by changing to different crops and different types of agriculture and nature areas. (fig 11)



Figure 9: Coastal water park, with saline land (light blue), and freshwater land (light green). Settlement areas are white with a black outline symbolising dikes. (Royal Haskoning 2012)

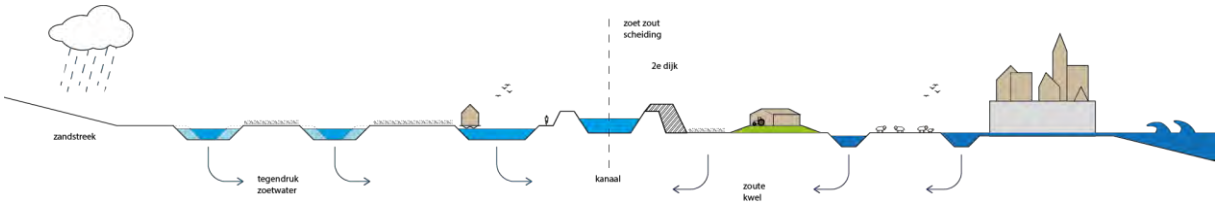


Figure 10: Section of coastal water park, with saline land (right), and freshwater land (left). (Royal Haskoning 2012)

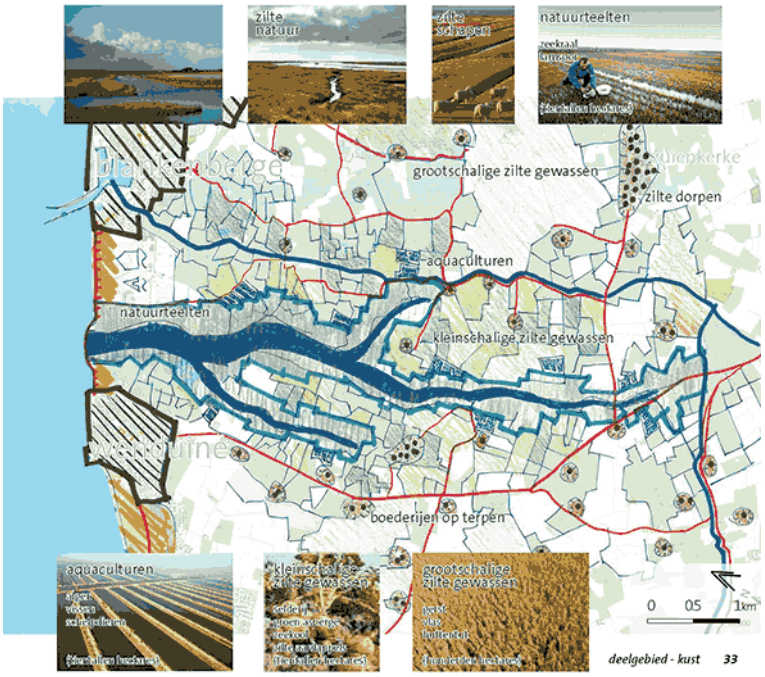


Figure 11: Part of the coastal water park, with an indication of crop types for maintaining the bioproductivity of this area (Royal Haskoning 2012)

This region specific spatial concept and regional design is further elaborated in a new project of 'explorative research by design' on the 'Metropolitan coastal landscape 2100' (coproduction of Flemish government Architect, spatial development department, and department of Mobility and Public Works). This current research is trying to explore a wide range of extreme and opposite concepts and at the same time is installing an intense collaboration between 3 policy fields (spatial planning, maritime accessibility and the government architect).

6. Conclusion

Paradox of research by design on a regional scale?

In the past 10 years we gradually established both (real) design and research by design on a regional scale in our administration of Spatial Planning Division, by doing it ourselves or by leading a external design team. Through a design attitude we analysed, reframed, represented and projected possible futures of a wide range of spatial challenges. Debates and experience on research by design on regional and city levels has learned us that often only 20% of the results are used but that the designing process has different outcome. From our 10 year-work in the administration (here cited work in this article), only the graphic research for the green paper 'Flanders 2050 – human scale in a metropolis?' became

(partially) integrated in a policy document. With this knowledge, we are trying to change of method by dividing current research projects into small topics, by which we try to establish the essence of designing on a regional scale. This gives us additional insight in the research by design process.

Today, based on our experience, we think that research by design on regional scale has always to link with the 4 following scale-lines, where the two opposite sides of the 'scale-line' are to be explored in an iterative process:

- from 'easy to understand' to 'comprehensive'
- from 'one sharp opinion' to 'a widely shared view'
- from 'strategic' to 'operational'
- from 'utopian' to 'realistic'.

This is inspired on the remarks Nel Janssens formulated in the spatial research conference of November 2013. On a continuous scale between 'paradigm confirming' and 'paradigm breaking' research by design, our work remains nearly in the middle, without moving from one end of the scale and back. This iterative method will give far more interesting results.

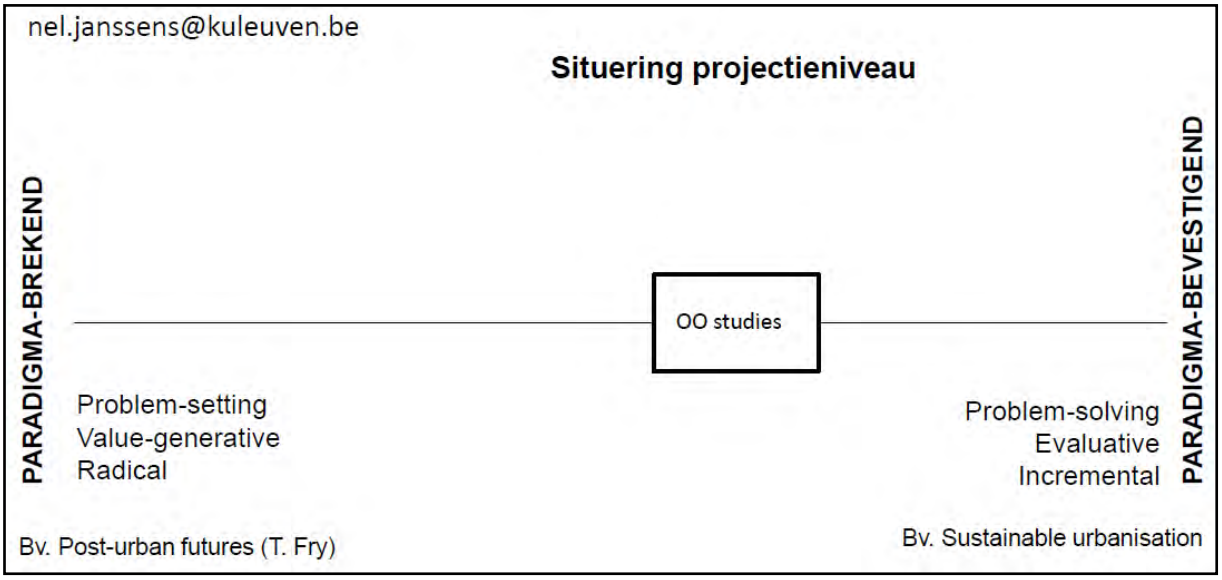


Figure 12: Scheme situating our past research by design projects between paradigm breaking and paradigm confirming (Nel Janssens, presentation during the Flemish spatial research conference, November 2013)

The current work of our research by design on regional level will focus on these paradoxes, and work on iterative design processes where both ends of the scale come into action. For example in the resilient coastal areas research we will work on 'the utopian' and 'the realistic', by involving real-life actors (of the agro-industrial production chain) in a discussion on post 2050 realism and utopia. Also for the further research on the Belgian urban system and certain cases of the Brussels Metropolitan Region we will try to install more iterative processes.

It is a great challenge to install this iterative method into the administration body and we are hoping to find international similar experiences to learn from.

It's a poor sort of memory that only works backwards. (LC)

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i The group started with four designers in 2004 (Sara Geens, Françoise Vermeersch, Charlotte Geldof, Jan Zaman). The work was interrupted between 2007 and 2009, where they focused on research by design on a small scale project base. From 2009 the research by design on a regional scale was incorporated in the preparatory work for the new Flemish regional spatial policy plan. In 2014 we are 5 designers (Sara Geens, Charlotte Geldof, Line Van Assche, Griet Hanegreefs, Jan Zaman).

Shaping and controlling the city skyline on the eastern side of West-Lake in Hangzhou, China

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1. Research background

The city skyline is the overall image display and the symbol of a city. Many successful cities in the world such as Manhattan in New York, Victoria bay in Hong Kong, The elegant " city skyline" becomes the symbol of the modern city. Since the new century began, driven by the real estate development, cities have been expanding rapidly and a large number of high-rise buildings and structures have been in a disordered state, which makes city skyline landscape based on the old town features get a huge impact. The relationship between development and protection appears to be a big issue in many fast expansion cities in China. This paper will focus on coordinating the relationship between the urban construction and the protection of the old town features in the city skyline research.

2. Research object

Reasons for selecting the West Lake in Hangzhou skyline as the research object are: Firstly, Hangzhou as a noted historic and cultural city, where there is clear historical and cultural value in historical development vein, which indicates the research an easier resolution path; Secondly, high-rise buildings have sprung up at the eastern side area of West Lake in Hangzhou, which makes conflict between urban development in eastern side and the lake landscape protection increasingly stand out. Research on this area will be very typical; Thirdly, Under the background of West Lake declaring world cultural legacy by UNESCO, this paper get promoted of the ideas and methods on landscape control guide of West Lake in Hangzhou, which shapes the city change at the same time undertakes protection of long profound historical culture inheritance in Hangzhou effectively. At this meanwhile, it also provides practical experience on the guide of city skyline landscape protection and control for the same type city.

3. The city skyline case studies at home and abroad

There is the most beautiful city skyline in Hong Kong as the world recognized. It is relevant to the world's most advantageous geographical conditions, that the city locates fronting water and with hills on the back. In order to maintain such beautiful city landscape, the development of the city and the construction of high-rise buildings in Hong Kong have been strictly controlled by the skyline- control system.There is a set of perfect, systematic standards and guidelines to measure what is good skyline at Planning Department of Hong Kong. As an important guideline of urban design in Hong Kong, it specifically pointed out that good urban skyline should be equipped with the following characteristics: (1) The relationship between single building and the other different buildings, land use of the building and open space around the building should be taken into consideration when shaping the skyline.(2) The skyline must be accord with the overall urban design, especially accord with the surrounding natural environment, such as ridges and peaks.(3) The skyline should strengthen the city image and shape traits and characteristics of the local environment.(4) The shaping of skyline must ensure that some buildings as the "city landmark ".



Figure 1: Hong Kong's Victoria harbour skyline

Shanghai, as the biggest city in Yangtze River delta area in China, of which the city skyline is in constant change with the constantly advancing urbanization. North and south side skylines On the both sides of the Huangpu River come in different styles, which forms the visual center of the different characteristics.West side of Huangpu River, from north to south, which is composed of in turn by the Shanghai Tower, Bank of China, Peace Hotel, Shanghai Pudong Development Bank, the observatory tower and other buildings, presents the image of a higher level and high level buildings arranged alternately, vying with each other for architectural beauty. It is billed as a most classic salient feature of Shanghai, and also the extension of the historic formed skyline which were still well preserved at present.



Figure 2: The bund skyline in west side of Huangpu River, Shanghai



Figure 3: The Pudong skyline in east side of Huangpu River, Shanghai

Nanjing has a history of nearly 2500 years, and is known as the capital of six dynasties, or ten regimes, whose landscape incorporates mountains, water, city and forestry. There are more than 40 classic city skylines in the city. By classification of these important skylines in Nanjing, it is not difficult to find that the landscape showed by the skylines are interwoven, but in general can be divided into four categories-- "mountain, water, city, forest" ,which is also the city features of Nanjing.



Figure 4: The city skyline of Nanjing

From the above case, the city where there is the world's cultural heritage should not be rigidly protected. Beside the continuation of the original heritage ontology and integrity, the most important thing is to protect and continue the heritage by urban culture and urban landscape features. There are important points about the control and development of the city's skyline as follows: (1) It should pay attention to the control of the high-rise buildings, and forms a multi-level height control zone. (2) It should pay attention to the protection of the ridge line of the mountain, which the architectural skyline should be coordinated with. (3) It is the key concern point of heritage conservation that whether the urban landscape and landscape features can be continued and optimized in the development. (4) It is also the important aspects of heritage protection that the material space and the visual landscape can express the complete overall regional culture which reflects the particular historical period, social, economic and religious development.

4. The evolution and problems of the city skyline on the eastern side of West-Lake in Hangzhou

Hangzhou is an international tourist city, a famous national historic and cultural city, a central city in the Yangtze River Delta, and the capital of Zhejiang Province. With West Lake, it boasts an unique city structure, which also constrain its further development.
Hangzhou and West-Lake, from Sui Dynasty are maintained with interdependent and inseparable spatial relationships, especially after Wu Yue Nation chosed Hangzhou for the capital, the city has been sustain with peripheral expansion like crumb around the west lake.

"Three sides of mountain & one side of city" and "the harmony combination of city and lake" has become one of the important features of Hangzhou. On the other hand, with the urban development and expansion, eastern side cities of West-Lake is not just an important part of West-Lake landscape, but also effects the environmental features of the whole West-Lake more and more significantly.

Since the wall along the eastern side of the west lake dismantled, city landscape becomes an important part of east interface in the west lake landscape. Under the premise of natural landscape defined by "three sides of mountain" remains the same, " one side of city "was influences by the complex economic, social and environmental factors, and formed a dynamic landscape relations with the west lake. It roughly experienced the following stages of development: (1) In the early 1990s, high-rise buildings began to appear in the west lake on the east. At the same time, as the city around the west lake expanded to the north, high-rise building began to invade the gem foothills, and appear in the near lake area. (2)In the late 1990s, eastern side of the west lake maintained the moderate the development of urban landscape, especially at the near lake area and basic control transition zone. The city skyline is flat, lack of Layering, the building volume increased along lake area, etc. (3) At the beginning of 20th century, as the city space transferred to the both sides of Qiantang River, super-tall buildings began to appear in the west lake landscape in sight.



Figure 5: The change of eastern side skyline of the West-Lake

West lake urban landscape development experienced a series of complex social impact, economic factors. Look back the process of changes of the city skyline, as if reading the historical Archives of urban development in Hangzhou. From the external image of the urban landscape and control strategies of west Lake's neighboring cities, its current development mainly performs in the following aspects:

(1) The city skyline in old cities becoming stabilized, the pressure of exploitation control in new zone raised. With the massive transformation in old city of Hangzhou, the area along the Qiantang River became the hot spots of new development. Meanwhile, the city skylines of east coast which is located in the control zone of waterfront area in east city, the tendency of

construction of high-rise building gradually warming, peak height limit began to appear. In addition, some construction was approaching to the transition zone of Wushan Mountain and Baoshishan Mountain. Following the new wave of urban renewal in the old city, the entire urban landscape boundary tend to become more compact.
(2) The city skyline appears to be flattening, lack of hierarchy and urban characteristics. With more and more buildings exposed at the waterfront area , the city skyline in the depth direction into deep space has weakened sense. Building cluster effect is not prominent, overall features are not clear. Main features are that the loss control at overall level of dull rhythm and volume scale contrast imbalance.

5. Landscape orientation of city skyline on eastern side of the west lake

From the perspective of the historical development of the city skyline, it teases out the city skyline general principle and method of landscape shape. Then, it makes analysis of West Lake landscape problems connecting with the view of urban development, and points out the key issues on landscape control of West Lake. Through judgment on the core landscape value of West Lake, it proposes the key control landscape area of West Lake.

Overall orientation: three sides of mountain, east side of city

What is the Hangzhou city like cooperating with the west lake? There must be he temperament of the west lake, which is like “three sides of mountain, east side of city”. Such city makes continuation of Hangzhou’s most valuable feature of the city landscape pattern of "the three sides of mountains & one side of city". Such city makes new and old buildings in harmonious coexistence with the west lake, where there is a beautiful city skyline which has its own characteristics. Beautiful city skyline on eastern side of the west lake makes the west lake scenery depth extends to the city.

6. Control and guide the city skyline on the eastern side of West-Lake in Hangzhou

The control of eastern side skyline of the west lake should be highlight to the natural landscapes, pure and beautiful city show elegant and delicate style and protection of lake city combination of humanistic model as the main target specific shape principle and control points is as follows:

6.1 High buildings cluster

First of all , it should attach importance and focus on the skyline of city main elevation, and when high-rise building layout of city skyline make an note on the influence of high-rise building group formatted like "crown", avoid the high-rise rising anywhere and everywhere with no centripetal compositions.

With Comprehensive consideration of various factors such as update status quo and future development, classification control cluster is recommended. Based on the overall image of the degree of attention of high-level cluster in the skyline on eastern side of the west lake, it can be divided into three groups: first level of commanding elevation, second level of cluster, third level of cluster.

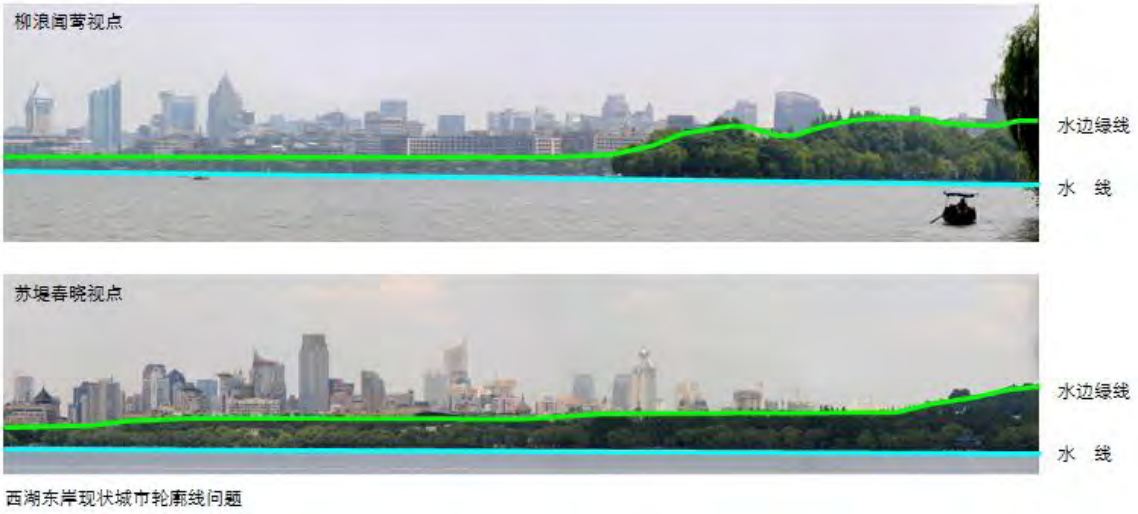


Figure 6: High-rise cluster and the city skyline

6.2 Harmonization of mountain and city

First of all, It should pay attention to the relationship of the terrain and the skyline: when building outline below the hills contour line is the best; When the building outline and the outline of the mountain cross rolling is good; When the building contour line is higher than the mountain contour line is not ideal; The most taboo is that the building contour line with mountain Outlines approximate or close.

Analysis of the city skyline on eastern side of the west lake of Hangzhou can reveal that the very beautiful status quo of west lake water and the water green line is an important part key indicator elements of the skyline on eastern side of the west lake, while building contour parts is not so good. Main problem appears to be the natural mountain and the building skyline existing with no harmony. The two independent element exists in the city skyline, and the control action of the main building in the city did not stand out.



西湖东岸现状城市轮廓线问题

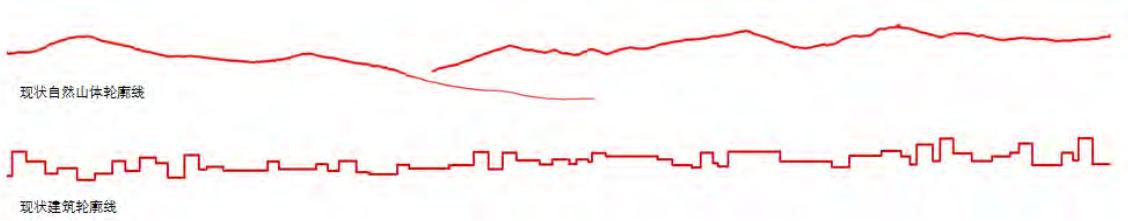


Figure 7: Existing building skyline contrast with nature mountain skyline

6.3 Rhythmic movements

High-rise building arrangement, in addition to the episodes, also there should formed by ups and downs and the change of the density interaction in order to form the skyline of rhythm. Like other arts, it follows the basic laws of aesthetics. The principle of actual and virtual is an important means of shaping a lively rhythm changes the city skyline of the west lake. From the actual and virtual relations, It need to be further differentiation of vertical parallel by the building elevation of the lake and the lake green corridor of spatial relations. Firstly, making construction scale adjustment, weakening of the urban construction interface is the basic way. Secondly, making large-scale vertical planting in a planned way is a fast way. Thirdly, increasing the vertical greening corridor construction to highlight the sky falsified.



Figure 8: conceive of vertical planting



Figure 9: The layout of green corridor on eastern side of the west lake

7. Conclusion

This research starts form the analysis and study of urban skyline and relevant theories, summarizing the type, structure, characteristics and influencing factors of city skyline in waterfront regions. Firstly, this research will present the planning principles and control factors of the water front regions based on the theoretical analysis of city skyline. Secondly, By analyzing the characteristics of West Lake landscape, this paper will clear and definite the relationships between the places of cultural heritage and the characters of city skyline, and puts forward the control principle and feasible landscape design methods for the sake of correct, healthy control guidelines of west lake eastern coast city skyline. There are some main conclusions could be drawn from the research:

(1) The protection of world cultural heritage should focus on that whether the urban landscape and landscape features can be continued and optimized in the development.

(2) West-Lake landscape, for quite a long period, as the suburb natural landscape garden, the border of which should separate the city and the lake by city wall, that it could makes the space relationship to be relatively clear.

(3) The cognition of the Eastern side city skyline landscape should be focused on the basis of the city and lake space landscape development pattern since the Southern Song Dynasty. What scenery "Ten Views of the West Lake " reflects as a guide, it tries to find out what coincide with the West-Lake cultural landscape of landscapes to the eastern side of West-Lake area.

(4) The city skyline evaluation should set the formal beauty, city image and Environmental Priority as standards.

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Centrality and urban transformations: An exploration of the process of live centrality in water related Cities in Southern Chile

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1. Abstract

Rapid urbanization is placing cities of the global South at the core of the developmental agenda of the twenty-first century. This intense transformation process poses both challenges and opportunities for thinking and acting on the future of cities. In Latin America, this process has modified and increased the scale of the urban environment by occupying extensive landscapes towards the periphery of urban areas. On top of that, the current urbanization models generally promote the development of spatial relationships that are detrimental to the environmental and social sustainability of cities. Thus, a physical and morphological deterioration of cities is observed, especially in their central areas.

The center of a city is usually defined by a higher concentration and mix of land uses and related activities in a prominent location within the urban area. Historically, it is understood that centers grow, shrink, shift and diversify; and their limits are often diffuse within the territory. The need for city centers to be revitalized has drawn attention to how little is known of the process by which centers are generated and sustained. The challenge is to understand centrality as an everchanging process determined by the relationships between activity and movement.

The aim of this paper is to explore a key aspect of centrality: the concept of “live centrality”, which is characterized by the presence of uses such as retail, markets, catering and entertainment, as well as other activities which usually benefit from the movement of people. The case study for the analysis presented here is based on Valdivia, a midsize fluvial city in southern Chile.

The research is based on the process of “movement economy”, using space syntax as method to explore the spatial patterns and activities that exist in the city. A syntactic analysis of Valdivia was performed using *Dephmap*. A GIS platform was then used to perform a spatial analysis of the data gathered. The study explores *how* different spatial configurations are influenced by the process of live centrality and how this plays a critical role in the formation and location of centers, both at a local and city scale. Also, the presence of different activities that define a centrality are identified and measured.

Results indicate that retail activities tend to concentrate around areas of a higher morphological integration. Furthermore, a high correlation is observed between the distribution of these activities and the location of the topological center of the city. Finally, integration analysis demonstrates that the location of the historical city center does not

coincide with the topological center, thus confirming the hypothesis that the expansion of the city is linked to morphological deficiencies of their centrality process.

2. Introduction

Rapid urbanization is placing cities of the global South at the core of the developmental agenda of the twenty-first century (UN-Habitat, 2011). New transportation and distribution systems are changing the scale and flow patterns of the urban agglomerations. Also, the effects of the general application of information and communication technologies in everyday life are barely to overlook. On the other hand, the social contrasts within these agglomerations are growing. Worldwide environmental problems, the necessity for a more efficient use of energy and natural resources as well as a limitation of CO2 emissions mean that we have to make adaptations to our urban structures and building fabric (Atkinson, 2007). These developments have become a fundamental challenge for the discipline of Urbanism, in which urban form and the functionality of the city are therefore a major focus (UN-Habitat, 2013).

The intense transformation process poses both challenges and opportunities for thinking and acting on the future of cities (Zumelzu, 2014). In Latin America, this process has modified and increased the scale of the urban environment by occupying extensive landscapes towards the periphery of urban areas; promoting development models that are driving the city over the edge, namely suburban living and the obsession with the automobile (Atkinson, 2008). On top of that, the current urbanization models generally promote the development of spatial relationships that are detrimental to the environmental and social sustainability of cities. Thus, a physical and morphological deterioration of cities is observed, especially in their central areas.

2.1 The phenomena of centrality as a process

The term "center" applied to settlements is defined as a concentration and mixture of ground uses and activity in a determined locality (Hillier, 1999). However, the concept of urban centrality refers to the capacity of certain spaces or urban elements to articulate flows of every type. The articulation of these flows depends on the degree of influence of these spaces on the rest of the components of the urban system (Sohn and Kim, 2010). The degree of centrality of a space is variable according to its capacity of attraction and articulation of flows. One of the most important aspects on centrality is the collective significance of the space. Construction of spatial significance is established by experience - direct form the urban place and by a valorization of the degree of importance of a space over another (Licnerski, 2005). Loss of collective significance of spaces provokes a decrease of urban centrality. The experience of the modern city has manifested the risk of regulatory process of the space that have pursued among other objectives, the functional separation of the city. The condition of centrality is not permanent, yet it changes and transforms, it discontinues and reconstructs in other forms. This means that centers not only expand or contract, but also the change their location, unfold and diversify (Hillier, 1996). This takes place simultaneously with a process of centrifuge, that is manifested on the urban border (city edge). Both processes, towards the periphery, as well as towards its own center, denote an instance of conflict that threatens the condition of centrality at different levels (Tella, 2007).

Historically, the phenomenon of centrality has been debated as a phenomenon of emergency meaning as an evolutionary and historical process, founding its systems on economic and spatial variables (Krafta, 2008). In urban planning, and under other terms such as accessibility, proximity, cost or effort, the concept of centrality has entered into the scene, being a steppingstone for the idea that some places - or streets - are more important than

others, given that they are more central (Porta et al, 2008; Wilson, 2000). A different redaction - "integration" and "connectivity" - has accompanied a pioneer discussion on centrality for the specific purpose of urban designers.

Hansen, for example suggests that accessibility would be a relevant factor on the formation of centrality (Hansen, 1959). His study *How accessibility shapes land use* shows how urban centrality can occur as a result of comparative location advantages. Better accessibility gives to some places better visibility, better exposure to consumers, and in turn converts them in preferential places for the localization of activities that at the same time depend on these factors.
Sohn and Tella concur that a space acquires a range of centrality when it incorporates at least three functions: social "equipment" institutional, of communications of finances or transportation (Tella, 2007; Sohn and Kim, 2010). Centrality could give birth to a situation of a determined number of positions and interactions of activity or communities, that, along with casual meetings int he public arena, would create a better social interaction as a simple sum of the parts (Barton, 2000). On the other had, if centrality is recognized under certain spatial and functional conditions - described as concentration and diversification of activities in a determined area - appears to explain in a more certain manner that the question of centrality is more of a spatial component, as a model that determines the key component in what is defined as a "process" (Hillier, 1999). In the same study, the author establishes that centrality is not a fixed state, but a "live" process determined by the relationships between activity and movement, consolidated when certain spatial configuration influenced by the determined flows of movement converts an area into an attractor whose different levels of intensity change as a product of continuous spatial-functional processes.

In general, it is understood that centrality is an evolutionary process, founding its systems on economic and spatial variables. But also, it forms part of the urban social-spatial dynamic and in itself is a process in constant modification and transformation. Morphologically, centrality is neither clear, nor stable in its focus or limits.

2.2 Live centrality

A key component of centrality is the concept of "live centrality," understood as an element of centrality which is guided by retail, markets, catering, entertainment and other activities which unusually benefit from the movement (Hillier, 1999; Batty, 2004). Normally, a center would be marked by a "live center" focused on markets and retail, with more tranquil areas of administration, business and religion in close proximate space, defining the limits of the central area. However, spatial processes that restrict live centrality appear to involve requirements above those related to other central functions, such as administration, business or religious offices. For Hillier, the key present in those places that achieve the conversion into live centrality is determined when the spatial component is influenced by an economic process in movement (Hillier, 1996). This is possible to research through the relationships between the spatial and functional dynamics, both intersected by socio-economic activity from each urban society, where the spatial patterns operate at different levels of centrality.

Spatially, the economic process in movement functions on two levels on the generation of a pattern of centrality: on a local level and on a global level. Globally, the process selects locations that have the appropriate degree of integration with respect to the settlement in its conjunction. Locally, places are selected with certain local conditions of the grid. Both aspects of the process are dynamic. As settlements grow, the pattern of global integration Is under probably change, and this creates a spatial pressure for a change in the focus of centrality (Hillier, 1996, 1999). Distinctive patters that interact as factors of models of the economy in movement whose processes create centrality, are influenced by the urban grid, giving place for connected centers that contain commerce and other activities driven by the interaction of flows and relations (Porta et al, 2009). Planners and geographers, that come

from distinctive perspectives, have prioritized commerce as the key measurement of urban vitality and determinant of the position of a center in the urban hierarchy (Vaughan et al, 2010).

The necessity ot revitalize urban centers has demanded attention within the little that is known about the process by which centers are generated and sustained over time (Porta et al, 2006). In morphological terms, the challenge is to understand centrality as a process in constant change, determined by the relationships between activity and movement.

2.3 Research objectives and methods

The objective of this paper is to explore the concept of "live centrality" in the city of Valdivia, an intermediate city of fluvial character located in the south of Chile. The objective lies in the exploration of different spatial configurations that are influenced by the processes of live centrality, and that play a critical role in the formation and location of centers, on a local as well as city scale. The space syntax method is used as a method to explore spatial patters and activities that exist in the city. Also the presence of different activities that define centrality are identified and measured, using *Dephmap* for syntactic analysis and a GIS platform to carry out spatial analysis of the information gathered.

In the Latin American context, especially in Chile, little has been studied about the processes of centrality and their relationship with urban morphology. The discussion of centrality, in general is known in a tangential manner, when it is debated from socioeconomic transformations that recent processes of urban expansion that have been felt by principal cities or metropolitan areas of the macro region. Their patterns define particular urban structures, functionally determined by ground markets that produce disperse and unequal urban structures (Abramo, 2012). The advance of polycentrism, product of expansion of activity and real-estate development, with new sub-centers that are not able to compete with the predominance of the broadened historical centrality whose substance continues being in the economic dimension of the space (Rodriguez, 2012).

As a starting point, the city of Valdivia in southern Chile was selected, evidencing a physical and morphological deterioration, especially in its central space. In this case, the objective is to confirm the hypothesis that demonstrates that peripheral growth and expansion in cities of the Austral south, bring with them other deficiencies, the physical and morphological deterioration of the central space, and thus the processes of centrality.

3. A case study of Valdivia

Valdivia, a fluvial city, is understood under a series of social and economic dynamics that have been marked by natural successes and humanitarian catastrophes in recent history. The period of 1880-1920 can be considered as the period of economic production, when Valdivia was the most important industrial city in the south of Chile, and a motor of an extensive regional economy that depended on it. The arrival of the railroad bolstered dynamism of the commercial movement within the interior of the region (Almonacid, 1995). A fire in 1909, a disaster that brought with it modernization of the urban scheme, as well as the earthquake of 1960, which jettisoned the city into a post-industrialized state, and configures a new urban morphology to which the city must adapt (Guarda, 2001). Planning and design throughout these successions have not been spontaneous, and the population dynamic has been paused since the large industrial complexes at the beginning of the century. Emergency situations to higher areas after the earthquake of 60 - *Process of Industrial Decadence* - until the peripheral expansion, developing a series of environmental problems in the present day.

3.1 ***Syntactic analysis***

Primary analysis focuses on the historical evolution of the Valdivia center, to examine its structure over time. Analysis of integration (Figures 1a and 1b), confirm that the urban center of Valdivia has suffered a process of constant modification and transformation, as a product of spatial, economic and catastrophic factors.
Topologically, in the year 1905, the integration levels (Rn) are high in a large part of the city, principally because of its compact nature of the urban structure. Centrality is concentrated on the interior of the urban grid, defined by its morphological limits, principally the longest segments; Cochrane Street toward the south and Picarte to the East.
The city experienced an important variation in 1909, date of the largest fire that Valdivia has suffered in its history, and a large part of the central area was consumed by the fire. In this manner, from the beginning of 1910, Parliament approved an urban transformation law in Valdivia. A new plan was designed for the affected are, that regulated the placing of the streets, their width and the river accesses. Some streets and alleys were eliminated, others were extended. Thus in 1920, the highest levels of global integration coincide with the original center of the city, principally in the streets General Lagos and Picarte, the latter with the arrival of the Railroad industry and the southern expansion of the working class. In 1945 the city remained integrated because of its compact grid, in which high levels of integration expanded towards the peripheral rings of the city, the streets Baquedano and Santiago Bueras. This was do to public infrastructure projects such as the hospital, military regimen, and the implementation of social dwellings at the southeast as a solution to "*conventillos*" (Figure 1a).

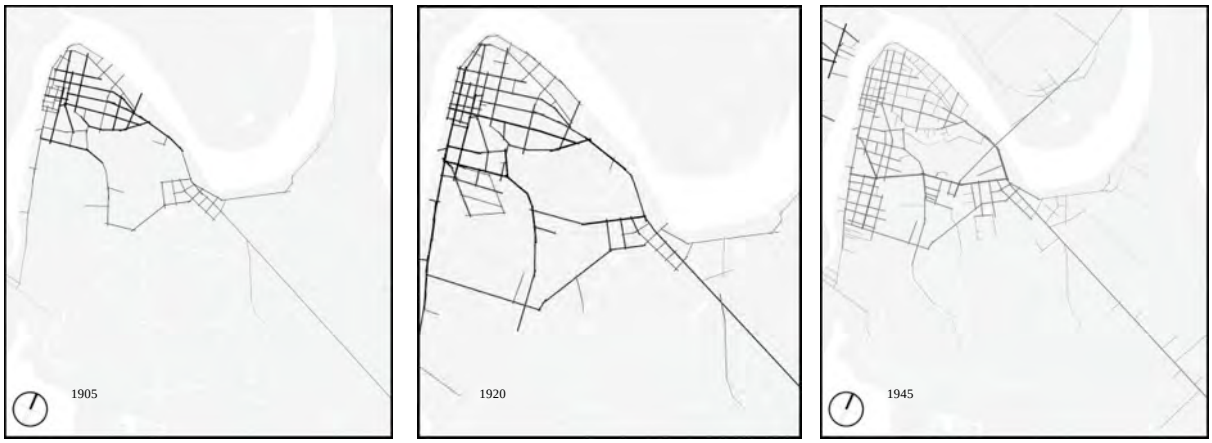


Figure 1a: Evolution of the axial map of Valdivia 1905-1945.

The earthquake of 1960 was the pinnacle of the decline of the industrial economy of the city. Valdivia's urban morphology was reconfigured to the point that the city had to adapt to the land that was available. Hence, the highest levels of global integration unfolded toward the eastern sector of the city, configuring in this place the topological centrality, because of urban expansion toward sectors with higher elevation within the city- the southeast sector.

Unfolding of topological center toward Picarte Street in 1979; the level of integration of Picarte Street is due to the formation of the Pablo Neruda neighborhood, as a post-earthquake emergency settlement. This consolidated the higher sectors of the city due to the new configuration of the landscape with the appearance of marshlands in the lower sectors (Figure 1b). Around 1995, Picarte is consolidated as the most integrated on a global level, before the inclusion of new commercial poles. The topological center unfolds from the historical center progressively toward Picarte.



Figure 1b: Evolution of the axial map of Valdivia 1960 y 1995.

Currently, the city of Valdivia is affected by urban expansion. Real-estate projects and land reservation tend to consolidate areas of high growth, provoking the conformation of suburbs in the southern and eastern zones, generating a demographic expansion and loss of the compact city oriented around the rivers, as it was before. Using a radius *n* (Rn) the distribution of global integration on the axial map of Valdivia is shown in Figure 2. The map shows the distribution of the global integration in the total system of the city wit the street of best integration, Picarte Avenue, along the eastern length of the city. This shows that Valdivia expands from the urban center toward the southeast of the city, being the area with best integration in the city. On the other hand, this approximation establishes that the historical center of Valdivia - the cognitive centrality- does not coincide with the areas of better global integration - topological centrality. There exists a spreading of the topological centrality of the city toward the southeast. Figure 2 also shows the urban units of both the south and the northeast of the city are the areas with highest segregation. These areas are of residential character, with the majority of its land use destined to housing and void of other functions such as local commerce, recreation and services.

In contrast, on a global level, highlighted are the lines of highest integration of Picarte in a darker color. As can be seen in Figure 2, for potential centers are systematically distinctive, standing out due to their better integration along Picarte - from north to south: the intersections with Baquedano, Simpson, Francia and finally, Ruben Dario.

As a conclusion, Picarte Avenue is the principal via of development of the city, not only because of its relevance in historical evolution, but also because of being the main place of movement in the city, connecting the historical center wit the southeast sector of the city. This indicates the reason why Picarte is the point having the best global integration; Valdivia does not present concentric growth, but expansive unidirectional growth that is determined by its geographic limits. This means that the rest of its grid is disconnected, with urban structures that tend to show fragmented growth.



Figure 2: Valdivia current situation. Integration map with radius n, integration of lines shown from dark to light.

An important analysis about the dynamics and patterns of movement within the city can been seen in the total circulation of origin and destination of the automobiles, being the urban center the highest affluence of all the sectors in the city. The urban center of Valdivia has importance of historical and cognitive nature. This is part of the city that holds the largest quantity of offices, administration, and retail that in other parts of the city do not exist. This means that it is only a receptor of floating dynamics.

The following stage looks to identify in Picarte - avenue with the best integration of the total system - and the urban center of Valdivia - historical cognitive center - concentrations of activities or live centers. This field study was carried out first, determining where along the principal line occur the principal concentrations of activity. The next step is to determine if these these segments of better global integration - localized on Picarte - possess the characteristics of live centers, as established in the literature

4. Identification of Live centers

A heuristic approximation was done to identify the existence of activities that determine the formation of live centers. The GIS platform was used for spatial analysis and collection of information. In the first part of the field study, 1110 activities were identified distributed in the historical center of Valdivia and along and around Picarte Avenue. These activities were types of commerce, markets, catering and entertainment, that defined the conformation of a live center. Figure 3 illustrates an axial map - global integration - that shows the 1110

activities identified, and their type situated by points. These points varying the scale from one store.

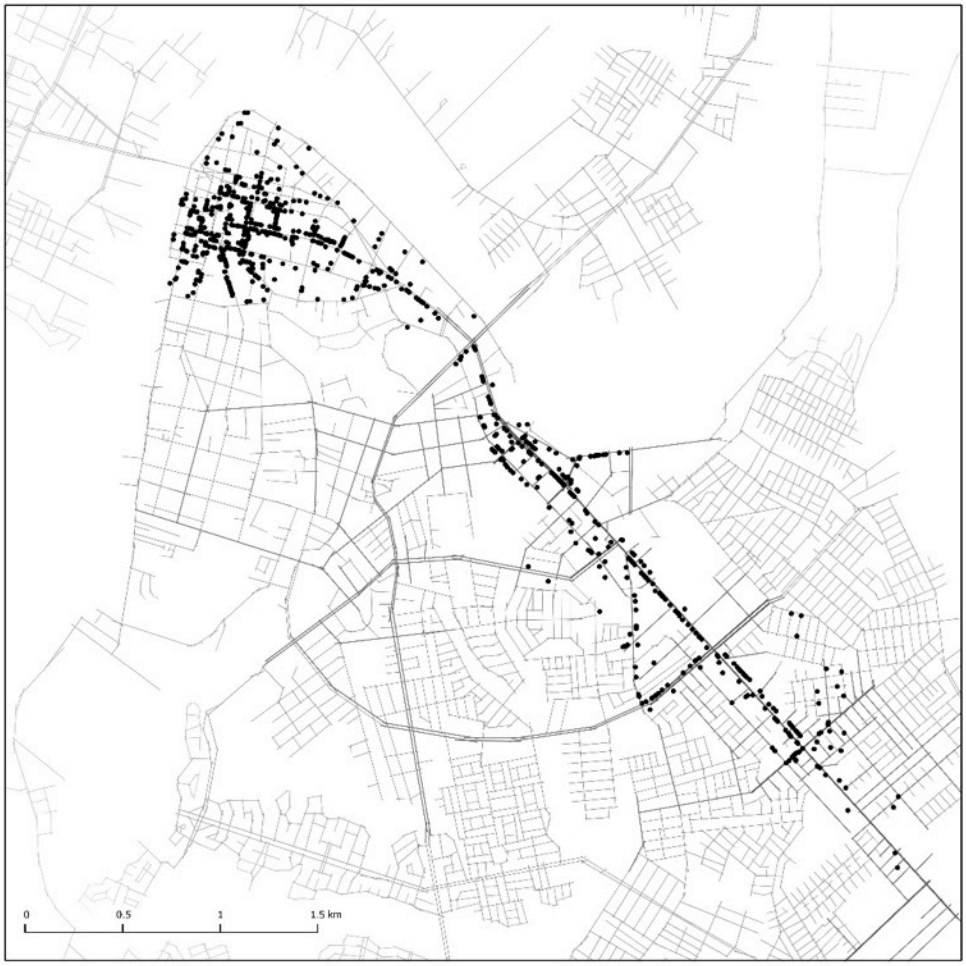


Figure 3: Location of shops and activities along Picarte Street and historical city-center on the field study..

In Figure 4 two groups of activity zones are identified: the historical center, and Picarte Avenue. The historical center is composed of a convex grouping of its activities, while on Picarte, the activities are organized linearly, in a disperse manner from northeast to southeast. The majority of the activities are focused on the historical center of the city, with a total of 814, in which small retail predominates. On Picarte, 296 activities exist, of a commercial tendency. Figure 4 shows four graphs illustrating the identified activities, organized according to the types that determine the formation of a live center.

On the Graph *a* it is possible to appreciate that in both zones there exists a great presence of activities of a commercial nature, yet there exists an important imbalance with the distribution of catering activities, entertainment and markets that are principally concentrated in the historical center, as is shown in the graphs *b, c,* and d, respectively. Thus, on Picarte Avenue - which has the best global integration - there is an almost exclusive tendency for retail, and little variety of other activities.

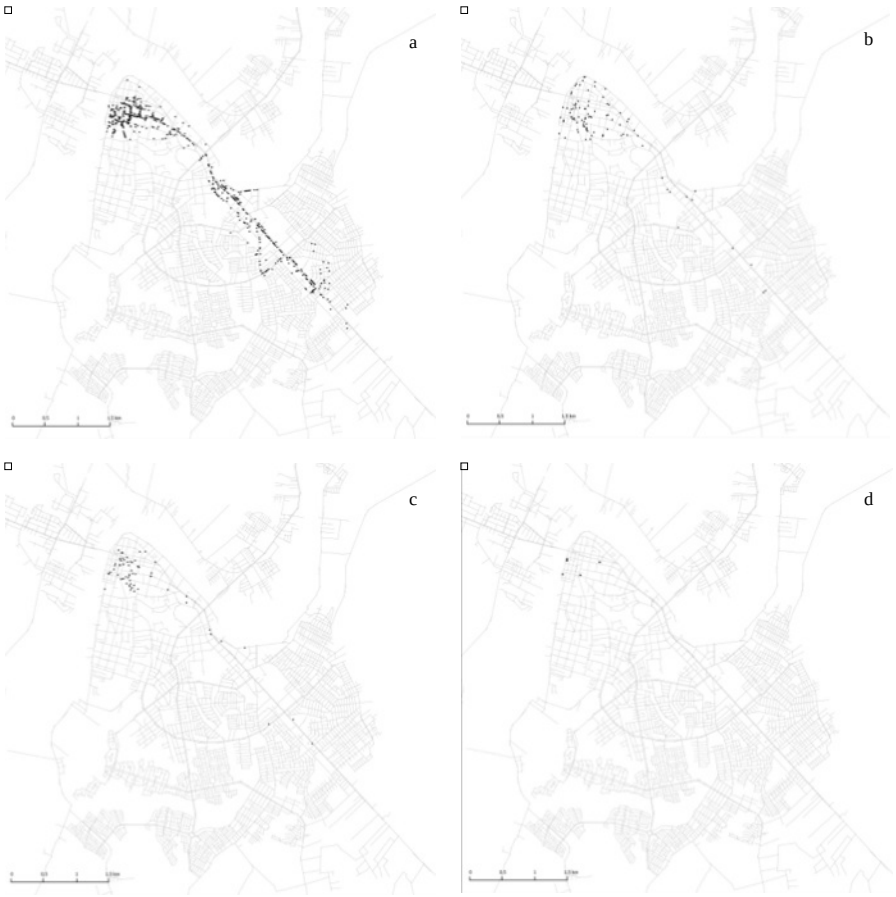


Figure 4: Concentration of activities by types along two-zones idenfified: a) retail; b)catering; c) entertainment; d) markets.

This leads to the understanding that the historical center of the city is still the center of all activity, not only quantitatively - in relation to the quantity of activities present - but also in relationship to the variety of activities that take place. The variety and quantity of activities identified in the historical center determine the localization of the predominant live center. Sintactically, the conditions that Picarte exhibits are favorable for the development of vital centrality: it is the principal arterial of movement, urban as well as intra-urban. It is also the principal access to Valdivia and is the segment that has a value of global integration of 0.983, being the highest in the total system. However, it presents retail of little variety, grouped linearly along the street, being a center with scarce activities and little vitality.

According to the literature, the location of live centers is given because of their position - of better integration - within the total system and because of the conditions of the local grid (Hillier, 1999; Kafta, 2008, Read, 1999; Porta et al, 2009). Notwithstanding, in spite of the unfolding of the topological center toward Picarte, it does not occur with its live center. The conditions of the local grid tend to be the key variable associated with degrees of local centrality. For this, further on a comparative analysis of both central zones is carried out, the historical and Picarte topological centers, to understand how these activities behave within the grid, and which morphological factors are favorable for the development of a live center.

5. Transect analysis

Previous studies demonstrate that the pattern of global integration in Valdivia changed radically due to the growth of the city during the last 50 years. This generated alterations in the global structure of the historical center that died not modify or change the localization of

centrality or an unfolding of the activities that determine its vitality. The transect analysis focuses on analysis of the conditions of the local grid, in order to determine if there exist morphological factors that have any relation with the conformation of live centers. This method permits a qualitative analysis of the local grid, to see if it has suffered changes, appreciating its different areas that conform and characterize it. In this case, two zones are comparatively explored, the historical center and Picarte Avenue, Camilo Henriquez y Picarte, respectively. Figure 5 is a Transect of Valdivia focused on the two areas of study, taking the entire route from the center Ch until the end of Picarte, northeast to southeast with a depth of three steps (R3) required to complete the grid.



Figure 5: Transect analysis of Picarte (Pi) and Valdivia historical center (Ch) - grid pattern created by three deep steps away from Ch through and until the end of Pi route.

On a large scale, the transect shows the local grid of Ch is much more complete in comparision with Pi, as well as the depth and density of the grid of Ch is higher than that of Pi, with a larger quantity of lines and reach. This is principally due to that the configuration of Pi is linear, elongated and fractured.

5.1 ***Historical center (Ch)***

Ch is recognized as a space with high local integration. Its urban grid with othogonal character is based on parallel and perpendicular streets that form a rectangle or "*Damero*", originating from the colonial city. Also, the grill offers small, geometrically clear blocks, which form rings of local circulation, favoring movement and connectivity. This is necessary for the

development of centers and economies in movement. The urban grid from Ch possesses favorable conditions for the creation of live centers.

For example, on a local scale, the segments with the best integration are the avenues of Arauco, Camilo Henriquez, Perez Rosales and O' HIggins. Arauco is an actively commercial street that coincides with being the principal integrator from Ch at a local level with 3,23. Essentially, tis street is related to small retail business with small shops and galleries. In the intersections with Perez Rosales and Esmeralda, the presence of some large stores as well as the presence of a commercial center and restaurants could indicate the formation or emergence of a live center, especially on the intersection with Beaucheff. This is where the largest commercial center of the city is located, along with a high school and supermarket (Figure 6).



Figure 6: Live center formed at Arauco Street.

On the other hand, small and large businesses which mainly depend on pedestrian traffic, tend to concentrate in inside the center of Ch, especially in segments of higher local interaction. For example on the intersection of the avenues Camilo Henriquez and Picarte, as well as that of O'Higgins and Perez Rosales, the majority of the commercial activity is concentrated (retail) and mostly on a small scale. Also there are cafes and restaurants inserted between mixed buildings of offices and apartments. These are places of strong interaction of flows, such as the Plaza de la Republica, where important civic an religious events take place.

5.2 ***The topological Centre of Picarte (Pi)***

The spatial structure of Picarte extends in one linear direct, from northeast to southeast, cutting through the entire city and being the topological center for the total Valdivia system. The topological center of Pi does not coincide with the historical center and this is essential due to the growth in expansion of housing caused by natural disasters, especially the tsunami of 1960, as well as real-estate expansion in the 80s and 90s. Despite the fact that Picarte is the principal integrator in the city, at a local level it presents deficiencies that are shown in its urban grid.

As is shown in Figure 5, the transect shows a continuous axis long the route of Pi, in which it appears to be a local segregating line between the outer northern and southern sectors, being axially disconnected with the annexed neighborhoods. At a local level, the urban grid presents conditions that do not favor the conditions for the development of a live center. It presents a local grid that is incomplete in both the north and the south, with irregular lines

associated to a fragmentation of its blocks. At the same time, toward the southern sector, blocks are seen that are much too large, hindering circulation and local connectivity. The conditions of fractured urban grid and disintegration with Pi is principally explained by the rapid expansive growth that the city has experienced towards the southeast, away from the River. Taking the role as principal intra-urban access, it is converted to a freeway within the city.

The largest part of the activities on Pi are linearly grouped along the axis. Examples of these activities are homes with small shops and other service providers, located along the topological center, showing a higher density between the avenues Pedro Montt and Simpson, where the organization lightly changes from linear to convex. This is because the local grid is slightly more integrated given the complete geometry of the blocks, especially on the north side. These streets possess integration values that are high on a local level, despite having low connectivity with Picarte.



Figure 7: Example of major retail activities take place along Pi, with closeness to Pedro montt (left) and Simpson streets (right)

In contrast, small businesses of mechanic shops, construction materials and auto parts stores are situated in an embryonic formation of commerce and specialized service along the axis of expansion closure to the southeast periphery of the topological center, at the intersection with Circunvalación Sur, where the urban grid of the outer neighborhoods is fractured and disconnected (Figure 8).

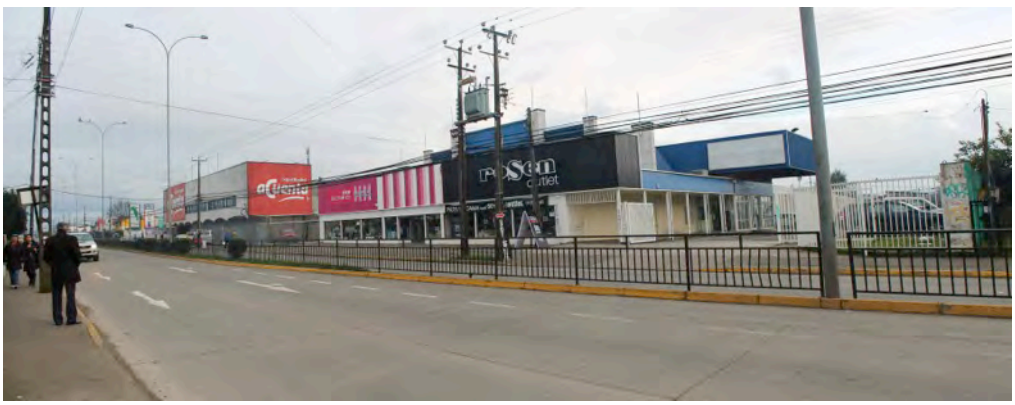


Figure 8: Example of activities established in the outskirts of Picarte topological center.

6. Conclusions and results

This article examines an approximation about how different spatial configurations pay a determining role for the location and formation of live centers, in fluvial cites of Latin America, taking Valdivia as a case study. In contrast to what occurs in cities in central Europe, namely in the UK, where the global integration of the total system is important for the localization of live centers (Hillier, 1999). Valdivia shows the pattern of global integration that he city radically changes due to the unidirectional expansive grown towards the southeast of the city, not coinciding with the historical center. This unfolding is defined by geographic characteristics of the city, as well as the result of historical catastrophic events. In other words, the river is perceived as a geographic limit that, after the tsunami of 1960, caused that the city did not continue developing around its river, orienting development towards the southeast, which are are parts of the city with higher elevation. Residential and real-estate growth lead this type of development, also corroborating the hypothesis with respect to the differences of the centrality processes are related to the processes of expansion of the city.

Results indicate that principally the activities of minor retail tend to concentrate in segments with better local integration values. The unfolding of the topological center of Valdivia generated alterations in the global structure of the historical center that did not modify or change the location of the focus of vital centrality or an unfolding of activities. The Historical center continued being the vital center due to its excellence, in which the morphological conditions of its urban grid have a determining role, especially with the diversity of activities that tend to concentrate in segments of better local integration. A different case is true with the topological center Picarte (Pi), that does not possess the conditions to generate urban vitality, principally because of the characteristics of its local grid. The expansive growth generates the condition that its urban grid at local level is disconnected and irregular, localizing its activities linearly about the avenue. However a light density and diversity of activities in better integrated local zones of Pi, where the local grid is presented with better layout that favors movement and connectivity.

These results suggest that in cities with fluvial character, the processes of formation of live centers and diversity of activities are conditioned by patterns of local integration. This contribution suggests more research to determine if these conditions are similar in other cities with geography related to maritime or fluvial ports, where the processes of growth tend to have different forms. This is especially true in Chilean cities that have ties to water, such as the case with Valparaiso, Talcahuano or Puerto Montt.

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Track 2: Social Aspects, Collaborations and Governance

50th ISOCARP Congress Proceedings



Reclaiming the River: Politics of Planning in Calcutta's Post-industrial Restructuring

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Synopsis
Looking through the prism of spatial reconfiguration of the extended Calcutta metropolitan belt, due to economic restructuring, this paper brings out the complexities of riverfront development in a globalising city of the Global South. Economic revival of the city after the decline of industrial manufacturing activities is facing road blocks due to land scarcity. But entrenched political interests are coming in the way of the city augmenting land supply for new investments in service sector, by recycling derelict 19th century riverfront industrial sites. An ambitious riverfront redevelopment program is turning into a token beautification exercise.

1. Introduction

Our understanding of the processes of waterfront development are to a considerable extent shaped by narratives from the Global North, where the past three decades had seen large scale transformation of nineteenth century factories, warehouse, railway yards and ports to retail, recreational and residential and commercial land uses, through the rubrics of urban revitalisation and guided by the sustainable compact urban form. Production spaces of the industrial era have given way to consumption spaces of the creative economy era. There is however, a dearth of research on reuse of old industrial sites of the nineteenth century colonial port-cum-industrial cities of the Global South

Looking through the prism of spatial reconfiguration of the extended Calcutta metropolitan belt, due to economic restructuring, this paper brings out the complexities of brownfield urban regeneration and in a globalising city of the Global South, due to the socio-economic realities of poverty and population. Calcutta was a major port – cum industrial city in the age of colonial mercantile capitalism and continued to remain India's leading city until the mid-1960s. The manufacturing sector, which mainly consisted of jute mills and heavy engineering industries, developed along the banks of the River Ganges (Hooghly) and the railway corridors along a north-south linear axis. However, the region's economy declined sharply from the late-1960s, due to socio-political turbulences, leading to flight of capital and middleclass brain drain.

Nevertheless, Calcutta still continues to be a mega-city of 14 million, the capital of the state of West Bengal, the leading urban centre of eastern India and of late, trying for an economic turnaround through skill oriented service sector jobs, such as Information Technology (IT) oriented back office works, speciality medical services and cultural tourism. Economic transformation from a declining industrial manufacturing to an emerging tertiary sector, is leading to a spatial reconfiguration of the Calcutta metropolitan region from its long established linear urban form towards a multi-polar structure. The economic gravity of the city is shifting away from the central core to the outer periphery and is generating new claims and conflicts over conversion of peri-urban agricultural land to urban usage. Land use changes compel rural agrarian communities to reorient their livelihood strategies – for which they are ill prepared.

The land conflicts played the most decisive role in the defeat of the Communist Party led state government of West Bengal in 2011, after 34 years in power. To avoid the need of new greenfield sites for economic growth, the new government is emphasising on reuse of the old industrial sites and initiated an ambitious riverfront redevelopment programme through British technical help – but faces major obstacles from entrenched interests. Through analysis of Calcutta's spatial restructuring, this paper brings out the complexities and contradictions which mark the city's planning culture.

2. Morphology of the Calcutta metropolitan region

Calcutta (Kolkata now) grew steadily in economic and political importance with the expansion of British colonial power from Bengal to the rest of the Indian sub-continent, to emerge by the 19th century as the capital of a vast empire and the preeminent port of Asia. The city's economic rise was closely associated with its becoming the dominant node in the colonial trade route linking distant forelands in Europe with China and southeast Asia, while at the same time acting as the gateway to a natural resource (e.g. jute, tea, coal, iron) rich hinterland of the northern India through an elaborate rail, river and road network (Tan 2007). Spread of English language and ideas led to formation of a large western educated middle class and a vibrant civil society in the city which subsequently led to nationalist political movements (Dasgupta, S 2007). Although the capital of British India was shifted to Delhi in 1912, Calcutta continued to grow commercially till mid 1960s (Goswami 1989; Raychaudhuri & Basu 2007).

The extended metropolitan region of Calcutta includes three 3 municipal corporations (Calcutta, Howrah and Chandannagar), 38 municipal councils, and 22 Panchayet Samitis (Rural Councils) in an area of 1851 sq.km (KMDA 2007) and has 14.1 million population (Census 2011). It is oriented along a north-south longitudinal axis with the River Ganges running through the middle. The Calcutta Municipal Corporation (CMC) area (as shown in Figure 1), which forms the nucleus of this agglomeration has a population of 4.5 million (Census 2011).

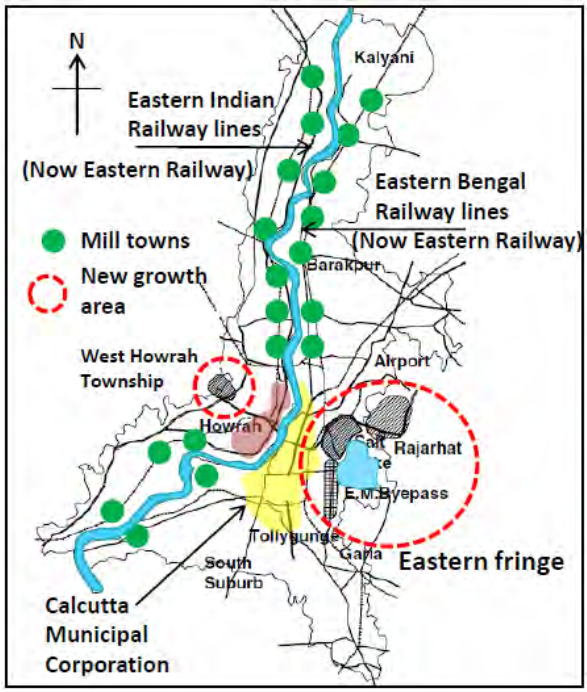


Figure 1 Calcutta Urban Agglomeration

The morphological structure of the CBD area, within the CMC boundary, bears much resemblance with the industrial port cities of Northern America and Europe (Kosambi & Brush 1988). Docks and warehouses along the river were located in close proximity to the trading houses and stock exchange. These crucial edifices of mercantile urbanism, along with the courts and offices at Dalhousie Square, European living quarters of Chowringhee-Park Street and military garrison at the Fort William, formed the colonial urban core, flanked by Indian settlements at north and south(King 1976). The city essentially grew in a longitudinal axis, hemmed in by marshy swamps and wetlands to the east and River Hooghly to the west (Dasgupta, K 2007).

With the port as the nucleus, an industrial complex started forming around Calcutta from the 1850s. Jute mills, were located in small towns sides of the river, to facilitate transportation of raw jute bales by tug boats from riverine regions eastern (Goswami 1989). Railway lines, which were also simultaneously laid in the 1850s parallel to the river, connected the mill towns to two major railheads (Sealdah Station and Howrah Station) located at the eastern and western flanks of the metro core.

Developed railway infrastructure of the suburban mill towns, availability of skilled labour force and proximity to banking, financial and administrative facilities of Calcutta, contributed to further growth in industrial manufacturing , between 1920s and 1950s, especially in areas of heavy mechanical and electrical industries (Such as rail wagon, ship building, motor cars, transformers etc.). Growth in heavy engineering industries in-turn led to formation of a large cluster of small scale ancillary workshops. However apart from the transportation network, rest of the city however grew in a haphazard unplanned manner.

3. Economic restructuring

Until the 1950s, Calcutta was still India's leading city. But the economy of Calcutta declined sharply by the 1970s due to several tumultuous socio-political events: loss of the jute producing hinterland of east Bengal (now Bangladesh) due to partition of India in 1947; national government's policies of balancing regional development which deprived the city of its locational advantages in engineering industries; and finally radical leftist insurgency, industrial unrests and militant trade unionism (Chatterjee 1990; Raychaudhuri & Basu 2007). Closing down of the big industries in-turn impacted the elaborate supply chain network of small-scale industries. To compound the economic woes, the port also declined by 1960s due to heavy silting in the river and forced shifting of the major functions to the newly developed satellite port of Haldia further downstream. As a result, economy of the industrial towns, along the banks of the river, went into terminal decline.

The woes of industrial decline at Calcutta's suburban belt was further compounded by unemployment of the educated youth due to shrinking opportunities in the office and financial services sector in Calcutta's metropolitan core. As the political and economic nerve centre of India for well over two centuries, the city developed a large educated service class population base in the city. The head offices of the companies which owned tea gardens, collieries and jute mills in distant parts of eastern India or manufacturing industries in the suburban belt were also centralised in Calcutta (Goswami 1989).

However, this formidable office services economy substantially declined in the 1980s due to anti-business attitude of the state government. The Left Front coalition, which came to power in the state of West Bengal in 1977 and remained so until 2011 mainly focussed its energies on rural areas of the state and neglected the infrastructure needs of its prime urban centre. Calcutta and its industrial periphery suffered long power outages and transportation delays due to congested road and rail networks. Moreover, during the 1980s, when computerisation of banks and offices started growing in India due to liberalisation of import regulations by the

national government, the Left Front government in West Bengal not only opposed the move but also tacitly supported the labour unions in organising protests (Sen 2009). As a result, the corporate firms began to move away to other states and Calcutta started to suffer middle class brain drain.

However, the Left Front began changing direction from the mid-1990s. A New Economic Policy encouraging private investments was announced in 1994. The IT sector was identified as a priority area – which could create employment opportunities for the large educated urban middleclass (Shaw & Satish 2007). To boost investor confidence, the IT sector was designated as a critical infrastructure – a safeguard against industrial strikes, thus marking a complete turnaround of the earlier policy of discouraging computerisation.

While this policy about turn did not did bring in resurgence in industrial manufacturing, but service sector activities, such as software development healthcare, retail and real estate registered quick growth. Growth of the export oriented BPO (business process outsourcing) sector is particularly noteworthy. Calcutta's cheaper real-estate compared to Bangalore, Delhi and Mumbai; availability of a large human resource talent pool and strong governmental support attracted several international and Indian IT-BPO companies to open offices in the city.

4. Post-industrial spatial reorientation

Decline of industrial manufacturing and growth in IT and allied export oriented service sector has majorly contributed to a reorientation of Calcutta's spatial structure, from a linear axis along the river to a more polycentric one. Departing from the long established rail transit oriented linear urban structure, of the extended urban agglomeration, Calcutta Metropolitan Development Authority's (CMDA) Perspective Plan (1976) and the subsequent Traffic and Transportation Plan (2001-25), adopted a poly-centric urban form, envisioning suburban growth centres around the metropolitan core (Dasgupta, K 2007). Although, in reality, much of the growth has been at the eastern fringe, directly abutting the urban core, which from the 1990s onwards has become the locus of the city's economic gravity, From 1990s onwards, the Calcutta's economic gravity has shifted towards the ecologically vulnerable eastern periphery.

This spatial reorientation programme ran against the spirit of the Basic Development Plan (BDP), which was undertaken in the early 1960s to arrest the decay of Calcutta, with technical assistance from the Ford Foundation (Banerjee & Chakravorty 1994). Taking into consideration Calcutta's role as *the* primate city of eastern India, the BDP (1965-85) adopted a two stage framework. At a macro-regional level, it proposed establishment of alternative urban-industrial growth poles within West Bengal (Bagchi 1987). At a metropolitan regional scale, the BDP advocated a bipolar spatial structure to decongest Calcutta, by developing a satellite township about 45km upstream along the river Ganges and suggested a comprehensive urban renewal plan for Calcutta's decaying industrial belt. However, political uncertainties in the late-1960s came in the way of implementing many of the suggestions of the BDP (Bagchi 1987; Banerjee & Chakravorty 1994).

The eastward surge of Calcutta began with the launching of the Salt Lake township project in the 1960s, which after two decades turned into a prime up-scale suburb (Dasgupta, K 2007).Construction of the Eastern Metropolitan By-Pass road in the 1980s and development of the Rajarhat Township (since 1998) have further augmented the eastward thrust. Proximity to the airport attracted the IT-BPO companies to locate in this area. West Bengal government under different political regimes encouraged this spatial reorientation: by relocating several government departments from the historic urban core (of Dalhousie Square – Esplanade area) and by facilitating development of high impact projects like IT

business parks, convention centres, luxury hotels, shopping malls and gated housing along the Eastern Metropolitan Bypass; and Rajarhat township.

While new economic opportunities have to a certain extent improved Calcutta's economic conditions and have created new job opportunities for the educated middleclass, the eastwards growth has became hugely controversial on two critical issues.

First, with the growth of the IT services and other high value investments in the eastern fringe, land around the Eastern By-Pass road, including the East Calcutta Wetlands (a large stretch of wetland protected under the Ramser Convention) has become the prime destination for speculative real estate and illegal construction activities. Petty developers in connivance with local politicians are encouraging land filling of fisheries, salt marshes and low lying paddy fields, jeopardising vulnerable ecosystems of the wetlands and the livelihood of the peri-urban fishermen and peasants.

Second, livelihood vulnerabilities of the peri-urban agrarian population and consequent land conflicts have impacted the growth prospects of the flagship Rajarhat project. The rural people whose lands were acquired by the government, to build the township started agitating from 2008 onwards, demanding greater compensation (Times of India 2011), Similar protests also erupted elsewhere in the state, as the Left Front government attempted to step-up industrialisation by acquiring farmlands through governmental machinery. The farmers felt monitory compensation, especially at the governmental rate, as a poor substitute against the livelihood security, which land holdings provide.

The rural discontents were effectively mobilised by the state's main opposition party TMC (Trinamool Congress) to expand its support base and finally defeat the incumbent Leftist coalition in the West Bengal state assembly election of 2011. After coming to power, the TMC Government has stopped further land acquisition in Rajarhat area (and elsewhere in the state) in accordance with the party's electoral manifesto through state machinery and favoured a market led approach. Investors and the corporate chambers however feel that it is practically impossible to assemble large chunks of land (required to set up high quality IT business parks or other industries) without governmental intervention, due to extreme fragmentation of the land market – the reason behind which could be attributed to the land reform movement launched by the Left Front regime in the 1970s and 1980s.

The land conflicts since 2008 impacted new investments flows to the flagship IT clusters at the eastern fringe, dimmed job opportunities of the urban middleclass – and prospects for Calcutta's economic turnaround have become questionable.

5. Reclaiming the River

At a time when eastward growth prospects of Calcutta through acquisition of agricultural land have created conflicts, paradoxically vast stretches of land are lying in disuse in the old industrial townships at the northern and the southern fringe of the city. A report prepared by Webcon, a state government undertaking, estimated that 347 closed industrial units are together in possession of over 42,000 acres of land between them (Livemint 2010)– that is nearly five times larger than the Rajarhat Township. This section discusses the factors behind this paradoxical scenario.

Unlike the Left Front, which remained in power for 34 years, on the strength of its rural support base, TMC essentially grew out of Calcutta and its depressed industrial periphery. Although championing of the rural discontents over the Left Front's land acquisition policy, finally allowed it to win the assembly election in 2011, Calcutta's urban electorate is important to the party.

The TMC electoral agenda for the 2011 West Bengal Assembly election declared its intent of bench marking “Kolkata (Calcutta) with the best cities of the world. Why should Kolkata not be comparable to London?” (AITC 2011 pp. 49). The fanciful London metaphor was clearly aimed at a broad section of the Calcutta’s middleclass for whom, the sepia tinted imageries of colonial Calcutta, which was often, referred as the ‘second city of the Empire’ has strong emotional resonance. On coming to power the TMC government announced a number of steps for Calcutta’s economic and physical renewal, to realise the ‘London dreams’ - at the crux of which lies the project to redevelop the Ganges Riverfront.

River Ganges is considered holy by the Hindus and several community rituals are closely associated with it. Therefore, spatial characteristics along the banks and visual imageries of Calcutta’s riverscape include an eclectic mix of spiritual and utilitarian. Over the years though, the connection between the city and the river had thinned and accessibility reduced. Between the 1980s and 1990s, a passenger rail line (part of the Circular Rail network) was laid along the thin strip of land between the river and the Strand Road to ease commuter movement between the CBD and the suburbs. But railway tracks also created a formidable physical barrier between the river and the city (See Figure 2). A long distance bus parking lot (along with several of cheap eateries) also came up in this area in a unplanned manner, which sharply contributed to the environmental degradation and rise of anti-social activities. As a result, Ganges Riverfront, the main public space of the city in the 19th and early 20th century, almost disappeared from the mind space of the average middleclass citizen – even though thousands of people cross the river daily on ferries as part of their daily commute (Mitra 2012).



Figure 2: The Millennium Park and its surroundings

There had been a few sporadic and small scale attempts in the past, to develop the river banks – of which development of the Millennium Park abutting the Dalhousie Square CBD area in 2001 is the most significant. It is a 2.5 km long narrow (less than 50m) strip of recreational green space, sandwiched between the tracks of the Circular Railway and the edge of the river (See Figure 2). Apart from these small scale interventions, the Left Front coalition neither made any concrete plan for the concerted development of the Riverfront area, nor did it pursue the issue with the central government agencies - the Port Trust, the Railways and the Defence Department - which owns most of the land along the river.

In this scenario, announcement of the redevelopment project by the Chief Minister of the state herself, suddenly rekindled much public interest. The keen personal interest of the Chief Minister and TMC’s participation in the coalition government at the national level

helped to kick start the project and overcame the institutional obstacles regarding coordination between State and Central government agencies. A coordinating mechanism was established, under the stewardship of the Calcutta Municipal Corporation, comprising representatives of these central agencies and other institutional stakeholders. The state government also appointed a consulting company to develop a comprehensive Master Plan for the riverfront within the CMC area and a small stretch opposite the Howrah Station area on the west bank (as shown in Figure 3).

Within the administrative limits of the CMC, the riverfront stretches for 17km and could be subdivided into four zones (Mitra 2012) as shown in Figure 2:

- Zone 1: Docklands to the south
- Zone 2: The Strand or public promenade having formal landscaping and colonial architectural character (roughly corresponding to southern part of the CBD)
- Zone 3: Warehouses along the Strand Road up to the Howrah Bridge approach (roughly corresponding to the northern part of the CBD) and the Millennium Park.
- Zone 4: Public space associated with traditional and cultural usage, such as bathing *ghats* (long stretch of steps and semi-enclosed pavilions), shrines, and cremation grounds at the northern part of the city. Thirty-three out of the forty-three bathing *ghats* of the city are located in this zone.

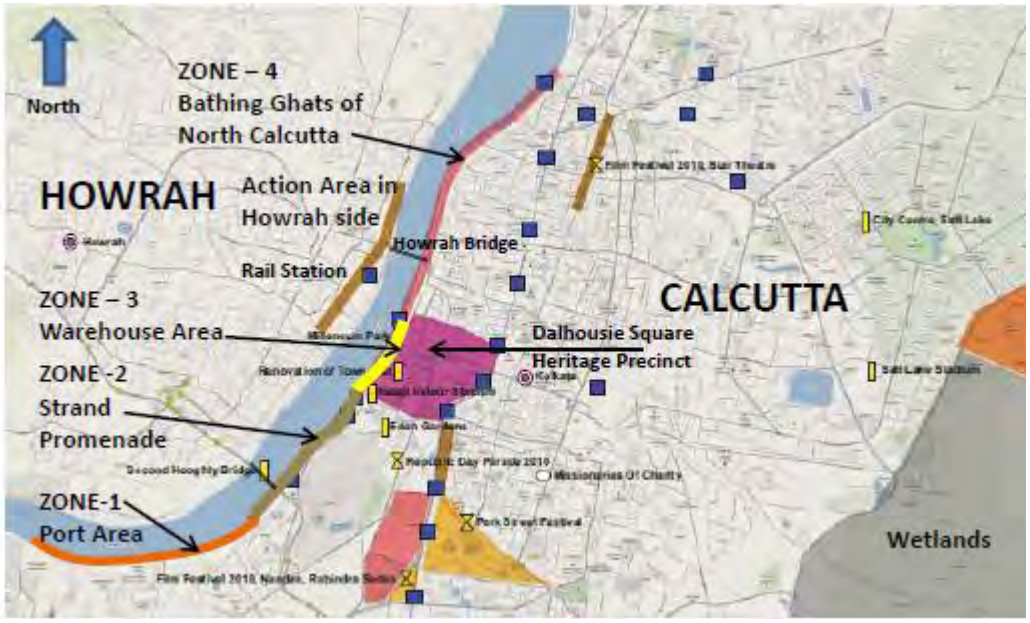


Figure 3: Calcutta Riverfront Project Area

Until now the focus of the riverfront project is restricted to improving the existing public space in Zone 2 and Zone 3, lying between two iconic bridges which connect Calcutta and Howrah. There is no plan yet for adoptive reuse of the port area, rail yards or the unused warehouses abutting the Dalhousie Square – due to problems of coordination between the state government and the national government.

The most significant improvement had taken place at Baje Kadamtala Ghat, which is the main site for immersion of idols after Hindu religious functions. The area has been widened

up to improve public access and new public facilities have been put in place. Apart from this, the colonial Strand promenade stretching from the Princep Ghat at the south to the Eden Gardens Rail Station abutting Dalhousie Square – have been beautified. Small colonial era structures, such as Gwalior Monument and Princep Ghat, which had fallen to disrepair, have been restored (See Figure 4). The high point of this initiative is the installation of a giant Ferris wheel or Kolkata Eye, mimicking the London Eye. As Mitra argues "In the minds of those responsible for the redevelopment, the planned image of Kolkata is to simulate London and therefore the accepted image of Ganga must be river Thames"(Mitra 2012 p. 70).



Figure 4: Princep Ghat after restoration and second (or new) Howrah Bridge

Yet beyond the token beautification measures, till now there are neither any attempt to improve pedestrian connectivity between the Riverfront and the CBD area by building underpasses or overbridge over the rail tracks; nor are their any time bound measures to improve the environmental quality of the surrounding areas. In response to a Public Interest Litigation filed by environmental activists, the Calcutta High Court has ordered the state government to relocate the long distance bus parking and remove the food stalls. But action on that front is still pending. Local architects, planners and environmental activists suggest that the political leadership is unwilling to take hard decisions and relocate encroachers and polluters from the area, fearing political backlash. The vision of the political leadership is restricted to the next electoral cycle after five years.

As a result, TMC's urban renewal agenda for Calcutta, and its flagship project, redevelopment of the Ganges Riverfront is oriented towards deriving immediate political mileage by focussing on 'soft' issues – rather than addressing long term issues through large scale planning interventions. Unlike the comprehensive Thames Gateway Strategy Plan, which incorporates an overarching vision for regional economic development through waterfront redevelopment, the approach towards the riverfront in Calcutta is restricted to recreational usage only, through landscaping of promenades, gardens and *ghats*, bereft of either economic vision or regional context. TMC's electoral manifesto promised to develop greater Calcutta area through a new plan – which is yet to materialise. Of and on discussions had taken place about recycling of the disused industrial lands in Calcutta and the mill towns, without much progress on the ground due to political and legal complicacies.

A veteran trade union leader from Howrah, who had been involved with jute mill workers union for five decades, mentioned two crucial hindrances, when interviewed (17 January 2012) –un-paid dues of the workers and land ownership pattern of the industrial units,

opposition by the unions. There are sick factories under the custody of the central government, the state government as well as in the private sector. Many of the closed industrial units are in the custody of the BIFR (Board of Industrial and Financial Reconstruction). Secondly, almost every closed factory (particularly those in the private sector) owes large sums of money to the workers and the financial institutions. And many of these lands, along with factory sheds and machineries are mortgaged to the lenders.

According to an estimate by Webcon, a consultancy firm under the state government, the sick units collectively owed INR 1,638 crores (USD 273 million) to their employees and INR 3,854 crores (USD 642 million) to the lenders (Livemint 2010). Again, many of the sick private companies are not officially closed, but under 'temporary lock-out' for several years. The worst sufferers in this scenario are off course the workers. Liquidation of the closed factories and recycling of the in land in their possession can generate revenue, which in-turn can help pay-off the worker's dues and create opportunities for new development. But the powerful union bosses are strongly opposed to such schemes, as that would reduce their political influence.

To untangle the complex politico-legal web in which thousands of acres of land are stuck till now, requires a determined political will, which neither the Left Front, nor its successor the TMC has displayed so far.

In mid-2000, real estate developers brought over a few closed factory sites to build luxury apartment buildings. For instance the South City project in Tollygunge area of Calcutta, (which includes Calcutta's tallest residential tower and a posh shopping mall), have come on the land what used to the site of the Jay Engineering Works factory site. Further south footwear manufactures Bata, have converted their factory town at Batanagar, to build an upmarket gated township called the 'Calcutta Riverside'. At the northern fringe, automobile manufacturers Hind Motors have sold part of their factory land, to develop an IT Park. All these projects were approved by the Left Front government. However, there was a major political hue and cry, by the trade union leaders against such conversion of industrial premises for real estate development and the government backtracked. A new legislation was passed to prevent such conversion and ensure that industrial lands are to be used to build factories only and not for other real estate activities (Livemint 2010).

However, this type of blanket legislation on conversion of industrial land to other usage is simplistic and does not take into consideration local context. Many factories in Calcutta were established in in the early 20th century, in areas what in those days were the urban fringe. However, the city limits has significantly expanded since then. Tollygunge is now an up-market south Calcutta locality – it is unrealistic to assume factories could come up there. Moreover, the economic trend in West Bengal as a whole shows that the manufacturing sector is in stagnating for past many years and service sector has become the dominant component. In this macroeconomic scenario, the possibilities of attracting manufacturing investments in the Calcutta metropolitan belt, which had slid far into the backwaters of India's industrial location map, is a hugely difficult proposition.

On the other hand, increased land supply for service sector usage (such as health care facilities, educational institutions, IT-BPO business parks, film studios and cultural facilities) has the potential leveraging Calcutta's core strength – that is availability of educated human resources. And it is possible to locate these activities along the riverfront, as several cities in the Global West had done after the decline of Fordist manufacturing industry. Rather than framing blanket legislations covering the entire state, banning conversion of industrial land, it is essential to take into account the locational context. Given the centrality of the 'land' question in the contemporary politics of Bengal, and that of Calcutta, there is a crucial need for a blueprint for land use optimisation and in this scenario recycling of the vast industrial areas along the river assumes crucial importance.

That kind of plan however, can only be prepared based on a comprehensive strategic vision for the Calcutta metropolitan region and its suburban periphery – the kind of approach adopted in Calcutta's very own Basic Development Plan, way back in the 1960s. But successive governments over the past fifty years had been unable to do so.

6. Conclusion

This article discussed the complexities of riverfront in a developing country city through the agencies of State in a politically polarised situation. Spatial transformation of Calcutta illustrates an apparent paradoxical situation, where large chunks of industrial land along the riverfront lie derelict and underutilised, while urban sprawl continues unabated to meet the demand for space. Decline of Fordist manufacturing and blighted dockyards spurred several waterfront regeneration projects in the 19th century industrial cities of the West, creating consumption spaces for the service sector dominated new economy. But in Calcutta, lack of political will and legal complicacies have come in the way unlocking the potential of the closed factory sites. Political dichotomies between the interests of the white collar and blue collar workforce have come in the way of recycling derelict industrial spaces for skill oriented service sector usage. Rather, the political decision makers found it expedient to acquire rural lands for greenfield projects, thereby generating new forms of claims and conflicts. Above all, the research shows the difficulties of urban restructuring and large scale planning interventions in socio-economically polarised areas, where the governing logic of the political elites are shaped by short term electoral considerations.

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THE RIVER FOR THE PEOPLE: The case for the Pedras River Revitalization in the West Zone of Rio de Janeiro

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Abstract
Rivers are critical elements of the urban landscape. Unfortunately, many of the rivers in Brazil were channeled and covered during urban development, causing them to disappear from the landscape and gradually from the memory of city inhabitants. River canals that remain in the floodplain areas are often exposed to untreated sewage caused by irregular settlements, such as in the case of the Pedra River. Flooding risks associated with these polluted rivers make them undesirable locations for real estate investments. And, the floodplain areas continue to be populated by irregular settlements. Data from the Brazilian Institute of Geography and Statistics (IBGE) indicate that of the 3,224,529 households living in low standard agglomerates or slums, 403,246 reside on or near riverbanks. In Brazilian cities, the invasion of land not suitable for urbanization, such as the floodplain areas, is a rule rather than an exception. The lack of housing alternatives for poor urban dwellers presents a serious and difficult challenge. It stems from a population that lacks access to a formal housing market and a government that lacks an effective social housing policy.
Brazilian legislation (Forest Code) prohibits urbanization and antropic actions in floodplains areas. The protected areas are proportional to the width of the river. Most urban rivers have a range of 30 meters of protection on each side. According to this code, occupation in these areas is illegal and consequently, populations that reside in these areas are excluded from the right to basic services. However, on March 28, 2006, Resolution 369 of the National Environmental Council (CONAMA) eased this legislation. The resolution highlights circumstances in which an environmental authority may implement intervention projects pertaining to social interest, sustainable regularization, and urban social concerns. This presents an interesting opportunity to improve environmental conditions in Rio das Pedras, a favela located in the West Zone of Rio de Janeiro. The densely populated slum (whose name originates from its close proximity to the Pedra River) is the ninth largest slum in Rio de Janeiro and contains 54,793 inhabitants. Rio das Pedras is a typical example of organic occupation without a clear definition of public space.
This project proposes an urban design solution to improve the housing and living standards for residents of Rio das Pedras. It addresses the critical relationship between the slum and the river, recognizes the intrinsic urban fabric and life of the slum as a vital part of the city, and seeks to promote greater integration between the urban community and the city. The project considers the perspectives of a water sensitive design and a city for the people (Gehl, 2013). Analysis of the Pedras River bank will inform development of design solutions to: revitalize the Pedras River, a source of disease caused by illegal dumping of domestic waste and improper disposal of municipal solid waste; redevelop the Pedra River bank through creation of a low maintenance linear park and social housing development; implement flood control measures; and revive natural vegetation.

1. INTRODUCTION

There are approximately 250 rivers in Rio de Janeiro, many of which are invisible in the urban landscape. Rivers that once flowed freely were straightened and covered with concrete. The rivers that remain free flowing today are commonly used as receptacles for untreated sewage. Although Brazilian law prohibits urbanization in floodplain areas, irregular

settlements continue to develop in these areas at a fast rate. In fact, data from the Brazilian Institute of Geography and Statistics (IBGE) indicates that of the 3,224,529 Brazilian households living in low standard agglomerates or slums, 403,246 reside on or near riverbanks. IBGE defines low standard agglomerates as areas containing at least 51 housing units that are populated by poor residents in need of essential public services. These residents commonly live in dense proximity to one another in a disorganized fashion, and occupy land (public or private) owned by others. The irregular settlements located in the floodplains are high environmental risk areas. The absence of formal sanitation structures cause local and widespread river pollution. Since rivers are connected with other channels as part of the broader water basin system, pollution from low standard agglomerates affect the entire water basin territory.

Favela Rio das Pedras is a low standard agglomerate located in the West Zone of Rio de Janeiro. The densely populated slum (whose name originates from its close proximity to the Pedra River) is the ninth largest slum in Rio de Janeiro and contains 54,793 inhabitants. Rio das Pedras presents a typical example of organic occupation without a clear definition of public space. This work proposes an urban design solution to improve the housing and living standards for the residents of Rio das Pedras. It addresses the critical relationship between the slum and the river through a water sensitive design.

Occupation along the Pedras River affects both low and middle income residents. The stark contrast between the living conditions of these residents is fascinating and calls to question how to deal with physical and social transition. Our purpose through urban design is to consider the perspectives of a resilient city, water sensitive design and a city for the people (Gehl, 2013). Examine design solutions for providing basic infrastructure and greater integration between the urban community and the city. The work respects the intrinsic urban fabric and life of the slum as a vital part of the city.

The first part of the project reviews concepts such as resilience, adaptive capacity, and water sensitive design. The second part addresses study area contextualizing, based on the work of Burgos (2002); data collected from Rio de Janeiro's housing planning department on the "Favela Bairro" urban upgrading project conducted the late 1990´s; and other government proposals for the community. Fieldwork visits carried out last year are also addressed. The main goal of the fieldwork was to analyze the urban structure of Favela Rio das Pedras and its surrounding gated communities to identify potential issues. Resident interviews of both segments (slums and condos) were performed during the fieldwork and a special emphasis was placed on the impact of floods on the lives of local residents.

The proposal is based on green infrastructure and water sensitive design concepts. It aims to preserve fragile environmental areas, fragments of native ecosystems, and enhance the overall quality of life for the local residents. The integration and connection of public spaces through the linear park ensures a well maintained ecosystem. Sustainable techniques are proposed through the use of rain gardens, infiltration ponds (detention basins) and stormwater (retention basins), green roofs and walls, constructed wetlands, and drainage floors.

This research is part of the Laboratory of Urban Water (LEAU) and it was object from a bachelor thesis from the Faculty of Architecture and Urbanism at the Federal University of Rio de Janeiro. In the future, the Pedras River proposal can be used to encourage implementation of new pilot projects that may eventually lead to large scale urban river revitalization projects.

2 .THE THEORETHICAL APPROACH: A RESILENT AND WATER SENSITIVE CITY

The resilience perspective is increasingly used as an approach for understanding the dynamics of social and ecological systems. Borrowed from natural sciences, the concept of resilience can be understood as a process that includes adaptive capabilities and flexibility for operation of a system after a disturbance. This concept has been discussed academically considering its possible applications on social sciences (Picket et all, 2004; Alaberty and Marzluff, 2004). Considering cities and urban areas as social ecological systems, that are facing an increasing number of concerns that induce disaster risk, this concept has been

used in the literature associated with the ability of a city to continue working – adapting itself – after disasters or abnormal conditions within the shortest time possible, therefore, not collapsing.
The Stockholm Resilience Centre (2011) adopts the definition of resilience as the ability of a system – whether an individual, a forest, a city, an economy – to deal with change and continue to develop. It is the ability to use the shocks and disturbances such as climate change or financial crisis to stimulate renewal over the long-term. The United Nations report entitled "Resilient People Resilient Planet: A Future Worthy of Choice," highlights the growing importance of long-term planning. Resilience is essential to improving the link between planning, urban design and ecology.
Along with the concept of resilience, the notion of adaptive capacity is defined by Norris et al. (2008), as a process that binds a list of adaptive capacity for a positive working path and adaptation after a disturbance. It thus extends the meaning of the term for seasonal and systematic (e.g. rainfall events) to not only natural disasters, but disturbances of any kind, which applies to the water cycles of a city. Thus, a path to build more resilient cities is to rethink urban water cycles and consider the perspective of a Water Sensitive City. Brown (2008) highlights that the hydro-social contract for a Water Sensitive City would integrate the normative values of environmental repair and protection, supply security, flood control, public health, amenity, livability and economic sustainability, amongst others. Some principles of water sensitive design are: minimize impacts on existing natural features and ecological processes; protect water quality of surface and ground waters; improve the quality of and minimize polluted water discharges to the natural environment; incorporate collection treatment and/or reuse of runoff, including roofwater and other stormwater; reduce run-off and peak flows from urban development; re-use treated effluent and minimize wastewater generation; increase social amenity in urban areas through multi-purpose green space, landscaping and integrating water into the landscape to enhance visual, social, cultural and ecological values.
From the perspective of Water Sensitive Cities, rectification and channelizing of rivers are unsustainable practices that may cause problems such as: soil sealing, which increases runoff, increases local temperatures due to deforestation, and removes riparian vegetation that absorbs part of excess river water during floods. Therefore, it is necessary to rethink this model of planning and development involving these concepts of resilience and water sensitive design and identify a pattern where economic growth is connected with social justice and ecological quality.
The work of Ghel, Cities for People (2013) is also a reference of the project proposed for Favela Rio das Pedras. It offers some guidelines to create mutually beneficial relationships between people's quality of life and their built environment. The idea is to create cities for people by carefully analyzing the spaces chosen for improvement, the 'life' that occurs in the study areas, as well as the qualities of the surrounding "spaces."

3. THE CONTEXT: RIVERBANK OCCUPATION IN RIO DE JANEIRO AND THE CASE OF FAVELA RIO DAS PEDRAS

The invasion of land in Brazil unsuitable for occupancy, such as river floodplains, is a rule rather than an exception and is caused by a lack of housing alternatives (Maricato, 2003). The problem is serious and difficult to solve, because it is directly linked to poverty. A significant portion of the population cannot participate in the formal housing market. This fact, combined with a lack of effective social housing policy magnifies the situation. In Rio de Janeiro, many irregular settlements are located along river edges from which their names originate. Examples include: Jacarezinho, located on the banks of the Jacaré River; Acari, located on the Acari River, and Rio das Pedras, located on the Pedras River.
Brazilian legislation (Forest Code) prohibits urbanization and antropic actions in floodplains areas. The protected areas are proportional to the width of the river. Most urban rivers have a range of 30 meters of protection on each side. According to this code, occupation in these areas is illegal and consequently, populations that reside in these areas are excluded from the right to basic services. However, on March 28, 2006, Resolution 369 of the National

Environmental Council (CONAMA) eased this legislation. The resolution highlights circumstances in which an environmental authority may implement intervention projects pertaining to social interest, sustainable regularization, and urban social concerns, like slums. The 2012 Forest Code endorsed this view in articles 64 and 65 that address regularization in consolidated urban areas. The articles allow social programs such as “My house, my life” (Minha Casa, Minha Vida) to exist. Adjustments shown to improve the environmental conditions through a study prior to their adaptation are considered for approval. Hence, an interesting opportunity arises to consider projects that improve the environmental quality of the riverbank regions while taking into account the factors of irregular occupation and housing provision.

3.1. History of Favela Rio das Pedras

The Favela Rio das Pedras is located in the West Zone of Rio de Janeiro between the districts of Itanhangá and Barra da Tijuca, and the shores of Lagoon Tijuca. It occupies part of an Environmental Protection Area. According to a survey conducted by the “Favela-Bairro” Program, occupation of Rio das Pedras began in 1951. By the 1960s, a few shelters developed along the Pedras River, near Jacarepagua road. However, despite the relatively flat terrain, not much occupation occurred before the 1970s. It wasn’t until the 1980s, with the development of the Barra da Tijuca neighborhood, that a large contingent of poor workers, most of them migrants from northeastern region of Brazil, were drawn to the slums along Jacarepagua road. The Central Area (1), named River Bank (Beira-Rio) was developed by its pioneers. Houses in this area are of better quality, having been subject to various improvements over time. Commercial activities are concentrated in this area. The soil is stable, necessities are accessible, and the neighborhood is consolidated. Subarea (2), known as Vila dos Carangueijos, was built on the banks of Engenheiro Souza Filho Avenue. This is where the first "invasion" by slum dwellers occurred in 1983. (Burgos, 2002). And previously the invasion was restricted to a range of 20 meters, because the landowner claimed the territory. Nowadays this occupation extends toward the Camorim Lagoon.

Subarea (3), named Areal I, was occupied in 1989 and is comprised of land donated to the dwellers by the Sate government. Initially, the land was planned to be a large social housing development, but was eventually donated to the community. 400,000 m2 were batched (50m2) and 3,600 lots were distributed by the Dwellers Association to the population.

In the early 1990s, the Delfim Company in 1977 built a residential complex in the neighbors of Areal I, in an area donated by the government. The Rio das Pedras Dwellers Association has claimed half of this land. On March 17, 1991, about six thousand people - the majority coming from the community - raided 15 residential buildings, built by Del together. The 982 apartments were closed for lack of occupancy permission. The “Delfim” Group, who eventually failing, planned to build 16,000 units in the region, divided into several condominiums. One of them came to be built with 1700 apartments. The buildings were abandoned after the failing of Delfim Company. There were no elevators and light installations, nor water and sewage. To live there, invaders were obliged to climb up to ten floors with water cans and used candles for lighting. The governor of Rio de Janeiro state, at this time, Leonel Brizola, that were very close to social movements, refused to use the police force to evict the occupants and, after negotiations, the families decided to leave. Many of them have settled theirs houses in marshland, next to the condo, with very unhealthy conditions: high density, no access to sewage and water, access to houses made by very narrow passages, some of them less than half a meter wide, lack ventilation and lighting. The result was the subarea Areal II (4) where they are until today. This invasion or this struggle for space is part of the collective memory of the slum habitants. Through this struggle, the governor negotiated concessions of new lands, later on the subareas named Areinha (5) and Pinheiro (6).

The Dewellers Association divided Areinha (5) in 1850 plots, considering Areal I (3) urbanistic parameters, which are close to those from the formal city. The dwellers built the landfills and the streets. The subarea Pinheiro (6) extends the occupation up the hillside, that borders the Jacarepagua road, and that is part of the Tijuca Massif. Unlike the Areal I (3) and

Areinha (5), the Pinheiro (6) was reserved for the “richest” dwellers of the Favela Rio das Pedras. The Tijuca Massif had still its original vegetation. (Burgos 2002). The reason for the high interest in the region was less exposition to recurrent floods. In this subarea is evident the process of land valorization and, therefore, the process of verticalization. The level of education of the residents compared to the rest of Rio das Pedras, is high.

During Brizola (1983-1986) government, families displaced by floods 1984 were settled in Rio das Pedras. Between 1984 and 1985 there were 2800 families settled at the favela. So, projects of urbanization were realized to reorganize plots and 130 titles housing were given by CEHAB-RJ. The minimum water and sewer services were initially obtained by illegal water connections. In 1986 CEDAE, state company responsible for water and sewage services, intervenes in the area through the program ProFace. The program aimed to regularize water supply system and implement sewage system. For water supply, the state company installed a pipeline and distribution system in main streets. The rest of the distribution system was installed by dwellers, without any technical supervision. (Mendes, 2006).

By the area near to “Areals” and “Areinha” there are new houses. They were built very close to Camorim Lagoon banks. This is a subarea continuously affected by the floods, exacerbated by conditions of soil, histosoils, soils that contain mostly peat. They are formed in wetland conditions, where flooding obstructs flows of oxygen from the atmosphere, slowing rates of decomposition. This area named “Pantanal” is an area of newcomers, where houses are most precarious and where there is no infrastructure. An area, where the poorest families are struggling not to stand in the street and seeking access to some social protection in the slum.

The Favela Rio das Pedras, therefore, presents a complex and diverse urban structure. The work of Burgos (2002) shows that the Dewellers Association reaches an important role regulating the occupation process and land assignement. It also imposes deadlines for start bulding a house in plot that is up to nine months. The idea is to prevent land speculation. Thus the slum is developped from a deliberate housing strategy. In the absence of legal rules, the Dwellers Association is responsible for real state in Rio das Pedras, offering guarantees based on the dimension of loyalty and reliability. The newcomers have always a kind of "informal guarantor" in general a relative or a friend living in the slum.

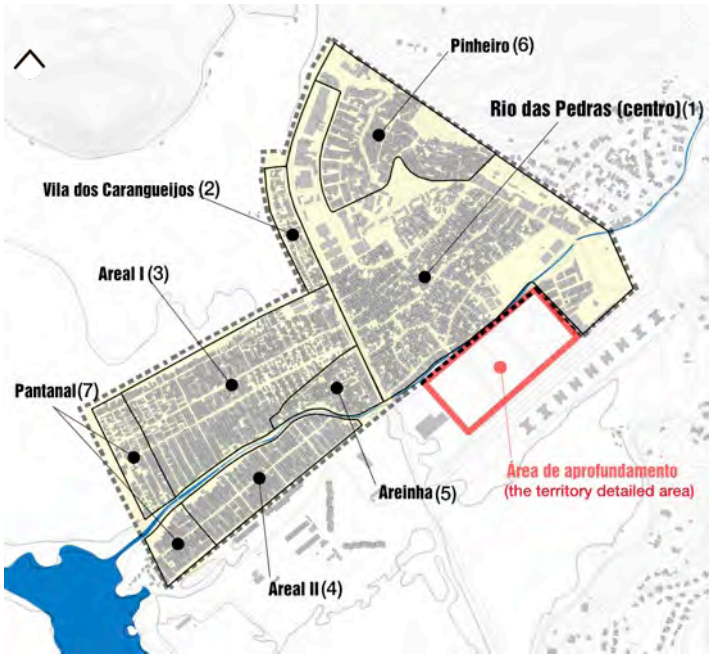


Fig.01 The different occupation areas of Favela Rios das Pedras. Source: Isabella Costa, based on the Burgos map (Burgos,2002 p.38-39).

4. A NEW PROJECT FOR RIO DAS PEDRAS COMMUNITY

Based on the ideas of resilience, water sensitive design and a city for people, this part of the article describes a new project for this community.

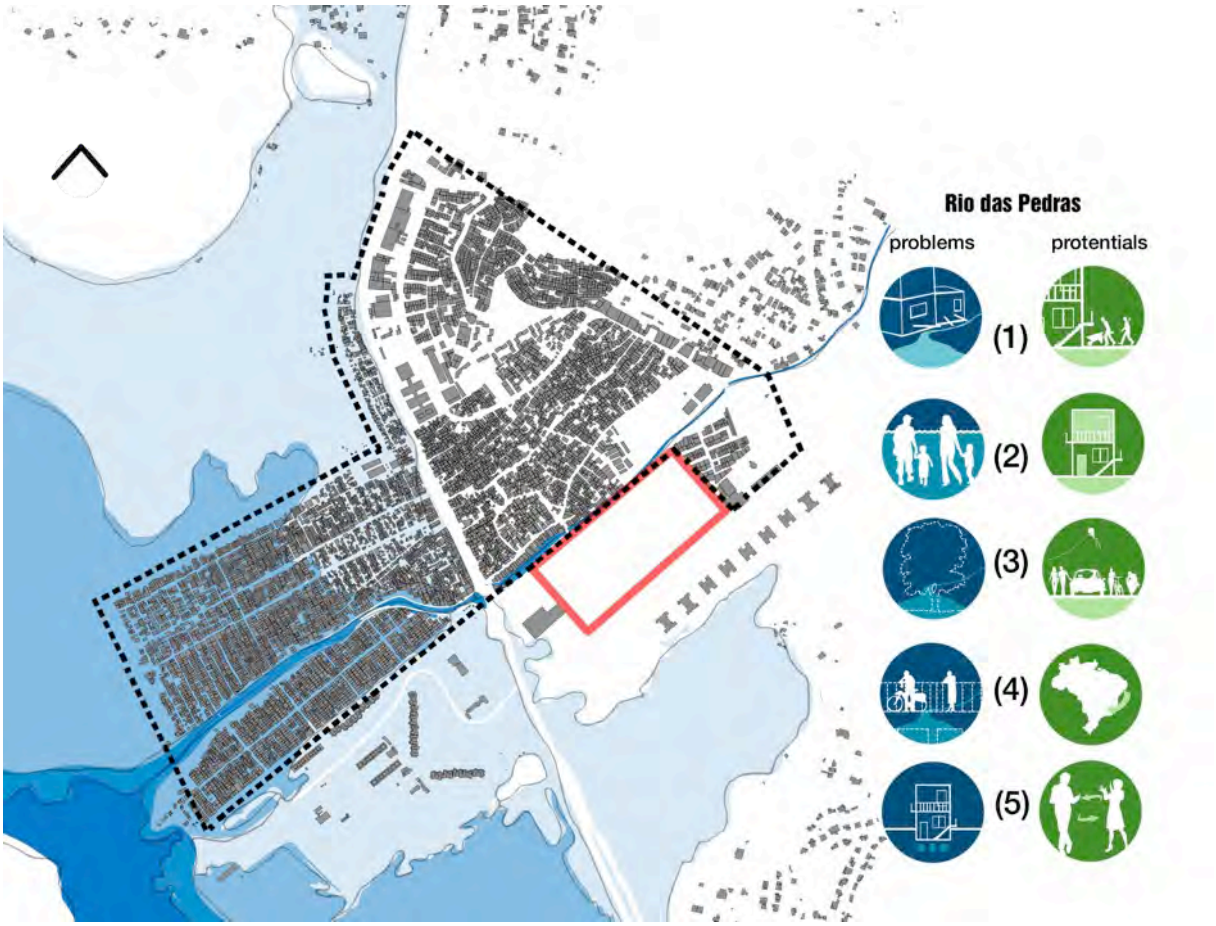


Fig.02 Empirical Map with the flood reach in Favela Rio das Pedras and key elements from the analysis of the problems and potentials along Pedras River. Source: Isabella Costa.

As previously mentioned the river revitalization project is based on analysis and studies of the major problems and potentials identified in Favela Rio das Pedras. The **problems** are:
(1) Lack of proper sanitation: the constructions are made spontaneously without prior planning and hard to reach places or even in hazardous locations with a lack of adequate sanitation. The result is the routing of all the sewage to the nearest river. In case, the Rio das Pedras.
(2) Recurrent Floods: In certain parts of the slum near Camorim Lagoon the flooding problem is recurring. Its clear the water elevation mark of the facades, or the attempt by the locals to remedy the situation by raising their homes, balconies or elevated access stairs from the second floor. The soil type is peat in these excerpts and the floodplain area was already flooded naturally in the region. Also the concrete walls lining the banks of Pedras River in a certain stretch of 1km in length cause the soil impermeabilization preventing water filtration, consequently the time reduction of water concentration increases speed of the airflow, amplifying the peak flows from urban watersheds and aggravating highest peaks of floods and flooding downstream.
(3) Lack of free areas: despite the „Favela Bairro“ program, there are still free, green and recreational areas. The few soccer fields are located on the border between the informal and formal city itself. These are temporary, designed to serve the public schools and the Dwellers Association. The green areas are preserved floodplains around the slum. Inside there are

few informal squares, which are concreted. Trees are felled for the construction of new homes. The free areas are considered their own, routes and soccer fields, which become multifunctional spaces meeting the varied demands of leisure in the region.
(4) Lack of crossings on the river: insufficient, precarious and temporary crossings. The materials used are not durable. They are mostly intended for pedestrian bridges, but end up being shared with motorbikes, bicycles and even cars. There is danger of collapse.
(5) Foundations of buildings: part of the land is located in the slum areas are of poor construction. The peat soil type hinders the establishment of foundations and acts like quicksand. However, it is extremely fertile ground for planting.

Even with all those problems, Rio das Pedras has **potentials** to improve people's quality of life and their built environment. As it can be listed:
(1) The capacity of auto construction and the community engagement in this process: there is a real engagement of residents in their own house construction where dwellers help themselves in building process. Usually made from reinforced concrete with brick walls some house are initially built using free materials found in different public spaces according to availability and need of each family (planks, scraps of wood in demolition sites, cardboard) and improved step by step, using standard building materials. Many houses are enlarged with the so-called "extensions" or "puxadinhos" in Portuguese, in a particularly creative process. The Rio das Pedras slum is one of higher growth currently in Rio de Janeiro. The building process is constant, with many constructions unfinished. The major characteristics and the possibility of a safe environment, protect from the violence due the drugs traffic that characterize other slums, is an attraction factor for new residents in Rio das Pedras.
(2) "Different Repetition": the individuality of residents is made explicit in their houses and, at the same time, each house is a part of a collective context. This individuality can be expressed by the different fasades built from the same structure of construction for example, because there are differentiation in the materials use and design solutions despite having the same structural grid and being supported on one another. Through different desires, tastes or even needs, homes are constructed differently. The dynamics of difference is present even regarding the houses uses; many of them have often a mixed character (commercial-residential-institutional). Also is the slab a common element. Slab in slum culturally introduces a notion of negotiation as it can be transformed into a possible future property. It is a source of income for the residents and also functions as a meeting point, as it could be seen lack of public open space areas. Therefore it should be considered as an important element, with different meanings from the formal city.
(3) Live Street and positive street life: in the absence of free areas, public roads are adopted as multifunctional spaces. All transportation models, such as automobile, motorcycle, bicycle and pedestrian, share the pathways. People share and walk through the same environment without floor levels of differentiation. The streets are also spaces temporary ownership by street vendors and commercial outdoors, and often by kids that improvise them as soccer field or playground.
(4) Culture mixture: the population has a large portion that came from of northeastern of Brazil, other large portion is composed by descendants of immigrants from the northeast of Brazil There is herefore a rich mix of values, customs and habits between nordtheast culture and carioca (term used for a borned in Rio de Janeiro city citizen). The migration largest portion occurred during the time of the real state investment property boom in „Barra da Tijuca" neighborhood. Significant part works in building sector. The knowlegde of construction legacy switches how to manage and build shelters in the slum, stablishing new thinking ways.
(5) Strong social interactions: by the urban laboratory researches and interviews reading, it can be noticed that construction in slum is directly linked to the social ties that bind the inhabitants. The neighbors are known and often participate in family environment, in situations of mutual aid (childminding while neighboring works, watering plants, etc.). They highlight advantages in their speech of being close to family, who already knows the neighborhood. On the other hand, the living street is busy, and it encourages these social

interactions. These multifunctional spaces provide a shared convival. Therefore, the housing removals policy is considered extremely complex because they often destroy these fundamental relationships that move residents' lives.



Fig.03 Table of images highlighting key inspiration situations for the development of the proposal for Rio das Pedras. Source: Isabella Costa. Photos of fieldwork conducted by the author.

5.3. Design Issues

The project handles three different scales, addressing problems and possible solutions for each considering the overall design concept. The scales are: the city scale, the territory scale and the multifamily social housing scale.

- In the city scale

1.1 How to intervene in the slum, understanding the characteristics of the informal city that the slums have with their own spatial identity (even though they differ from each other) while being part of the city as a whole, and the urban landscape.

1.2 Understanding the river as a whole, as a body with a beginning, a middle and an end, and as part of a larger complex system. Regarding the phenomenon of river flooding is a natural process, how to respect this process while at the same time allow coexistence with the community without providing risk to residents near the river?

1.3 How the transition zone between the informal and the formal city works?

1.4 The sewerage of dwellings drains through the natural river system, a problem that affects the entire city of Rio de Janeiro, as the river flows into the lagoon complex of Barra da Tijuca. This complex is part of the program of the 2016 Olympics. How to integrate and provide a plan to clean up the river through, less aggressive green measures is an issue since the soil is typical of lowland peat type, especially near the edge of the lagoon, where the river flows?

1.5 How to accept the existence of slums and integrate them effectively into the city, treating them not as a problem, but seeing their potential and value to the city.

1.6 Are the spaces proposed for social housing in the community programs appropriate to local conditions? Are there other alternatives?

- In the territory scale. On the scale area proposed for social housing (The land and its immediate surroundings covering the stretch of the river);

1.1. How to design the buildings to prioritize the use of pedestrian access, encouraging potential in the new slum project to share the street as an urban amenity, while valuing individuality through a collective context (different facades). Community engagement in the construction and expansion of new buildings in the slum by the residents in previous areas of ownership by the residents themselves is also a possbility?

1.2. How to treat the lot in this situation?

1.3. How to incorporate green open spaces, giving relief to the climate and recreational areas shared by public roads?

1.4. How to create the river-community identity. The river as not a threat that must be tamed but as part of the community an das en element that structures the urban landscape.
- On the scale of **multifamily residence social housing**.
1.1 How to provide quality spaces and increase the possibilities of construction and architectural solutions according to the needs and desires of each family?
1.2 How to handle and predict the constant transformations in informal city within the project of social housing?
1.3 How to keep the idea of individuality identity in a collective, community context?
1.4 How to solve the issue of sanitary and hydro electric plants?
1.5 What structuring element to use for housing?
1.6 How to embed workplace in the proposal?
1.7 How to promote spaces where people meet to exchange experiences and information?

6. Proposal

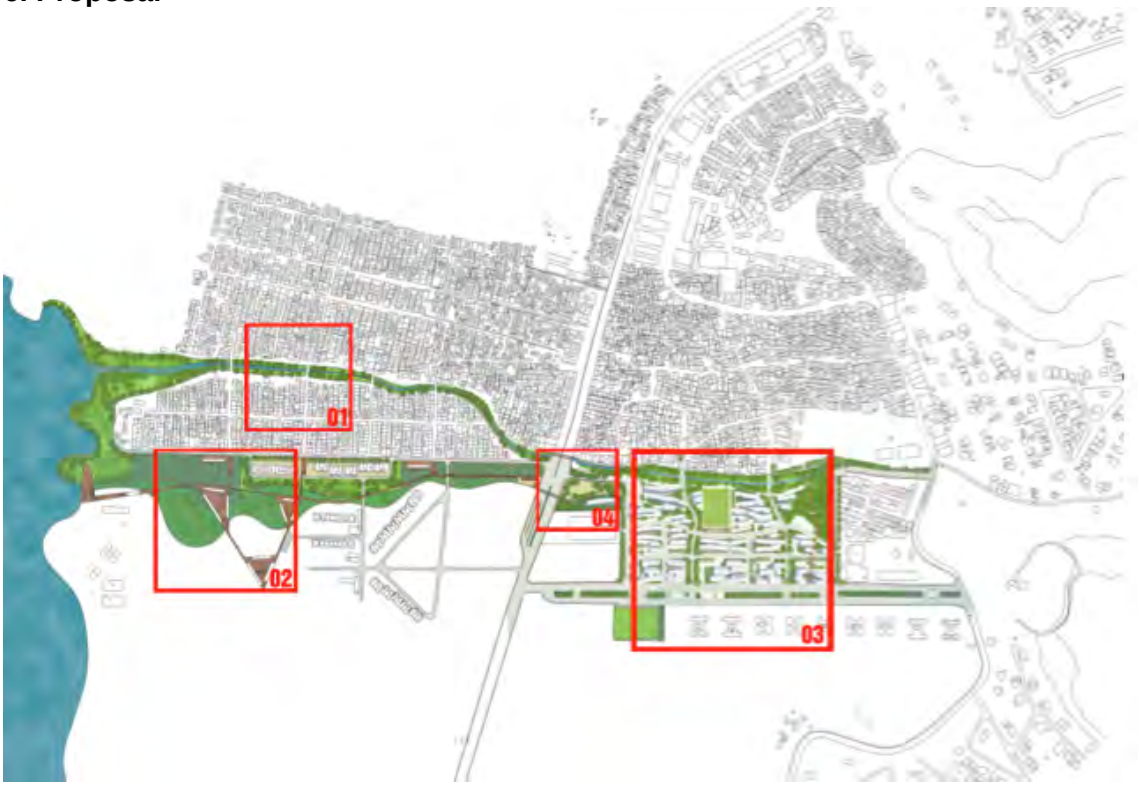


Fig.04 Proposal General Plan, highlighting areas of intervention actions. Source: Isabella Costa.

For Lynch (1997) watercourses are very important elements of the landscape, acting as structural axes of urban development as well as limiting and barriers.
The low-maintenance linear park is proposed for the entire length of the Pedras River. It is a network of combined proposals for new social housing, open public spaces and riverbank treatment, intended to address the problem from a new way of seeing the occupancy of the riverbank by structuring the urban landscape. A space where water can expand mitigating floods in the region in an integrated solution to the environmental, social, economic and cultural aspects. Minimize environmental impacts means minimizing future problems of urbanization and built a more resilient landscape.
A linear park that restores environmental and landscape importance as a space of coexistence with nature while creating pleasant living space and biodiversity may also fulfill the function of ecological corridor and be a tool for the sustainability of life in the middle of urban areas. Thus the identity of the river that gave the community will be restored, and green recreational areas offered free to residents and visitors.
It is important that people assign value to the presence of the river in the urban landscape and become aware of the importance of its preservation in the context of resilent cities. The

quality of urban open spaces is directly linked to its use by the public.



Fig.05 Schematic cuts of the plain. The major traffic roads named "primary capillaries" and water filtration; the second sketch are along the revitalized Pedras River. Source: Isabella Costa.

The General Plan is divided into four major interventions. The first (Intervention 01) is the river itself. The second (Intervention 02) is the area for wetlands and walkways integration with the waterway system, building on Lagoon Complex in Barra da Tijuca. The third (Intervention 03) is in the detailed area of study, the new housing and old concreted stretch of Pedras River. And finally, the fourth (Intervention 04) is the integrated square that extends from the river to the community experimental building.

-. Intervention 01 unlike the proposal of the “Favela-Bairro“ program, the river is the integrating and structuring element of the whole urban planning proposed and it is up tot he river that the others interventions are developed. Therefore, the river rather than concreted, is back o green and open to the public. Communication and awareness with the locals is direct. In this sense, the intervention 01 is characterized by linear urban park low maintenance combined with macro urban drainage, or replanting of riparian vegetation along the river; opening of concreting the riverbanks and reordering the river beds; By replacing the makeshift crossings planned crossings secure about flood level of the river; replanting of riparian vegetation near the river downstream (wetland) with construction of "urban channels" system, guaranteeing not flood the urban fabric, to turn the area of wetlands for treatment and remediation; use of drainage floors; integration of various systems to the river to obstruct the flood in the region, such as soccer fields and unspoiled mangrove areas functioning as possible reservoirs of temporary water; greater access to the river (near the crossings) at strategic points promoting meeting points and contemplation for the population;

- Intervention 02: Areas of wetlands are reserved for treatment of rainwater and flooding river areas and also function as emergency reservoirs to avoid possible flooding. These are integrated into the Pedras River through a system of conduits which prevent the river flooding the urban fabric. Associated with this system there is a green buffer area, where the water would returns to its source the Camorim Lagoon. This intervention also includes suspended walkways, integrating the slum to the future of the waterway system of Barra da Tijuca Lagoon complex, and while not built, operates as eco-tour through the wetlands, and a commercial lookout for Barra da Tijuca neighborhood. The project has bike racks and as much of the population works in Barra da Tijuca, coomutes this transport in the region. It would be an alternative to public transport for the population;

- Intervention 03 (detailed area of study). Also different from the “Favela-Bairro“ program, the project doesn’t require the removal of slum dwellers, but is presented as an alternative housing and prioritizes the most affected areas. The work is done in partnership and with the awareness of residents in order to avoid future advances of inadequate slums residences in the area. The support of the Dwellers Association is critical in the process, it is an institution respected by locals. Future residents are part of the planning process of the houses and can customize their apartments according to their financial means or even have the option of receiving only the structure with all electrical and sanitary installations. Thus, there is incentive to mix between different social strata. The project brings innovation as areas of

appropriation intended for residents themselves to create interventions (as free areas where there may be community gardens, barbecue, different floors, etc ...) including its own facade, allowing the project even after initial completion to be constantly changing the very fabric of the slum, or to allow the residents to co-author the project. Workplaces are also provided for each apartment, which can become places of trades and / or business for the locals. The housing proposal are included in the urban proposal. The linear park penetrates the territory through pathways called "primary and secondary capillars" and prioritizes the shared use of roads and the presence of an integrated green base system.

- Intervention 04 The community experimental building. The idea is an integrated square riverfront building. The building would involve workshops, library, outdoor cinema and evening lectures. The concept used and integrated into the overall proposal was the transformation. The building would have unfinished walls which could then be completed in a workshop with one type of tile of green roof to be completed later, etc ...





AFTER Fig.07. Perspective of old channeled part of Pedras River, encompassing the Areas of Intervention 01 (Revitalization of the Pedras River) and Intervention Area 03 (New social housing) of the proposal. Source: Isabella Costa.



Fig.08 Perspective of proposed community experimental building, comprising the area Intervention 04 Source: Isabella Costa.

6. Conclusion

The project seeks to combine resilient city and water sensitive design principles, in order to improve people's quality of life and their built environment. Regarding the first aspect, the proposal is to revitalize the Pedras River through urban linear park; remove the point sources of pollution (sewers); recover riparian vegetation; promote sustainable rainwater drainage (wetlands); conserve or restore wetlands (floodplains); mitigate flooding (areas through the green buffer); avoid waste disposal; strengthen local identity (the slum originated by the river) recompose the morphology of the river; restoration of aquatic biota and finally, introduce social participation in all actions. The linear park combined with proposed social housing introduces new concepts of housing models whose intent is to establish a dialogue between

the slum dwellings erected by the residents and to enact new projects planned with the participation of the residents.
The living spaces have been articulated in the construction for human relations and sociability. Each plot is linked to the city and needs to be analyzed from the scale of the city to its own scale. Building thought for future projects must have this holistic view of the city functioning as a whole complex of different natural and built systems interconnected and simultaneously understanding the complexities of each part, each field and its relation to the immediate surroundings and the identity of its population and the significance of this overall context is a challenge. This requires a total immersion in the field, recognizing the informal and formal environment ignoring pre-established prejudices, seeking to understand how they work and coexist within symbolic as well as well-defined territorial boundaries. In order to build this reflection the study area chosen was the boundary between the Rio das Pedras slum and condominiums in the formal city. This is an opportunity to study the formal and informal woven fabric and the relationship between them.
Finally, In regard to the urban slums, in order to preserve positive elements of their own identity, aesthetic specificity, we need to encourage thinking about the notion of participation, and at the same time preserve these spaces, however professionals often struggle exactly against this "natural" motion, in order to establish an alleged "order." (Jacques, 2001).

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From Life to Manufacture, From Manufacture to Leisure : Evolution and Development of the River System of Chinese Ancient City Luoyang under Different Social Backgrounds

(From Life to Manufacture, From Manufacture to Leisure :River Evolution & Social Development)

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1. Introduction

Luoyang lies in the Luoyang Basin in western Henan province of China. In the history of China, the regions along Luohe River and Weihe River, with Luoyang as the center, were called “Henan”. It is an earlier political activity center of the Chinese nation and one of the birthplaces of Yangshao culture.



Figure 1: Location of Luoyang in China

Luoyang has excellent natural and geographical conditions. It is surrounded by mountainous regions, embraced by a line from Taihang Mountains to Zhongtiao Mountains on the north, facing Funiu Xionger Mountain on the south, reaching Huashan Mountain on the west and joining Songshan Mountain on the east. With the mountains surrounding it, Luoyang is a place easy to guard and hard to conquer. The Yellow River runs through the Luoyang Basin from east to west, and constantly extends to form the developed water network system of the regions along the Yellow River and Luohe River. According to ancient documents (He Zun Inscriptions), the Luoyang Basin where Luoyang is located was also named with the Chinese characters “Zhong Guo”, that is, “middle of the world”.

According to verified historical data (Historical Records), during the 3000 years from the beginning of Xia Dynasty (about 2000 BC) to Song Dynasty (about 1000 AD), there were 13 dynasties in total that had founded a capital in Luoyang. It is the earliest capital of China with the longest history, and also a city where the most dynasties had founded a capital (Jiuchang L, 2007). So far, the capital relics discovered mainly include the capital relics of Xia Dynasty, Shang Dynasty, Zhou Dynasty, and the ancient Luoyang relics of Han, Wei, Sui and Tang dynasties, known as “five capitals gathering in Luoyang” in history. The location of the capital of each period is closely related to the Luohe River, Jianhe River and Lihe River. Yihe River and Luohe River are the resources for the capital founding and development of Luoyang, which is one of the important factors influencing the urban spatial development, land utilization and function layout.

Chinese scholars have made considerable achievements in the research concerning the ancient capital of Luoyang. Since the Qin Dynasty (around 200 BC), there had been scholars studying the development history of the ancient capital of Luoyang according to time sequence and trying to restore the development situations of the capital city in different periods. Since the 1950s, with more and more archaeological discoveries about the ancient capital of Luoyang, scholars began to make research on the capital's construction dynasty, urban location, the nature of the capital site, and the shape and structure of the capital etc. Most research focused on the compilation and study of historical data. After the 1980s, along with increasingly complete historical data of the capital city Luoyang, scholars began to expand their areas of research. At the macro level, they incorporated this ancient capital to the development history of Chinese ancient capitals and studied its role in the overall development of these ancient capitals. At the micro level, scholars made more in-depth studies on the shape and structure and the urban planning of the ancient capital of Luoyang, which were nevertheless related mainly to basic restoration. Since the 1990s, scholars paid more attention to the cultural factor of the ancient capital of Luoyang and the influence of natural environment and proposed the concept of "Heluo culture" (The term "Heluo" here refers to the Yellow River and the Luohe River). Even though considerable research has been done with regard to the ancient capital of Luoyang, most of them have a single point of focus, such as the shape and structure, city planning, water conservation development etc. in a specific period. There are few studies on the docking of geographical and social space or the continuity of the development of the ancient capital city (Jiuchang L, 2007).

This paper will make horizontal studies from the aspect of historical development and rely on different ideological and social forms in different periods as the main clues. Different aspects will also be discussed vertically to study the relationship between the functional evolution of rivers near Luoyang city and the ancient capital at different stages and in different periods and make clear the historical axis of river functions and city development. Chapter two starts with literature review. Chapter three illustrated the site selection of the ancient capital of Luoyang city and its original shape. To analyze the relationship between the early city and the water based on the life service and resisting the foreign attack. At the time of low-level productivity, people not only simply depend on the river system, but also awe and fear it. Chapter four we analyzed the influence and limitation of the thoughts of " traditional ritual system " in ancient times of China on cities development, then further studied the function changes of rivers system as well as its relationship with cities in the background. Chapter 5 indicated that as we entered to industrialization and Luoyang was determined as one of the main industrial cities of the new China, river functions had a qualitative change. The mode of urban development changed from "etiquette" to river. But in the context of industrial development, the destruction and pollution of river and environment has caused the decay of the ancient capital. Setting "building a harmonious society" and "new pattern of urbanization development" presented in recent years as the main time background, Chapter six discusses the relation between river system of ancient capital and city development and explores the developing direction of the river functions in the last part of the paper.

2. Literature Review

Before the year of 2000, researches related to the ancient capital of Luoyang mainly focused on the restoration of its basic data. Scholars examined and studied historical data to explore the city's relations with its river system and surrounding environment from different perspectives, building a basic research framework. Ziyin P (1982) studied the development history of the ancient capital of Luoyang, restored the plans of this capital city in different periods, and represented the thousands of years of capital construction history. Yizhu H (1984) studied the Heluo area at the center of Luoyang city, relied on the sprout, prosperity and decline of the area's economy as clues, and analyzed the interrelations between the economic development of Heluo area and the changes of geographical conditions in

different periods before the founding of New China. He proposed that the economic development of the ancient capital of Luoyang is closely related with the utilization of rivers. The superior geographic environment fostered the prosperity of agriculture, industry and commerce in the ancient capital of Luoyang, while the pollution of environment and rivers constrained the further development of the ancient capital. Runtian L (1985) started with relevant records about the changes of rivers in Luoyang and stated that the supreme geographical conditions promoted the birth of Luoyang and the founding of capital Luoyang in Zhou dynasty. He also pointed out that the diversion of water into Luoyang propelled the development of Luoyang capital in Han and Wei Dynasties, and the Grand Canal built in Sui and Tang dynasties brought the development of Luoyang ancient capital to a climax. Meanwhile, based on the historical data of his research, Runtian also pointed out the river blockage and the destruction of the ecological environment, which directly led to the downfall of the ancient capital of Luoyang. Finally, he emphasized that in future urban planning and construction, we must attach more importance to the coordination between city and nature, strengthen environmental protection, and follow the laws of nature in urban development. Zhongxun N (1985), in his research on the water conservancy development of Yi and Luo rivers, expounded the distribution of Yellow River, Yi River, Luo River and other rivers closely related with the development of Luoyang, as well as the changes and utilization of these rivers in different historical periods. He pointed out that adequate water for irrigation was the basis for the development of Luoyang; the development of river systems for grain transportation to the capital marked the prosperity of Luoyang; and the necessity of flood control influenced the migration of the capital Luoyang from another aspect. Pengqi D (1999) analyzed the phenomenon of capital site migration of the ancient capital of Luoyang, discussed the relationship between the changes of geographical conditions in Luoyang basin and the actual situations of capital site migration, and explained that the migration of capital Luoyang was closely related with specific local geographical conditions and water supply. Jun W (2000) analyzed the geographical reasons for the selection of the ancient capital Luoyang, summarized the relationship of the capital with rivers as the overall integration of “mountain, river and city”, and summed up the relationship between river systems and the capital city Luoyang in Han & Wei Dynasties and Sui & Tang Dynasties. On this basis, Jun integrated the “ritual” thought into the relationship between river system and ancient capital, and pointed out that the construction of ancient capital should follow the concept of natural coordinated development.

After the year of 2000, the focus of researches on the ancient capital of Luoyang began to expand. Some scholars continued to engage in researches related to the shape and structure of the ancient city. Some scholars focused more on the role of “ritual” thought in their researches on the ancient capital. Jiangtao G (2003) combined archaeological materials with research literature, restored a complete and detail picture of the ruins of the capital Luoyang in Xia Dynasty, and pointed out that main reasons for choosing Luoyang city as the capital lay in the superb climate conditions and adequate water supply in areas near Luoyang. In 2005, Jiuchang L conducted in-depth studies on the spatial evolution of the ancient capital of Luoyang based on relevant archaeological data and literature material, made detail analysis of the historical reasons for building the capital in Luoyang by taking natural environment and social factors and other conditions into consideration, analyzed the evolution of Luoyang capital from the asymmetrical pattern of a single palace to the symmetrical pattern of multiple palaces, and studied the spatial differentiation phenomenon and other core issues under different social backgrounds. In 2007, after studying 100 pieces of research literature conducted since 1950s on the ancient capital of Luoyang, Jiuchang L classified scholars’ researches on the capital city of Luoyang into six categories, including researches on the construction dynasties of the capital, researches on the plan and layout of the capital, researches on the economic market of the capital, researches on the residential areas of the capital, researches on the ecological environment of the capital and researches on the culture of the capital. He pointed out that most of these researches focused on historical conditions and data restoration and compilation and other microscopic areas. Few

researches were found on geographic and social space docking, historical continuity, the future development of Luoyang and other macroscopic areas. Finally, he indicated that in future researches scholars should explore more on the relationship between capital development with ecological environment changes, the continuity of Luoyang capital and other macro aspects. In the same year, Jiuchang L summarized relevant researches on capital Luoyang in his book State, space and social space --- Evolution of the ancient capital of Luoyang. He pointed out several representative periods in the development history of the ancient capital of Luoyang, namely, Xia Dynasty, Shang Dynasty, Han and Wei Dynasties, Sui and Tang Dynasties, as well as the North Song Dynasty. In his book, Jiuchang L for the first time associated the development of the ancient capital of Luoyang with social, special and political factors, laying a foundation for subsequent researches. Ying T (2008), after making brief description of the relationship between city layout and water system in Xia Dynasty, Shang Dynasty, Han and Wei Dynasties, made a detail analysis of the function distribution and water utilization of the ancient capital of Luoyang in Sui and Tang Dynasties, analyzed their interactive relations. He pointed out that water environment influenced the structure and layout of the ancient capital of Luoyang in Sui and Tang Dynasties and meanwhile the development of Luoyang capital in Sui and Tang Dynasties influenced the water environment. Ruilin S (2008) started with the relationship of Luoyang capital with the Silk Road, analyzed the Silk Road by land and the Silk Road by water. Ruilin pointed out that Luoyang was the metropolis with diverse cultures in the world at that time due to its prime geographical location as the “Center of the World” and its convenient transportation by land and by water.

In the recent two years, scholars pay more attention to the relationship of the ancient capital of Luoyang with its culture, thought, ecological environment and other aspects. Zeyang J (2012) relied on the development of Chinese traditional “ritual” thought in different periods as the axis of the research, described the development of “Ritual” thought from its germination in Zhou Dynasty to the establishment of “Ritual” thought as the only moral norms in Han and Wei Dynasties. He discussed the combination of ritual thought and empirical autocratic system, made in-depth discussion about the role of “Ritual” thought in the evolution of the layout and structure of the capital city, summarized that the “Ritual” system first influenced only religious architectures and then palace architectures and finally controlled the spatial layout of the entire ancient capital. Haipeng C (2013) considered the river system as one of the core elements carrying the history of the ancient capital of Luoyang, summarized researches conducted since the founding of New China on the urban planning of the capital Luoyang in different periods. He pointed out that we should take rivers as the linear elements and pay attention to historical factors of Luoyang city to make urban green system planning and create unique urban characteristics.

3. A Water Gathering Place for "Life and Religion" in Xia, Shang and Zhou Dynasties

3.1 Residing in River Confluence Reaches

Xia, Shang and Zhou dynasties saw some development in terms of production capability, along with the division of labor in the society. For example, handicraft industry and commerce gained independence from the division of labor. However, productivity was still in a relatively backward state. People's life was mainly concerned with primitive labor work, and all construction was closely related with labor. The selection of capital site was primarily based on needs of military defense and water supply. Residing along riverside was the historical characteristics of city development. Meanwhile, because people had no ability in conserving and controlling rivers, when choosing the capital site people had to consider the flat lands in Yiluo river basin where Luoyang was situated, the mild climate, the moderate rainfall, the fertile soil and the interconnected system of Yi, Luo, Li, and Jian rivers. (As shown in Figure 2) The ancient capital of Luoyang in Xia Dynasty was located to the north of the old course of the Luohe River. However, as the course of the Luohe River changed, the Luohe capital was moved to the confluence of the Luohe River and Yellow River in the Shang Dynasty, still to the north of the Luohe River. When it came to the Zhou Dynasty, Emperor Cheng reconstructed the Luoyang capital and after careful examination of geographical conditions, moved the city westward to the middle and lower reaches of Luohe River, alleviating people from the suffering of the Yellow River flood. (As shown in Figure 3)



Figure 2 The Relations of Natural Geographical Areas of Luoyang City

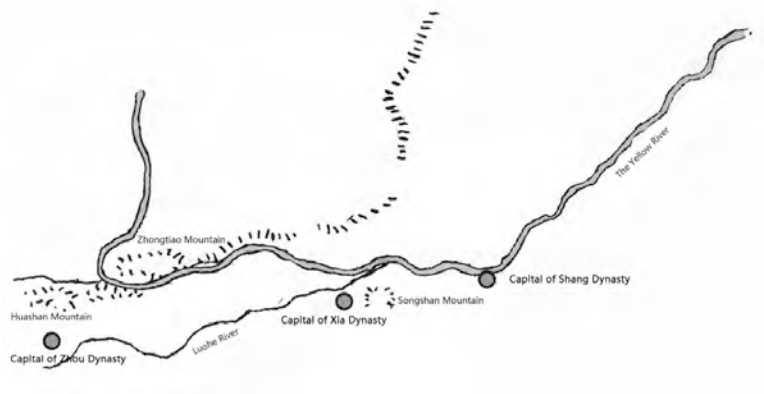


Figure3 The Migration of Capital Sites

3.2 Evolution of River Functions in Xia, Shang and Zhou Dynasties

In Xia, Shang and Zhou dynasties, the primitive society was undergoing the transition from the slavery society to the feudal society, and the ancient Ritual thought came into being and had certain scale of development. During the period, the social pattern was shifted from "divine right" to "military power". The Luoyang capital of Erlitou in Yanshi was built on the basis of primitive tribes, the earliest capital with the planned structure of single imperial palaces. The overall space was formed by scattered building complexes of different sizes and with simple layouts. The internal structures of building complexes all showed the

symmetrical relation of “Ritual” thought in its early stage. The whole town was centered around the palace complex and early ritual temples (Chunhua L, 2006). Casting bronze sites were found around the palaces. People believed that “water was the home of gods” (namely, where there were rivers; there were the power of God), so offering sacrifices to the gods was one of the main activities of ordinary life. When rivers were offering water for irrigation, they also supplied water for the manufacturing of copper, iron, and other daily appliances along riverside areas. (As shown in Figure 4).



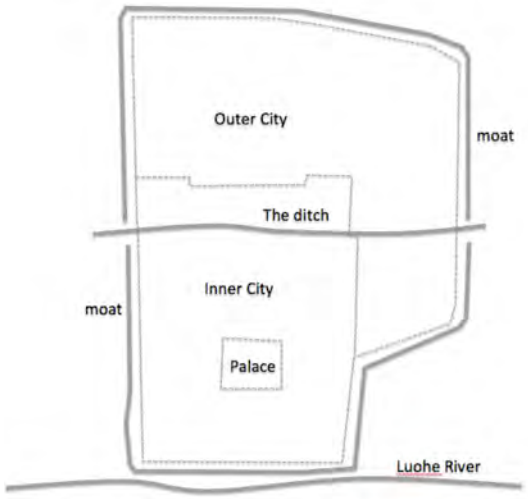


Figure4 River Function & Capital of Xia Dynasty Figure5 River Function & Capital of Shang Dynasty

The Shang Dynasty was transiting from monarchy to theocracy. Luoyang capital was the earliest capital with city walls in China, and showed the structure of dual cities. Dual cities at that time were mainly city areas with palaces. The function of rivers was not limited to riverside sacrifice ceremonies, daily life, handicraft industry development and other aspects. Rivers also played a more significant role of city defense. The capital of the Shang Dynasty was built with moats around to divert water and protect the city. There were also rivers running across the city to satisfy the needs for irrigation and everyday life inside the city. During this period, temples for sacrifice ceremonies still occupied a dominating position. (As shown in Figure 5)

Up to Zhou Dynasty, there emerged the ancient book Zhou Ritual and Architectural Records (Zhou Li Kao Gong Ji) where “Ritual” thought was applied to urban construction. The book describes the core concepts of “Ritual” thought in city planning: order and hierarchy. (as shown in Figure 6) The imperial palace was flanked in the outer city by the temple for ancestors and the temple for the god of the land and the god of grain (representing the divine power and the military power). The center position of ancestral temples was weakened by the imperial power; the hierarchical order was preliminarily formed; and the divine power existed to facilitate the military power. In 1059 BC, Emperor Cheng of Zhou built the Luoyi city. The Jianhe River passed the capital city from the west and traversed workshop areas and the palace regions (Xiaoyu N, 2010). In the Eastern Zhou Dynasty, as the center of the handicraft industry for officials, Luoyang became the hub interconnected with other areas of the state. During this period, water transportation had not yet well developed, and rivers played a more important role in supporting the operation of workshops and supplying water to the imperial palaces. (As shown in Figure 7)

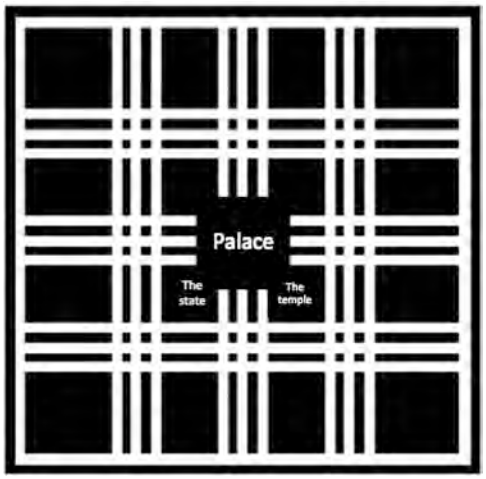


Figure6 Ritual thought Model

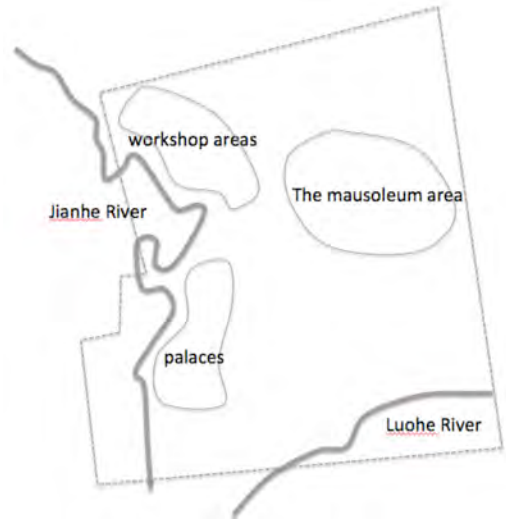
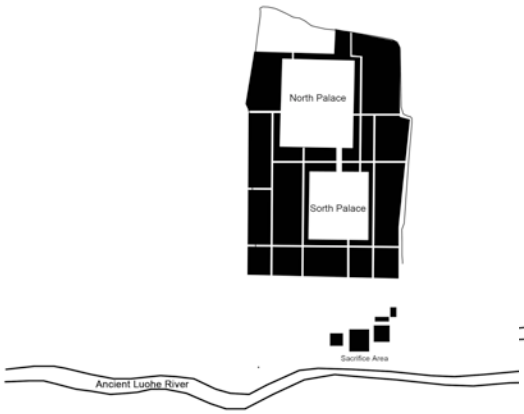


Figure7 River Function & Capital of Zhou Dynasty

4. Dominant "Traffic" Functions under the Rule of the Ideology -"Ritual"

4.1 Development of River Transport Functions in Han and Wei Dynasties

Luoyang, the capital in Han and Wei dynasties, epitomizes the social form of highly centralized monarchy. It is the period of the gradual development and improvement of the "ritual" thought. The layout of Luoyang city in Eastern Han dynasty is an irregular rectangle. The inside and outside of the city were connected by 12 doors. The city was divided into southern palace and northern palace, occupying almost a half of the land. The living space of general citizens was very narrow. Worship places, schools and other buildings were located in the south, being close to the ancient Luohe River. Though the overall layout of the walls was irregular, the inside of the city was neat and rigorous. The countryside between the southern and northern palaces was square, with cross streets being square-shaped, five streets in the east-west and five streets in the north-south. Most of government offices were near the imperial palace. The main axis of the palaces was perpendicular to the old Luohe river way. The main road had a direct connection to the north bank of Luohe River. To the Northern Wei dynasty, through the dynasty replacement, the "ritual" order of the form of the ancient capital - Luoyang was more obvious. Southern and northern palaces were developed into a three-layer symmetrical pattern - the Imperial Palace, the inner city and the outer city. Under the control of "ritual" ideology, the palace directly was outward connected to Luohe River, forming the axis of the main road and integrating Luohe River into the overall structure of the city. Due to the higher terrain of the palace building, Qianjin Canal was excavated in Han and Wei dynasties, being straight to the inside of Luoyang, thus providing a guarantee for living water. From the Eastern Han dynasty to the Northern Wei dynasty, river transport functions of the ancient capital - Luoyang progressively developed, and trade markets were gradually increased. In Luoyang of the Northern Wei dynasty, there were two markets for citizens to conduct various transactions, and Sitong City (meaning a market connecting to four directions) was newly constructed on the south shore of Luohe River, which was specially built for trade exchanges of merchants from waterway. Near Sitong City, caravanserais were built for the rest of business travelers on both sides of the axis of the capital. This has fully demonstrated the function of Luohe River evolves from the simple living services into the dominant "traffic".



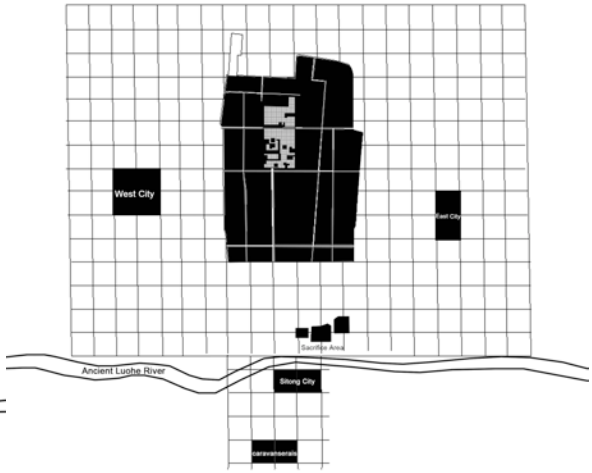


Figure8 River Function & Capital of Han Dynasty *Figure9 River Function & Capital of Wei Dynasty*

4.2 The Highly Developed River Transport Function of the Ancient Capital of Luoyang in Sui and Tang Dynasties

The period of Sui and Tang dynasties as the most prosperous period of development shows the coexistence of closed and diversified social formations. On one hand, Luoyang was the political center of ancient China in Sui and Tang dynasties, with more obvious hierarchical differences and order of imperial ruling. In respect of the layout of ancient Luoyang in Sui and Tang dynasties, an asymmetric layout was formed with the imperial city and imperial palaces located in the northwest corner of the whole city and the main axis laid on one side, but this does not mean the offence of ritual. The imperial palace of Luoyang was built to better highlight the thought of the emperor in “the center of the world”, and its elevated location emphasizes the hierarchical system of the supremacy of emperors. The imperial city surrounds the imperial palace on the east, west and south outside the imperial palace. According to records in ancient books, there were “four walls surrounding the imperial palace”, which reinforced the defense effect. The whole city can be called a creation of “planning”. On the other hand, in the development of Luoyang in Sui and Tang dynasties, Luohe River was used directly as the axis in the east-west direction, which divided the ancient capital into two parts in the south and north. Business markets were formed along both sides of Luohe River. The north market was used as the dock for the boats and ships passing to berth, while the south market was mainly for making various business transactions. The excavation of the Grand Canal further promoted the development of water transport function of Luohe River. The merchants from other countries not only can reach Luoyang along the Silk Road by land, but also can get there through the waterway of Silk Road. The convenient traffic promoted the prosperity of trade and the multi-culture integration, as well as established the historical position of Luoyang as the economic and trade center of the world.

Due to its political status and location as a traffic fort for thousands of years, ancient Luoyang was a city with a large population, which at that time took up a half of the total population of the country according to statistics. The large population resulted in great demand for water, and also caused serious pollution. Moreover, Luoyang has been a place of strategic importance since the ancient times. After undergoing several large scale wars, the rivers in Luoyang were blocked seriously and the capital outlook was nearly destroyed. From the Song Dynasty, the ancient capitals gradually moved to north, and Luoyang was on the decline.

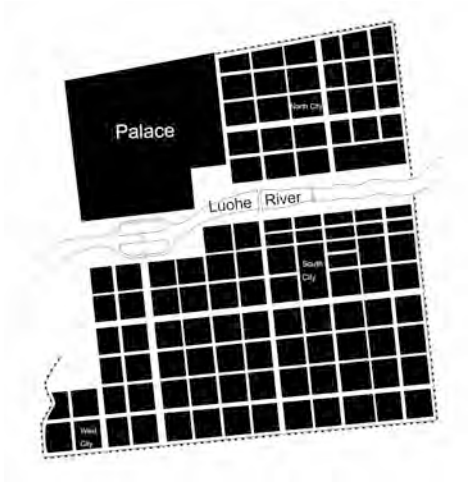


Figure10 River Function & Capital of Sui/Tang Dynasty

5. "Productive" Water Source Under the Background of Industrial

Development in 1953 based on opportunity of the first five-year plan, Luoyang edged into the top ten heavy industrial bases in China, establishing industrial zones on both sides of Jianhe River and Luohe River. From the 60s to 80s, China had been constructing industrial projects in Luoyang, whose economic lifeline has been supported by its industrial development. As a result, industrialization has been developed accompanied by the urbanization of Luoyang which broke the original model and displayed its dendritic growth pattern of the development along the river, which has continued ever since. However, the development of industry has caused serious pollution to Jianhe River and Luohe River. Luohe River's water supply was damaged, leading to not only a massive reduction in the amount of water but also insufficiency of the river to bear its original capability for transportation. And the "productive" function fully dominates.



Figure11 River Function & Old Industry Cluster

6. Construction of Recreational Water Source in accordance with the Guideline of Harmonious Society and New-type Urbanization

6.1 Harmonious Development between Human and Nature

Since 2002, the concept of constructing harmonious society has been introduced into urban development, and the harmony between human and nature has become the focus of attention. So Luoyang also increasingly attaches importance to the harmony between rivers

and urban development. According to the tourism development scheme of Luoyang, with Luohe River serving as the axis, an urban landscape belt along both riversides will come into existence. The belt will stretch both eastward and westward, and connects to various historic sites of Luoyang to form Longmen scenic spots, historic sites of King castles of Zhou Dynasty, Luoyang scenic spots of Sui and Tang Dynasties, ancient castles of Han and Wei Dynasties, Luoyang historic sites of Ming and Qing Dynasties, etc. Due to chronic siltation and pollution, Luohe River is no longer suitable for daily water supply source. From the perspective of harmonious development between human and nature, it is quite essential to maintain the original style of the rivers in the ancient capital Luoyang. In recent years, greenbelt corridor along the northern bank of Luohe River has been built. What's more, urban parks, for example silk road park, Luopu park, Sui and Tang historic sites botanical garden (castle sites of Sui and Tang Dynasties), Mount Zhou forest park, King city zoo (historic sites of King castle of Zhou Dynasty) have also been built relying on Luohe River, Jianhe River and historic sites of the ancient capital. The role of rivers is gradually shifting to recreational purpose.

6.2 Construction of Featured Ancient Capital

The proposal of new-type urbanization in 2007 has shown a different direction for the development of Luoyang ancient capital. Under the circumstance of new-type urbanization, it is necessary for the ancient capital to seek for a featured development pattern. In accordance with the development strategy of "prosperity through tourism" made in the urban comprehensive planning, Luoyang has given full play to the historical and cultural qualities of the ancient capital and has built the Peony Garden at the southern bank of Luohe River for Chinese national flower, based on historical and ecological environment of Luoyang. In addition, the International Peony Festival is hosted in Luoyang in May of each year. In this way, the recreational function of Luohe River has been significantly enhanced.

7. Conclusion

Since 2000B.C, with changes in the social backgrounds of the ancient capital Luoyang, the relationship between the rivers and the urban space has also changed accordingly. The function of the rivers has changed from the original single one to meet people's needs for daily life and irrigation of farmland to the religious one to build places of worship and religious rituals along the river, then to the use for being extended into the diversified river network integrated with handicraft production and transportation function. The promotion of industrialization has prompted a qualitative change of the function of rivers. Nevertheless, after 2000A.D the functions of rivers in Luoyang for subsistence, production and transportation have gone, while the recreational function of the river as an integral part of landscape has been focused on more. In the future, the functions of rivers in Luoyang will be inevitably towards diversified direction based on the recreational function so as to adapt to changing social environment.

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Evolution of new coastal Urban Lifestyles in West Africa: Implications for planning sustainable African Cities

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ABSTRACT

UN Habitat reports that though Africa is still the least urbanised continent of the world, it however, has the fastest rate of urbanisation. Two third of this population reside in small and intermediate coastal centres with 60% in cities of less than 500,000 inhabitants. The major trend in Africa like other places in the world shows that a larger portion of these urban areas are located in the coastal zones. In West Africa the rate of this growth is higher than the continent's average. Urbanisation in West Africa is poverty driven with very low socio-economic transformation; this has led to the evolution of different lifestyles among the people even in rich countries like Nigeria. This rapid urban growth has led to the drowning so to say of the original inhabitants of those areas. In the area, the current thematic coastal issues of climate change and sea level rise have captured researches interest with little focus on lifestyles of the inhabitants of these cities. The study therefore aimed at examining the possible evolution of new lifestyles over time resulting from the urban expansion and the wider implications of these especially for the socially excluded- fisher folks, wetland farmers, indigenous people, women and the youth of West Africa in these urban centres. The study relied mostly on data from Nigeria where a case study was taken. Five coastal cities were sampled and studied. These were purposively selected based on their history of rapid urbanisation in recent years and the fact that they have some incredible, outstanding and natural beautiful beaches, and extensive coastal wetlands and mangrove forest. The study covered traditional coastal cities with population of 20,000 and above. On the whole one thousand four hundred thirty six respondents were studied. The result presented similar situations in all cities though some were more pronounced in cities of Calabar, Bonny, Illaje and tended to show poor or lack of physical planning as a major indices leading to the evolution of such lifestyles. The study made strong predictions as well as suggest planning framework to improve and integrate the lives of all population groups in West African cities.

Keywords: coastal zone, urbanisation, lifestyle, sustainable city, West Africa, physical planning

Introduction

Cities in West Africa are characterized by rapid urbanization and primacy. They are poverty-stricken, socially divided and present land use planning issues as those of insufficient and inadequate housing, lack of infrastructural facilities and unemployment on a scale hitherto unencountered by administrators in developed nations. In recent times, there are the problems of environmental degradation mostly from resources extraction for foreign market and climate change issues with drought and starvation in the North and sea level rise, flooding and coastal erosion in the South.

What makes West Africa cities or other Africa cities to be poverty stricken and socially divided has been noted by researchers like Mabogunje (1968), Santos, (1979); Lowder (1986) and Ekpenyong (1999) to be political and well as economics constraints within the cities evolve. These cities like their counterparts in other developing countries have substantial populations that are by any standard poor or do lack facilities, but their land use problems do not arise from population growth and ignorance. Rather and as Ekpenyong (1999) asserted are symptoms and process within their economies. The planning, development and organization of these cities are colored by historical, economic, political and socio-cultural structures.

Though generalization sometimes is difficult because of scarcity of data, there is abundant evidence that West African cities, infact African societies are heterogeneous in their socio-politico organization, but the common ground is the location of their economies at the periphery of international capitalism. Since these economies are structured to meet the needs of the capitalist system, they are made to assume a depending status (Mabogunje, 1968). The economies are export oriented; many cities own their origin to administration and service functions rather than the scale of their productive activities. Since it is commerce and not industry that is the major characteristics of peripheral capitalism, it is therefore commerce and administration that have provided the impetus for urbanization in Africa. This according to Ekpenyong (1999) emphasizes the importance of transport. nodes, ports and the capitals political and beauracratic roles and not even distribution of wealth and infrastructure. The effect of this is felt differently by different group and sectors of population. By wealth and lifestyle which seems to be the distinctive features in the cities among it dwellers, the principles of organization of society have been transformed and social structures are realigned along economic interest than the communal (kinship ethnic) ties. Community interests are replaced by class interest but social class groups are most often heterogeneous.

Many land use planning researchers in West Africa as in other parts of Africa are directed to the plight of the most impoverished residents living in derelict tenements or in makeshift shelter erected on any vacant plot or shanties that surrounds major cities. The lifestyle of these indigenous people are most often overlooked resulting in wasted effort while trying to incorporate them into the main stream of urban life. Land use planning had followed this pattern over the years where only few metres of areas are planned off the transport routes, modes, ports and few housing estates for the elites. Compounded with the current thematic coastal issues of climate change and sea level rise, desert encroachment and drought the land use planner seems helpless in the face of growing informalities.

This study is an attempt to draw out intersections between the two of the most important socio-ecology issues of the 21st century. That is the rise of the urban form as the dominant coastal geographical context for life in West Africa and the emergence of new lifestyles of the indigenous people drowned in the wave of this urbanization trends. This, the paper hope, will well equip the land use planner to better plan for this section of the cities.

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The Study Area

West Africa is the western most region of the African continent with most of it in sub-Sahara continent. It comprises of 16 countries lying between Nigeria in the east and Mauritania in the west. The Atlantic ocean form the western as well as southern borders of the region and Sahara desert in the North (Fig.1) it is a very diverse region and the most densely populated in Africa. Most West Africa countries were colonized by Britain and French, after many years waves of independence swept across the region.

West Africa is home to some incredible, mind-blowing beautiful beaches (Wikitravel, 2011) such as Northumbria, (Senegal), bar beaches in Lagos and Ibeno (Nigeria). The feature had been the major attraction of large population and expansion of cities. Traditionally, before the advent of oil exploration in West Africa, the main occupation of the people in these coastal cities were fishing, trading and farming. Here, Haakensen (1990) observed that African Artisanal fishermen predominantly belong to a handful of ethnic groups. The principal ones include the Wolof, Bebai, Nyominka and Fantegal (Senegal), Adan and Ewe (Ghana) and Ijaw and Ilaje (Nigeria). That basically the Adan Eve, Ijaw and ilaje came migrated from Senegal. Majority of these fishermen fish occasionally either on subsistence level or to supplement income from other sources of agric activities. Out of 1.9m people engaged in either full-, part-time, and seasonal fishermen/women about 98% belong to the artisenal sector (FAO, 1991). The sector is characterized with low technology, lack of modern equipment, low fund to expand and thus makes the bulk of their operation labour intensive with little or no opportunities to expand.

In all locations, fishing represents one of the main activities for women. In Senegal for instance, more than 90% of women are involve in fishing processing. The processing sector is controlled by women. This activity takes place along the Atlantic shorelines where fishing products are discharged.

However, with rapid urbanisation and increased oil exploitation there has been deteriorating environmental conditions which have affected fishing activities.



Fig. 1 Map of West Africa showing the Sixteen Countries
Source: adapted from Africa.world.net

Urbanization in West Africa

The rate of urbanisation especially in the developing world is on the increase due mainly to natural increase (migration and birth rates). The UN (2007) estimated that by 2050, over 70% of the people will live in cities especially in Asia and Africa. That report noted that global urban people has quadrupled since 1950s. According to the report cities of the developing world account for over 90% of the world population African urban centres for instance are growing in leaps and bounds, thus resulting in exploding cities (Oyesiku, 2009). This growth which is put at 5.50% is far above the general 3% rate for developing countries.

West Africa also has its own share in this urban explosion. Though there are indications of over exaggeration (Potts, 2013) and difficulty in the general overview within the region (Africa polis/SEDET, 2012) yet urban growth remain one of the fastest in the world.

Thus the fishertolks even in the remotest villages, form new social, economic and political. They now find themselves having to perform and survive in a modernizing and dynamic, although technologically low-level, socio-economic market system. In order to survive, they have assumed new way of living (lifestyle) – commercial and social attitudes – that are appropriate in such a system.

Cities and settlements are changing and need new insights to meet these challenges. These cites and governments which have not changed have generated added problems in terms of generation of non-inclusive cities and accelerated incubation of factors for the formation of shims and informal settlements (Aduwo 1999) Town Country Planning or Urban Planning is a modern phenomenon, a 19th century term 1st formally used by the British in 1906 as a contained in Housing, Town planning, etc Act of 1909. Expectedly, the modern planning activity within Nigeria like other British colony are traceable to a few towns – Lagos, Calabar and Port Harcourt (Nigeria), Dakar (Senegal) and Freetown (Sierra Leone) being well known ports of early colonial adventure in the region. Therefore, the way planning is perceived on the modern sense was not widely operational in different parts of the countries before the colonial era.

A review of history of the urban regional and planning in West Africa must be well positioned not only planning legislations and politico – economic scene alone but also in context of the accentrate urbanization and which attract the attention of physical planning are those of transportation development particularly rail and road during and after colonial period, economic development strategy, which in turn led to the emergence of economic “island” that was favoured by rail sup road transport as well as port and marine transportation development.

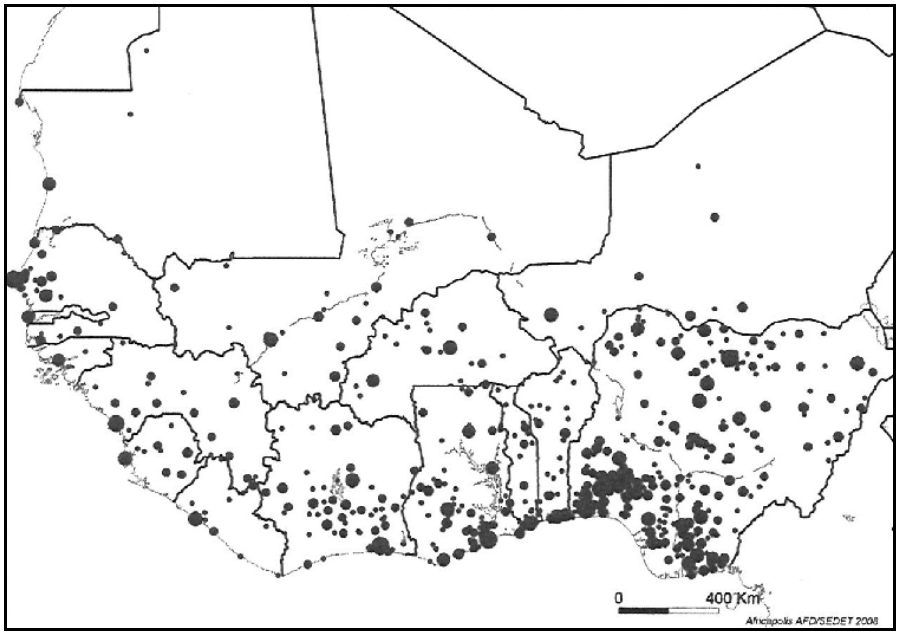


Fig.2 Distribution of urban areas with population of 20,000 and above(1998)
Source: Africapolis (2012)

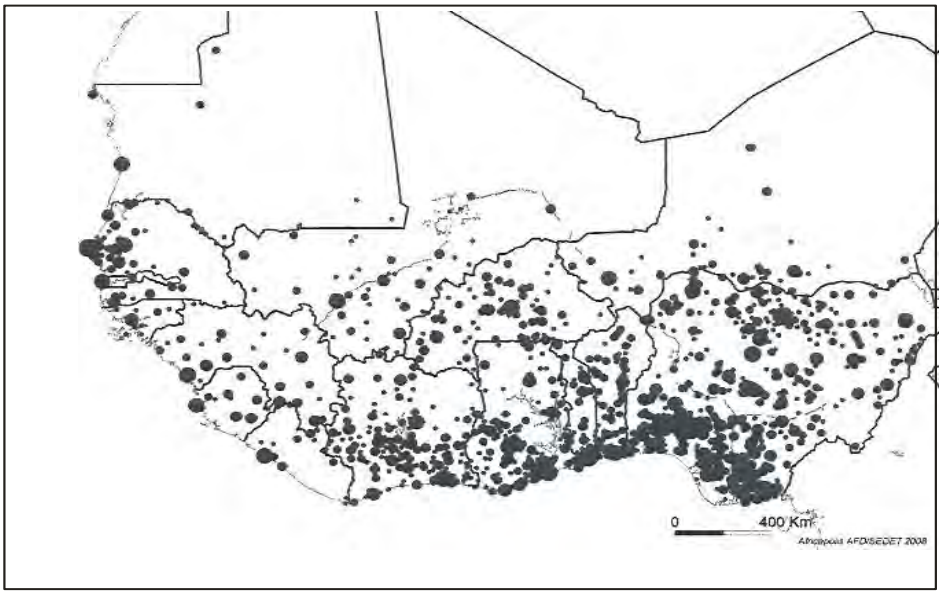


Fig. 3: Distribution of urban centres with population of 20,000 and above 2010
Source: Africapolis (2012)

Fig 2 and 3 shows the agglomerations of urban centres of more than 20,000 inhabitants and their environment for 1980 and 2010. Three unique characteristics can be seen. The 1st is the rapid increase of urban centres of 20,000 to 100,000 inhabitants from less than 23 in 1950 to 194 in 2000 giving an increase rate of 11.8% per annum. This shows that region is experiencing an unprecedented rate of urban growth, outpacing other regions.

The second characteristics derivable from the map is that a large percent of the population live in the coastal cities. Many researchers attest to the fact that majority of these growth is within 60km of coastline. For example, in Nigeria about 20 million people (22.6%) of the national population live along the coastal zone, about 4.5m Senegalese (66.6%) live in Dakar alone, while about 90% of the industries are located in these cities. In all the countries

bordering the Atlantic ocean – Sierra Leone, Togo, Nigeria, Ghana, Benin, etc most of the economic activities that form the backbone of the national economy are located within this zone too. The coastal areas also form the food basket of the region off shore and onshore areas, as well as estuaries and lagoons, support artisanal and industrial fisheries accounting for more than 75% of fishery landings.

Coastal population pressures with expansion rate of 5.1% per annum (Africapolis, 2012) and increasing exploitation of crude oil has resulted in environmental degradation, coastal erosion, flooding, pollution (air, water and land), salt water intrusion, subsidence and deforestation of mangrove forests. Coastal erosion already has been reported to reach 23 - 30m annually in some parts of the West African coast (Ibe and Quelennac, 1989). Reports of mangrove clearing for oil installation, infrastructure and housing has also been reported. For instance, in Nigeria, WRI (2010) reported that 40% of the mangrove had been lost by 1980 and about 60% in Senegal. The report also showed that most the clearing was for urban development, coastal erosion and increases in salinity of water and soil resulting from the recent climate change.

Africapolis/SEDET (2012) reported that between 1950 urban growth within region have been stimulated by crude oil exploration and tourism. This oil rich area is spotted with industries, associated installations that often pollute the water and air. These installations, whether extractive, service or accommodation stations are served by a fleet of high powered tugboats that speed over the waters, deltas, creeks and canals. And against the background of the cleared mangrove forest and the fisherfolks thatched dwellings and dugout canoes, they almost look like water-borne Unidentified Flying Objects (UFOs) (Potts, 2012). Some researchers have noted that the oil industries although geographically interlaced in the area, a part from its pollution has no visible effects on life, work or income of the indigenous people (Fisherfolks). Here, one sees two separate and parallel worlds, one which is opulent in technology and living conditions, the other which is wretchedly poor, and with each seemingly ignoring the other.

Traditionally these coastal towns were small fishing ports inhabited by fisher folks who used traditional methods for their fishing. More than 80% of the fishes consumed in the region and/or exported came from here. However, the growing commercial success and subsequent foreign inhabitants working mostly in oil industries brought about a substantial infiltration of the existing coastal lifestyle. This with the new social, economic and political realities affecting their attitudes and since fishing is no longer lucrative (Moses, 2000) they now have to seek other ways to survive in a modernizing and dynamic, although technologically low level world.

Conceptual explanation

The concept of LifeStyle (LS) or Style of Life has a wide range of meanings and uses depending on the interest of the users. It has gained importance in the relevant literature within the fields of public health, marketing, social psychology and sociology (Cathelat, 1993; Holt, 1997; Bell and Hollows, 2006; and Heij et al., 2009). In these fields, researchers use the concept to explore consumer's diversity in relation to consumption (i.e. marketing); societal aspects (sociology) or individual group or culture which for example manifest in coping with physical, psychological, social and economic environment on a day-to-day basis. It is defined as the distinctive behavioural expression of a characteristics pattern of values and beliefs and that it is operational in terms of a recognizable set of personal construct

rating of everyday characteristics (Horley, Carroll and Little, 1988). LS is expressed in both work and leisure behaviour pattern and on the individual basis in characteristics, attitudes, interest, opinion, values and allocation of income. It also reflects people's self image or self concepts; the way they see themselves and believe they are seen by the others. In Wikipedia (2011) LS is seen as a composite of motivations, need and wants, and is influenced by factors such as culture, family, reference, groups, social class and location.

LS embodies the pattern that develop and emerges from the dynamics of living in a society. Thus, LS approach serve as an additional tool for traditional socio-demographic differentiation, because it includes aspects such as subjective patterns of values, intentions and preferences. Diverse societal changes like individualization and cultural emancipation are agents behind the current success of the LS concept (Bootsma, *et al,* 1993 and Kiprus, 2004).

A method of measuring LS patterns was based on their relationship to consumer behaviour. The most widely used approach of measurement was AIO (Activities, interest and opinion) rating statement (Williams and Tigert, 1971). Here LS pattern measures people's activities in terms of :

1. How they spend their time
2. Their interest, what they place important on, their immediate environment
3. Their opinion in terms of their view themselves and the world around them.
4. Some basic characteristics such as their stage in life cycle (age), income, education and where they live.

The basic premise of lifestyle research is that the more you know and understand the people, the more effectively you can communicate and market to them (Plummer, 1974) and of course the more you can integrate them into physical planning.

Over the years, a number of constructs have been useful in better understanding of the people's LS. The most popular is demographic, social class and psychological characteristics. Demographic have received broad acceptance and lend themselves easily to quantification and classification. However, demographics lack richness and often need to be supplement with other data, social class adds more depth to demographics but it, too often need to be supplemented in order to obtain meaningful insight into evidence. Lastly psychological characteristics are often rich but may lack reliability when applied to mass audience that result may be difficult to implement. However, the new construct now combines the virtues of demographics with the richness of and dimensionality of psychological characterise and depth research (Plummer, 1974). Based on this approach LS deals with everyday, beahvioural oriented facts of people as well as their feelings, attitudes and opinion.

In Land use planning, the concept of LS has been used to describe resident diversity in specific neighborhoods. In the past, planners especially those in housing had tried to characteristics or understand residential migrations in relation to residents demographic or socio-economics profile (families with children, young families, elderly, etc.) their knowledge had been used when designing specific houses for a particular target group (family houses, houses for the elderly, social houses or houses for starter).

Recently, however, planners have devoted attention to the concept of LS in different research contexts. Fredrichs, *et al* (2003) used the concept of LS to study the association between neighbourhoods characteristics and individuals out comes. Other (Pisman and Lambaerde 2011) used the concept to reveal new insights in the "driving factors" for the residential choices". Residential self selection, the spatial division of LS groups in different

neighborhoods as a result of the prior self-selection of residents into a built environment that is consistent with their per-disposition. This is considered to be one of the most important spatial impacts of LS. In this study, the AIO measurement approach was used.

Methodology

The methodology of the presented research is qualitative, since its aim to understand the underlying reasons for the existing situation and to provide insight into the setting and circumstances of existing problems and finally to generate possible ideas for planning solutions and recommendations. In order to examine life styles, qualitative methods were used. Since no data on life style aspects was available within the study area questionnaire was designed to provide information required. This was supplemented with interview about their socio-economic and demographic background. The questions include – Attitudes, Interests and Opinions as listed in Table 3. The aim was to get insight into their behaviour, values, and personality with regards to the environment, economic and cultural dimension.

The survey was conducted among residents from 18 years and above living in fishing neighbourhoods in selected coastal cities. Respondents were selected by the means of random walk method. This literally means walking through the neighborhood and interviewing/questioning residents or workers by the fishing ports. Since there are no official demographic data on the residents living within the neighbourhoods. The study was carried out between June 2013 and March 2014 to cover fishing period in wet and dry seasons. Other information was based on reviews of literature on land use planning and lifestyle.

On the whole about 1,436 persons were interviewed (Table 1), made up of fisherfolks, government officials, personnel in NATIP, planning officers and NGOs involved in various aspects of life in informal settlement and poverty reduction and some aspect of the coastal environment.

Results and Discussion

City	No. of Households	Population 2013	No. of questionnaire	No. of response	% of response
Ikot Abasi	27,643	163,091	288	273	18.20
Calabar South	39,922	235,539	310	296	19.73
Bonny	44,772	264,160	322	315	21.0
Illaje	60,417	356,464	380	364	24.27
Okoroette	12,501	73,756	200	188	12.53
Total	**185,255**	**1,093,010**	**1,500**	**1436**	**95.73**

Table 1: Distribution of Respondents

Source: field survey (2014)

Age	*Ikot Abasi*	*Calabar South*	*Bonny*	*Illaje*	*Okoroette*	*Total*
	Number of respondents					
18 – 27	69 (25.27)	75 (28.38)	71 (22.54)	92 (25.27)	40 (21.28)	347 (24.76)
28 – 37	74 (27.11)	84 (25.34)	77 (24.44)	90 (24.73)	42 (22.34)	367 (25.56)
37 – 47	58 (21.25)	61 (20.16)	72 (22.86)	67 (18.41)	35 (18.62)	293 (20.40)
48 – 57	40 (14.65)	52 (17.57)	56 (17.78)	62 (17.03)	38 (20.21)	248 (17.27)
58 &above	32 (11.72)	24 (8.10)	39 (12.38)	53 (14.56)	33 (17.55)	181 (12.61)
Total	**273 (100)**	**296 (100)**	**315 (100)**	**364 (100)**	**188 (100)**	**1436 (100)**
Sex						
Male	129 (47.3)	145 (48.99)	162(51.43)	186 (51.1)	92 (48.94)	714 (49.72)
Female	144 (52.7)	151 (51.01)	153 (48.57)	178 (48.9)	96 (51.06)	722 (50.28)
Total	**273 (100)**	**296 (100)**	**315 (100)**	**364 (100)**	**188 (100)**	**1436 (100)**
Income (₦'000)						
Below 5	25 (9.16)	38 (12.83)	40 (12.70)	48 (13.19)	22 (11.70)	173 (12.05)
5000-10	59 (21.61)	62 (20.95)	66 (20.95)	78 (21.43)	36 (19.15)	301 (20.96)
11000-15	64 (23.44)	71 (23.99)	70 (22.22)	81 (22.25)	40 (21.28)	326 (22.70)
16 - 20	70 (25.64)	77 (26.01)	80 (25.40)	83 (22.80)	48 (25.53)	358 (24.93)
21000+	55 (20.15)	48 (16.22)	59 (18.73)	74 (20.33)	42 (22.34)	278 (19.36)
Total	**273 (100)**	**296 (100)**	**315 (100)**	**364 (100)**	**188 (100)**	**1436 (100)**
Occupation						
Fishing	36 (13.19)	41 (13.85)	35 (11.11)	53 (14.56)	32 (17.02)	197 (13.72)
Farming	50 (18.32)	44 (14.86)	42 (13.33)	49(13.46)	29 (15.43)	214 (14.90)
Civil servants	62 (22.71)	67 (22.64)	61 (19.37)	75 (20.60)	42 (22.34)	174 (12.12)
Trading	21 (7.69)	47 (15.88)	46 (14.60)	42 (11.54)	18 (9.57)	307 (21.38)
Artisans	80 (29.30)	75 (25.34)	83 (26.35)	91 (25.00)	46 (24.47)	375 (26.11)
Others	24 (8.79)	22 (7.43)	48 (15.24)	54 (14.48)	21 (11.17)	169 (11.77)
Total	**273 (100)**	**296 (100)**	**315 (100)**	**364 (100)**	**188 (100)**	**1436 (100)**

Table 2: Socio-economic characteristics of Respondents
Source : Field Survey (2014)

Table 2 shows the occupational structure of the people. It reveals that majority of the people are artisans (26.11%), followed by other occupations such as trading (21.38), farming (14.90%) and fishing (13.72%), civil servants (12.12%) and others (11.77%).

S/N	Activity	Ikot Abasi	Calabar	Bonny	Illaje	Okoroette	Total	%
1	Fishing	14	16	19	21	15	85	3.27
2	Farming	11	9	7	13	8	48	3.34
3	Canoeing	10	8	10	14	6	48	3.34
4	Hunting	7	6	9	7	5	34	2.37
5	Entertainment	23	27	29	31	12	122	8.50
q	Politics	25	22	31	28	13	119	8.30
7	Sleeping/relaxing	19	20	19	17	10	85	5.90
8	Gambling	20	23	24	26	9	102	7.10
9	Smuggling	17	21	26	29	14	107	7.45
10	Lumbering	27	24	22	32	16	121	8.43
11	Net mending	8	11	10	12	5	46	3.20
12	Boatmaking/repairs	9	10	8	10	6	43	2.99
13	Housekeeping	4	4	3	6	2	19	1.31
14	Fish processing	14	20	21	24	18	97	6.75
15	Trading	23	28	32	35	20	138	9.61
16	Mat making	7	9	5	3	4	28	1.95
17	Firewood	8	10	8	12	9	47	5.91
18	Gathering (NTFPs)	12	13	15	18	7	65	4.52
19	Sand mining	6	9	12	16	5	48	3.34
20	Wine tapping	9	6	5	10	4	34	2.36
Total		**273**	**296**	**315**	**364**	**188**	**100**	**100**

Table 3: Activities among respondents
Source : field survey (2014)

Table 3 present varoius activities engaged by the respondents. From the table activities as matmaking (1.95%), netmending (3.20), house keepking for women (1.31) and boat repairs (2.99) are becoming unpopular among the residents of these communities. It shows a decrease in the number of people engage in the tradtional activities normally encountered in fishing communities. Rather occupations like lumbering (8.30%), entertainment (8.50), and trading (9.61%) are now the major activities of the people, followed by fish processing (6.75%), firewood selling (5.91%). Other activities such as gambling (7.10%), smuggling (7.45%) and sand mining (3.34%) are new activitiies which are becoming quite popular now in fishing communities.There is upsurge of illegal lumbering and firewood selling in all the cities studied which has resulted in a massive deforestation. Deforestation have been noted to have a range of consequences for both the people and the environment. These activities are on the increase in the area since enforcement officers hardly entered this part of the city because of their perculiar (poor acessibility and lack of infrastructure) terrain which provide hide out for criminals. Politicians also use these communities to carry out nefarious (kidnapping, hiding of ballots during elections, etc) activities which intensifies crime rate.

The result shows three patterns emerging from the study.
Urban Life*:* these group preferred the urban environment than their natural coastal/fishing communities. They are ready to spend all their income and even sacrifice to be on the other side of the city. One respondents interviewed was of the opinion that “since there was a total breakdown of their occupational activities and the world was evolving around them, there was no need waiting”. People in this group ended up taking menial jobs in the Government

Reserved areas as cleaners, cooks even as prostitutes. These are the people engaged in gambling and smuggling and politics who still maintained homes here.

Culture: to elicit information on culture questions were raised on marriages, ceremonies, dressing, recreation, housing and so on Fig.6a & b. depicts the new and old housing styles.



Fig. 2a Old housing design



Fig.2b New housing design

source: field survey (2014)

Occupation*:* Traditionally in the communities, the men were always out in the sea fishing or as recreation activities sit on the shore mending their nets and taking sips of palmy – a local liquor tapped from the raffia or oil palm tree while their women were processing fish for sale in the market from the last catch or engaged in petty trading and as part time sit out and gossips. But now things have changed. The progress of tourism development oil exploitation has brought in its wake significant lifestyle change. Locals who originally were subsistence farmers – fishing for men and farming and trading for women - are now employed in tourism relating facilities and services. Fishing are no more lucrative or the water is not yielding, so some of them become tour guides. Also the once busy fishing ports have been taken over by timber salers and smugglers bringing rice, household items and exporting petroleum products. The coastal areas are now littered with waste (fig.3 and 4)



Fig.3 polluted coastline filled with wastes



Fig.4: Timber business now takes over the ports

Plate 1 new lifestyle in beach beside the Marine club



Fig.5a Fishing port (2014)
Source: Field survey (2014)



Fig.5b same Fishing port in 2011
source:www.mundusmaris.org/images





Fig 6: Smugllers loading their boats in almost empty beach
Source: Field survey (2014)

Recommendations

1. There is need for a sustained education and awareness creation to be mounted in the rural communities on the nature, causes and effects of deforestation on the environment and human livelihoods. Such awareness campaign is very necessary as it will act as a source of empowerment to the locals on ways of managing the forest resources in their areas in the face of the climate change. Communication with stakeholders opens up the opportunity to initiate societal dialogue to create common vision of sustainable society.
2. Urban policies should support city design that will reduce social difference and invariably sprawl and ensures safety of the inhabitants. Since Lifestyles are so profound, cooperation between various actors are needed where each will contributes in its own way to the common goal of sustainable cities.
3. Since the main constraint to effective urban land use planning is the adoption of improper planning tools[see Mabogunje, (1968), Ujoh and Ifatimetion (2010) and Yahaya et al, 2013 for instance)]. The use of master plan in place of strategic plan should be reviewed. This is because master plan is static and assumed a slow growth of cities and tends to ignore the household preference and lifestyles. Government should adopt the structure plan which tends to provide a broad framework for citizens decisions and participation. This will help to reduce crime and environmental problems which is plaguing the region especially in the coastal areas in the face of the current climate change.
4. Intergrated coastal planning and management should be adopted as this will set priorities and enforce development setbacks to protect the coastal zone from the spread of urbanisation.

Conclusion

This paper was an attempt targeted at examining lifestyle among slum dwellers in coastal cities in West Africa. The study showed that urbanisation driven by poverty had led to exclusion of a large population of indigenous people living in fishing communities of cities. Since lifestyle components can be used be to develop urban plans which have the potentials of improving decision making, inform planning decision and incoorperate lifestyle of the people. There is therefore a call for a wider study of lifestyle and land use planning within the region, this is hope will build data and information to support interventions by nationals, governments, funding agencies and urban planners in the fight against insurgencies and poverty which as reveal in this study arises from poor planning and management of the urban environment.

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Reservoir urban space quality improvement on the post-three gorge era: case study on a few towns

Abstract

Three gorges dam is the largest hydropower station in the world, and is also China's largest ever construction project, with more than 20 counties involved and millions of immigrants generated by the engineering project. As the Three Gorges Dam getting into the process of operation and management, entire reservoir living environment is facing greatly reconstruction. Preliminary relocation and basic construction, challenge in urban space construction is much harder than the previous work. The post three gorges Plan was launched in 2010, country is promoting the development of urbanization in the form of transfer payments, with construction, employment, ecological compensation the main focus. According to precious studies, rapid urbanization, town homogenization, excessive commercialization and urban-rural mixture are key problems for urban space in such immigration new town. Since most traditional blocks and neighborhoods are flooded by the rising water levels amount to over 50 meters, the immigration new towns were designed and constructed very fast. Due to changes in building height, density, volume rate as well as construction materials and methods, the connotation of the past urban space demised. Economic development of cities and towns in the region was at a very low stage before the project and was worsen by the migration. Simultaneously, low-level equilibrium in both social economy and urban space together restrict the sustainable development of the reservoir area. The paper discussed the river culture of three gorges area and its spatial patterns of history, from the time-space-humanity perspective. Through case studies on a few towns of the reservoir and with the focus of their public space, the paper provides a series of human settlements improvement strategy in landscape, culture and social construction. It is further argued that simple policy support and transfer payments will work in a limited level, and urban space quality improvement should be much more important to the 20 counties, and millions of immigrants involved in the Three Gorges Project, as well as their sustainable development.

Keywords: urban space, reservoir, immigrant, Three Gorges region

INTRODUCTION

The Three Gorges region is situated in the main stream of Yangtze River, with its west from Fengjie in Chongqing Municipality and its east to Yichang in Hubei province. It has a total length of 193 kilometers. The Yangtze River cuts Wu Mountains within this region, forming Qutang Gorge, Wu Gorge and Xiling Gorge, which is extremely rich in the water power resources, (Zhao, 1997).

The Three Gorges Dam is considered to be the largest hydropower station worldwide and also the largest engineering project in the Chinese history. Since it caused many problems such as immigrant relocation, environmental pollution and so on, its

construction is always at issue. The Three Gorges Dam has many functions, for example, shipping, generating electricity etc. In 1992, National People's Congress approved of the construction of the Three Gorges Dam which started in 1994. The reservoir dam began the reservoir filling and power generation in 2003. The project was completed by the end of 2008.

The immigrant relocation from 1993 to 2009, which account for 45% of the total investment of the construction, is the biggest problem of the project. When finishing the reservoir filling, Wanzhou, Fuling and dozens of small cities were flooded, generating 1,400,000 people to immigrant. Mostly, the immigrant relocated backward, nearby and to other cities in other provinces, (Duan, 2011).

So far, the immigrants from the Three Gorge have already started their new life. Meanwhile, the cities of immigrants are rapidly formed in a generation or less, which have boomed along with a series of problems worth to be studied. After launching the follow-up work plan in 2010, the government attempts to support the construction, invest in the infrastructure, conduct career training and complete the social security, which indeed contributes to the development of the cities of immigrants from the Three Gorge. Nevertheless, most of the industrials in the cities are still in the recession on the originally weak basis, which creates a large number of unemployed. The monotonous and rough construction mode of new cities of immigrants has replaced the original riverside cities and towns in the Three Gorge, leading to the serious urban homogeneity. A large number of rural population were forced to dwell in the city, however, it is too hard for them to adapt to urban life. Urban employment depends too much on the tourism, which results in the coexistence of excessive commercialization and the lack of popularity. The quality of built-up space is not that good, which restricts the sustainable development of the dam region on both spatial and social economy.

The study focus on the new cities that rebuilt for the immigrants nearby the original cities flooded before, the spatial characteristics that are generated after “space-time compression urbanization” in short period and how to improve their space quality. This study took Wushan and Fengjie as typical examples of study. In Wushan, there are 96% of population that came from Wu Gorge, and in Fengjie Town, there are 98% of residence that immigrated from Yongan Town. The central downtown of these two towns were directly flooded. However, Wushan is the typical example of the cities in the backward economy situation in the region of the Three Gorge, Fengjie is above the average.

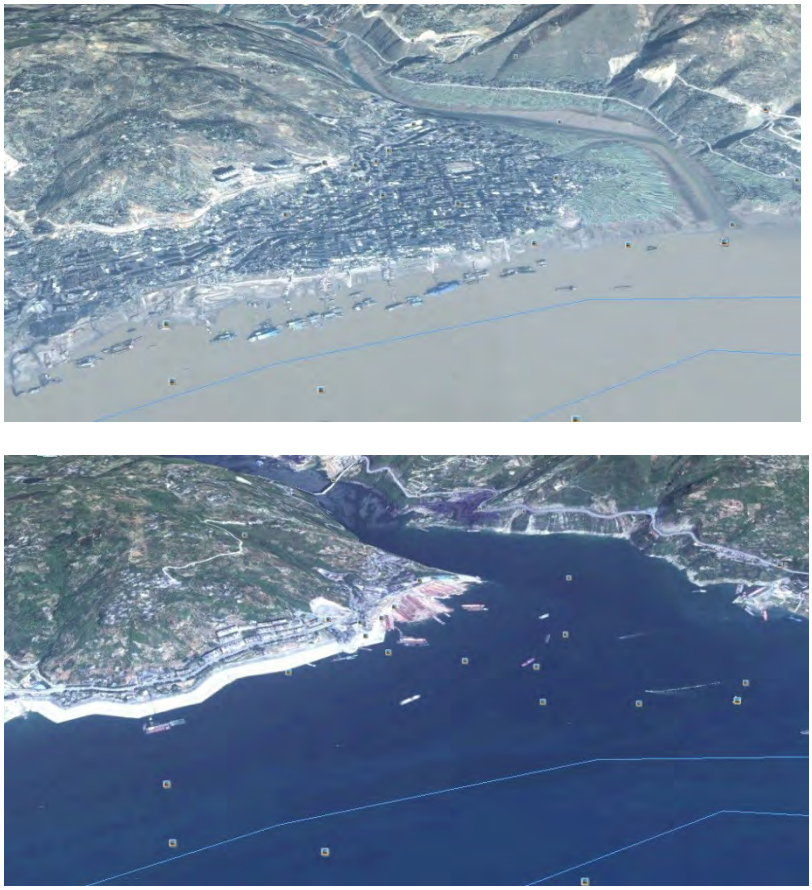


Figure 1: *The contrast of landscape of Fengjie between 2000 and 2014*

HISTORICAL CHARACTERISTICS OF URBAN SPACE

The towns along the Three Gorges have characteristics of waterfront development in history. People in the Three Gorges completely cannot live without water, because of the steep mountains, lack of agricultural land, people turned to water to make a living, forming the customs of "male water female farming," varying other parts of China greatly.

For thousands of years, people rely on the Three Gorges to make a living, eat and drink by the river crafts. Relying on the golden waterway to come out from Sichuan and go to Chu area, it gave birth to a unique maritime culture, as well as unique lifestyle of driving the boat, pulling the tow rope, and shouting chant.

From the beginning of the Three Gorges areas' human's settlements formed by water, urban space in the Three Gorges area formed typical characteristics. Most ancient towns are located the along the river or in the confluence of two rivers and rivers form from the intersection to large towns, the river forming from the intersection to town. In the long historical development, even before the starting of the Three Gorges project, the Three Gorges areas were inaccessible by land and the Yangtze River shipping took most passengers and cargo flows. Urban development by combining pier, along the river is also the origin and development of the town center area. In the

direction of the formation of the traditional commercial district and the vertical waterfront development, generally there will be one or more longitudinal development axis leading to different piers.

At the same time, due to the development of waterway, towns are in the Riverside area along the river. The Three Gorges areas are special in topography, geomorphology and diverse with complex geological conditions. So that different towns are generally smaller, in the form of self-organization, following the mountain's flexible layout, forming street space along the mountains.

In the Three Gorges region's history, there were a lot of the historic cities towns, such as the Ningchang Town, Dachang Town, Xituo Town, etc. In some existing town space with the Three Gorges watershed characteristics, we can feel the vitality parallel to the riverbank and vertical lines in the urban development of the spindle climb. Especially the commercial space along the rung up, due to changes in its elevation, it forms extremely rich spatial effects.



Figure 2: *The typical urban space*

URBAN SPATIAL CHARACTERISTICS AND THEIR CAUSES

Overall relocations take place in many towns the reservoir area in very short times. Relocation, re-planning, rebuilding and reconstruction are compressed in about 10 years for those towns of Three Gorges Reservoir Region. The time and space compression in large-scale with mutation and evolution is hard to repeat in China, not to mention in the rest of the world. In China nowadays with rapid urbanization, such offsite urbanization for up to millions of people is very distinct for Scholar to do various researches. Geological disaster prevention, engineering quality maintenance and ecological safety preservation are all the basic problems to Three Gorges Reservoir Region, (Zhao, 2013). In addition to these, we mainly focus on social structural imbalances, cultural space loss and urban space deterioration with such rapid physical space growth in these areas. Such time and space compressed

urbanization has negative effects on both the social- economic and the urban built environment. Negative effects are multiplied with each other to restrict the sustainable development of the region, (Nie, 2011).

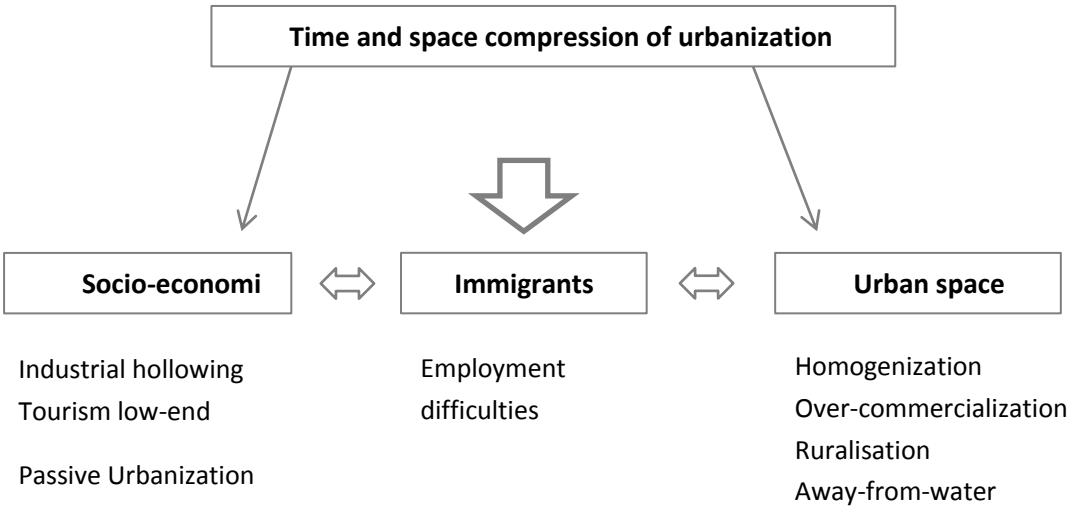


Figure 3: *The model of urban spatial change*

SOCIAL ECONOMIC ASPECT

1. The hollowing of Secondary industry and the rely on Tourism industry

We selected two cases to do such research, one is Wushan County and the other is Fengjie County. Wushan County is famous for its witch culture while Fengjie is known as the Poetry City. The three industry structure of Wushan County is 22.3：34.9：42.8 and the three industry structure of Fengjie County is 19.7:36.5:43.8. Both cities have the comparatively higher share of tertiary industry.

Not only for those two counties, the tertiary industry shares of most counties and cities in Three Gorges Reservoir Region are high, and mainly for the tourism industry. The share of tertiary industry amounts from 35% to 45% in those counties and cities. They rely on the development of the tourism industry. In addition to these, agriculture occupies a large proportion in many of them except for Changshou City, Wanzhou city and Fuling city.

Many historical reasons can be used to explain the generally underdeveloped secondary industry. Inaccessibility transportation, insufficient investment and incomplete environment all lead to bad industrial development. Small-scale industrial enterprises with low output value have not survive in Three Gorges resettlement project even with special policy for industry preservation and development. With the improvement of traffic conditions, most enterprises go bankrupt and close down in increased competition. According to previous study, the proportion is as high as 62% in Three Gorges Reservoir Region. The status of industrial enterprises is also not

optimistic since the technology gap is very deep for them. Subsequent development can hardly make contributions to urban development. That is the jobs offered by second industry do not meet the needs of the original urban migrants in quantity and quality, not to mention those rural migrants, (Nie, 2011).

As advocated in Post-Three Gorge Planning of the country, tertiary industry is the key to future development in Three Gorges Reservoir Region in the future with tourism industry the main focus. Under the existing conditions, tourism industry is not the main promotion of urbanization quality. A large number of the employed population work in commodity sales service for tourists. Homogenization competition lowers their income and reduces the quality of tourism industry. Since the main focus of tertiary Industry is on the tourist services, the lack of overall commercial atmosphere and low-end of the local purchasing power all result in a large number of shops idled.

County	Proportion	Primary Industry	Secondary industry	Tertiary Industry
Wushan	22.3：34.9：42.8	Forestry and animal husbandry, Medicinal herbs, Flue-cured tobacco	Energy, Building Materials, Pharmacy, Coal Chemical	Tourism
Fengjie	19.7:36.5:43.8	Ecological Agriculture	Energy, Fruit processing, Business	Tourism, Trade and Logistics, Environmental Information

Chat 1: *Comparison between Fengjie and Wushan*

2. Passive Urbanization for farmers and the Reaping without Sowing Sprit

The immigration policy divides immigrants into two categories, the units and the individuals. Immigrant communities for the units are built in central parts of the city space and are under closed management. Immigrant communities for individual citizens and farmers are constructed in the edges with low quality and vulgar landscape. The both coexist of such two communities constitutes a fragmented urban social space, (Nie, 2011).

A considerable part of farmers with low professional skills and cultural level do not adapt to urban lifestyle. They are placed into town with former farmland flooded. Meanwhile, there are not enough jobs for them in small cities and towns, Wushan and Fengjie are typical cases. After painful seeking for jobs, they choose to stay at home. As far as we have investigated, many young men stay at home and live with minimum living allowance provided by the government and gradually lose the interest in work.

The cases are common in Three Gorges Reservoir Region and they are mostly in rural migrant communities. Indolence and idleness spread in many rural migrant communities and breed serious social problems. Social isolation between unit

immigrant communities and individual immigrant communities is worsened. In Poetry City Fengjie, a historic city with numerous famous poems, people take playing mahjong as the only live entertainment. Many people start playing mahjong in the morning and ends until midnight.

URBAN SPACE ASPECT

1. Urban landscape with homogenization, over-commercialization and ruralisation

Immigrant Cities and towns in Three Gorges Reservoir Region are mostly constructed in 1990s and are built in less than 20 years. The construction speed is so high that the spatial characteristics are not clear. Almost all the towns adopt similar construction elements, building scale and colors. Urban landscape can't be optimized in such time-space urbanization. From above the Yangtze river, differences between the towns are hard to be compared by the visitors.

As restricted by the terrain for those submerged old towns, the per capita land amount for construction is low. The urban space used to be crowded but vibrant. In new immigrant town planning, the per capita land amount for construction doubled several times. The expanding urban scale leads to the complete urban fabric loss. Meanwhile, the hills are flattened for more development space, which add to the further loss mountainous area characteristic.

On this basis, excessive commercial land as well as rural landscape in town is such urbanization result. In order to generate more commercial space, the first floors for many urban residential areas are shops, (Huang, 2011). There are too much more shops than the city real need so many of the shops finally close down. In contrast with it, in some farmer communities, people use house glades to plant vegetables. They add to the dramatic urban landscape while homogenization, over-commercialization and ruralisation take place at the same time.



Figure 4: *Urban landscape with homogenization*

2. The city getting away from the water

The towns in Three Gorges Reservoir Region gradually move away from the water. Waterfront areas are changed into large cement slopes for the prevention of geological disasters that may occur. Especially when the Yangtze River water level is not high, the huge cement slopes for nearly 30-40m are in stark contrast to urban space. The city seems to stand in a cement slope from the above water view.

Riverside avenues and parks are built in most reservoir resettlement towns. The desolate riverside strip with huge non-human scale makes people feel uncomfortable. In former towns of Three Gorges Reservoir Region, the waterfront is the space for business, assembly and commercial. With the increase of Yangtze River water level up to 100 meters, those areas are mostly flooded as well as the city vitality.

On one hand, it is because that the city centers planned are mostly in geometric centers with flat zones. They treat the towns of Three Gorges Reservoir Region as those in plains. On the other hand, the former rely on water is decreased by the improvement of traffic conditions.

Stairways perpendicular to the water lose vitality at the same time. This space functions as the connection between the pier and the inner town for business. Porters, peddler, traders, buskers, pacers and shoppers use the space together. The space is informal commercial space for the city.

In town and city planning for Three Gorges Reservoir Region, such traditional spatial organization is inherited but changed a lot, leaving at least one Thousand-steps Stairway in each city. Scale changes a lot from several meters to over 30 meters wide and linear is fixed as a straight line with no small spatial variation. On the details, a serious shortage of trees, shade and seating leaves the space unpleasant and unused. The flattened policy for sloping fields make the city space more suited to car traffic, further reducing the use of this space. Deng Stairways and Zhaojun Stairways are typical examples for such kind of space. The Buyun Stairways of Fengjie County is a good case with its moderate scale and informal trade allowance.



Figure 5: *Stairways of Yunyang and Fengjie*

CONCLUSION: URBAN SPACE QUALITY OPTIMIZATION STRATEGY

Recently, the country mainly focuses on the promotion of tourism industry and the education for immigrants. The education and development will play a role in long-term and then lead to the improvement of urban space.

At the same time, the optimization of urban space can help improve the social-economic situation. Though the social gap is obvious, it is impossible for the government to directly invest in further immigrant housing construction with the limit of budget. Optimizing the quality of urban space can start from the details of urban space as mentioned.

1. Increase of the use of waterfront space

With waterfront activities and events, the waterfront vitality will be stimulated and the waterfront will be used in people's everyday life. Waterfront will act as the important entry into the town of Three Gorges Reservoir Region, differences in development can increase the degree of recognition for different cities. Senior travel services industry should be conducted there.

2. Urban growth boundary established

The flatten land and land sprawl damage urban space a lot and they eroded landscape background of beautiful waters and hills. We should follow the laws of the development of the mountainous city and promote the multi-center development.

3. Landscape adjustment in public space

Increase the vertical commercial space activity with the addition of public platforms, trees and seats. Informal commercial activities should be allowed as well as other Informal activities such as Playing cards, playing chess and chatting. Informal commercial activities can provide informal employment jobs for people while informal activities can provide more social life than simply playing mahjong.

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The Impact of Water Resource Planning on Water Issues in Beijing, China

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1. Introduction

Beijing is currently facing extremely serious water resource problems. The most prominent issues include acute water shortages, severe water pollution, flooding, soil erosion and the deterioration of aquatic ecological conditions. The severity and complexity of the overall water resource situation are manifested by intertwined multiple crises and challenges. A number of studies have analyzed the relationship between urbanization and water resources; the findings revealed the intensity of the impacts of urbanization on water quality (Fang, 2008; Haase, 2007), water recycling and water use (Alberti, 2007; Poelmans, 2010; Deng, 2009). However, the issue of whether urbanization or the past approaches to urbanization have influenced water resource problems has not been discussed. Urban planning reflects the city's approach to urbanization. As a part of urban planning, water resource planning refers to the development, use and management of water resources, and reveals what people value and the way in which they approach water use issues and problems. Thus, this paper examines the relationship between water resource planning and water resource conditions in Beijing over the past 60 years to explore the relationship between water resource problems and the implementation of urban water resource planning in Beijing (Figure 1). That is, the impact of Beijing's approach to urbanization on water resource issues was analyzed.

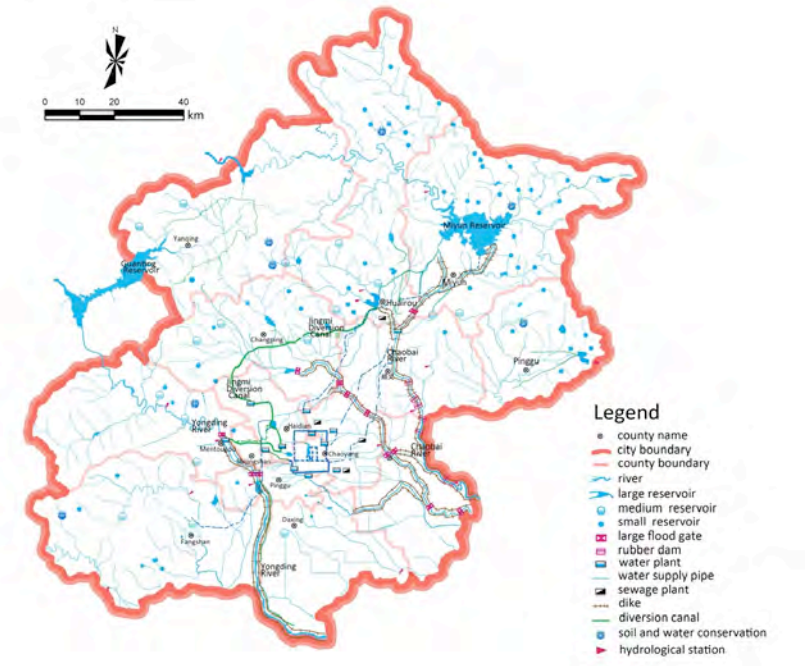


Figure 1. Distribution of Beijing water resource planning projects

2. Changes in water issues in Beijing since 1949

In 1999, the total amount of water available to the city of Beijing and the surrounding areas started to decrease markedly, and the amplitude of fluctuations in water availability also declined (Figure 2).

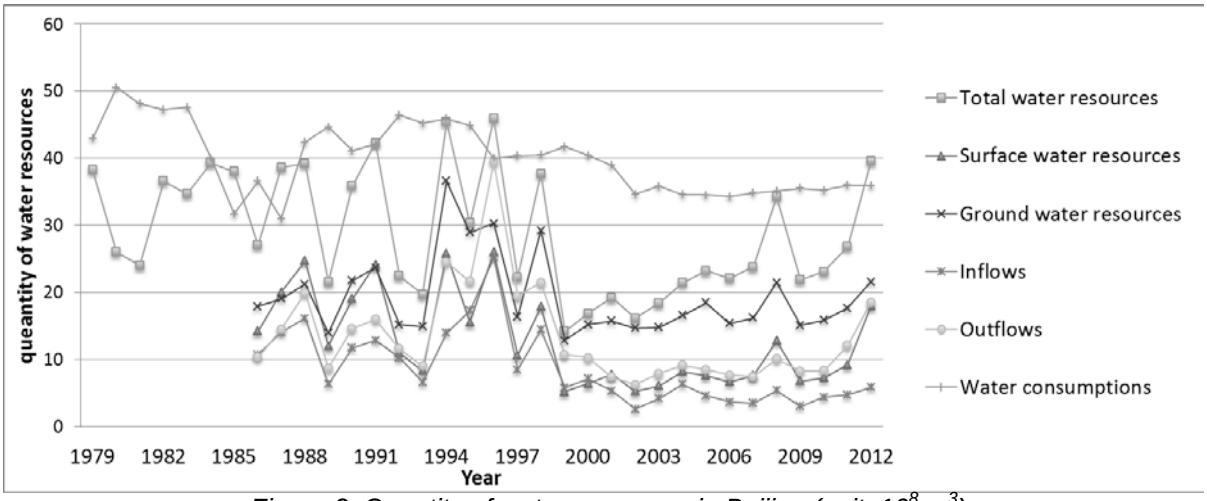


Figure 2. Quantity of water resources in Beijing (unit: 10^8 m^3)

The inflow to Guanting and Miyun reservoirs has declined continuously since the 1950s and dropped sharply around 1999 (Table 1). The water table also gradually dropped. In the 1950s, the water table was very shallow, at only about 1 m in the eastern outskirts of the city; yet in 2010, the average depth to groundwater was more than 25 m (Table 2).

Table 1. Guanting and Miyun, the two main reservoir inflows since 1949.

Decade	Guanting Reservoir		Miyun Reservoir	
	Average precipitation in the basin (mm)	Average inflow (million m^3)	Average precipitation in the basin (mm)	Average inflow (million m^3)
1950s	477	2030	701	2992
1960s	417	1321	484	1113
1970s	426	831	514	1278
1980s	404	561	462	596
1990s	415	404	503	749
2000s	375	150	467	280
2010s	557	113	635	294

In terms of water quality, wastewater discharge (Figure 3) and water pollution in Beijing gradually increased during the study period. In the 1950s, only a very small number of rivers were polluted. Yet in the 1970s, based on monitoring data from 26 rivers, canals were receiving more than 50,000 cubic m of industrial wastewater daily, mainly concentrated in the Tonghui and Liangshui river systems; in the western part of Beijing, groundwater was contaminated by phenol and cyanide; in the eastern suburbs, a total of 63 plants in the industrial area on both sides of the Tonghui River caused serious pollution to downstream rivers and farmlands, resulting in salinization of farmland and the elimination of all fishery and shrimp resources in the rivers; wastewater posed a serious threat to water quality in Nos. 3 and 4 water plants; some plants discharged a large amount of steel slag, ash and calcium carbide that blocked Yongding River and other rivers(Beijing Local History Compilation Committee, 2000). In the 1980s, more than 30 rivers and ditches were contaminated; among the five major water systems in the city, with the exception of upstream areas where water quality was relatively good, the majority of the middle and downstream rivers were increasingly polluted; in the urban area, more than 450 km of downstream river channels were severely polluted, including over 50 km of channels were filled with lifeless dark and putrid water. In 2010, all drainage channels were contaminated or dry to various degrees; water quality in 967.6 km of river channels fell below grade V, accounting for 44% of all river length evaluated (Zhang, 1992; Yan, 1999).

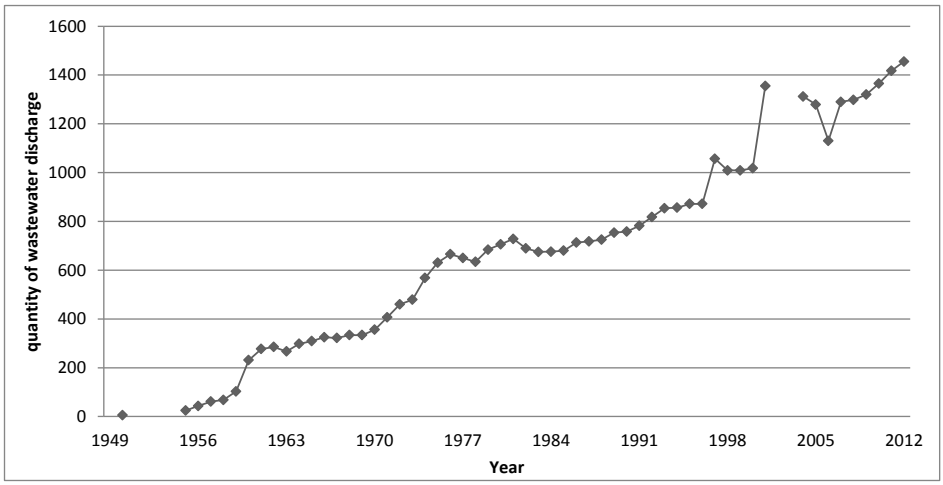


Figure 3. Wastewater discharge in Beijing since the founding of P. R. China.

According to the Beijing water authority and water conservancy logs, in the early 1950s Beijing's water resource problems mainly involved water-based environmental contamination and flood drainage problems, while during the 1960s the water resource problems mainly involved flood control and water supply. Nevertheless, a number of water resource issues started to appear after the Cultural Revolution; after reform and opening up of China, Beijing continued to be aggravated by water resource issues. Today, water resource problems have become extremely severe and complex; individual issues have gradually evolved into complex issues with each facet becoming extremely complicated. In particular, water shortages, water pollution and ecological problems have become issues no less severe than floods. Therefore, changes in water quantity and quality along with changes in water resource issues over the past 60 years suggest that Beijing's water crisis is becoming more complicated and intertwined.

Table 2. The average depth to groundwater in Beijing since 1949.

Year	1960	1970	1980	1985	1990	1995	2000	2005	2010
Average depth to groundwater (m)	3.09	6.32	7.24	9.58	10.62	11.26	15.36	20.21	25.33

3. Evolution of water resource planning in Beijing since 1949

During the initial restoration of the aquatic environment and the construction and development of water conservation projects (1949–1957), to solve problems related to delayed maintenance of old, dilapidated water conservation structures, contamination of a disorganized water management and flood drainage system, river channels were dredged and repaired. Water resource planning and development during this period mainly involved construction of the Guanting Reservoir, stabilization of the embankments of the Yongding River, construction of power stations at reservoirs, development of the Yongding River diversion project, as well as construction of second, third, fourth water source plants for Beijing, which used underground water sources. In addition, the government encouraged the masses to dig wells in response to drought and to develop farmland irrigation systems. During this stage of large-scale construction of water diversion facilities and the associated adjustments needed for aquatic resource planning (1958–1965) several projects were initiated. These projects targeted flood control and water supply, which were the major water resource problems of the time. Large-scale water control planning and related construction focused on flood control, developing water supply sources, irrigation, and dealing with farmland waterlogging and saline-alkali soil conditions. The Ming Tombs, Huairou and Miyun reservoirs were constructed. Stone embankments upstream of the Marco Polo Bridge on the Yongding River were restored, and Jingmi Diversion Canal was excavated. From October 1962, people on the outskirts of Beijing started to install wells with electrical pumps, to

supplement irrigation water. The fifth, sixth, and seventh water supply plants of Beijing were also constructed. During this stage, both the speed and size of construction projects in support of Beijing's municipal water supply exceeded that of the previous stage. However, under the influence of "Great Leap Forward," some water projects were launched in haste, and the resulting facilities failed to serve the intended purpose.

The next stage involved chaotic development and use of water resources (1966–1978). The Cultural Revolution disrupted and damaged the original water conservation projects in Beijing. Five medium-sized reservoirs and more than 30 small reservoirs were built; the left embankments upstream and downstream from the Marco Polo Bridge on the Yongding River were heightened and strengthened repeatedly. After the 1972 drought, another round of well digging began. By 1978, nearly 40,000 wells with electrical pumps had been built, and Beijing's eighth water supply plant was constructed.

During this stage water resource planning and water source treatment plant construction centered on the development of a modernized city (1979–1998); problems including water shortages, water pollution, poor aquatic environments and continual floods continued to aggravate the Beijing's water problems at an ever-increasing rate. To solve these problems, integrated use and planning of the river channels were carried out. Based on functions other than flood control and drainage, the city river channels were divided into three categories: water resource channels, landscaping and ornamental river channels, and irrigation aqueducts. In addition, left embankments upstream of the Marco Polo Bridge over the Yongding River were reinforced, and a new flood control hub was built. Two medium-sized reservoirs, Shirakawa and Yaoqiaoyu reservoirs, were constructed and two channels designed to provide supplemental water for Guanting and Ming Tombs reservoirs from Shirakawa Reservoir were built. Twelve small reservoirs were completed. A ninth water supply facility was constructed, and the project known as the Xiangyang gate drainage was launched.

At the stage when resource-oriented water supply construction was active with the goal of achieving harmony between humans and the nature world (1999–2012) (Wang, 2005a), the comprehensive South–North Water Transfer Project was launched with the goal of fundamentally solving urban water shortage. Water source protection and the rational allocation of water resources were proposed as a way to achieve a balance between supply and demand. Methods of using recycled water, rainwater and other non-traditional water sources were developed. The rivers, lakes and canals of Beijing were included in the overall planning with a goal of building various parks and recreation facilities. The central city flood control plan was still guided by the strategy of "storing in the west, drainage in the east, and flood division in the north and south" (1992) and included comprehensive management of rain and floodwaters.

4. The impact of water resource planning on water resources

4.1 The impact of water resource planning on water shortages

Since the founding of the P. R. China (1949), a large amount of surface water has been developed, mainly in the form of the construction of reservoirs, embankments, sluices and gates designed for controlling base flow impoundment. In 2011, among the five major river systems that pass through the Greater Beijing area, with the exception of Juma River, controlling reservoirs have been built on all these river channels. A total of ten rivers, large and small, in the Beijing area have been under the control of such reservoirs with a capacity of 3.1 billion m^3 of water. The list includes these rivers (reservoirs): Yongding (Guanting), Chaobai (Miyun), Wye (Huairou), Dongsha (Ming Tombs), Ju (Haizi), Yanxi (Beitaishang), Taoyugou (Taoyukou), Xiekuo (Tiankai), Baiyanggou (Wangjiayuan), Wenyu River tributary (Shayukou). The five remaining free-flowing rivers contained 1.9 billion m^3 of water. Currently, most of the usable runoff is controlled by reservoirs. Among the 1.9 billion m^3 of uncontrolled water, only 100 million m^3 of water can be used effectively (Beijing Local History Compilation Committee, 2000).

Changes and improvements to the water resource situation along with the water conservation efforts revealed that these developments have been ineffective in relieving the pressure on the water supply or the water crises. Instead, many new water shortage problems were spawned. In particular, Guanting Reservoir was built as an urban water supply, yet a series of problems occurred. (1) Limited progress of water and soil conservation within the watershed was only achieved because the reduction of sediment has proved difficult, when supplying water for downstream industries and urban water needs. This problem, experiences that led to severe sedimentation in the reservoir. (2) As upstream urban water consumption increases, the water table in the vicinity Beijing drops very rapidly; this situation together with poor control and management of soil erosion, has caused the amount of inflow into the reservoir to continue to decline (Figure 4). In 1984, the amount of inflow was reduced to about 300 million m^3, and was no longer able to meet the water needs of Beijing. From 1986, each year 60 million to 100 million m^3 of water was diverted from Baihebao Reservoir for the purpose of providing an urban water supply to Beijing. (3) Since water was not released from the reservoir, and because wastewater discharged from plants built on the banks of the rivers that supply water to the reservoir discharged polluted and untreated water, the lake water became contaminated. The source of contamination is mainly from both sides of the Yang River; each year 40–100 million m^3 of sewage were discharged into the Yang River. In the 1970s, organic pollution increased, and the water became eutrophicated; weeds grew on the dam, and the water turned black, smelly, containing severely excessive amounts of ammonia and coliform bacteria. Biochemical oxygen demand exceeded the available dissolved oxygen. These problems ultimately caused the water stored in Guanting Reservoir to be removed from the urban drinking water system. These issues and factors illustrate that as a complex water system, the Yongding River water system cannot be properly controlled by simply constructing a series of projects for different purposes. With this approach, efficient use of water resources cannot be achieved. The fact that the water in Guanting Reservoir was removed from the municipal drinking water system, in a sense, was a waste of water resources, and exacerbated water shortage problems.

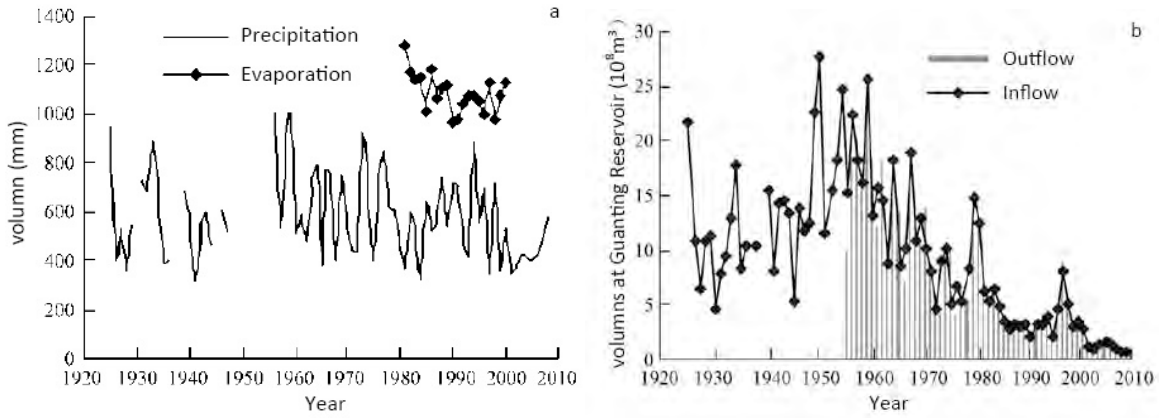


Figure 4(a). Precipitation in 1925–2008 and evaporation in 1981–2000 in Yongding River Basin (Beijing area). (b). Inflow in 1925–2008 and outflow in 1955–2008 Guanting Reservoir. (Source: Yu et al., 2011)

4.2 The impact of water resource planning on the complex conflicts in water resource issues

Since the founding of P. R. China, the Yongding River has experienced many impoundment projects, embankment projects, sites of streambank stabilization projects and floodwater retention projects, designed to control floods and attempt to store rainwater. At the same time, the Yongding River was used as an urban water supply and for agricultural irrigation, hydropower development and sand mining. For flood control, embankments were heightened and strengthened in 1966, 1967, 1969, 1973, 1974, 1976, 1978, 1979, 1980, 1982, 1983, and 1984(Beijing Local History Compilation Committee, 2000). Even when the Yongding River dried up, flood control projects were still in progress. Meanwhile to control water from

the Yongding River, reservoirs were constructed (1954) and aqueducts were built for water diversion (1956)(Zhang, 1992).
However, the impoundment at Guanting Reservoir led to drying up of the Yongding River. In the last 50 years, inflow to Guanting Reservoir dropped sharply at a rate of 23 million m^3 yr^{-1}. Correspondingly, its outflow was reduced from 2 billion m^3 yr^{-1} in the 1950s to 43 million m^3 yr^{-1} in 2008. Thus, although drainage from Sanjiadian was reduced, the proportion of water drained from Sanjiadian tended to grow, rising from about 20% in 1957 to around 50% in the 1960s; in the 1970s, the proportion of diverted water continued to exceed 80%, sometimes even reaching 100%. This caused the runoff at Sanjiadian to fall from 35 million m^3 yr^{-1} to essentially zero after Guanting Reservoir was completed (Figure 5). As a result, segments of the Yongding River in the plain often dried up, exposing the riverbed and contributing to severe sandstorms.

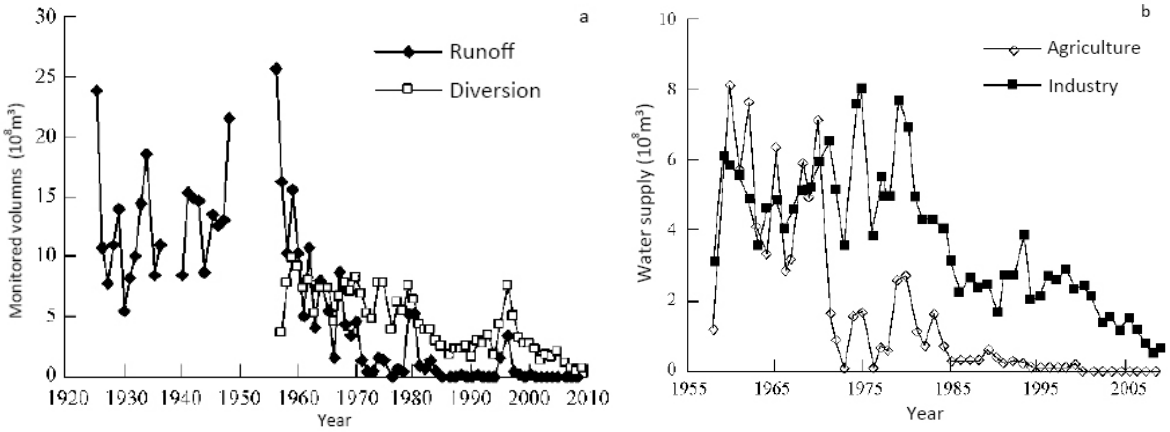


Figure 5(a). Runoff in 1925–2008 and diversion in 1957–2008 at Sanjiadian Station, Yongding River. (b). Industrial and agricultural water supply from Guanting Reservoir in 1958-2008. (Source: Yu et al., 2011)

In the 1980s, the limited water resources in the Yongding River were almost completely drained for industrial use in the western part of Beijing. This exacerbated the drying up of the Yongding River at Sanjiadian. In addition, economic development along the riverbanks introduced increasing amounts of sewage discharge that polluted the river channels. Together with the sandstorm arising from sand and gravel pits, the environment of the Yongding River was deteriorating. Thus, the previous several rounds of flood control and water resource planning did not consider all aspects of the needs of the Yongding River, and different individual projects designed for various purposes jointly led to conflicts between flood control, water shortages and deterioration of the environment. Similar problems also impacted the Chaobai and other rivers.

4.3 The impact of water resource planning on aquatic environment

According to statistics, 1×10^4 km and 4000 km of the river channels in the Haihe River Basin dried up, including the part in the Beijing area (Xia, 2004). In 2011, numbers rivers had dried up or shown signs of seasonal drying in the Beijing area. These include all or part of 18 rivers. Here, the Chaobai River basin, which suffers from most serious drying and negative environmental impacts, was analyzed as an example.
When the P. R. China was founded, the Chaobai River had abundant water. Starting in 1950, exploitation on the Chaobai River water resources gradually increased. A number of projects were carried out in the middle and downstream reaches of the Chaobai River, including embankment restoration, excavation of the new Chaobai River, expansion of the Dong Yin River, Qinglongwan dredging, the Niumutun flood diversion and the Huangzhuangwa floodwater detention project. Miyun, Huairou and six other large reservoirs were constructed, and the Jingmi Diversion Canal with Xiangyang Floodgate was built for impoundment of the river's base flow, in order to supplement water to the eighth water supply plants in Beijing and for irrigation of surrounding farmland.

Since 1965, the Chaobai River has continued to dry up and dry up earlier in the year and for longer periods of time; the dry segment continued to expand upstream (Figure 6). Development and use of the water resources of the Chaobai River in the past 60 years can be summarized as follows:

1) Before 1960 the river flowed continuously. The construction of flood control embankments and diversion for irrigation continued started in this period. After 1960, when Miyun Reservoir had been impounded, runoff values measured at different hydrological stations downstream from Miyun Reservoir were substantially reduced (Table 3), apparently a result of the construction of the Reservoir.

2) After the establishment of Miyun Reservoir the number of projects designed for water resource management and development increased. In 1960–1981, a total of 15 medium and small reservoirs were built in the upstream reaches of the Chaobai River, allowing control of all runoff in the upstream area; these reservoirs were then further developed for power generation and as water sources. The Niumutun flood diversion project in 1971 was considered to be a major part of the Chaobai River project; nevertheless, in 1972 and 1975, the most serious drought since 1949 occurred. At Ganshui Dam Hydrological Station, the drying of the Chaobai River was first monitored in 1972, and the drying phenomenon has continued along the Chaobai River channel.

3) In the 1980s, Beijing's experienced rapid economic development. Increases in industrial and other water consumption exacerbated the urban water shortage. Drought occurred in two consecutive years, 1980 and 1981. In 1981, Xiangyang Floodgate was constructed for impounding base flow, to supply water to the eighth water supply plant for Beijing, which had pumped groundwater too rapidly, causing a rapid decline in the water table, and to supply Gaobeidian power plant with water. Data measured upstream of Suzhuang Hydrological Station showed that during this time period, the Chaobai River runoff exhibited another sharp decline after 1961 (Table 3), presumably because of a rapid increase in water withdrawal from Chaobai River.

4) In 1990s, seven rubber dams were built on Chaobai River to strengthen the impoundment of floodwater, alleviating the decline in runoff. Yet long-term drying still occurred; infrequent and unstable runoff occurred only during heavy rains in the rainy season, when the reservoirs were overfilled and needed to be drained.

5) In recent years, the past history of seasonal drying of the Chaobai River has turned into long-term drying. At least five large water-use-intensive golf courses have been constructed in the vicinity. In addition, persistent exploitation of groundwater had led to a decline in the water table, making it impossible for groundwater to supply water to the river. Furthermore, the contamination of groundwater at the bottom of the river and sand mining over large areas have led to increasingly complex and severe problems threatening the environment of Chaobai River.

Table 3. Runoff from the Chaobai River measured at Suzhuang Hydrological Station.

Years	Runoff (10^8 m^3)
Before 1960	19.85
1960–1970	9.95
1971–1980	9.32
1981–1990	0.81
1991–2000	1.2

From 1949 to the end of the last century, Chaobai River was controlled by various large and small water diversion projects. The sharp declines in runoff and water quantity, as well as the drying of the river coincided in time with several major water diversion projects. After 2000, the government focused on integrated management and ecological re-construction of the Chaobai River. However, because of the excessive project-oriented water diversion and severe lack of resource-oriented water conservation in the past, it will be extremely difficult to restore the Chaobai River to its original state because of ongoing drying and environmental degradation. Thus, excessive project-oriented water withdrawal and a lack of resource-

oriented water conservation have intensified the worsening of the aquatic environment and a loss of the associated water resources.

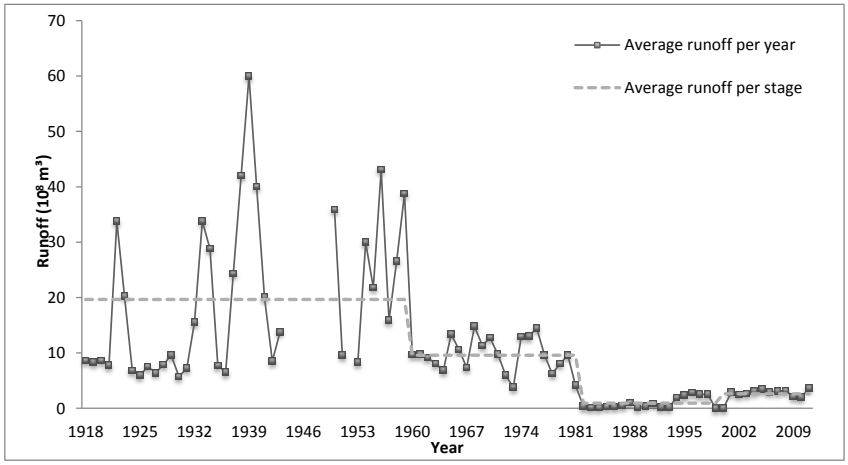


Figure 6. Different stages in the evolution of Chaobai River runoff (Suzhuang Hydrological Station). Unit: (10^8 m^3)

4.4 The impact of water resource planning on groundwater decline

Since the founding of the P. R. China, the use of groundwater and well water as water sources has continually increased due to the increased population and the associated industrial and agricultural needs for water. In suburban areas, a major part of drought mitigation often involved the digging of wells. The amount of groundwater available was never considered before groundwater was withdrawn to meet the increasing demand. Especially from the 1960s, as a result of two major droughts in 1962 and 1965, as well as the "Great Leap Forward," urban and rural water wells were excavated in unprecedented numbers.

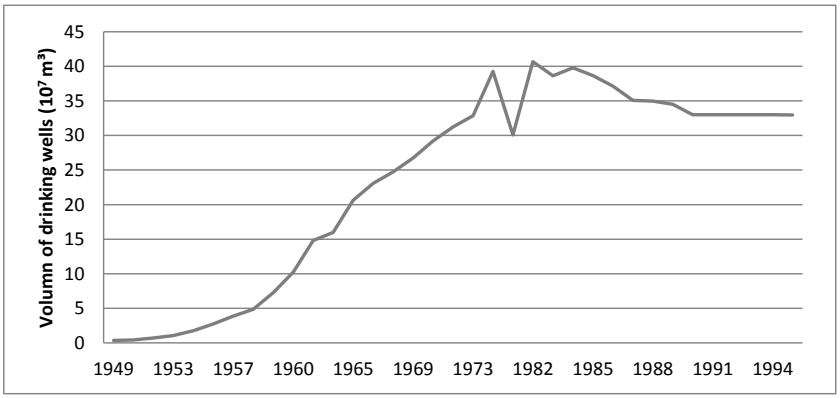


Figure 7. Volume of privately funded drinking wells in Beijing in different years. Unit: (10^7 m^3)

In 1961, the government first began the first detailed surveys of groundwater resources, and the result suggested that Beijing was blessed with abundant High quality groundwater, suited for irrigation and drinking. Thus, large-scale use of groundwater started. In 1954-1963, the government constructed five water plants that used groundwater as a water source for the urban areas to increase the supply of domestic water (well water); the total number of water plants built during this period accounted for half of all water plants built since the founding of P. R. China in the Greater Beijing urbanized area. Different businesses also began to exploit a large number of privately funded and managed wells which were largely used as legal water resources (Chen, 2011). The volume of privately funded drinking wells in urban areas increased greatly starting in the 1960s (Figure 7). In rural areas, electric motor-fed wells were also developed to provide water without restrictions and the use of ground water rose sharply. In 1960–1973, land subsidence began to increase in Beijing, i.e., sedimentation

accelerated(Figure 8); yet in 1961–1970 there was almost no population growth (Table 4). Rapid land subsidence and water table decline were positively correlated (Wang, 2010); in other words, the water table also declined rapidly in 1961–1970. Since population did not change during this period, this indicated that the drastic increase in the number of wells drilled accelerated the decline in the water tables and generated related issues. The policy planning that encouraged the drilling of wells was an important cause of the severe decline in the water tables. With this policy and planning, the use of the groundwater supply was based solely on irrigation and drinking water demand, and thus water table decline was both exacerbated and accelerated.

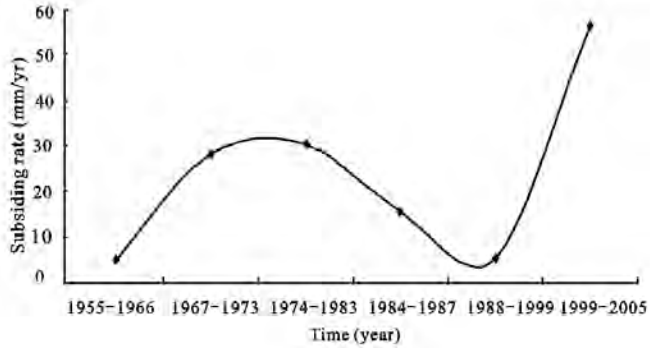


Figure 8. Changes in the rate of land subsidence in Beijing since the founding of P. R China. (Source: Chen et al, 2011)

4.5 The impact of water resource planning on water pollution

When the P. R. China was founded, Beijing already faced an overall shortage of water resources. With the rapid economic development and the improved standard of living at that time, water use almost approached a critical state 50 years ago. A shortage of irrigation water for agricultural production became increasingly severe because of the rapidly growing industrial and urban domestic water use. At that time, it was thought that the problem of insufficient irrigation water could only be solved by water-efficient irrigation, wastewater irrigation or increased exploitation of groundwater (Yan, 1999). Starting in the early 1950s, local farmers started to use industrial wastewater from the Shijingshan steel plant for irrigation, and this continues even today. A large number of sluice gates and pumping stations were built, and sewage irrigation developed rapidly.

In 1962, the Beijing Municipal Committee issued a document, stating: "The use of sewage water on production farmlands has increased productivity (for example, for the Gaobeidian production team, in fields not irrigated with sewage the yield of corn was 1.24 kg/ m^2; yield in fields irrigated with sewage was 2.16 kg/ m^2, an increase of 70–80%). Thus to make full use of sewage, the area of sewage irrigation should be expanded. This will greatly benefit agricultural production." Due to the short-time conclusion that sewage irrigation can increase production, the government encouraged further expansion of sewage irrigation. As a result, the use of wastewater to irrigate farmland became more and more widespread, covering regions from the western to northwestern and northern, then to southern and eastern suburbs of Beijing. The use of wastewater in cropland irrigation created the following issues. (1) Because the low quality wastewater treatment that was used, the quality of sewage water used for irrigation was excessively poor, leading to severe pollution of farmlands; (2) Blind expansion of sewage irrigation area, without a relevant monitoring and management system, led to increasing contamination of groundwater; (3) Most irrigation channels in the suburbs, as a result of sewage irritation, ended up turning into channels for wastewater discharge (Liu, 2008).

Sewage irrigation led to a series of problems including river and groundwater pollution, further complicating the water resource problems in Beijing. Treatment of groundwater pollution is particularly difficult (Chen, 2011). Thus, as part of water resource planning at that time, the use of sewage for irrigation of agricultural fields resulted in serious consequences.

Table 4. Beijing population statistics in different stages.

Stages	Feature of population changes in each stage	Population at the beginning of each stage		Increase of population at the end of each stage (million)	Population growth rate in each stage (%)
		Year	Population (million)		
1950–1960	Rapid population growth	1949	4.201	3.195	76.1
1961–1970	Fluctuation in population growth	1960	7.396	0.447	6.0
1971–1978	Recovered population growth	1970	7.843	0.872	11.1
1979–1990	Steady population growth	1978	8.715	2.145	24.6
1991–2010	Population growth due to large amount of migration from other areas	1990	10.86	6.090	56.1
		2010	19.61		

5. Conclusions and suggestions

Since the founding of the P. R. China, Beijing's water crisis has been complicated and grim. This was partly caused by the adverse effects of the increase in population, the associated industrial and agricultural development, and the expansion of urbanized land. However, problems related to water resource planning and implementation also exacerbated Beijing's water crisis. Although most observers agree that urbanization influenced the water crisis in Beijing, here we propose that urban planning, an aspect of the approach to urbanization, is the key factor that contributed to the aggravation of the water crisis. Thus, attention must be paid to urban planning, which guides urbanization. Urbanization itself should not be blamed. Regarding water resource issues as they relate to Beijing's urbanization, the author suggest that the following changes should be made.

The approach of focusing on technical issues of various individual projects separately should be gradually be replaced by the study of water resource problems from a comprehensive perspective followed by the development of carefully planned solutions. Specifically, the old approach of managing water quantity, water quality and water power separately, and controlling water supply, use, discharge and recycling with different systems, should be changed into comprehensive and unified allocation of water resources that takes the overall, integrated situation into consideration.

The strategy of protecting humans from harm caused by water should be changed into a strategy of protecting human from harm caused by water that also includes protecting water from harm caused by humans. In the past, to prevent floods, many water conservation projects were built. These measures were designed to protect humans from harm caused by floodwater. The harm that humans cause to water quality and quantity are mainly reflected in water pollution and the results of unplanned use.

The old water management system that determined water supply based on human needs, that manifested itself in the construction of diversion projects to meet the needs of industrial development and agricultural production should be changed into a new management mode that fills needs based on supply after a proper assessment of water resources and integrated planning.

The fixation on water control or withdrawal projects alone should be changed into the study of construction projects in a way that strengthens non-engineering-oriented development and uses scientifically-based resource management. In the past, attention was paid to the development, use and management of water resources, and a large amount of relevant work has been done. However, water resource conservation and protection, especially water allocation, were not properly addressed. In fact, water resource allocation is a large part of water management. The conventional view of treating water more as a resource should be changed into treating water more as an ecosystem.

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The Future Commons 2070: the ethical problem of the territorialization of the North Sea.

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1. The hunger for land

As commonly known, the largest part of our planet (about 70 %) consists of water, seas and oceans. Mankind lives on the other 30%, which is land. Although water is not the natural habitat of us humans, we have always been attracted by it. We have built their living environment, in particular cities, at riverbanks and most of all at coastlines, bordering between land and sea. Being physically and biologically land-creatures, we need land to survive and we have always displayed a hunger for land to establish and constantly re-affirm our existence on earth. This resulted in dynamics of territorialization ranging from the cultivation of wild nature over colonization and urbanization to wars over land and resources, a continuous redrawing of borders defining man's territory. This hunger for land has also redrawn the border between land and sea. Since ages we have pushed the flood line back by means of dykes and de-poldering to win land from the sea in order to enlarge our biotope. Nowadays however, extremely sophisticated engineering and technological innovations create the possibility for a whole new dimension and scale of such land win operations, especially on oceans and seas. In this light, we plea for an ethical debate on spatial planning, more specifically on marine spatial planning, a branch of planning which is growing rapidly.

1.1 The need for land versus hunger for land

Winning land on the sea or land reclamation has become booming business. Coastal areas have always attracted people. Today about half the world's population lives within 100 km of water. René Kolman (2012), Secretary General of the International Association of Dredging Companies, sees two main reasons to argue for gaining new land on the seas and oceans: lack of space for a growing population and ensuring economic growth. The rising world population and the economic attractiveness (harbors, tourism...) of the coastal areas to allocate new populations and the (alleged) lack of space are frequently posted as the main reasons to look towards the seas and oceans to find new territories by expanding land onto sea (artificial islands, land reclamations, land extensions...). Since the '70 until now we witness worldwide an increasing amount of realizations of land reclamations. Different spatial-economic programs are organized in this new spaces gained on the sea: airports (Singapore's Changi, Hong Kong's Chek Lap Kok and Japan's Kansai airport), harbor extensions (first and second Maasvlakte Rotterdam, Singapore's extensions on Jurong Island and recent expansion projects on Tuas), urban expansions (Beemster, Haarlemmermeer, Flevoland, IJburg-Amsterdam), touristic and recreational infrastructure (the Maldives next to Male, new island called Hulhumale, Dubai, Florida), etc.. Today, with the growing blue energy, we find projects even of energy-storage islands (FOD VVV Leefmilieu, 2014a, FOD VVV Leefmilieu, 2014b).
But why do we want to claim parts of the seas and oceans to resolve this spatial planning programs which are actually land-bound? Is there a real lack of land or do we merely choose the path of least resistance? Land reclamation has become a huge economic driver, offering relatively cheap land and hence providing an easy way out of complex planning issues by locating difficult programs away from the already built up areas (the so-called NIMBY syndrome). Couldn't we rather look at the existing land and try to organize this better to cope

with challenges as new population densities, instead of expanding on marine spaces? This is foremost an ethical question. Seas and oceans to a large extent still have the character of being common to mankind. They are not characterized by the same kind of territorialization and ownership structure that is typical to land. Planning land-like infrastructure on sea results finally in transposing the same ownership and territory logics to the sea and hence, weakens the 'common-pool resource' the sea and oceans still are. The sea has this unique value to society: common interest. Everybody has the right to use the sea, to enjoy its benefits. Just like forests, water and the atmosphere, the sea can be considered as a 'common-pool resource', a natural common resource, quasi-free for anybody to enjoy. This is why the sea needs to be properly managed as a valuable common good.

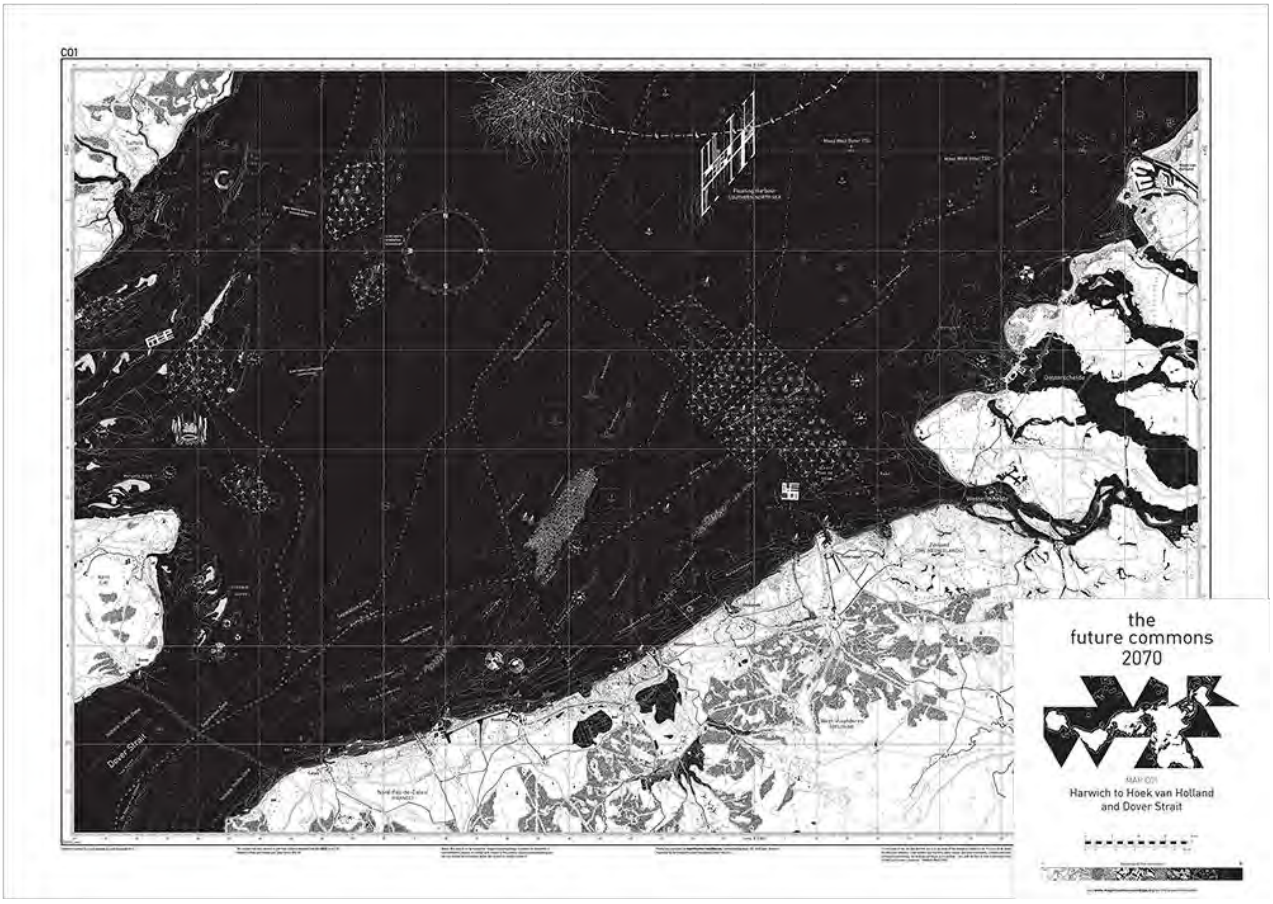
2. Introducing the idea of commons-based marine spatial planning

In 2011, the collective of independent researchers 'maginificentsurroundings.org', led by Charlotte Geldof, published the 'Future Commons 2070, Map C01 Harwich to Hoek van Holland and Dover Strait' (fig 1 - 2) (Geldof et al, 2011). This map is a first, tentative attempt at developing a critical vision, introducing the commons as leading principle for marine spatial planning in this part of the Southern North Sea, the coastal area and the polders. The Future Commons 2070 is a design-based research into an updated concept of commons and aims to inject the debate on marine spatial planning with a new impetus, stirred by a socially-ecologically inspired basic principle. It starts from the observation that the seas and oceans, being an immense open space on earth, are increasingly under pressure. The increasing rate of land wastage is just one of the factors that will cause the demand to make open sea-space available for development ever more urgent. Quite soon, if not already, we will be witnessing nothing less than a form of colonization of the sea, the reclamation of extra space for extra (economic) development.

In spite of all kinds of exploitation already happening, the sea still kept a strong commons character. If we now start to treat this water-space as if it was land-territory, if we start to apply principles of land-planning to the sea, we risk that the sea will quickly lose its strength as common pool resource. Throughout the centuries, maritime law has kept on connecting ever-larger maritime areas with their adjacent coastal states, and this is an ongoing trend. By issuing its 'Law of the Sea' in 1982, the United Nations has allocated sovereign rights and obligations relating to the first 12 nautical miles of 'territorial sea' and the next 12 nautical miles of 'contiguous zone' to coastal states worldwide. Beyond the outer limit of these zones, 'exclusive economic zones' (EEZ) have been designated, which run to an outer limit set at maximum 350 nautical miles into the sea measured from the land/sea limit (baseline). Within these EEZ, coastal states have been allocated certain rights and obligations of research, exploitation, maintenance and management of natural sources found within the head of water, on the seabed and in the upper subsoil layer. At the moment, about 30% of the surface of oceans and seas on earth is situated within the EEZ of a sovereign coastal state, and the impact of this EEZ-status on a global level is strategically important. Those parts of seas and oceans located just outside these three delimited areas are called 'international waters' or 'high seas'. These remaining 70% are (to put it simply) intended for collective use; this part can be defined as a collective space on a worldwide scale. However, a collective status that has not been allocated or recognized explicitly is all too often demoted to the vulnerable status of 'freely available'…(Geldof et al, 2011) Filip De Rynck (2007) refers in this respect to what Elinor Ostrom (1990) calls the 'tragedy of the commons'. The lack of some kind of 'ownership' and moreover, some kind of responsibility for collective goods, makes it very hard to manage them. De Rynck states that the sea is a common with many users and many 'inhabitants', without a clear 'owner' and situated in a very fragmented institutional landscape. The sea crosses many governmental borders and a broad range of stakeholders act upon certain parts of the sea. For some aspects rules are developed but often independent from each other, for other aspects there are no rules at all and the use is

free (De Rynck, 2007). This problem of the commons, in our view, needs to be put central in marine spatial planning.
Clearly, marine spatial planning is on the rise worldwide. Policy concerning this matter is evolving steadily. While Europe is setting out the basic outlines for its future marine and maritime policy options, project developers are already proposing their first initiatives. The allocation of parts of the sea (the head of water, the seabed, the upper subsoil layer) with the belonging living and non-living natural elements to the sovereignty of nation states is, as explained above, a historically grown process (Geldof, 2009). Without a regular ethical evaluation, this trend could pursue and evolve into a partly privatization of strategic parts of the sea and our common pool resource, something which has already happened on land. In order to avoid this, we plea for a commons-based marine planning that aims at securing the sea as a common good and guarantees consolidation of its social, economic, environmental and spatial significance in a dynamic whole. In addition, establishing additional commons on land - inland extensions of the sea - will create opportunities and favorable conditions for managing the effects of climate change in coastal zones. This commons-based marine spatial planning (CB-MSP) centers on three basic rules of conduct. These will be elaborated in the following sections (3, 4, 5).

Figure 1: The Future Commons 2070, Map C01 Harwich to Hoek van Holland and Dover Strait (Geldof et al, 2011).



3. Mind the sea! - rule of conduct CB-MSP n°1

The sea deserves due care and there is a need for a global vision on how planning should be conducted here. 'Planning' for the most part implicates accepting development, which, in terms of spatial use, translates as 'appropriation of extra space'. But Europe's intention to guarantee economic growth in a climate of sustainable development sounds a lot like its credo for planning on land, whereas planning and designing for marine areas is in fact a very different, location-time-specific matter. If we are prepared to validate this specificity, it seems more than probable that for marine spatial planning, different planning principles from those for landlocked projects will be required. The first principle (rule of conduct) therefore is that each planning activity should start with an inquiry into the necessity to organize a new function on the sea and parallel, an inquiry into the feasibility to organize it on land. In other words, is it a matter of need for land or hunger for land? Are the arguments to develop something on the sea ethically (socio-ecologically) inspired or rather opportunistic?

This is not a matter of being overly moralistic. On the contrary, it concerns the first principle of sustainability which is being cautious and mindful with regards to effects of our actions we cannot fully predict. The seas and oceans are for a large part still unknown territory. Water-life and its related eco-systems are still a mystery in many respect. Hence, we cannot be sure how far-reaching, disturbing and possibly irreversible the consequences of our actions might be. We know that already today we have caused immense damage to the oceans and seas (plastic pollution...) because we tend to consider the sea and oceans an easy, nimby-like dumping place. But this huge water 'reservoir' actually lays at the base of our very origins and makes the earth inhabitable for mankind. Fishery and aquaculture today provide a living for approximately 540 million people (Unesco 2010). The resources and industries present in marine and coastal areas represent over 5% of the global GDP and constitute worldwide an important economic factor. On top of that, the oceans have a crucial not market oriented role in climate regulation, carbon sequestration, habitats, biodiversity etc. However, today 40% of the oceans worldwide is severely affected by human activity and unsustainable management. Unesco (2010) reports that this major natural resource is threatened and recommends to gather knowledge, distribute this knowledge widely, develop marine spatial planning, enhance the sustainable development of coastal and sea areas en to pay more attention to our submarine heritage (Geldof, Janssens, 2014).

Also on the European level these concerns have become important. In March 2013 the European Commission proposed legislation concerning a common frame for marine spatial planning and an integrated management of coastal areas. Each EU-country can still plan its own maritime activities but the local, regional and national planning in common waters has to be better coordinated according to minimum requirements. The current proposition of the EU directive aims to establish and execute marine spatial plans and strategies that implement an integrated coastal management that is based on an eco-system approach. This eco-system approach has to enable co-existence and prevent conflicts between competing sectoral activities in marine waters and coastal zones. The proposal is not yet ratified. (Geldof, Janssens, 2014) This shows that the themes that The Future Commons 2070 project formulated already in 2011, i.e. marine spatial planning and eco-system approach, have now become more actual than ever. The Future Commons project links the ecological issue closely to the issue of the commons, which is ultimately an issue of social responsibility and leads to the second rule of conduct.

4. Strengthen the commons - rule of conduct CB-MSP n°2

If after checking rule n°1 it turns out that a new function indeed needs to be planned on sea, the second rule says that the common character of this new function should be guaranteed. This implies in first instance that the quality of the sea as natural common pool resource cannot be affected. Just like forests, water and the atmosphere, oceans and seas can be considered as 'free' natural common resources. As they are exhaustible, common-pool resources are sensitive to problems like pollution, spillage and overuse. This is why the eco-system approach is of fundamental importance when administering the sea as a valuable common good. Hence, the first question is whether the planned function respects the marine eco-system and serves the common good of society? The overall aim is to strengthen and enhance the commons and to stop any further land-like diminishing of the commons through privatization (territorialization, further parceling out), exhaustion and pollution. Such a commons-based marine spatial planning requires a transnational approach. Transcending the existing state structure will allow the implementation of an international, coherent land, water and seas policy. Therefore, the 'Future Commons 2070' project advocates conservation of the sea as a common and recognition of its growing importance, strongly regulated by the European Union. Starting from the conviction that a relation exists between overexploitation of natural resources and the current use and governance of oceans and seas, we propose that the governance of all EEZ on a global scale should be reconsidered with this reflection in mind. We are proposing 2070 as the target year by which EEZ worldwide will convert into 'marine commons'. In accordance with this future vision, these marine commons will be administered with a view to putting the common good at the top of the agenda, meticulously striving for a more balanced use of natural resources and respect for the dynamics and evolution of nature and species in oceans and seas. Hence, we propose to bring the former EEZ, including the 'contiguous zone', under the government of the European Union and consequently to divide it into larger, supra-national natural-jurisdictional parts, based on its constituent ecosystems. Within a coordinating European policy framework, the territorial zone remains to be administered regionally. Anno 2070, the former EEZ have evolved to become the European Maritime Commons Zone (EU-MC), administered by the European Union, in accordance with policy based on 'limits to growth'. Regulations against overfishing, loss of biodiversity, a significant shifting of fishing grounds caused by climate change and strict European standards have ultimately led to a scale down in fishery. Temporal and geographical restrictions were also imposed on ecological fish farms, and some oyster banks were established. As sand and gravel became increasingly scarce, exploitation of raw materials has been restricted. Aided by heightening general interest in the environment and successive economic crises in the first decades of the century, this scarcity has led to a strict European mining policy. Anno 2070, mining activities are only permitted for those purposes for which no re-use alternatives have been found. The offshore windmill parks from the 2010's-20' have been interconnected and connected by the North Sea Ring to the European Low Carbon Super Grid. Production units for the generation of renewable energy have been maximally concentrated and interconnected and are now combined with, among other things, sea-farms, work and monitoring platforms, transformation and connection platforms. In our world of global networks, shipping routes are being adapted constantly. Experiments have been run with floating 'Intermediate HUB-terminals' that will enable the European port infrastructure to accommodate super ships using renewable energy. This makes further extensions to existing inland ports or sea harbours redundant.

The 'Future Commons' project thus pleas for the conservation and an increasing importance of the sea as a common strongly regulated by European policy. The starting point is a conviction that preservation and development of commons are essential in order to support positive societal evolution and to meet challenges such as climate change, migration toward coastal areas and energy demands. Earlier research into commons as they were in 2010 led us to a definition and classification of commons on a regional level and a method for mapping commons (Geldof et al. 2011). The map of commons in 2070, which is based on

research of the existing commons (natural, community and cultural commons according to the classification of Peter Barnes (2006)), provides a vision of a potential evolution of commons over the coming six decades.

5. See to low and temporary impact - rule of conduct CB-MSP n°3

The sea is an exceptionally dynamic environment. Its growing appeal and its increasingly intensive use have prompted us to set out a number of preconditions necessary to preserve its uniqueness as a common, as described in the above. A broad range of novel uses (recreation, production units for marine culture and for generating renewable energy, anchorage for port activities and navigation) has appeared in addition to more traditional uses of the sea such as navigation, fishery, shipping, transport and mining. All of these have to conform to tight restrictions in order to safeguard ecosystems and to preserve the commons. Therefore, the first two rules of conduct were proposed.

The third rule emphasizes time as the sea's fourth dimension and stipulates that all new programs should be conceived of as temporary, reversible, reusable and/or suitable for multipurpose use. As such, all spatial constructions connected with the planned activities are, by necessity temporary, floating structures, built in such a manner that they have zero negative impact on the marine environment and their ecological footprint remains low. Technological ingenuity is a crucial factor in meeting these preconditions for preserving the commons. In the territorial part of the North Sea, a strong concentration of diverse coastal area functionalities, marine functionalities and vulnerable ecosystems has by necessity led to the replacement of the existing location driven regional planning by time driven spatial management. It is crucial to the implementation of such time driven spatial management that continuous, intensive monitoring and adequate empowerment of users of this large-scale common is set in place.

Figure 2: Excerpts from the Future Commons 2070 map (Geldof, et al., 2011)

Fig. 2a) Vision on the future partitioning of the juridical EU zones on seas and oceans: proposal for Maritime EU Commons 2070.

Fig.2b) Scale bare of densities of the commons with gradations of black proportionate with the presence of commons. The blacker the surface, the more commons are established in that area, the whiter, the less commons are present, at this scale.

Fig. 2c) Extract: commons on land, commons on the maritime coastal zone, commons at sea / 2070

Fig.2d) New commons 2070: living to the rhythm of the sea in the maritime coastal zone; throughout time (i.e. low and high tide, storm...) a certain area can be flooded partly or totally. Man has to adapt his lifestyle to the unpredictable, temporary flooding of the land.

Fig.2e) Image of EU network: maritime cargo transport network in 2070: introduction of 'Intermediary Hub Terminals'

Fig.2f) Image of renewable energy transport network in a low-carbon Europe 2070 North Sea area

Fig. 2g) Longitudinal section: recalibration of the coastal urbanization and the connection between the land-sea zone and the sea zone, anno 2070.

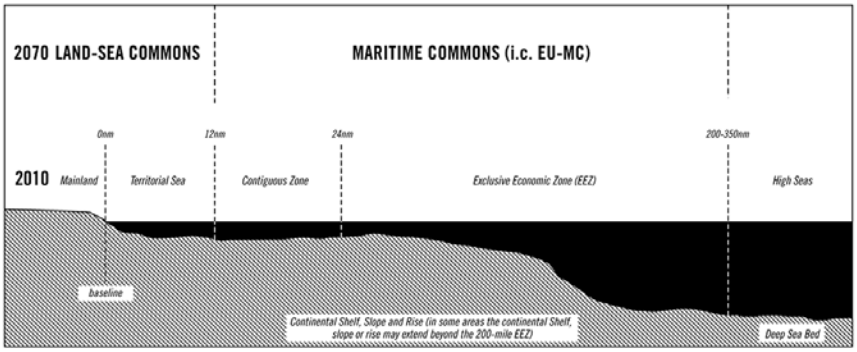


figure 2 a



figure 2 b



figure 2 c

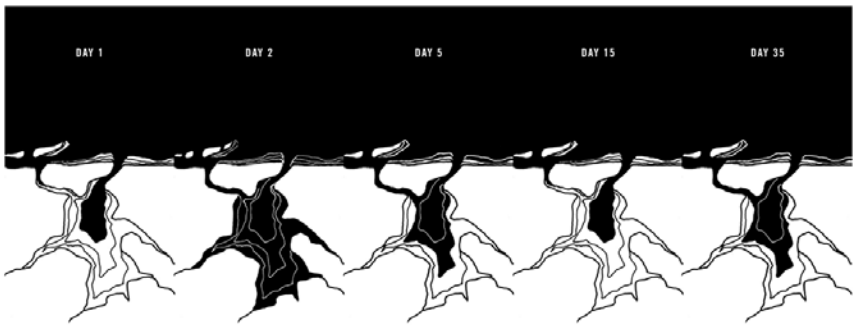


figure 2 d

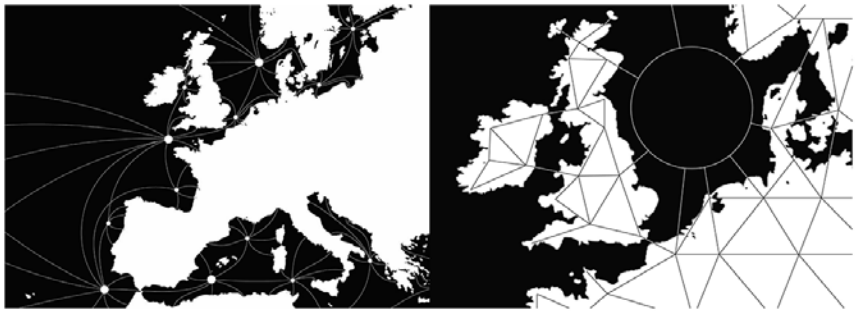


figure 2 e, 2 f



figure 2 g

7. The Future Commons 2070: critical projection as vision-forming research

Marine spatial planning is still in its infancy and it is early days now to evaluate the direction it is taken. Probably strengths and weaknesses of commons-based marine spatial planning will be put to test quickly when the next requests for concessions pop up and it is likely that only when new constructions on sea or operations of land reclamation are already constructed that a sharpened discussion on their common character will emerge. Will a plea to establish these constructions as common good come to late then?

The purpose of a project like 'The Future Commons 2070' is to anticipate a reality-to-come by means of creating critical projections of a possible future scenario. All kinds of questions emerge here: Is there room and an open, critical state of mind to embrace such commons-based marine spatial planning? Does the juridical format of a domain-concession offer sufficient guarantee to ensure the 'not-to-be-appropriate' status or do we have to develop other juridical instruments? What if an atoll for energy storage is built on sea? How then could we safeguard its common character in the long run? Are we really ready for 'green growth'? Such questions touch the very fundaments of existing (socio-economic and hence, planning) systems and their detrimental impact on the sustainable development we envision. It has become clear that this widely advocated sustainable development cannot be obtained by mere technological solutions, political regulation or financial instruments. It requires a profound change in both our thinking and acting. Critical projections like 'The Future Commons 2070' help to make such fundamental transitions both thinkable and imaginable. Such projects belong to a branch of research by design which is called 'projective research'. Here the power of projective and anticipative imagination of designerly thinking is used as the driving force of research (Janssens 2012). This type of research is used in contexts of systemic changes (economic, ecological, political...) to learn from the future and to indicate a directions for change by revising and repositioning the basic values on which a socio-spatial vision of our world can be built. Projective research by means of critical projections of a possible future also plays an important role to sensitize and increase support of broader parts of society. It provides a frame to stay in touch with the evolutions at stake and to detect important points of attention. In this respect, we have noticed that the spatial vision the 'Future Commons 2070' formulated has a certain impact within the emerging marine spatial planning in Belgium. Trans-border themes like energy production, shipping and harbor development, coastal development, and measures for mitigation adaptation in the light of climate change are part of this policy development and the offer keys to several design exercises for the new European spatial condition. Certain terms that typify the sea are getting cautiously incorporated in marine spatial plans, for instance: 'not-to-be-appropriated' and 'four dimensional space'. Whether also the terms 'common good' and 'common pool resource' will be adopted remains to be seen. Europe today is also very careful when it comes to introducing marine spatial planning and currently only does so in combination with integrated coastal zone management. A thorough spatial reorganization of the borders will only make it to the top of the agenda if some 'emergence' happens. Although the concept is maturing, we are still far from an established EU-marine commons. The stakes here are enormous and the complexity of the problems is hard to grasp. A ready-made solution is therefore not the issue here, so much the more is a continuous and evolving effort to formulate a critical vision on this mainly ethical issue. Critical projections that develop (planning) concepts, values and their spatial translation, play a so far underestimated activating role in helping developing a favorable state of mind. The experience with the 'Future Commons 2070' project learns us that the power of such a critical, synthetic and (scientifically) well informed image of the future does indeed has an impact on the present.

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Multi-Department Cooperativeness for Implementation Plan of Waterfront Urban Design

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Abstract:

Waterfront development is becoming complicated involving various aspects of function composition, spatial structure, financial balance, industrial structure, traffic organization, ecological protection and so on. However, the connotation is to seize the integration of urban planning, land use and water management. Core essence of integration, which we should mainly focus on, is to make comprehensive arrangement of space, land and water resources in one implementation plan of waterfront urban design to achieve optimization of quality space, effective construction, and sustainable environment. Concretely, collaboration organization platform is built to support institution system, plan framework from macro, medium to microcosmic level is established for fusion compilation system, and method of control, restriction, review make sure the dimension balance of technical approach.

Multi-department cooperativeness, emphasizes the engagement of policy making, institutional cooperation, integrated plan, feasibility demonstration, practicable management and safeguard approach effectively to promote the control of land and water resources use being coordinating with urban construction. As for the urban plan action, the bureau should strengthen the requisition land and water resources in the urban planning process, regulate the land market operation, adjust the water network organization, and promote more intensive utilization of land and water resources reasonable use. Land management department needs to found the unified land institution of arrangement and reservation, carry out land possession, demolition and reconstruction over-all plan, and focus on the land policy to seek breakthrough for assuring the sufficient and effective supply of urban construction land. Water management department should formulate reasonable water network scheme, and conduct the verification and argument of pollution prevention, water network organization, rainwater treatment and revetment build. Meanwhile, the other departments should support the maximization use of land, water and urban space resources. In this way, the coordination mechanism of three departments is set up, integrating professional work to the unified implementation planning scheme, so that the urban function layout and spatial development strategy can be put forward for orderly implementation.

The government of Wuhan city has practiced the policy of “Land-Urban Planning Alliance” since 2009, and some efforts have been made to work within promoting the regularization urban construction. Based on the united practicable experience, the government decided to set up the implementation plan of waterfront commercial district on both sides of Yangzi river in Hankou, and Wuchang, two center districts separated by the river, collaborated with multi-department such as water management, commerce, tax and so on. This paper analyzes the key elements of effective multi-department coordination in each levels involving planning program establishment, cooperation framework organization and policy making of supervision, summing up the conclusion including the detailed contents of planning program, design comparison and review approach, formulation conditions of planning permits, collaboration effective promotion and power balance regulation. Finally the paper is expected to figure out the methodology of multi-department cooperativeness, in order to achieve the rational utilization of spatial resources, land resources and water resources and ensure the effective implementation of waterfront urban design.

Keywords:

Multi-department cooperativeness, waterfront urban design, implementation Plan, Land-Urban Planning Alliance

Foreword

Wuhan, a city of eight million residents located in the middle field of China, with the advantages and opportunities of “Central Rise” on the national urban pattern, identifies the goal of “National Central City” based on the middle area, facing the country-wide, and stepping to the world. In this historical proposition, as guide behavior of government co-ordination arrangements spatial layout of urban development, urban planning bears the task of both leading implement and balancing variety of elements.

Coincides with the realization of “Land-Urban Planning Alliance” since 2009, Wuhan City is making the concept of “Land use” transforming into “Land Planning”, which makes a great improvement to promote the regularization urban construction with effectively combining land management and spatial planning. Meantime, the innovative plan study with integration of land use and urban plan makes generalization significance for “Multi-Department Cooperativeness”. Based on the background of “Land-Urban Planning Alliance”, pointing at the goal of building “National Central City”, in Yangzi Waterfront Commercial District, as the first leading areas for enhancing urban space in Wuhan, a revolutionary planning work has been tried out for embodying multi-departments collaborative mechanisms to establish the cooperation with departments of Water, Tax, Commerce and so on. That is the implementation plan of key functional areas in the city, and then we expand the study for the establishment system and planning policies, in order to achieve the win-win goal of intensive use of land and water resources and urban construction development, innovative planning compilation and feasible implementation management.

1. New Understanding of “Land-Urban Planning Alliance”

In the late 1980s, rigid prominent land use administration system began to be formed from the central to local. As opposed to local government-led traditional urban planning and management system which focuses on spatial expansion and uncontrolled land use proportion in fast urbanization, the ring interlocking hierarchy of land scheme-plan-supply-supervision made the planning implementation undertake tremendous pressure. Under the regime context of "Separated Land-Urban Planning”, land planning and urban planning mismatch themselves widespread with living on their own, lack of communication and difficult to reconcile.

1.1 Connotation – One planning

According the timing process of “Land-Urban Planning Alliance”, with difference of local economic development stages and goals, the original meaning of “Urban” and “Land” gradually expanded from the original pure urban master planning and land use master planning to an integration of urban, land, economy, industry, transport, ecology and various other levels in China.

However, the divergence of the relationship is always continued extended around the core connotation. A clear connotation of “Land-Urban Planning Alliance” will make sure truly achieving integration. We can talk about this in different ways. For the mechanism forming a relatively complete regulatory platform of Land-urban should be founded. For the establishment the system depth integration from the macro to micro level should be achieved. And for technical approach both the reasonable control of planning by land use and the effective implementation of land by planning should be strengthen. In conclusion, the

connotation, in essence, is to achieve a double standard to meet urban and land use plan on one planning as to achieve urban construction and land use optimization".

"One planning", emphasizes effective convergence between broad urban planning and land use planning in the development of urban space and layout, and promotes the orderly land use controls and coordination of urban construction. As for urban planning behavior, "One planning", in the planning process, is to strengthen the regulation of land, regulate the land market, contribute to collaborative land use, determine the unified land preparedness agency, carry out the program of land collection, purchasing and storage, and ensure that the city adequate and efficient supply construction sites based on seeking the breakthrough in the core of land policy, so as to the orderly implementation of spatial development strategy and land layout proposed by urban planning.

1.2 Practice - Implementation plan

“Land-Urban Planning Alliance”, the end result in the planning, the focus in the construction space, through the manner of regime reform and integrated planning, is to solve the existing problems of planning management, establishment, coordination and other aspects for coordination and integration of urban space development and orderly construction.

For achieving the connotation of “Land-Urban Planning Alliance” and practice of “One planning”, the key of planning establishment is to build an active process of gathering information, determining the nature, choosing the options, and deciding the policy, and it is a continuous dynamic process to achieve the planning objectives through practice. Therefore, a planning-oriented unity of establishment and practice comes into being - the implementation plan.

1.3 Multi-Department cooperativeness extended from “Land-Urban Planning Alliance”

Based on the alliance platform the implementation plan, breaking the bottleneck link of urban and land planning areas, has provided a broad space of more multi-department cooperation. The innovation lying on implementation plan is not on purely paper design of urban planning department, but the comprehensive project with varieties aspects of funding, environment, implementation, management and so on. The grassroots community councils investigate for research, the economic departments provide funding balance support, commerce department offer the comprehensive analysis of the formats, the environmental protection department makes environmental impact assessment of the sensitive elements within the area, land use department analyses land preparedness and land value, planning department carries out the framework and integrated deployment with overall design by the joint excellent design corporation, and the City Construction Commission ultimately unified construction management. Overall, the whole planning activities are lead by the coordination of regional government, so as to achieve the Game balance between centralization and decentralization and to guarantee a mediation of fairness and efficiency.

2. Definition of the Implementation Plan

Implementation plan, with the guidance of urban master plan, recent construction plan and annual practicable schedule, based on the platform of regulatory detailed plan, is to figure out strategies for land-use, project programming, spatial landscape, road transportation, municipal facilities, funding estimation and construction arrangements within the range of planning in a certain period of time, which is more performance as a practicable mechanism of proactive guiding the planning solutions.

In the implementation plan, we should fully integrate the urban planning and land use planning requirements, and make regulation and restrictions for each plan content in the form of planning policies and land policies. And policies on macro-control of urban construction and management should be executed based primarily on the implementation plan. The

implementation plan should also be an important means of restricting short-term behavior of urban land policy and macro-management.

First preparation of the implementation plan in the key functional areas (such as waterfront area), as the core of urban structure and an important part of the city functions, will be quick and effective demonstration of the city nature and characteristics, and make the statue of regional center and city image promptly be reflected in the physical environment space.

3. "Land-Urban Planning Alliance" Reflects in Implementation Plan

To carry out the implementation plan, is a combination of urban and land planning dual-track system, aimed at promoting the co-construction of spatial pattern, industrial structure and production lifestyle conserving resources and protecting the environment between urban plan and land use, in order to ensure the effective implementation plan and maximization the benefits of land use.

3.1 Economy - Balancing the land costs and development funds

For the lack consideration of the huge urban renewal investment and planning behavior ignoring the economic benefits, when facing at the comparison of the declined old town and prosperity beautiful blueprint, the city government is always feeling despair and limping. In the implementation plan, we make grand planning boot on the ground by focusing on the economic effects of planning, on the one hand sort out land resources and the cost of all the land, on the other hand mobilize the market, orderly conduct of investment work in accordance with the implementation plan, and balance the land costs and development funds.

Combined with land preparedness, the implementation plan measures the level of funds balance in the views of finance, society and environment, and considers the relationship between intensive use of land and construction of comprehensive benefits. The funds balance should be weighed from both the supply and the needs to solve the revenue problem of land costs and development funds. The public projects and operating projects should be separately estimated the investment income, while be overall arrangement of demolition and building back. The plan involves carrying out the implementation subject, control requirements and development timing of the public projects, formulating variety policies of land use, economy, finance, tax, environment protection and others to stimulate investment enthusiasm, and putting forward the planning guidance requirements by the market means to achieve economic benefits.

3.2 Feasibility – Proposing the program of land reserves and resettlement

Readiness to the unified land planning agency, the implementation plan carries out land storage, collection and resettlement construction work through land reserve plan, land and housing levy scheme, building back sites plan, construction design plan, demolition compensation, resettlement programs and some other relative projects.

Through the measures of tying both the protection housing construction program and the "Functional area reformation", acquiring low-cost housing adapted to implement the nearest settlement, the establishment of cross-districts compensation mechanism to implement cross-districts resettlement, with core breakthrough of land policy, the implementation plan achieves a refinement practicable plan for land reserves and resettlement to efficiently ensure the feasibility planning.

3.3 Manageability – Integration of establishment and implementation

Giving fully play to the advantage of "Land-Urban Planning Alliance", on the basis of overall planning, the implementation plan founds the projects libraries of land use checking and

funds balance for different subjects and categories. With the key functional areas leading the implementation plan co-ordinates the city's industrial development, land reserve supply, urban investment and financing, urban road transportation, municipal infrastructure, environmental protection, and another all types of construction projects, to achieve the integration of establishment and implementation, for leading the drive to promote the role of government investment in social investment.

On the “Land-Urban Planning Alliance” platform, with integration of industrial planning, land use planning, landscape planning, transportation system planning, historical culture protection planning and another special planning, by taking the division way of high market acceptance, and upgrading package of multiple projects libraries, the implementation plan transfers the spatial regulatory content to programming practicable platform, to better serve the government investment and play the role of binder for the government and the market.

Integration of establishment and implementation, is an innovation of embodiment management, in the context of “Land-Urban Planning Alliance”, to form the relatively independent and management throughout practicable subjects. What’s more, it needs to give legal status to the implementation plan, and adopt different managements between that in general areas and key regions.

4. Specific Practice of Implementation Plan in Wuhan Yangzi Waterfront Commercial District

Implementation plan of key functional is an important starting point to create the “National Central City” in Wuhan. The establishment of implementation plan not only helps build the practicable type of planning system with the core of recent construction plan to highlight the recent strategic orientation, but also strengthens initiative planning ability of planning department so as to give full play to the initiative action of planning.

Through the preparation of “Implementation Planning along the Hankou Riverbank”, and “Wuchang Riverside Implementation Plan”, the Wuhan City planning department summed up the basic working mechanism and operation method of the implementation plan. Facing to a series of problem relating with land reserve and planning development, such as how to construct the truly original characteristics, complex land-use situation, diverse funding balancing factors, heavy task of urban renewal, the planning to implement is obviously a complex giant system.

However, the challenge comes at the same time, what we are talking about above, the trends of “Land-Urban Planning Alliance” and the platform of “Implementation Plan” bring a rare opportunity for the city revival. In this context, we figure out the concept of “Multi-Department Cooperativeness”, and from planning conception, planning establishment and practicable projects, make multi-department collaboration in each link of programming design, funds balance, work organization, and management implementation, in order to promote the planning implementation in waterfront districts.

4.1 Reflects on the programming design

The programming design, through qualitative analysis of relevant cases, format features, zoning differences and quantitative analysis of planning index, format management, benefit calculations, is to consider the possible type of development projects and best land use.

(1) Qualitative Analysis. The design department summarized like industrial support, property bearer, land features, policy control and other aspects of the law and experience worthy to learn. The Bureau of Cultural Relics gets the understanding of characteristics of relevant historical and cultural protection area, and advises the positioning of land types and function characters differentiated with the historical area. Combined with the format support and case analysis by commerce department, we sets up general recommendations for the division of regional land development and property type ratio. With the difficulty of land development

offered by land development, water impact assessment report offered by water department and municipal facilities plan made by construction commission, we provides for the regional development program to develop a reasonable timing paths.

(2) Quantitative Analysis. Through site visits, customer interviews, we understand and analyze the main operating efficiency indexes of various market formats in historic preservation district in Wuhan. With the combination of the status quo and existing regulatory detailed plan, we sort out and analyze the potential regional space of transformation land use. The analysis involves calculations of the preservation and restoration capital requirements for land update or development with investors together, as well as the main revenue and funding source of land consolidation in the government-led regional land. What' more, the comprehensive benefits in the balance of land cost and development funds should be figured out according to economic growth, import formats, industrial development, tax contributions, the population evacuation, employment and other more aspects.

4.2 Reflects on the funds balance

Funds balance is the premise of the feasible project. As plan to be implemented, the key point is with actionable value to the economic forecast in the planning stages.

The implementation plan, firstly, combined with the early basic research, determines the key waterfront areas under the proposed stage, based on the screening of the status quo by three models of retaining, renovation and alteration, surveys together with local community commission about the land reform demolition data, and estimates resettlement scale.

Secondly, in combination with "Intensive and Conservation Land Use Plan" provided by land department, compiled by research for the status of ownership, present land approval and other related tools, the existing land stock of waterfront district should be preliminary questioning for getting the information of total land stock, stocks distribution, and the ratio of planning functions.

Thirdly, based on the land stock inventory, the plan figures out the resettlement models, the ratio of local and remote rebuilding, and the new building proportion, then combined with the overall consideration of the funds balance in whole city scope besides the district, carries out building back points, and complete the work of land spatial reasoning, planning index acquisition, land consolidation, land expropriation, housing collection, building application and construction.

In brief, making good preparation of funds balance to ensure the implementation of land consolidation is in great favor of demolition and resettlement for the latter functional areas transformation and blueprint practicable on the ground.

4.3 Reflects on the work organization

Since 2009, the Wuhan Urban Planning Bureau and Land Resources Administration merger, the newly formed "Wuhan Land Resources and Planning Bureau", assume the functions of the city's land management and planning. A unified system platform on coordination with urban planning and land management provides a breeding ground for the work of "Land-Urban Planning Alliance".

In the implementation plan, a specific planning group to be responsible for the planning and implementation is formed by the municipal planning department and the district government together. The group periodic holds united review meeting for implementation plan, schedules the work progress of implementation plan, and makes the decision on major issues, including the expropriation, resettlement, land operations, financing, investment and so on.

Especially in the aspects of funds balance, resettlement, building back, land consolidation, preparatory investment, the whole work organization is taken responsible by the Collaborative Office in Government, while the relevant land authorities and planning

departments co-ordinate with the office to complete the site location and planning feasibility studies. Meanwhile, as for the innovative design work of building back design and land construction development, it is the way of open door to be taken, inviting domestic and abroad well-known design agencies with extensive experience in the relevant field to program research, planning consulting and international design collection, so as to ensure a high level and advanced prospective of planning projects.

4.4 Reflects on the management implementation

After the implementation plan is approved, it steps into the phase of management implementation rapidly, and fully swings in preparation for investment based on control of implementation plan. The management should be led by the district government to speed up the construction of waterfront district, coordinating between the land department, water management sector, investment sector, construction commission, forestry bureau and tax bureau. Through that, a regional investment atmosphere should be formed with adequate land storage and mature market, involving improvement of regional infrastructure and public space landscape enhancement works, introduction of relevant incentive policies, and appropriate relief related taxes and government revenue.

Combined with the actual situation in the project libraries founded and land development types, the scope of develop models is to be determined, such as the government-led model, or the private system model.

Then, it is to establish the investment and financing platform for construction in waterfront district, integrating all of the region's development land resources. The platform will be the main subject to achieve financing docking with banks, trusts, funds and other financial institutions. It is the platform to attract investment of market subjects to set up the two levels of development by the way of stock cooperative mode. In future, taking advantage of all the land resources and regional development profitable of the platform, to be listing will be come true. Through rolling development, achieving the continuous land operation of the “demolition-storage-building-selling” model, the platform will ensure the continuous flow of funds and sustainable profits.

Identifying different attraction of land development and planning is for determining ways to attract investment for different project. First, we provide cultivated land for investment, focus on the current land reserves, refine the plots function according to the implementation plan, and determine projects fixed with refined plots to improve land value, so that the overall efficiency of land resources will be maximized. The second way is attracting investment by planning. In the context of implementation plan, we refine the development intensity of district function plots, land space environmental quality, industry-oriented and other indicators to guide investment with detailed planning.

Afterword

Under the objectives and requirements of national new urbanization, “Land-Urban Planning Alliance” is an important path for Wuhan to taking a new road of urbanization, archiving the “Central Rise” and constructing the “National Central City”. After years of theoretical and practical exploration for the planning and implementation in Wuhan, with “Land-Urban Planning Alliance” as a precondition, implementation plan is innovatively put forward in planning approach. Through the integration of urban construction and land use, planning establishment and management, and full use of the leading role of territorial land use planning, the urban space can be optimized and upgraded. More importantly, we figure out the “Multi-Department cooperativeness” according to the promotion of these specific measures.

In recent years, through the theory and practice exploration for implementation plan work to in waterfront areas along the Wuhan Yangzi river, the planners in Wuhan clarify the elements

and working phases of the “Multi-Department Cooperativeness”, and construct the working mechanisms and operation methods of implementation plan from each aspects of programming design, funds balance, work organization, and management implementation, especially explores the way of effective practicable plan and maximization the benefits of urban space and land use. This paper makes the above study to establish the guidelines and framework paradigm accepted by the market, government, society and multi-department, in order to narrow the gap between planning establishment and implementation, and achieve unified management and urban construction.

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Flood Risk Mitigation: Public Policy vs. Actual Practice

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Synopsis: The aim of this paper is to find out why we have not being able to transit from the political discourse to the actual practice regarding risk management, especially the flood and risk mitigation, since these have been the most frequently occurring disasters events since 1900. Case of study: Mexico (Chiapas).

Introduction

Throughout human history, the occurrence of disasters has been a major challenge, mainly due to its effects that impact directly over human population and their reproductive systems -social, political and economic-. On countless occasions such impacts arise in a short span of time, affecting and even exceeding the response and recovery capacity of society to disasters, which imposes a set of challenges manifested physically in the territory, putting citizens and its political-economic system security at risk.

On this matter, floods and storms have been the most frequently occurring disasters events since 1900, causing severe damage. One of the primary causes is the uncontrolled urban growth which is not regulated within sustainability and risk management perception. Cities, because of their magnitude, the almost total lack of planning, and the precarious urban growth, have become highly vulnerable to natural phenomenon. Such vulnerability, of cities, is evident with the disaster flooding and landslides occurring around the world over these last decades.

Therefore, disasters have been present constantly on the agenda of government agents as well as the scientific research agenda. Making a gradual transformation on the way disasters are conceptualized and addressed. In the past, public policy regarding risk management and disasters was generated to be implemented only at an emergency stage, however since the 90's began a process of change in the paradigm seeking balance in the care provided by the State at the emergency situations and the prevention and mitigation stages. Despite this change, today still is conspicuously absent governmental public policies or at least actions for the reduction, prevention and mitigation, being tangible ,as mentioned, because of the magnitude of disasters that have risen all over the world on recurring basis.

Concerning this matter the aim of this paper is to find out why we have not being able to transit form the political discourse to actual practice, based on a rigorous analysis of the Mexican risk management public policy and the presence of floods which frequently occur in the country.

1. From Emergency to Prevention: Dominant Paradigms

Currently there are two prevailing paradigms, the "naturalistic - physicalist" and “social”, these two differ in the way the disasters are conceptualized and analyzed. These also diverge in how to respond and react in front of disaster situation.

1.1. "Naturalistic - Physicalist" Paradigm

The paradigm "naturalistic - physicalist" is one in which continues to prevail the idea that nature is the cause of the disaster, i.e., responsibility for the effects of a disaster lies in nature or natural phenomena and not actually in the true causes of the risk -State and population-. The adoption, conscious or unconscious, of this paradigm allows the evasion of responsibilities and legitimizes the State as the protector of the population by a reaction to the emergency and reconstructive care upon the occurrence of an event, allowing evade its responsibility as one of the main factors in the construction of risk.

Unfortunately, as will be discussed later, this is still the dominant paradigm in Mexico, although a transition to the social paradigm is seen, in which disasters are conceptualized as a process, not a product.

1.2. "Social" Paradigm

The aim of this paradigm has been to change the way that disasters are understood and conceptualized, seeking to change the dominant idea of so-called natural disasters by socially constructed disasters.

This is based, in general terms, that there are natural phenomena that impact certain territories, but if these would not have affected human populations, simply would be the occurrence of a potentially destructive event, but at the moment that combines the potentially destructive natural event and social vulnerability, this can turn into disaster. Therefore, it is important to insist that disasters are not natural, they attend a social construction.

Given that disasters are a process that is built based on the relationship between man and nature and the built environment, then it would be possible to stop the process of construction of risk and even in some cases deconstruct the risk, mainly through prevention and mitigation.

Therefore this fact has an important meaning in terms of the responsibility of the agents involved, because under this premise, responsibility for the reproduction and permanence of existing and future risks lies within social agents, having the State as main player responsible for the construction of the risk (Lavell, 2004).

This allocation of responsibilities to certain agents from the perspective of social paradigm, has led this approach not been adopted as quickly since the naturalistic paradigm allows to continue calling "natural" disasters, making them oblivious to the decisions taken by the State and the social and economic processes.

One of the main challenges then for the adoption of the 'new' paradigm is to achieve that the State, i.e. the decision makers, and that society assume their role as major disasters detonators, in order to achieve the transition from the emergency reaction to prevention to the greatest extent possible.

2. Public Policies of Disaster in Mexico

The public policy of disaster in Mexico, as the current global disaster paradigm has being changing, however, raises the idea that there is a lack of articulation between theory and

practice, which is expressed directly in the number and magnitude of events that have occurred in the country and even in the world over the past two decades.

Even in some cases still continue to generate public policy aimed mainly to emergency care with no prevention view (Rodríguez, Lucatello and Garza, 2008:9). This is clearly seen in the politicization and designation of the economic resources in the Mexican case, where is given a higher priority to emergency care.

A striking example of the above statement is observed when analyzing the allocation of resources given to the FOPREDEN and to the FONDEN that are the federal level. In the budget of expenditure of the Federation for the fiscal year 2013, in branch 23 within economic and wage provisions, was assigned to the FONDEN a budget of$ 5'507, 887,975.00 pesos, while FOPREDEN $322,920,000.00 pesos.

The FONDEN is given one budget that is 17 times higher than the one of the FOPREDEN, or seen from another perspective, the federal Government allocates less than 6% of the monetary resources to disaster prevention. This evidence allows to claim that the paradigm that remains in place is that of emergency, since while the law already has a preventive approach, in action yet we continue giving higher priority and attention to the emergency.

However, the effort that has been made in the country to initiate a transition in the approach used to address disasters must be highlight. Relatively few years ago, still ruled a civil protection system focused, in all areas and levels, basically to the emergency care, consequently you can say that changes in the regulatory framework and institutional has been favorable in general terms and in a term that can be considered as short.

2.1. Preventive Policies

The creation of CENAPRED was the first public policy aimed at preventing disasters, mainly engaged in the development and dissemination of knowledge about disasters, both professionals and people so they know how to be managed against a natural event, as well as to the study of technologies for the prevention and mitigation.

The second took place with the establishment of FOPREDEN and FIPREDEN, in 2005, these being important actions to promote the shift of paradigm in public policy of disasters in Mexico. However, as already mentioned, it is important to emphasize that despite the creation of the mentioned agencies, the allocation of resources to the Fund of natural disasters (FONDEN), dedicated to emergency responders, is significantly higher, according to the figures published by the national system of Civil Protection (SINAPROC).

When comparing the disbursements destined for disaster response with those aimed at prevention in the period 2005-2010 figures are much more alarming than those presented above. The FONDEN resources were $56,772 million against $1,368 million allocated to the FOPREDEN. In sum, the FONDEN has received one 42 times greater than the FOPREDEN budget. This last fund expenses represent only the 2.34% of the total budget allocated to the two funds. In conclusion, and as said before, it is possible to observe, that Mexico is still in a time of change and in a process of transition on the theme of disasters.

Another of the important changes that have been made in Mexico on public policy regarding disaster through the SINAPROC, is the new 2012 Civil Protection Act, since it completely modifies the view on the matter.

2.2. New Civil Protection Act

The new Civil Protection Act, which came into force on June 12, 2012, seeks to remedy most of the shortcomings of the previous law, reinforcing the importance of prevention efforts in the three levels of government, it recognizes the priority toward preventive counseling and the need for prevention and mitigation criteria, integrates the concept of comprehensive risk management.

It also recognizes the multifactorial origin and the permanent process of social construction of risk, and other very important amend is that it assigns responsibilities to those who build, rebuild or intervene in the creation of risk, this change in legislation makes evident the transition matter in which we find ourselves in terms of the paradigm shift. Despite the short time that has passed since the law was passed, it has had positive effects in some States already.

2.3. Public Policy Limitations

It is important to note that the majority of actions mentioned are to prevent future risks. So the difference in relation to temporality on prevention and mitigation policies is important since there are two moments, the future and existing ones as a result of the bad practices of the past, and in order to solve them it is necessary to intervene and to mobilize different actor in each case, and also the actions need in each time period do not have the same weight or political and economic costs.

Says Lavell (1996:21), the control of future risk on many occasions is perceived less costly in economic terms in relation to the need to deconstruct the risk, which is necessary to reverse processes already bound in time and space, compared to the future prevention where only regulate and control new developments are required.

Also included in this law there clear identification in competencies and responsibilities of the three areas of Government and the various governmental institutions, which will hinder accountability not only to a level of budget, but also actions and evaluation of results.

Therefore there is a need to form a link between the different public sectors, at the three levels of Government and with society in a transverse manner, the socialization of the law it is also needed, so population could appropriate and learn about the issue of disasters, and contribute to the decrease of vulnerability and therefore the risk, since if this is not achieved, the regulations alone does not guarantee compliance.

The difficulty in order to achieve the transition, is that it is not only required to pass laws and acts, as it is currently happening in Mexico, but the rigorous implementation of the same is also necessary, coupled with a transparent decision-making and an effective accountability by public servants.

Therefore one of the main problems is the lack of rigor in the implementation of prevention policy, because there are flaws in the regulation and reinforcement of these policies,

meaning an absence of obligation of these polices in order to be adopted by political and social actors. Therefore risk management depends almost entirely on the political will of our leaders.

Regarding the disconnection between public policy and current practice, the case of Chiapas, Mexico is a good example. From 1999 to 2012, 21 natural disasters were recorded; of which 19 were associated with storms and floods, out of which 8 were of high magnitude, occurring in short periods with regular cycles; which demonstrates the absence of flood mitigation policies and the lack of prevention from different sectors and levels of government, especially because the large sums of money that were received for recovery and rehabilitation.

The contribution received for 4 out of the 8 events, was $4,236.8 million dollars. Consequently, it is clear the poor administration of the resources, which makes evident the need of a regulatory framework that stipulates mandatory accountability and to be applied rigorously, as the exposed certainly indicates the existence of lax regulations on the subject.

From the above, it is manifest the existence of a political negligence from all spheres of government. And for these reasons cities are facing to great fragility and vulnerability against flood risk. Therefore it is essential to impose risk management as an imperative in urban planning to generate actions that let us to achieved risk mitigation and the development of a culture of prevention.

Therefore to implement a Comprehensive Risk Management Policy, is imperative that public disaster policy provides five normative axes, these proposed by Puente (2001:3) which are: efficiency and equity, integrity, transversality, responsible stewardship and accountability, and it is also essential to create instances for the verification of this five axes.

3. Transversality in a Comprehensive Risk Management (CRM)

As emphasized, an essential element of the CRM is transversality, most as a result of the frequency and magnitude that have had recent events considered disasters, not only in the country but around the world, which puts in evidence the lack of capacity of many Nations to face such events.

To achieve a real reduction of global vulnerability to disasters and risks, it is necessary to have a vision that understands the multiple variables interrelated - social, economic, political, environmental, among others-, which is where the relevance of transversality (mainstreaming, cross-cutting) is inserted in the public policy of disaster.

In order to achieve an efficient policy of prevention and mitigation of disasters is necessary transversal coordination, due to the heterogeneity of the actors who build risk and the intervention of different and various fields, areas and sectors (environmental, economic, and social) among others to deconstruct and prevent risk.

Achieve cross-coordination or transversal coordination is one of the greatest challenges for the implementation of the CRM and to make the transition from political discourse to action. If an actual cross-coordination between the different stakeholders and different spheres of Government is implemented, this would create synergies. Therefore Transversal Synergies

could become a tool or strategy for the implementation of public policies for disaster prevention and mitigation.

3.1. Transversal Synergies: A Tool for the Implementation of a CRM

The idea of applying the so-called Transversal Synergies is to obtain greater results, by identifying the positive externalities that occur when implementing prevention and mitigation actions on other policies and exploiting them, creating interorganizational scenarios and generating mutual benefits in different sectors.

In order to generate concatenated positive effects in terms of prevention, mitigation and vulnerability reduction it is needed that agencies in the different levels of the government and with the inclusion of civil society to create societies, alliances, partnerships, and inter and intra-sector coordination. And this is are the Transversal Synergies.

4. Conclusions

As discussed at the beginning of this paper, one of the objectives to be discussed was the paradigm shift from emergency to prevention. In this sense, we find that we are still, both globally and at national level, in a moment of transition of the paradigm from the "naturalistic - physicalist" to the social, clearly showing a greater advance in a theoretical level than at a practical level.

We found that there is a strong and clear link and have even improved communication channels between theoretical postulates and the legislation in disasters matters, disruption occurs in the implementation of public policies, which is directly expressed in the number of high-magnitude events that have occurred in the country and the world.

Therefore, one of the main challenges for the transition of paradigms is that our leaders and decision makers are no longer seen as priority emergency care and begin to carry out measures and actions of prevention and mitigation of disasters, this clear, while continuing to meet emergency moments.

For this transition it is also imperative to ensure that all assume our role as detonators of disasters, and be aware that we are all responsible for generating, increase and perpetuate the risk. And is also required a rigorous implementation and reinforcement, coupled with a transparency in decision-making and a mandatory accountability for public servants (government employees).

This is a great challenge at least in Mexico, since both transparency and accountability are not everyday life within the exercise of public office, leaving us at the expense of the political will of our officials to achieve prevention and mitigation activities.

In terms of the public policy of disasters in the country, before the year 2005, only the stage of emergency care was taken into account, started to make major efforts to initiate the change of paradigm with the creation of the CENAPRED, FOPREDEN and FIPREDEN. However, as it was showed, it is given main concern to the emergency stage, at least strong priority in the allocation of resources between the FONDEN and FOPREDEN, therefore, it is needed to achieve a balance to move to a paradigm of prevention and mitigation of disasters in the country.

The case of Chiapas also manifests the existence of a political negligence from all spheres of government. And It is possible that this is one of the main reasons that cities are facing a great fragility and vulnerability against flood risk. Therefore it is essential to impose risk management as an imperative in urban planning to generate actions that let us to achieved risk mitigation and the development of a culture of prevention.

The major changes that are occurring in the country in terms of the transition of paradigm, is the new law of civil protection, as mentioned, completely modifying the vision in the field of disaster. It recognizes as a priority the preventive orientation, integrates the concept of comprehensive risk management, acknowledging the multifactorial origin and the construction of the risk process, responsibilities are assigned to those who build the risk. Also indicates co-responsibilities to deconstruct mandatory risk, this new law considers a crime the construction of risk, either through ignorance or omission.

To deconstruct risk is essential, as already mentioned, a change in social responsibility, because the risk is socially constructed and all intervene in the process of construction, so this is necessary to reach a comprehensive, efficient and responsible public disaster policy.

An strategy to deconstruct risk and make greater changes in the actions of prevention and mitigation are the Traversal Synergies, because this helps generate concatenated positive effects in terms of prevention, mitigation and vulnerability reduction, this is possible with the creation of societies, alliances, partnerships, and inter and intra-sector coordination from the different levels of the government and with the inclusion of civil society.

Taking into account all of the above, it is clear that the reinforcement of the law is one of the main issues in order to achieve the transition and shift of the paradigm, since currently it depends basically at the political will, and as demonstrated there is political negligence at the three levels of Government and sectors, at least as far as the issue of disaster.

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The Study of Transformation and Usage Situation of the Waterfront Public Space—the Case of Suzhou Creek in Shanghai

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Abstract

Waterfront space is always in the spotlight during the urban development. As the important river in Shanghai, Suzhou Creek has experienced a transformation from the" the black and stink" to a good city image during the decades. Through information sorting and spatial analyzes, the investigation reveals the history and change of the waterfront space before and after the rehabilitation. Then the ways to activate the region are discussed and different aspects to improve the quality are studied. At the same time, the analysis includes the process of the reconstruction, the policy of the government, and the requirement of the people. This study also selects the representative public space along Suzhou Creek to explore the situation of the waterfront public space. The assessment of the project implementation is also revealed by analyzing people's view, with the methods including behavior observation and analysis, participatory observation, the questionnaire, and in-depth interview. Through the survey from the residents, analysis of the usage situation in the waterfront public space is used to reflect people's demand. In addition, suggestions about the construction and the management are made, which may provide better design advice and strategy for urban waterfront public space in the future.

1. Introduction

With the rapid development of cities, urban waterfront space has been one of the sensitive issues in the planning study. As a specific area connecting the land and water in the city, it represents the image of the city, has a large economic value, and plays as an important component of the urban ecological environment. From the specific concepts, urban waterfront space means the area of the land or buildings near rivers, lakes, oceans and the part of the town near a body of water (Breen, A. & Rigby. D., 1994). It refers to the formation of urban water system, covering the water space and the adjacent city road area with the width of 200-300 m (Wang Jianguo, 2001).

Waterfront space has a great value in improving the environmental quality of urban ecology, showing city features and richening city's regional styles. It blends the artificial environment (buildings, squares, and roads) and the natural environment (water, wetlands, and revetment) and gathers public events, history, culture and other factors. Since the 70s and 80s of the twentieth century, urban waterfront space around the world has been unprecedentedly valued. The construction and renovation has also become an opportunity of urban regeneration, such as the update of the Yarra River's waterfront in Melbourne, the revitalization plan of Thames ports district in London and the development of the waterfront public space in San Francisco.

Shanghai, "Born with water and prospered with water", has been plagued with water. Suzhou Creek, known as the mother river of Shanghai and flowing in the heart area of Shanghai, has given birth to the modern urban civilization, witnessed a century upheaval of Shanghai, and also carried the history, heritage and memory of Shanghai. The research on renovation of Suzhou River's waterfront public space and the analysis and evaluation of its usage can attract more attention to the ecological environment, upgrade urban quality and improve public services. It is of great significance to the construction of the modern city and the optimization of urban form and space.

2. History

2.1 The Period Before Shanghai Opened As the Treaty port

Suzhou Creek, formerly called "Song River", flows from Tai Lake in Jiangsu, totally 125 km in length. It flows through Jiangsu Wujiang, Suzhou, Kunshan and other places. Then It measures 53.1 km in the area (eight districts and one county) of Shanghai (Figure 1) and has 59 tributaries in total, of which the urban segment is about 23.8 km with an average width of 70-80 m.

Suzhou Creek has always been responsible for the Tai Lake's flood. At the same time, It is also the main trunk o freight between Tai Lake Basin and Shanghai, linking Shanghai, Tai Lake and inland areas. If we say Huangpu River is the living room of Shanghai, showing the flourish and generosity, then Suzhou River is like the garden of Shanghai, where the vicissitudes of city life is happening, quietly and peacefully.



Figure 1: The geography map of Shanghai in Song dynasty
Source: Wu Jiang (1997) Shanghai architectural history in 100 years, Tongji University Press

2.2 Semi-colonial Era

Before 1900, the invasion of modern colonial brought an initial expansion period of urbanization. After the Opium War, Shanghai became one of the five treaty ports in 1842. With the constant development of the concession area and the construction of the infrastructure, Shanghai's center was strongly dependent on the area along the Huangpu River, expanding westward in the form of cross-section (Figure 2). Suzhou Creek didn't become a development axis of the city, but attached to the edge area of the Huangpu River. Its main role was to transport waterways and drainage. Both sides of the river slowly evolved into the gathering place of Shanghai's modern industry with the gradual improvement of its roads and docks construction.

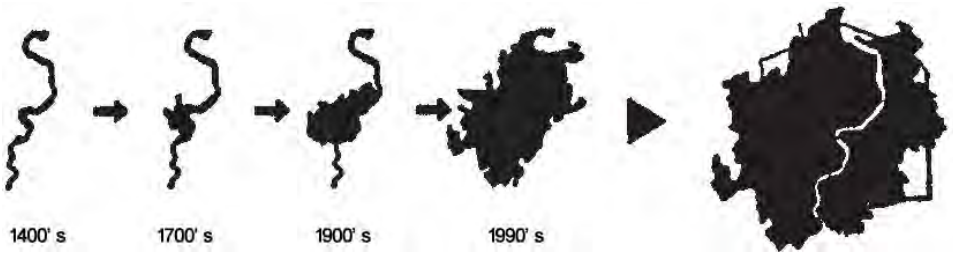


Figure 2: The special development of Shanghai
Source: Zhu Bo (2010)"Shanghai world expo and the formation of urban spatial morphology"

Between 1900 and 1930, the rising of capital and industry brought upon a large scale construction of waterfront industrial zone. The waterfront area had become city's production and transportation center. Due to the rapid growth of industry and population around Suzhou Creek, large quantities of domestic sewage and industrial sewage were poured into the river. In 1920s, water of Suzhou River began to emit strange odor and demonstrate unusual color.

Despite the fact that water has the ability of self-purification, Suzhou River had little power to purify itself because it was a rapid-stream river with small rate of Clearwater. With increasing scale of factories, congregations, domestic and industrial sewage, the situation became worse.

Between 1932 and 1949, as the battle of Shanghai went on, the entire city was in stagnation. Affected by the Second World War and domestic war, spatial construction of waterfront area as well as the entire city was put on hold. Large area of debris and slumber's appearances accelerated the pollution of Suzhou Creek, which leads to aggravation of environment quality around the river.

2.3 The Period Before Reform and Openness

At the beginning of 1950s, issues about the economic recovery had the priority. Under the policy of planned economy, the government played the hand in urbanization, which means that government not only played the main role of city construction, but also the main role of urban development. The second industry became the absolute lead during this period. Increasing number of industrial buildings appeared around Suzhou Creek with large scale of industrial projects. Industrial zone and workers living quarters were built around the shore with a gradually increasing density. In addition, the construction of flood wall separated the water space from the urban living space, opposing to the multi-function use. Then Suzhou Creek was heavily been polluted, thus becoming "the black and stink", which gave off a horrible stench and can hardly find any sign of life in it.

3. Renew of the Waterfront Public Space

From 1980 till now, the government still plays an important role of urbanization. However, there are other forms of power, such as communities, individuals, enterprises as well as their combinations. The planning pattern is not limited only to "top-down", there are other forms such as "down-top", "internal collaborations", "external collaborations", etc.

With the development of the third industry and auxiliary industry, industries related to zone planning has also been developed. At the same time, the tertiary industry of the city and its affiliated industry are booming. Various related industries and the land market have been rapidly developed. People's acknowledge of the waterfront area began to change. And the transformation and renewal of waterfront public space have become important means of urban energy regeneration (Figure 3).



Figure 3: Suzhou Creek in Shanghai

3.1 Environment Improvement

In 1996, Shanghai government compiled *the comprehensive improvement planning of environment in Suzhou Creek*. Since 1998, three comprehensive improvement projects have

been implemented, which lasted for 11 years (1998-2008), with a total investment of about 14 billion Yuan.

During the first period (1998-2002), the goal is to deal with the malodorous black problem in the main stream and the black belt in the interchange with the Huangpu River. Ten projects including "Sewage interception project", "Integrated water diversion project", "Disposal of sediment dredging engineering" were implemented. In the second period (2002-2006), the stabilization of the water quality and the construction of green environment were the main objectives. "Engineering project of drainage and sewage" and "Reconstruction project of Tibetan bridge" were carried out with other 6 projects. The intention of the third period (2006-2008) is to improve the water quality and restore water ecological system with the implementation of five projects. After the comprehensive improvement, the strange color and reek has been dispelled. And tremendous improvement of offshore environment has been made with the change of the public space.

3.2 Planning and Development

Suzhou Creek began to get rid of the bad impression "gutter" gradually, towards the direction of urban ecological landscape. In 2002, *Waterfront landscape planning of Suzhou Creek* was approved and the implementation of the plan was subsequent. Simultaneously, numerous kinds of waterfront update planning and development projects were on the way. The planning and development of riverside public space has entered a new stage (Figure 4).



Figure 4: The map of planning area

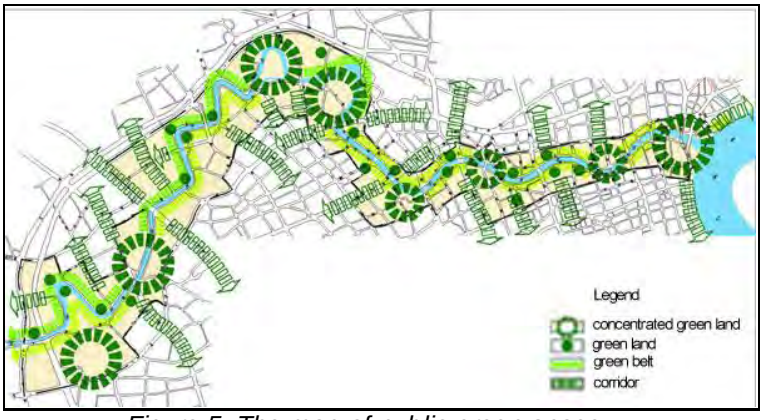


Figure 5: The map of public green space

(1) Increasing green area, creating public space and reducing the density

With the improvement of water quality and the environment around Suzhou Creek, various types of residential units have been developed. However, parts of the excessive development, where high-rise buildings are densely packed, have caused the visual pollution and mental pressure. As a result, it is disadvantageous to the public environment of the waterfront space. According to people-oriented principle, the Urban Redevelopment Authority has put forward the developing strategy of "increasing green area, creating public space and reducing the density". Firstly, Building capacity in riparian areas has been strictly ruled. The plot ratio of the Residential building should not be greater than 2.5 while the public building is not greater than 4.0. Secondly, green space and public space have been increased. With the design ideas of "Jewel" and "Necklace" (Figure 5), more than 100 green spaces would be constructed on both sides of the Suzhou Creek. These "green jewels" would provide more green public space for citizens. While "Necklace" represents green belt along the Suzhou creek.

(2) The publicity and continuity of waterfront space

Like sunlight, air and water, waterfront area should be shared by all citizens. Spaces along the Suzhou Creek are planned as "the paradise for all the citizens". However, "the shared paradise" had been dismembered into individual private domain before. Ordinary citizens

were unable to have access to the waterfront space. Urban public resources were occupied by a few people in a certain extent, which had caused the gap between different social classes. In addition, the biggest characteristic of urban waterfront landscape is the continuity of bank line with green space. Privatization of the space made the loss of the landscape character artificially in the past.

During the renewal of the waterfront space, the government is the key element with the investment on environmental protection. The results of social investment should be shared by the public. After the waterfront block developed by the land developers, the public space should not only belong to one community, but to all citizens. In the past, there was little awareness of this problem, which leading to the passive situation in development and management. Subsequently, in the planning process, people-oriented emphasis has been put on the initiative of the management, with the continuity of the landscape.

(3) Public space: being closer to the water

The design of the public space along Suzhou Creek has mainly experienced three stages of transition with three kinds of special form. With the consideration of the flood protection and drainage function, the vertical revetment (Figure 6) is used in the waterfront space. The flood prevention wall, with façade beautified, is 1-2 meters above the ground. Convenient passageway and proper rest area are left. In the place with lower requirement of the flood control, the stepped revetment (Figure 7) is used to enlarge the space. In flood season it can be drown, while in drought season it is available for people. As a result of considering the natural ecological restoration, the revetment of gentle slope (Figure 8) is design to create space closer to water. With biodiversity recovery and ecological protection, people can interact with the nature.



Figure 6: The vertical revetment



Figure 7: The stepped revetment



Figure 8: The gentle slope

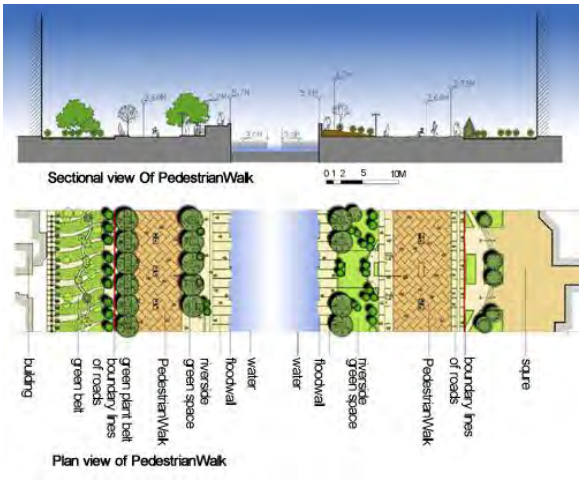


Figure 9: The pedestrian walk

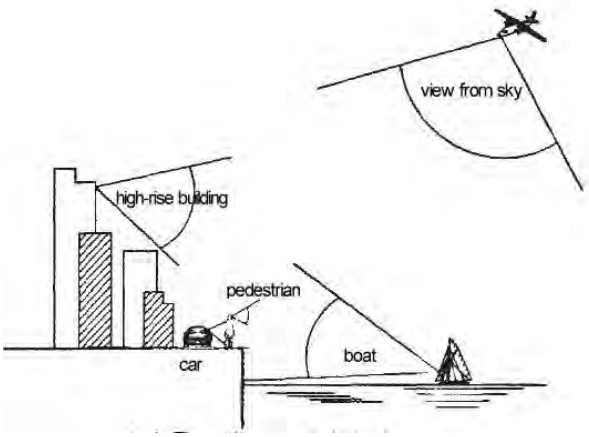


Figure 10: Multi-angle for the space

Traditional way to watch the scenery is through walking (Figure 9) and driving. With the development of tourism and the change of the mode of land use, the different way of

recreation psychology and perception has begun to be considered during the planning process. Multi-angle and full-range experience is provided for the tourists (Figure 10).

4. Methods

4.1 Area Selection

The regions are the public waterfront spaces along Suzhou Creek, totally 23.8 km in downtown area. The main observation areas: the area (Figure 11) near Guangfu west road, the waterfront area (Figure 12) beside Zhongyuan Liangwan City and the Dream Garden theme park. These Spaces directly adjoin the river bank without the separation of buildings.



Figure 11: The research area Ⅰ



Figure 12: The research area Ⅱ

4.2 Investigating process

Post Occupancy Evaluation (POE for short), means the system description of the environment and evaluation of empirical research from the perspective of users. This research method includes observation, record, questionnaire and interview as a combination, with the performance measurement of the buildings, squares, green spaces, and parks, etc. The intention is to test whether the use has achieved the desired vision (Han Jing, Hu Shaoxue, 2006).

(1)Observation

By the observation and record of people's activities from 8 am to 8 pm on weekends and weekdays separately, the activity purpose and activity situation of the users are studied and the problems are been summarized.

(2) Questionnaire

To investigate users' information, questionnaires are distributed on weekends and weekdays respectively. The preliminary data of basic information, space satisfaction and activities are collected by the survey. To avoid the singleness of the objects and to make the results more reliable, the investigation deliberately targets the people of different age paragraph and the crowd of different activity preference. 230 copies of questionnaires were distributed with 211 effective and the effective rate was 91.7%.

(3) Interview

Through face to face and in-depth interviews, their usage situation, the interaction within the public space, and their perception of the waterfront environment can be studied. At the same time, their view of ecological environment and the design of waterfront public space can be learned. 30 people are interviewed.

5. The Users' Needs of the Waterfront Public Space

5.1 The Characteristics of Users

In the 211 samples, men take the percentage of 52.6% while women account for 47.4%. Male proportion is slightly higher than that of women. For the age distribution (Figure 13), middle-aged (29%) and old people (44%) account for the high proportion. Under the age of 18, samples are less (7%), for the situation that children are companied by the adults. From the data, we can see that it is essential to consider the design for the elder people, especially different kinds of facilities.

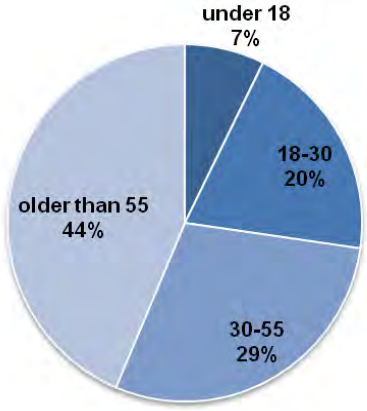


Figure 13: The distribution of the age

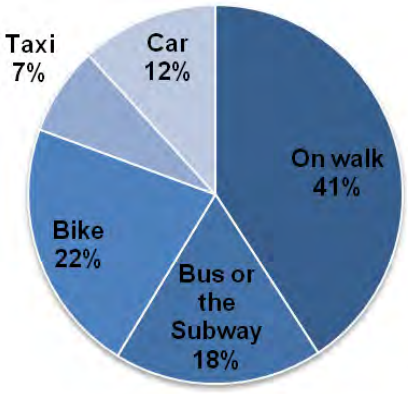


Figure 14: The type of the trip mode

5.2 The Analysis of User's Activity

(1)The choice of users' trip mode

In the survey of transportation means choice to the waterfront public space (Figure 14), 41% people choose to walk, followed by the people (22%) using bike. This result reflects the characteristics that people often have activities in the neighborhood. Because the number of elder people takes up the most percentage, walking or using the public transportation is the common. As for the residents living nearby, exercise and doing leisure activities have become the main purpose in the waterfront space. Different from general amusement park or attraction, waterfront public space acts as the open corridor of urban ecological landscape, and has the important ecological recreation function. Also, the function to meet the requirements of the residents in their daily life is of great importance. In addition, Emphasis should be put on the accessibility when designing the waterfront public space.

(2)The types of user's activities

Through the observation, the user's activities are divided into rest, communication, exercise, entertainment, cultural activities, sightseeing and other activities. Statistical analysis for the activity survey (Figure 15) demonstrates that communication (28%) accounts as the main type of activity, reflecting the waterfront space as an important attribute of urban public space, which also reflects the people demand for high quality environment. In the survey, waterfront public space is an important media for people to interact with each other. Exercise activities account for 21%. Tai chi, running and ball games are the most popular sports referred in the interview. Many users have mentioned the lack of sport facilities in the public space. As the demanding for sports, more attention should be paid on it. Taking rest constitutes 14%, as many people would like to read books, sit around and admire the scenery peacefully. For these activities above, the surrounding residents are the main users.

Entertainment activities（13%）include fishing, playing cards, gathering and kite flying. Cultural activities such as dancing, exhibitions, outdoor concerts, occupy 10%. These two types of activities attract people from far places, especially on weekends. Then Sightseeing represents 9% while other activities including walking through and short stay account for 5%.

5.3 The User's Evaluation of Waterfront Public Space

(1)Satisfaction evaluation

According to the data (Figure 16), 83% of users gave a positive evaluation (45% satisfied, 15% very satisfied) of the waterfront public space. No one thinks it is poor. This shows the planning of waterfront public space can be a success. 90% of consumers think the ecological environment is good (Figure 17), with a lot of people mentioning the poor situation before. And the good environment plays an essential role in waterfront public space, which lead to the attraction of people's gathering. Thus in the process of urban development, the importance of the ecological environment should be considered and the old way of treatment after pollution should be avoided.

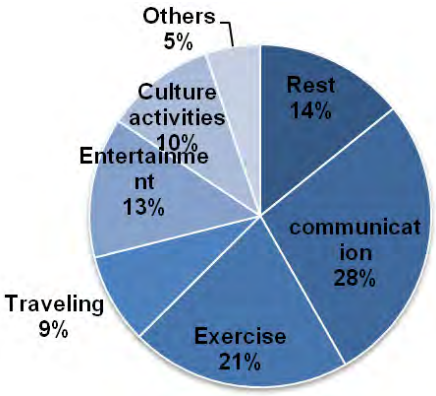


Figure 15: The type of activities

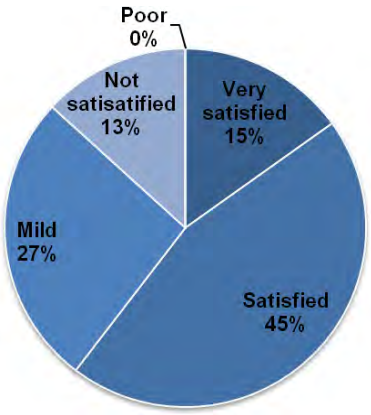


Figure 16: Satisfaction of the public space

(2)Evaluation of the design

Preferences on scenic spots for activities are different (Figure 18). Viewing platform acts as the connection part of the landscape and the ground, providing a good landscape view, which appeals to the users mostly (30%). When it comes to the mini-square, it provides the space for public. Therefore, 24% of the respondents choose it as a favorite spot. Thus, the design of the platform and square is of great importance. Plants and lawn are the indispensable ecological elements, which provide beautiful natural environment and space. According to the survey, more attention should also be paid to the organization of inside traffic to form a reasonable walking system, which can make visitors be in the plane of different height freely and get multi-height and multi-angle point of view. Simultaneously, making the space lively to improve the attraction is essential.

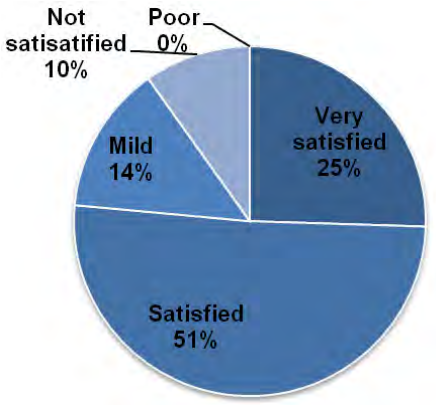


Figure 17: Satisfaction of environment

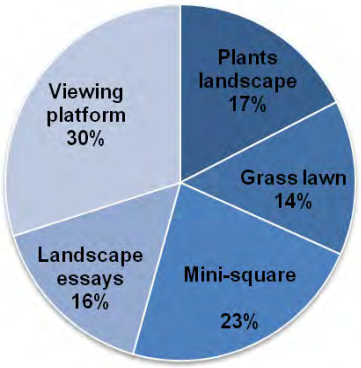


Figure 18: Preferences of scenic spot

On the seasonal preferences for activities (Figure 19), spring and autumn hit a higher ratio, respectively 42% and 33%. The temperature in summer is high outdoors without effective plants cover while winter is so desolate. Thus the preference activities ratio of both two seasons is relatively low. Some respondents also proposed the relationship of plant

landscape, sculpture and platform, etc. Along the river bank a variety of greening form should be used. Green corridor, square green space and road green space should be a organic combination, which can provide open space for different groups.

(3) Evaluation on the service facilities

In the interview, many suggestions are been made to the service facilities of the waterfront public space. The distribution of seats cannot satisfy the demand (Table 1), for the current situation of uneven setting. There is no consideration of the relationship between the sun and rain, with no shade and shelter facilities. At the same time, there is a large demand for physical exercise facilities for running, exercise and other activities. And for the setting of public toilets, people generally reflect the difficulty to find the toilet and the long distance.

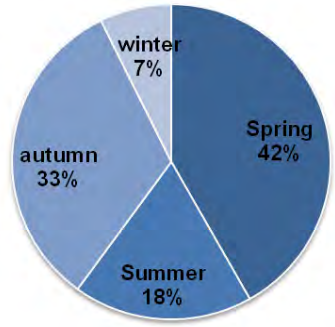


Figure 19: Preferences of season

evalustion	good	relatively good	mild	relatively poor	poor
percentage	17.2	27.6	31.1	16.5	8.6

Table 1: The evaluation of the seat distribution

(4) Evaluation on the management

The management problems of the waterfront public space are reflected in the following aspects. Firstly, it is forbidden to fish in the Suzhou Creek. However, the survey found that there is a big demand of fishing with the support of surrounding Residents. For the consideration of safety and management, fishing areas should be introduced in, which will protect the ecological environment, meet the demand of people and activate the space. The other issue is about the lawn management. Respondents think design and human factors both lead to the problem, thus people oriented design should be in application.

6. Suggestions

6.1 Protection and Development

How to protect and develop natural ecological landscape of the city is always in the spotlight in order to maintain urban style and features. In terms of the natural ecological environment, protection is important with the consideration of the capacity of the environment, which can regulate the urban microclimate. On the regional protection and renew, a reasonable development of the theme is needed. Only with In-depth research and the well understanding of the region can we protect the public space, the landscape, the history and the cultural.

6.2 The Maintenance of Public Properties

The waterfront space is generally agreed as the public space of citizens. Firstly, waterfront space should have a good environment. The ecological environment should avoid pollution. Attention should be paid to the maintenance of water quality and the plant cover. Secondly, the design should satisfy the demand of people. The requirements of man‘s scale should be Conformed and more convenient facilities should be provided.

6.3 Evaluation Research on Waterfront Space

According to the different situation of every city, special evaluation study on waterfront space should be implemented. The examples are as follows. Government can arouse the enthusiasm of citizen participation in urban construction. Planners should understand the using requirements of people, making the environment and space satisfy the need of people. Effective procedures and methods for evaluation can be established, as well as the long-term

mechanism and standards. Then evaluation on the space designs, monitoring of the ecological environment, study on performance and feedback can all be on the way. Establishment of an effective management system for water environment and the waterfront can provide effective institutional guarantee for development and construction.

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Conjoining Formal and Informal Systems in Water Governance. A Socio-technical Perspective.

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Abstract

The provision of water and sanitation services is a fundamental dimension of the 'right to the city'. Nonetheless, the fulfilment of this right is not yet universally granted. This is the case of several suburban and rural areas in Brazil. Water and sanitation governance requires the respect of these social entitlements as well as an adequate level of technical solutions. When these two components are not present, informal solutions arise, producing new alternative systems. How public institutions, formally responsible to provide basic water and sanitation services, interact with informal mechanisms activated by local communities? Which are the innovations that, combining social and technical requirements, allow conjoining formal and informal systems while addressing water democratization? To answer these questions, we adopted a fieldwork approach and applied it for a selected case study: the municipality of Queimados in the Rio de Janeiro Metropolitan Area. Research findings show the role of water springs as an informal system for service provision, even if it leads to emphasizing the potential risks related to the lack of institutionalization. We recommend socio-technical innovations as a third way to conjoin formality and informality. Moreover, we stress diversity, institutionalization, and participation while implementing them in vulnerable socio-environmental contexts.

Keywords: socio-technical innovation, informal systems, water and sanitation governance.

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1. Introduction

The provision of water and sanitation services is a fundamental dimension of the 'right to the city'. Even more, water access is not only a civic but also a human right. However, the fulfilment of this right is not yet universally granted, as in several regional and supra-regional contexts, especially in developing and emerging countries, it represents a crucial challenge. This is the case of several suburban and rural areas of Brazil, although it is no longer considered a developing nation. Water and sanitation governance requires the general respect of these social entitlements as well as an adequate level of technical solutions. When these two components are lacking, informal solutions arise to produce new systems, which are alternative to the official and formal one. The coexistence of two different water supply systems, one formal and the other informal, is at the same time a cause and an effect of unequal socio-environmental conditions, and exacerbates socio-environmental vulnerability. Without a secure access to safe water, people from the lower classes, living in marginalised areas, search for solutions and end up with the creation of precarious alternatives. The inaction of governments and public institutions makes these alternatives permanent. In this research we start to understand water and sanitation services (WSS) as socio-technical systems, consisting of formal and informal elements on both micro and macro levels. We then confront the following research questions: how do public governance institutions, formally responsible to provide WSS, interact with informal mechanisms that are activated by local communities? How is it possible to promote innovations that can blend social and technical requirements, conjoining formal and informal systems while addressing the governance process towards water democratization?

To answer these questions, we adopted a fieldwork approach and applied it to a selected case study. The municipality of Queimados, in the Rio de Janeiro Metropolitan Area (RJMA), was chosen as it is characterized by the socio-environmental vulnerability typical of this region and, beyond that, by the co-presence of a formal and an alternative, informal, water supply system.

The research presents limitations due to its exploratory nature, being the earlier part of a wider research project funded by the UE Seventh Framework Programme, named DESAFIO[1], which is still in its first year. Notwithstanding that, it offers an original research in an under-explored territory and insights to contribute to academic and planning practice debate on WSS governance. The paper is organized in the following five sections: 1) Presentation of the theoretical background and outline of the current academic debate; 2) Description of the research rationale and methods selected for its implementation; 3) A brief description of the local case study; 4) Presentation of the results; 5) Discussion of the research findings on the basis of the revised theory and a presentation of final remarks for future research and governance practices in the area studied.

2. Background

2.1 Formal and informal systems in water and sanitation governance.

The concept of urban governance entails an interactive and pluralistic approach to the administration of the city. According to Castro (2007), the notion of governance implies an *asymmetric articulation* amongst *power-holders* such as governmental institutions (organization established by state law), the private sector and the organized 'civil society', entailing not only negotiation and dialogue but conflict and uncertainty as well. This articulation and the related social and political processes drive urban transformations. Especially in the global south (Ahlers et al., 2014), these transformations occur as an effect not only of institutional planning activity, but also of informal processes. In the economic and organizational literature formality and

informality are two antithetic concepts, opposed by the presence/absence of written rules, stated goals and clearly defined procedures (Scott, 2013). While formal organizations are associated with visible and planned entities, the informal ones are invisible and spontaneous (Williamson, 1994, Barnard, 1983). Authors such as Assad (1996) prefers to identify these concepts as attributes of *transactions* occurring among different organizations (*institutions*) in society rather than entities themselves. In the planning and socio-political realm, scholars maintain the inadequacy of the dichotomist perspective, stressing that 'formal' and 'informal' are intimately related being both integrated components of the public system (Roy, 2005, Porter et al., 2011, Simone, 2001, Kudva, 2009, Misra, 2014), which produces, at the same time, formal and informal mechanisms of social organization (Roy, 2005). Following a similar view, Misra warns us to avoid the logical equation: legal/formal, illegal/informal (Misra, 2014). Generally speaking, scholars agree that the formal and informal coexist in society and thus the public governance activity cannot afford them separately. In the academic debate on the governance of WSS, especially the part focused on cities in developing countries, the discussion on the role of informality is gaining momentum (Ahlers et al., 2014).

Building on the development model boosted by the industrial revolution, from the eighteenth century until the end of the twentieth century, urban development has been associated in an almost undisputed manner to the large infrastructure network (Graham and Marvin, 2001, Gandy, 2004). This model is also identified with *conventional network* (Coutard and Bris, 2008), i.e., with an interconnected set of equipment, centrally planned and managed by a single operator offering a seamless service in a given territory which it makes increasingly interlocked. These large artefacts, made by central government policies and choices, have at once generated new demands and affected future trajectories of urban policies and design (Swyngedouw, 2005, Gandy, 2004). Especially when implemented in developing countries, this centralized model often appeared ineffective to face the urban demand, also because the acceleration in urbanization that occurred in the last decades (Ahlers et al., 2014, Nilsson, 2006). It leads to the question on the role of the state and large infrastructural solutions in public services provision, while reconsidering the potential of informal or alternative solutions. Studying WSS provision in urban contexts in the global south, scholars have found that large public centralized systems recursively (*re*-)produce spatial inequalities (Harvey, 2010), excluding peripheral areas or lower income class neighbourhoods (Nilsson, 2006, Kudva, 2009, Misra, 2014). Joshi and Moore (2004) argue that, in such cases, small-scale and even informal providers may offer a more far-reaching and flexible service, also capable of supplying less accessible regions, responding to a differentiated demand and specific needs. In the view of these authors, the informal and the formal can be complementary services, *co-producing* a more effective system. They stress that this co-production for service delivery can work insofar as it is *institutionalized*[2] (Joshi and Moore, 2004) and that it represents an alternative that can be suitable for some context but not for others. Hence, it may represent an alternative but not necessarily the best one. Their concept of co-production is rejected by critical authors (Ahlers et al., 2014), who see co-production not as a cooperative process, but rather as a mechanism of urban inequality reproduction.

2.2 The socio-technical perspective

We acknowledge that there is no viable solution once and for all. Debating, researching and testing intermediate solutions is necessary for the democratization of services, taking into account the diversity of local contexts and the high degree of complexity of the WSS issue. Networks intervene in human communities, intertwining with them and forming socio-technical systems (Graham and Marvin, 2001) where social organizations and technical artefacts *co-evolve* (Geels, 2004). Starting from

these ideas, we approach the problem of WSS provision from a socio-technical perspective. In the academic literature the 'socio-technic' attribute is mostly associated to the notion of *landscape*, *regimes* (Rip and Kemp, 1998) or *niches* (Geels, 2004, Smith et al., 2010). It underpins the idea that technical elements and society are conjoined. Indeed, the technical is the implementation of knowledge to produce artefacts which human beings use to carry out their own life (Santos, 1996) and respond to social needs. From this perspective, WSS ought to be understood as socio-technical systems, with a technical dimension, formed by organizational and institutional structures, as well as a social dimension, involving cultural values and meaning. The combination of these components is often unbalanced. Especially when artefacts are produced by a single, centralized agent but for a multiplicity of users, as in the case of a public service. The Moses Bridge, connecting Long Island to the city of New York, is a typical example of an infrastructure missing the social dimension. Being unsuitable for public transport, it excluded low-income users (Winner, 1980). In the WSS realm (as well in other public service provision ones), to carry the discussion over the formal *vs.* informal dichotomy, also assuring the socio-technical balance requires a shift towards diversified, alternative, and adaptable solutions. Such a change demands innovation. Innovation implies not only a new idea (which would correspond to invention) but the implementation of this idea into practice (Hartley, 2005), making new ideas work (Mulgan and Albury, 2003). We argue that socio-technical innovation can offer a third way to manage WSS, when driven by democratization principles[3]. Therefore, we propose a definition of socio-technical innovations as the set of strategies and actions inscribed in a perspective of governance based on the recognition of the informal system by formal institutions (Ostrom, 2009), made by the collaboration between the two dimensions, and aimed at generating technically viable solutions also capable of supporting the fairest functioning of public services. In our view, socio-technical innovation is the result of a vision for the management of public services that combines, in a balanced way, the formality of plans and technical structures, with the informality and diversity of human communities and their needs.

2.3 Formal and informal WSS in the Rio de Janeiro Metropolitan Area

Almost all municipalities of the Rio de Janeiro Metropolitan Area have their water supply and sanitation services managed by the Rio de Janeiro state company, CEDAE, created in 1975. Water supply in the RJMA is based on two macro systems. The first is the *Guandú* Macro System that supplies Rio de Janeiro and most of the western municipalities of the Guanabara Bay Hydrographical Region (also known as *Baixada Fluminense*). The second is the *Imunana-Laranjal* Macro System, which draws water from rivers *Macacu* and *Guapiaçu*, which supplies the municipalities of the eastern part of this region (i.e., Niteroi, São Gonçalo, and Itaboraí). The choice for macro supply systems, that is, for a central organization providing water and sanitation for the majority of the population, caused the increasing abandonment of the ancient micro systems, based on the catchment of local water sources.

To supply this region two pipelines were built: the Main *Baixada Fluminense* (BF) Pipeline (APBF) in the 1980s and the New *Baixada Fluminense* Pipeline (NABF), completed in mid-2013, supported by the funds of the Brazilian Growth Acceleration Programme (PAC), devoted to water and sanitation (PAC I). Without these water pipelines, it would not be possible to bring water to the existing reservoirs, many of which are still disabled, and others still unimplemented, with no deadline for their completion. The largest part of this sub-region has problems with the irregular frequency of supply, lack of pressure and a bad quality of tap water. Data from IBGE (Brazilian Statistics and Geography Institute) on the National Basic Sanitation show the need for water rationing in all the Baixada Fluminense municipalities (PNSB, 2010), which is mostly attributed to storage problems. Having no water in reservoirs,

many areas of the BF depend on manoeuvres in the system by CEDAE technicians, who end up having the power to choose those to be served, and those to be excluded from the water supply network. Recent analysis made by external consultants hired to prepare municipal sanitation plans, report an overview of water in the BF featured by intermittent supply, deficits in reservoir volumes and an insufficient capacity of the distribution pipelines (Torres, 2014). Furthermore, it is observed that the water volume available from the Guandú system, 43m^3/s, is mostly supplying Rio de Janeiro's capital city (about 6,300,000 inhabitants). Before the NABF, only 9m^2/s went to the BF (about 3,300,000 inhabitants) (Torres, 2014). Indeed, the expansions in water production and piping provided through the construction of the Guandú System have not generated sufficient volume to supply the BF. This expansion was neither accompanied by the construction of further reservoirs nor by a clear definition of the related area to be supplied. This badly structured process led to a system with a high degree of uncertainty, operating precariously, based on permanent water manoeuvres performed randomly, but with the DAEs (water and sewage districts) often favouring certain users. Hence, in the more peripheral areas of the RJMA, situations of great precariousness in water supply linger on. In the BF sub-region it is possible to find several municipalities where 30% of the households have no access to water (SNIS, 2012). A number of users take water directly from the main pipelines, these connections being mainly clandestine. This situation leads to damage to the pipelines, causing leaks and consequently water wastage.

CEDAE is responsible for providing the water services but there are other actors appointed in the RJMA for water resources management, i.e., the river basin committees: the Guanabara Bay River Basin Committee and the Guandú River Basin Committee. Committees consist of representatives from water user groups, government, and the organized civil society. The committees meet periodically and have among their competences the design and implementation of bulk-water permit and charging systems, approvals for river basin management and water zoning plans, facilitation of conflicts and resolution among users. CEDAE is the main user with a seat in the Guandú River Basin Committee. The City Government also has a seat in this committee. Domestic users do not participate directly in the Committee. Nonetheless, the water and sanitation operators that the Law recognise as the formal 'users' have the right to participate in the Committees, also representing them.

3. Methodology and method

3.1 Research strategy

We shaped our study as a field research, conceived as a methodology driven by the social context to be investigated and focused on the interactions occurring in that context (Burgess, 2002). This approach implies that the research design and the related methods are not defined *a priori*, but rather during the research work, which starts with the observational activity of the field (Burgess, 2002). According to this methodology the researcher/research-team works as a craftsman who selects and combines methods to collect and organize the data (both qualitative or quantitative), following his/her own research policy, which reflects a specific strategy and professional ethics (Olivier de Sardan, 2000). Central to this conception of field research is the interaction between the researcher and the field, that is, its inhabitants, institutions, organizations, and form of representation, such as local prints or earlier studies and publications (Burgess, 2002). We approached the field research as an iterative and learning path, implying that initial research questions or hypotheses can be modified or deepened during the work of field observation (Edmondson and McManus, 2007). We chose this methodology because we have dealt with a general problem (socio-technical innovation for WSS), within a wider

research project (DESAFIO), investigating an underexplored territory (Queimados, RJ). Thus we could little rely on earlier studies and we needed an exploratory approach, allowing us to find the very heart of the problem.

3.2 Method

Our research was carried out in a one-year fieldwork and was based on a combination of different methods to collect and analyse data. We employed a mixed approach for data collection aimed at gathering both qualitative and quantitative information. Thus we combined the following tools: overt and participant observation, informal conversations, secondary source investigation, semi-structured interviews, and a survey. The informal supply system is poorly documented in official sources. However, along our research we could rely upon relevant secondary sources, namely, institutional and governmental documents (e.g., City plans, state government maps, basin committee publications), and previous academic works. Amongst these sources, our point of departure was the study by Gonçalves et al.(2010), which identifies twenty-one water springs in Queimados, providing water characterization and quality analysis for a sample of them. Drawing upon this source, we selected two water springs to be surveyed. We made this choice after six months of fieldwork, carrying out three semi-structured interviews, monthly informal meetings and conversations with local officials and governors, overt and participant observation at local events and inspections of the most utilized water springs and reservoirs. These preliminary steps of field research, documented in seven field reports and a photographic archive, outlined a two-fold situation for water supply in Queimados. On the one hand, the part of the city connected with the main public water pipeline and on the other that which is not reached by this infrastructure. Thus we selected a water spring for each of these two kinds of supply condition. In the next section we describe them briefly. We carried out a survey based on a short 9-point questionnaire, administered on a purposive sample of 90 dwellers. Interviewers administered the questionnaire in three different days of the week and time of the day, including a day in the weekend, to involve the more differentiated social categories. Thus, respondents were selected subjectively only by being spring users.

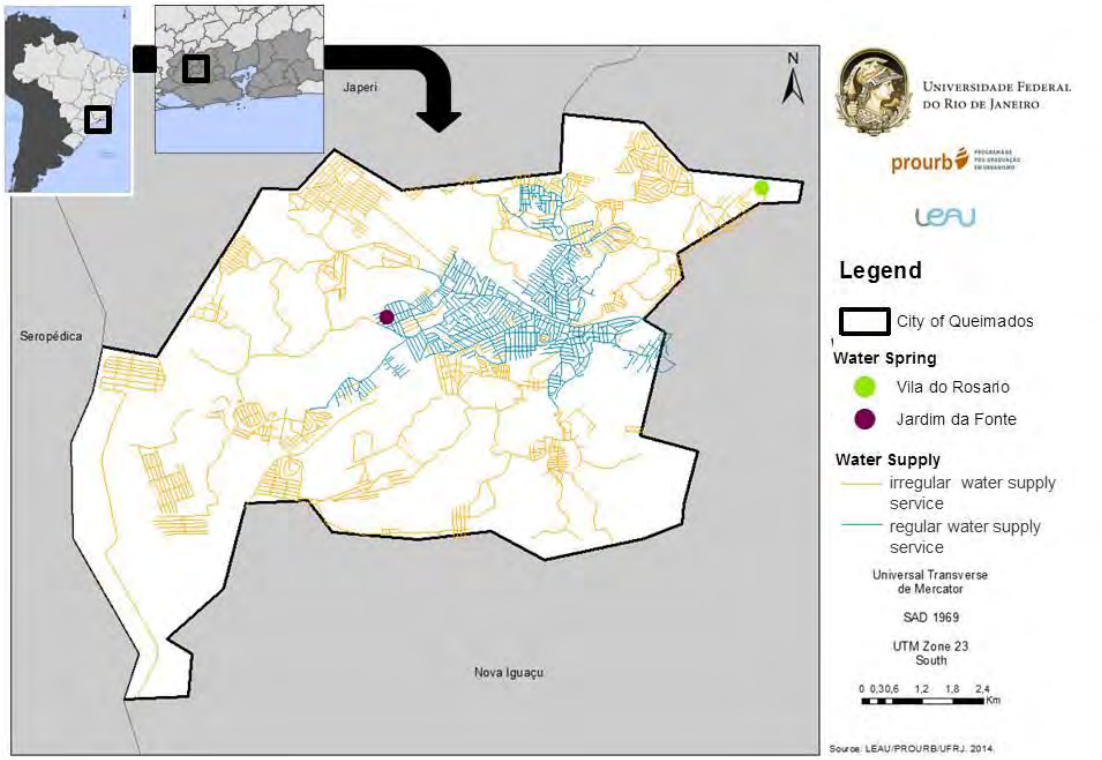
We analysed this empirical material in a two-step process. First, we georeferenced the data collected through the survey, merging it with the census information. In this way we produced a map showing both Queimados' formal and informal systems. Secondly, we joined this first result with the other field materials and analysed them inductively through the theoretical categories identified in the revised academic debate. We attempted to broaden this debate, by posing further questions, while providing empirical evidences for Queimados and the RJMA.

4. Case Study: the municipality of Queimados

We selected the municipality of Queimados as a case study as it presents a deficient formal system and a widespread tendency of the local population to use informal water supply structures. It epitomizes the contradiction of a territory where the natural water resource richness and a precarious and insufficient water service delivery coexist. Queimados has a land area of 75.6 km^2, corresponding to 1.42% of the RJMA, where currently 137,962 inhabitants live, resulting in a population density of 1,822.60 per km^2. About two-thirds of this population are aged 15-59 and were born in Queimados. Sixty per cent declare to be African Americans and 52% have no education or have not completed primary school. Approximately 44.5% are economically active and 80% of this group have formal employment (IBGE, 2013). The Municipality's GDP is US$1,017,279.00, whose main contribution is

manufacturing and rents (Simões, 2006). Similarly to other municipalities in the BF, Queimados depends on financial transfers from the state and from Central Government as it does not have a balanced budget. The average household income is $1,600,00, about 3 minimum wages (PLHIS, 2011).

As other peri-urban municipalities, Queimados presents a widespread situation of irregular urban settlement. The residential type is characterized by a predominant self-building homogenous pattern. In the residential areas, two-floor edifications prevail. They are mainly with no plaster nor grout and house more than one family (PLHIS, 2011). Over the last ten years several social housing condominium have been planned and carried out, through a partnership with the Rio de Janeiro State Government and a City Ministry social housing projects, namely “Minha casa minha vida”(PLHIS, 2011). As for water supply, the municipality is partly served by the *Guandú* System and for the rest by a local system, built in the 19th century to provide water to the BF, named *Acari* System, which is formed by five water sources and pipelines (i.e., São Pedro, Rio Douro, Tinguá, Xerém, and Mantiqueira). There are only two reservoirs in Queimados. One supplies exclusively the industrial district, called CODIN (Industrial District Company of Rio de Janeiro). The other provides water to the central area of the municipality. According to Brazilian statistical surveys, 83% of the Queimados households are connected to the system (SNIS, 2012), and just 17% of population are not supplied by public network. Nonetheless, these numbers are based on data provided by CEDAE, as the state water provider. There is no data on those households that are connected to the system, which, on the other hand, do not receive water or use it regularly. The two water springs we selected are: the water spring of *Vila do Rosario* (VdR), located in the eponymous north of the city, next to one of the two railway lines crossing Queimados; and the so called ‘bus stop spring’ located in the *Jardim da Fonte* (JdF) neighbourhood (See Map 1). The JdF presents a precarious urban infrastructure, but with services such as school and health centre, located close to the centre of Queimados and the Via Dutra motorway. This neighbourhood is marked by a consolidated residential settlement, integrated in the urban context, with a better construction standard, paved streets and it is connected to the public water supply network. On the opposite side, VdR has more peri-urban characteristics, with no infrastructures and services for residents, except for the waste collection. This neighbourhood has no connection to public water supply system, a relatively more precarious constructive standard, self-built houses, single-family homes, even when housing more than one family. The population is largely low-income in both neighbourhoods.



Map 1. Queimados' water supply systems
The map shows Queimados' localization, the CEDAE network, and the water spring location

5. Findings

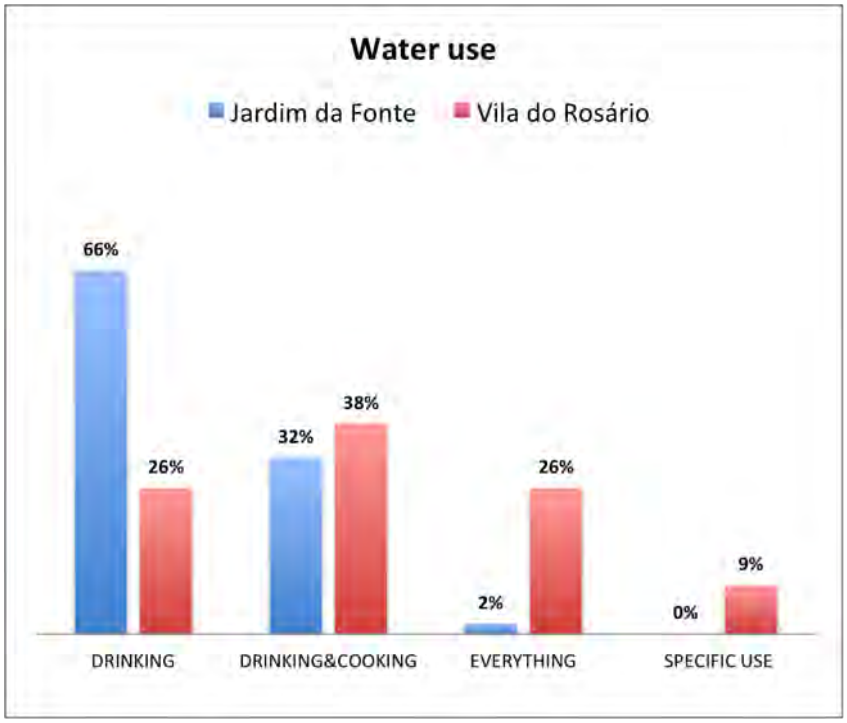
5.1 Formal and informal systems in Queimados

Empirical evidences cast doubts on the percentage of households served by the formal system. Indeed, in contradiction with national statistic data, municipal officials, contacted in the first phase of our field research, informed that the largest part of Queimados is not formally served by the public water infrastructure and that the majority of the households is supplied by wells. Moreover, one of the secondary sources we relied on (Gonçalves et al., 2010) shows that urban dwellers broadly use water springs as an alternative form of water supply. During a semi-structured interview, in July 2013, the Urban Development Secretary said that the largest part of Queimados' population, and he himself, uses private wells for water supplying (Bianche, 2013). The results of our survey are consistent with this information, as 53% of our purposive sample declared to have an artesian well. The possession of private well prevails in *Vila do Rosário*, the farthest neighbourhood from the city centre (see Table 2) and the one with a far lower percentage of houses connected to the water supply network (see Table 1). This neighbourhood is also characterized by the multiple uses of water springs (see Graph 1). Indeed, interviewees gathering water from this spring use it to drink although some 74% of them said they also use for all other basic functions such as cooking and personal hygiene. It is worth noticing that this percentage involves both people who have tap water (even if in this neighbourhood it entails a minority) and people who do not have access to other water sources. Indeed, 26% of those subjects sampled said they preferred water from a spring to that from a well – in the case of *Vila do Rosário* - and water from a spring to tap water - in the case of *Jardim da Fonte*. The higher percentage of

habitants who state they use water from a spring to drink is from JdF (79.5%). This spring represents a fundamental point of informal supply water, also serving several functions, as the field notes on the conversations with local users pointed. The spring attracts dozens of people daily who also come from the nearest neighbourhood and neighbouring towns. Researchers observed the existence of tacit rules and routines organizing the collective use of the spring, i.e., right of way to pregnant women, the elderly and children. The users community has identified one of the residents as 'Guardian of the Spring", the one who cares for the cleaning and maintenance of the place.

In both water springs the respondents cover an average 600-650m and collect water in plastic bottles or equivalent plastic containers. In one of the field notes the researcher wrote:

> […] *People clean containers on the site. They fill part of the bottle, shake it and throw away the water. The potential for external contamination of the water in these actions should be noted* […].
> Field note 5, 16-02-2014



Graph 1. Relative frequencies of water use

The 'specific use' category entails activities such as washing clothes, personal hygiene, pet food preparation, and household cleaning

Table 1. Percentage of houses connected with water public network

Supplied water		
Class \ Variable	*Jardim da Fonte*	*Vila do Rosário*
NOT	22.5%	77.5%
YES	91,7%	8.3%

Table 2. Houses supplied by private wells

Artesian well in each area		
Class \ Variable	*Jardim da Fonte*	*Vila do Rosário*
NOT	78%	22%
YES	44.7%	55.3%

5.2 Two systems or a hybridized one?

The two systems, formal and informal, coexist in Queimados even if in a poor interaction (See Map 1). When asked about the use of local mines, the CEDAE's Director informed that the State Water Company avoided being involved with the informal mechanisms of water supply.

> 'These *alternative sources* […] *are monitored by the State or City Health Departments, while CEDAE is concerned with the quality of the water produced*'(Motta, 2013).

He implied that water springs are not a Company responsibility. Through conversations with an official at FUNASA (Brazilian Health Foundation), who accompanied us in some fieldwork and inspections, being one of our main informant, we learned that a small FUNASA office located in the Queimados Municipal Hospital, carries out a periodical quality test of both piped and spring water, as well as that from private wells, when properly required by the owner. In a conversation held on May 30th 2014, our informant told us that the last water quality analysis for JdF, made in November 2013, reported the presence of Escherichia coli and faecal coliforms[4]. In the opposite direction, and according to the same source, the water from the VdR, collected for analysis on May 21th 2014, has satisfactory quality, i.e., absence of Escherichia Coli and faecal coliforms, good level of turbidity (see Map 1). It is worth noticing that despite the technical evaluation of FUNASA, 96% of the JdF sample showed a very positive judgment on water spring quality. Furthermore, 25% of this percentage clearly stated to prefer spring water to tap water, which is normally used for several uses except for drinking. Similarly, 34% of the VdR respondents said they preferred spring water to well water, which they do not rely on for drinking, while they have no connection with the formal supply network. In both cases the largest part of the respondents displayed an excellent perception of spring water quality and a very bad judgement of the CEDAE system. The inconsistency between perceived water quality and technical water analysis shows the importance of cultural factors in the water use pattern and highlights risks for public health.

The Gonçalves et al. analysis showed that the main source of the Queimados water springs contamination is Escherichia Coli, an indicator of human faeces. Queimados has no sanitation service, as informed by the Urbanism Secretary in the semi-structured interview (Bianche, 2013). In this interview he also referred to CEDAE as the main agent in the water and sanitation infrastructure.

> […]*They are planning to make a single treatment plant for the entire region and asked for a year and a half to finish […] treatment plants* […] (Bianche, 2013)

The Sales and Distribution Director at CEDAE, Marcello Motta, interviewed on December 2013, admits a delay of the State Company in meeting the public demand for sanitation in Queimados (Motta, 2013). At the same time he proudly recognizes significant steps forward in the expansion of the infrastructure and improvements in service delivery thanks to considerable financial resources provided by the Brazilian Federal Government through the PAC. Nevertheless, the work financed by the PAC and implemented by CEDAE will not bring a solution to the water supply and sanitation systems in Queimados in the short and mid terms. Many neighbourhoods still lack a water reservoir, and have no distribution lines, as the area of VdR, and there is no forecast on the implementation of the infrastructure needed in this area. It is worth recognizing that an important part of the Queimados' population collects water for their own basic needs through informal sources (springs and wells). On the one hand, the alternative sources are currently ensuring a more universalized water access than the formal system. On the other hand, the absence of a formal, institutionalized control of water quality makes citizens, who use springs and wells, vulnerable and subjected to waterborne diseases. This situation is also worsened by the lack of sewage systems, which increases the likelihood of contamination in shallower water reservoirs, accessed by the largest part of population who use artesian wells, built by the dwellers themselves, with no universalized technical support.

As stressed by Alhers et al. (2014) formal and informal systems are not antithetic ways of organization, but rather a part of a same hybridized system. The Queimados water supply service is delivered through this kind of hybridized system characterized by an increasing vulnerable informal dimension (white arrow in Figure 1), fed by the inefficiency of a formal dimension (blue arrow in Figure 1). Indeed, the public institution in Queimados (the formal system) is doing nothing to embody, support, improve, or remove the uncontrolled use of alternative water sources. Then, the case of Queimados does not fit Joshi and Moore's definition of co-production as its hybridized system is poorly institutionalized (Joshi and Moore, 2004). It presents no recognized organization – neither private, nor public – taking on the informal sources. It is produced by spontaneous, autonomous initiatives by one or more citizens, who do not act as an institutionalized (Ostrom, 2009) group, even if making a group of users who act, sometimes collectively, to maintain the infrastructure.

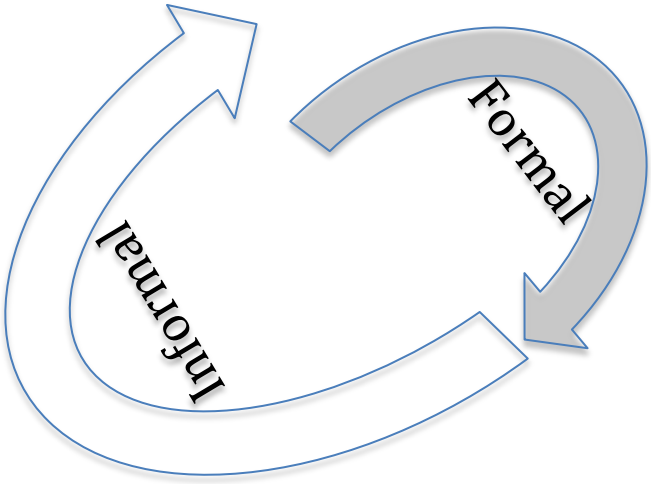


Figure 1 Hybridized water supply system

The figure represents the interrelation between formal and informal dimension, showing the asymmetric structure emerging in a not institutionalized system.

6. Conclusions

6.1 Socio-technical perspective: towards new water governance approaches?

While we acknowledge the relevance of public ownership for *commons*, such as water, the preliminary findings of our field research led to questioning both the effectiveness and the fairness of a traditional, centralized, public water and sanitation system. In Queimados, the protracted inadequacy of such a formal infrastructure boosted the use of alternative sources. As a matter of fact, the CEDAE system excludes at least 17% of Queimados population (23,454 residents) and leaves a number of users unattended, who, even if officially connected to the CEDAE network, do not use this water for their basic needs, such as drinking. Indeed, our research showed that a share of this population, even if not surveyed in official statistics, relies more on spring water, located in urban areas, without sewer systems, than on the tap water distributed by the State Company. The alternative sources have worked as vicarious solutions for the insufficient public service, creating the hybridized system described hitherto.

The problem of this hybridized system is that its vicarious component has been currently working in an informal and spontaneous way, with no institutional framework. Agreeing with the basic idea of an institutional perspective on the governance of *commons* (Ostrom, 1990) and their implementation in more recent empirical researches carried out in the global south (Joshi and Moore, 2004), we found that the Queimados' hybridized water supply system has generated a vulnerable context, for whom no existing institution recognizes a responsibility. CEDAE does not accept responsibility for the precariousness of the informal water source quality, where water springs are spontaneously exploited by citizens, and with WSS formally established as a duty of the Municipality (Alochio, 2013). The Municipality, at once, does not accept responsibility for a system whose construction has been assigned to CEDAE. Citizens carry on using inadequate water for drinking, also exploiting a public good in an uncontrolled manner. The socio-technical perspective allows us to reverse this vicious circle. Under this perspective formality

and informality are not opposed forces, but rather fundamental and integrated components of one same system (See Figure 2). In adopting innovation as the pivotal concept, it is possible to join the social and technical dimension of a public service provision system. Spontaneous grassroots initiatives, often promoted by users, are more feasible and flexible than large infrastructures, are open to changes, and consequently more innovative. At the same time, innovation demands replicability and standardization, i.e., rules and techniques. Hence, for community initiatives to be turned into innovation they need to be a part of an institutional framework.

Observing the case of Queimados we may conclude that after ten years of a relevant financing effort made by the Brazilian Federal Government through the PAC to support public infrastructures, the State Company has taken a few steps towards the universalization of water and sanitation facilities, and even less for the democratization of these basic services. What if this money would be allocated to support the institutionalization of the informal service delivery, rather than concentrated in the expansion of the centralized infrastructure?

The final report of the study that underpins the development of the Water Resource Plan of the Rio de Janeiro State recommends the search for alternative water sources (SEA-INEA, 2014). It shows that the main water springs which feed the RJMA public water system are overloaded for more than ten years and that they will be even more overburdened in the future, as they serve the two largest Brazilian metropolitan areas (i.e. São Paulo and Rio de Janeiro). This result corroborates the importance of conjoining large infrastructure and local solutions for the democratization of water supply. We recommend a socio-technical innovation approach for governmental strategy, because this approach allows combining the advantages of both small and large scales solutions. Small-scale initiatives are more resilient as they are easy to be managed, being also less expensive and time-consuming. On the other hand, large-scale infrastructure provides a long-run service, the employment of more advanced capital-intensive technologies, a higher potential for quality control.



Figure 2 Socio-technical innovation-based institutionalized water supply system

The figure shows the pivotal role of socio-technical innovation to create a mixed, more balanced system, boosted by the dialogic interaction between grassroots (spontaneous) initiative and institutionalized (organized) interventions

We stress three important factors to embody socio-technical innovation as defined in this work in the governmental practice: 1) diversity, 2) institutionalization, and 3) participation. In Queimados both the formal CEDAE network and the alternative one, represented by wells and water springs, supply the local population. The integration between these two systems seems more promising than the selection/exclusion of only one. For this reason we stress the notion of diversity. Still, we argue that their integration can represent a better solution than the current situation insofar, which occurs without an institutionalized framework, namely, a framework where actors, rule, and roles are defined and recognised. Within an institutionalized context the water service sector can also generate indirect positive impacts, such as the creation of new jobs. Finally, to ensure the involvement of all these relevant actors and innovation as the system pivot, both the institutional design and management ought to be participatory. With specific reference to the case of Queimados, the Guandú Basin Committee could offer a rooted point of departure being a participatory institution, enrolled in the water resource management system and actively engaged in the improvement of the water supply service through several local initiatives. For the local governance systems in general we recommend to keep in mind that to innovate is not necessarily to start from scratch; making better use of what one has may already be a good start.

Endnote

1. DESAFIO is a research project, which received funds from the European Union Seventh Framework Programme for research and technological development. The project started to operate in 2013 and concerns the study of the democratisation of water and sanitation governance through socio-technical innovations. More details at: http://desafioglobal.org/.
2. They use the term ‘institution’ in the sense of Ostrom’s‘ prescriptions that humans use to organize all forms of repetitive and structured interactions including those within families, neighbourhoods, markets, firms, sports leagues, churches, private associations, and governments in all scales ’(2009)
3. Castro stresses the difference between the two concepts of ‘universalization’ and ‘democratization’ of WSS (water and sanitation services) in general. While the former implies a wide water service infrastructure, the latter also involves the socio-political

dimension, the public engagement in service governance. Castro (2012).

4. Source: City of Queimados Health Department, Office for Monitoring and Control of Non-Biological Risk Factors. Analyses made by this body follow protocol and criteria established by ordinance 2011/2914 of the Brazilian Department of Health.

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Changing patterns*:* Major Water-Bodies and Urbanization in *Ethiopia*

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Abstract:
Ethiopian urban settings seem to defy the common notion about water bodies and sites surrounding them as the favorites for locating cities or the notion of large water bodies as facilitators of urbanization. In the presence of large water-bodies - major rivers and significant number of lakes, urban centers and dense settlements in Ethiopia seem to predominantly prefer highland sites- distancing from major water bodies and relying on springs, smaller rivers and seasonal rain for their water source. The article claims that this longstanding pattern is changing with sites around major water bodies becoming increasingly contested for both habitation and production (agricultural or industrial) - instigating a new socio-spatial pattern, which demands an appropriate hydro-social organization. Fueled by poverty; steady population growth; determined need for economic development; and the fragility of the regional ecological balance, the paper assumes that this emerging pattern, if not sensitively guided, can become a cause for additional challenge within the large scale environmental and socio-political relations. Hence, in an attempt to establish a basic understanding, the article discusses the nature of the relationship of water bodies and urbanization pattern in Ethiopian urban tradition. It discusses the forces which confined Ethiopian urbanization on highlands and distanced it from major water bodies. Moreover, it traces changes within these forces in order to establish the contextual basis for the emerging patter. In conclusion, it highlights the possible impacts of such changes on policy and planning practice in Ethiopia.

Key words*: urbanization, major-water-bodies, highlands, change, Ethiopia*

Introduction

In 1986 FAO reported that the highlands of Ethiopia contain one of the largest areas of ecological degradation in Africa, if not in the world – losing an estimated 1900million tone of top soil every year (FAO 1986).Taking 1500m as a traditional divide between lowland and highlands, only 11% of the population lives on lowlands which covers 61% of the country while 90% of the population lives on 39% of the land which is above 1500m. (see fig. 1).These highlands have been the home of an indigenous class society of lords and peasants for many centuries; however, although trading settlements have undoubtedly existed for a very long time, urbanization was a weak force (Freund 2007).Currently, various reports estimate that less than 17% of Ethiopians live in urban areas - localities with more than 2000 inhabitants - but if towns with less than 10,000 inhabitants are discounted as urban, the proportion drops to 3% leaving the country as the list urbanized in Africa (UNHABITAT 2008). According to the World Bank report Ethiopia is also grouped among the poorest countries in the world with a struggling agrarian economy. With the current population estimated at 94million and growing at the rate of 2.7% (UN - DESA2012), the country, according to the vision of the government, is expected to transform rapidly from a predominantly subsistence agrarian economy to become a middle income economy (MoFED2010). In such ambitious transformation plans of social and economic structures, sites with key natural resources like water become primary targets for large scale appropriations in both formal and informal modes of development.

Historically, Ethiopian urban centers and major settlements are located on highlands away from major water bodies contrasting the general trend of world population distribution which favors

lowlands and water bodies. While the country is 61% lowland and 39% highland (above 1500m), the population distribution is a reverse - about 90 percent of the population lives in the highlands and only 11 percent are living below 1,500 meters (see fig. 1). Moreover, most lake shores and banks of large rivers located in both highlands and lowlands have long been desolate or scarcely populated. The current capital city, Addis Ababa, and all major historic cities and capitals are situated on highlands above 2000m with more or less similar hydro-social relations which distances major water bodies and rely on smaller springs (Addis Ababa - 2500m, Gonder - 2133m, DebreBirhan - 2,840m, Lalibella -2500m, Axume 2131m, Harar - 1885m). While Ethiopia is referred as the Water Tower of Africa with more than 70,000km^2 area covered with natural water bodies including rivers, lake and associated wetlands (Wood and Talling 1998 quoted on Ayenew 2009), compared to any of its neighboring countries, the role of major water bodies in the formation of urban centers in Ethiopia is insignificant. Lake Tana and the chains of Lakes in the Rift valley; and the multitude of large rivers crossing the country, including Blue Nile River, have little accounts in Ethiopian urbanization history, saving few young cities like Bahr Dar. This article highlights the emerging change in this long standing settlement pattern which is producing new socio-spatial, socio-economic and environmental configurations around key natural resources - particularly major water bodies. This phenomenon of change is imbedded within two intricate contextual settings: 1) Rapid urbanization characterized by informal mode of production (Davis 2006, UNHABITAT 2008) and 2) An urban and architectural tradition lacking historical experience in handling the complex relationship between water bodies and the built environment.

The article, in its first part, identifies and discusses forces which confined Ethiopian urban settlements on highlands and distanced it away from major water bodies. The second part traces changes in these forces in order to establish a contextual understanding of the basis for the emerging urbanization pattern. In its conclusion it highlights the possible implication on policy and practice. The study is conducted through literature and document reviews, in-depth interviews and open discussions with inhabitants on selected sites near water bodies, practicing professionals in the field of planning and design, government authorities, and scholars on various fields of studies related to water bodies and urbanization in Ethiopia. Extended on-site observation on selected sites around water bodies – Addis Ababa river bank informal developments, Bahr Dar lake shore development, and developments around Lake Zeway and Lake Langano - was also employed to cross check information gathered from various sources. The article is a result of an ongoing PhD study in HafenCity University Germany which attempts to develop spatial design guidelines for the emerging urbanization around water bodies in Ethiopia.

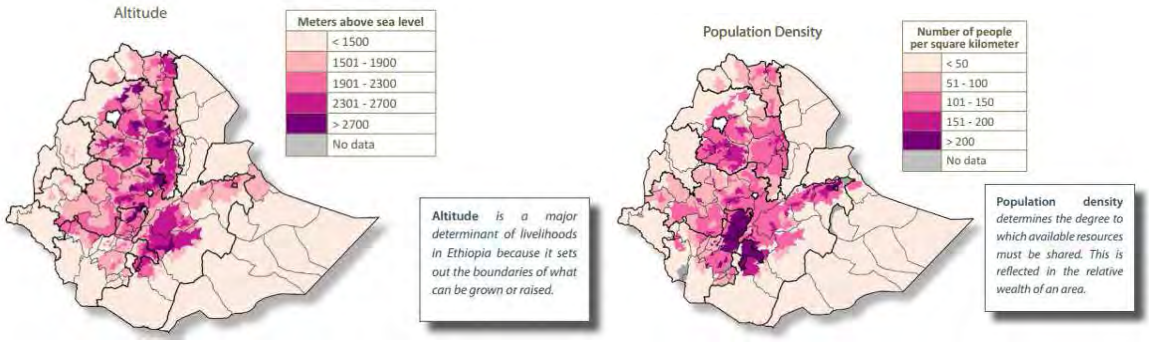


Fig. 1 Altitude and population distribution
Source: (An Atlas of Ethiopian livelihood 2010)

1. Why was it so?

Factors which forced Ethiopian urban settlements to assume a pattern seemingly unusual - compared with the normal – surface water friendly pattern of urbanization - are multiple and complex. These forces which confined the majority of Ethiopian urban settlements on highlands, distancing it from large water bodies, can be discussed under four interrelated categories: socio-political forces, environmental and geographic conditions, socio-economic structures, and cultural and religious norms.

1.1 Socio-political forces:

Security within sustained geo-political tension: After the decline of the Aksumite Empire, it is believed that the political center of the state moved southward, losing its urban character and acquiring new organizational features (Encyclopedia Aethiopica 2003). In the absence of proper administrative apparatus, it was forced to adapt new systems which required the monarch to be mobile in order to control and defend the large territory from the continuous external aggression and internal conflicts (Alvarez translated by Beshah 1966, Pankhurst 1986). It is assumed that the temporary encampments of the mobile monarch (wondering courts) have become the main blue prints for the formations of many of the cities in the country up until the early 20th century. The Amharic word for town or city - 'Ketema' - originates from the common designation for such royal itinerant military camps (Encyclopedia Aethiopica, Pankhurst 1986). These encampments demand strategic locations for war which obviously favors higher grounds ('amba') with ample natural resources and headwaters. Even Gonder – the capital of the kingdom for over 200 years (1635AD to 1855AD), which was believed to mark the reemergence of permanence and urban character in Ethiopian polity, was influenced by the 'ketema' logic in its location and operation. It served as the seat of the kings usually for the rainy seasons when campaign is not possible due to the overflowing of rivers. Generally, Lake Shores and deltas of big rivers were taken as less strategic than headwaters and hilltops. The selection of the site for the last capitals – Entoto and latter Addis Ababa - also displays the same logic – access to water for daily consumption and hilltop for security. Even if Addis Ababa latter was favored over the higher site of Entoto for its milder climate and hot springs, its many rivers served no more than border lines among properties of the chiefs and their soldiers.

Rivers running from the highland of Ethiopia are also identified as one of the major causes for the regional political tensions. Even though it is difficult to establish a direct relationship between the hydro-political tensions and pattern of Ethiopian urbanization, recorded negotiation over water resource among rulers of Ethiopia and Egypt which dated back to the middle ages reveal that news of attempts to use major water bodies by Ethiopian kings was seen with resentment by Egyptians (see Pankhurst 2000, Arsano 2007, Tefla 2000). However, isolated islands have been used for hiding and securing treasures of kings and churches in times of regional wars and large scale internal conflicts.

Land tenure and development policies: It is plausible to think that successive Land tenure systems in Ethiopia have contribution for the low level urbanization of the country in general and for the lack of an urban tradition which could make use of water bodies in particular. The Ethiopian empire (referring to the pre-1974 regime) accommodated a land tenure system that is described as one of the most complex compilations of different land use systems in Africa (Joireman 2000 quoted in Crewett, Bogale and Korf,2008). According to many critics, these land rights - including the post 1974 regimes - have been referred to as tightly linked with the exercise of power over the rural peasantry (*Crewett & Korf 2008*, Rahmato 2004*)* which neither allowed the peasantry to exercise its free will to search for a better life in cities – discouraging urbanization – nor allowed it to fully engage with the land to maximize productivity through a

more long-lasting investment (Rahmato 2009) like irrigation, soil and water management. Particular to the post 1974 tenure regime, which is characterized by state ownership, both opponents and proponents of this regime agree that the system has played significant role in slowing down urbanization by tying farmers on the rural land **(**Adal 2001, 2002; Jemma, 2001 in *Crewett & Korf 2008*). Accordingly, development directions adapted at least in the last three political regimes share the same orientation of a strong affiliation to the countryside (Rahmato 2009) founded on agrarian economy which has little regard to urbanization in general and the appropriation of surface waters for production and habitations in particular. Various discussions with senior inhabitants on sites near water bodies, both in emerging settlements and in cities, confirmed the same. Prior to the 1975 nationalization, sites which are currently appropriated by informal development on the study sites, used to be owned by aristocratic families who reserved it for forest land. After nationalization, these sites either fell under direct state ownership or distributed to peasant associations and latter redistributed to individual small hold farmers. In all cases the land - water relationship remained largely unproductive.

1.2 Environmental and geographic conditions:

Climate and disease patterns: The relatively mild and healthy climatic condition of the mid-highlands has been the most obvious reasons associated with the confinement of urban and dense rural settlements on highlands in Ethiopia. Deltas and large surface waters are usually located in lower altitudes which are warmer and prone to diseases particularly malaria ('*nidad*'). Almost all historic cities and capitals have distanced themselves from water bodies. Pankhurst quoted Alvareez on one of the rare experiments of Ethiopian Emperors to build their capital on lake shores. Emperor Susenyos (1606AD to 1632AD) tried to build his capital in Gorgora – a city on the north-western shore of Lake Tana – but had to leave it and move to Danqaz, a site of greater elevation after the epidemic of fever in 1618 (Pankhurst 1982).

Wood, Water and landscape: One of the factors which determines the particular location and the length of stay of the wondering courts 'ketema' was the availability of wood (for fuel and construction) and water(for drinking and hygiene. 'Ketemas' were mentioned as an environmental catastrophe for the specific locations of camping. However, prior to the 20th century, the availability of enough wood and small springs on the highlands has offered enough wondering space without being forced to look for alternatives. However, river ways (gorges) on highlands are dangerously deep and water flows are rough - which makes the water difficult to tame and the landscape challenging to work on (Arsano 2007). On the other hand, the low lands - where rivers slow down - in addition to being disease ridden, they are also prone to flooding and hence both are avoided.

1.3 Socio-economic structures:

Trade and manufacturing: Cities are primary organs for both economic and cultural development. It is in cities that new goods and services are first created and hence trade (exchange) and manufacturing are the main foundational activities in cities (Jacobs, J. 1969). The development of trade and manufacturing entails the demand and increase in the appropriation of water bodies. Cities ('ketemas') created on the basis of encampments of kings are primarily political centers based on taxations of the local population. Having no permanent population(fluctuating with the seasons), and being neither a centre of handicrafts nor trade, the demand for natural resources in cities of Ethiopia('ketemas') were limited to daily consumption - wood (for fuel and construction) and water (for drinking and hygiene). Consequently maximizing agricultural productivity through irrigation and adding values through handicraft could not hold roots. In the long and continuous dynasty of the Ethiopian empire, prominent cities after the fall

of Aksum - like Lalibella and Gonder – earned their importance for their associations with royalty and the church rather than trade and handicraft (Crummy 2000, Pankhurst 1982, 1985).

Market and Dietary habits: the dietary habits of the majority of Ethiopian population, which is directly related to altitude among many other factors (Woldemariam 1986), though diverse and complex, is based predominantly on cereals (see also Jared Diamonds). The most important basic food crops - Teff, Wheat, Maize, Barley, Sorghum, Millet and Inset (ibid) – have been produced based on relatively consistent seasonal rain without a need to develop irrigation. Observation and interviews confirm that farmers with plots around large water bodies rely on seasonal rain for the cereal crops and prefer to use irrigation for vegetables. However, they also have indicated that the absence of market for vegetables/fruits has been one of the major reasons not to use the available water resource in the past. Furthermore, the lack of storage facilities and transport systems to main cities has also been indicated as additional reasons for the underdevelopment of irrigation.

1.4 Socio-cultural and religious norms

The culture of craftsmanship and trade**:** the absence of trade and manufacturing from urban centers in Ethiopia cannot be totally explained only through the political economy of the monarch system which was based on taxation. The association of manufacturing, artisanship and technology with witchcraft and 'evil'-spell have been the longstanding dominant cultural and religious norm in Ethiopia (see also Haile 2011, Cherenet and Sewnet 2012, Kebede 1999). Many early 'modernizers' in Ethiopia have noted the open antagonism between the deeply traditional norms and modernization attempts in the early 20th century (Zewdie 2002, Kebede 1999). The continued struggle of forward looking emperors against the religious establishments particularly since mid 19th century -Emperor Tewodros and Emperor Minilik - has been the common tale in Ethiopia. Associations of crafts with evil spirits could still be observed through the spatial segregation of artisans and craftsmen particularly in small urban centers in highland Ethiopia (Heldman 1998). Trade and making money were also related to greed and worldliness (Kebede 1999). Thus, it is plausible to assume that such cultural climate, which disfavors the most important engines of urban development - trade and manufacturing - has been one of the fundamental reasons for the slow processes of urbanization as a whole and a failure to develop an urban tradition which can appropriate natural resources like water bodies.

Water and spirits I – Holy for God**:** For more than millennia, the church has been an important player in Ethiopian social, economic and political organization. Ethiopian Christianity focused particularly on monasteries usually situated on higher grounds rather than urban cathedral (Freund 2007). Even in cities, churches are fenced and secluded structures. Though the contribution of churches for urbanization in Ethiopia needs further investigation, in both urban areas and rural settlements churches claim the most captivating natural objects - commanding locations, important water bodies and sources(springs). Moreover, following the devastating religious civil wars of the middle ages, many islands and peninsulas in major lakes were used as safe places to hide church and palace treasures. Since then, these sites remained sacred sites reserved for monastic and church activities. In these areas cultivation and manufacturing activities are largely prohibited saving limited activities of monks and nuns. Observations on islands and peninsulas in Lake Zeway, Lake Tana, and Lake Wonchi confirmed that the longstanding culture of consecrating sites around water bodies determines land use. Other than the prominent church, other dominant religious and cultural practices also claim water bodies as sacred. Lake Awassa is a sacred site for Sidamma cultural and religious festivities and Lakes in Bishoftu are sacred sites for the most important Oromo religious festival and cultural practices – 'Irrecha'.

Water and spirits II – controlled by the devil**:** Parallel to the belief in the sanctity of water bodies, the widespread belief which attaches water bodies with bad spirits can also be taken as one of the reason for the ambivalent relationship between settlements and surface water bodies. The devastating forces of water bodies and the wild nature of its surroundings, which usually is claimed by outlaws('Shiftas') and wild beasts, are referred by current inhabitants for the development of fear and the association of the devil with such sites. The closer look into expressions in traditional and folk songs and prose reveal the same. According to Bairu Tefla, traditional Amharic songs and prose largely depict water bodies as places of bad spirits and death (Tefla 2000). Moreover, people who prefer to stay near water were regarded as lower classes or migrants. Examples are Woyto and Shenash people, who lived around Lake Tana and along the Nile river banks respectively, were believed to come from Egypt and Sudan on account of famine (Yakob 2007, Tefla 2000). **I**n Zeway the author witnessed the same classification of town inhabitants with social class. Recent interviews (2013/14) made with senior inhabitants in Batu Town (formerly known as Zeway) confirmed that people living near water were either homeless or those who are considered to have bad spirits. However, some argue that such groups are attracted to these sites due to the availability of free land ('bahirshesh mereat') for building shacks and cultivating vegetables without being bothered by the state or landlords. Others also mention the presence of churches in these sites which attracts the poor who are in search of donation from parishioners.

2. What is happening?

The ecosystem of the highlands with their fertile soils, regular seasonal rain and reliable springs, a climate favorable for farming and relatively secured from malaria, tsetse and foreign aggression, have supported a growing farming population of the country for thousands of years. The nature of these conditions has been changing through the years which consequently indicate the impending change in the spatial organization of societies. Tracing changes within the conditions discussed above is believed to reveal the contextual basis for the emerging pattern and its growing hydro-spatial configurations.

2.1 Changes in regional and local socio-political structures:

Political hegemony, new organizational apparatus and relative stability: Though many of the southern towns ('*ketema*') of Ethiopia were created with the same logic of military strategy by Minillik's army (Pankhurst 1986), the centralization and stability of the kingdom by the end of the 19th century - after the battle of Adwa - heralded the beginning of the end of the camping capitals (*medina*)(see Pankhurst 1985). It also signaled the emergence of a regional power which could effectively negotiate with neighboring principalities on territorial and resource conflicts - changing war strategies and heralding the development of trade and infrastructure. After the establishment of Addis Ababa, the reinforcement of the central government through regional administrative systems and the beginning of the development of infrastructure of communication replaced the moving court and give way for a new urban scheme. Regional capitals and trade posts grew following the new administrative system and infrastructure lines. Addis Ababa became the last camping city. Even though water bodies did not fall on spotlight for long, the brief development activity of the 1960s which favored large scale commercial agriculture opened doors to explore potentials of large water bodies. The current federal organization of the administrative structure has also opened more opportunity for regional states to explore potentials of water bodies within their respective regions. Cities on Lake Shores became strategic political centers - Bahr Dar and Awassa have become the most sought-after regional capitals.

On a regional scale, water bodies have become an economic asset than being only a political capital. Even though the longstanding hydro politics continued to cast its shadow in the regional political stability, the Ethiopian government has steadfastly continued to develop its water resources. Large scale hydroelectric generation and major irrigation projects indicate the creation of settlements around surface water bodies – reservoirs and tamed rivers - in considerable number.

Land policy: The subsequent radical changes due to the 1974 revolution and 1975 land reform, which nationalized all land, and the 1991 political change, which introduced ethnic federalism, created a new political landscape for urbanization patterns. The 1975 land reform obviously shunned down the mushrooming commercial agriculture which used to fuel the appropriation of large water bodies and the creation of related urban settlements. While land remained under state ownership in the post 1991 renewed tenure regime, the policy which was adapted to encourage investment allowed land leasing for private commercial agriculture. In many of these appropriations, water bodies are the centre of negotiations and are expected to reproduce water related semi-urban settlements.

2.2 Drastic changes in environmental and geographic conditions

Diminishing resources and growing population: Highly agrarian and densely populated - relative to its fragile natural resource base - Ethiopia appears to be a modern embodiment of the Malthusian prediction that unchecked fertility rates amid fixed land and water resources will lead to periodic famines (Derek Headey et al. 2013). The availability of wood, water and fertile soil on the highlands is seriously devastated by natural and man-made calamities. Deforestation has been a defining phenomenon of the highland region for considerable length of time. It has caused extended erosion of top soil and the loss of water sources (springs and smaller rivers). Moreover, the consistent population growth without diversification of livelihoods is a formidable force pushing the peasantry out from the overused highland sites. The recent data shows that while the annual national population growth is 2.7%, the urban population grows with more than 5 percent a year. Referring to the general population, Ethiopia's population has quadrupled in the last 50 years from 18.4 million in 1950 to 82.8miilion in 2009 and projected to cross 150 million in just 30 years(DESA 2009). For a family of 7, the average land size in Ethiopia has decreased to 0.5 hectare in 2000(CSA 2009). Such a geometric growth of population and depletion of resources leaves no other chance than intensified contest for fertile water rich sites.

Disease pattern: Malaria is still one of the major public health challenges in Ethiopia - an estimated 68% (52 million) of the population are at risk of contracting malaria (MoH 2014). Its prevalence has increased its altitude. It was observed that the annoyance of mosquitoes and other insects is a primary challenge that settlements around still-water bodies (lakes and reservoirs) have to struggle with. However, the growing awareness and accessibility of precaution methods and expanding health services (ibid) are making the threat controllable. Discussions with inhabitants reveal that the routine of precautions has become manageable and effective. World Health Organization(WHO) has reported that Ethiopia is striving to achieve the Millennium Development Goals (MDG) in HIV/AIDS and Malaria prevention (UN2013).

2.3 Changes in socio-economic structures:

The resurgence of commercial agriculture: In the period of 1960s to early 1970s mechanized large scale agriculture mushroomed on fertile Rift valley and Awash river Valley through both rain fed and irrigation agriculture (see Rahmato 2009). Coupled with the development of transport infrastructure, small towns associated with water bodies mushroomed – Meqi, Zeway, Awassa, Arba Minch, Wonji, Koka, Metehara, etc.. However, at a closer look - irrespective of

their physical proximity and their economic tie through irrigation projects of the nearby commercial farms – the spatial and environmental relations of these towns with their respective water bodies can be referred as ambivalent.

It is quite possible to assume that the expansions of towns associated to water bodies slowed down with the death of commercial agriculture after the 1974 revolution. After the nationalization of land in 1975, except some large farms which remained under state ownership, the peasantry who were given the right to use land remained on subsistent farming demanding water for nothing further than basic use. The current resurgence of large scale commercial farms which demands large water resources is changing the statuesque. Since the shift of policy by the government to accommodate capitalist farming and particularly since 2008 when total land request by investors picked 2million hectares (Baumgartner et. al. 2013), commercial farming have become a main force demanding reorganization of rural settlements through the development of housing for workers or displaced farmers. The author has participated on the design of a housing scheme (workers town) for flower farms near Koka reservoir.

Economic growth, global market forces and the emergence of industrialization: over the past decade, Ethiopia has achieved high economic growth, averaging 10.7 % per year (World Bank 2013). Deviating from the long standing development direction and coupled with the brutal market forces of globalization, trade, manufacturing and urbanization are slowly taking centre stage. Service particularly tourism was encouraged through various incentives including land lease priorities and tax exemptions which helped the development of hotels and resorts around water bodies. In the last 8 years alone, it was possible to observe the souring contest for waterfronts around almost all major lakes. Though the rate could not be quantified due to poor documentation in government offices, intensified resort development around major lakes - Tana, Zeway, Awassa, Langano, Abaya, Chamo, Wonchi, and lakes in Bishoftu town - has been observed first hand by the author as a participant architect on development projects around these lakes. While lake shores happen to attract hotels and resorts in addition to both formal and informal agricultural developments, rivers and deltas primarily attract agricultural activities including processing plants like sugar factories ushering the development of sizeable settlements.

Dietary habits and market: Official reports and discussions with inhabitants near water confirmed the steady increase in the demand for vegetables and other irrigation-friendly products (see Mariame and Gelmesa 2006, Wiersinga and Jager 2009). Fish demand has also shown a consistent increase particularly in the fasting seasons of Orthodox Christians (March-April full months and Wednesday and Friday in year round) (see Janko 2013). In addition to market generated from urban growth, the campaign by the government to promote healthy diet in the rural area, which favors vegetables and fruits, is believed to boost their demands(MoH 2014). The most surprising emergence in crop culture which also dominated production activities around water bodies is Khat (Catha edulis) - a rapidly expanding perennial crop grown for the production of leaves that are used as a stimulant. While its production is replacing cereal production and coffee in many parts of Ethiopia (Feyisa and Aune 2003), its excessive informal plantation using irrigation is mentioned as the main reason for the drying up of one of the important lake in the south eastern highlands – Lake Haromaya. It was observed that most of emerging small scale irrigation and informal development around Tana (in and around the city of Bahr Dar) are related to the cultivation of ‘Khat’. Developments of markets for vegetables and ‘Khat’ - according to small hold farmers interviewed on site - have encouraged irrigation works which in turn encourage settlement and markets in the area.

2.4 Changes in socio-cultural and religious norms:

Theorists of modernization have argued that economic development brings wide range of changes in cultural norms. Even though some cultural values and norms are persistent, economic development is generally associated with shifts away from absolute norms and values (Inglehart and Baker 2000). The expansion of secular education and mass media plays a decisive role in inducing and shaping new norms and values. In Ethiopia, a country which passed through a sustained economic and cultural isolation for more than a millennia (Cherenet 2010), the sudden opening up in the early 2000s have caused an economic and cultural pressure which instigates multifold changes.

Technology**:** Satellite based wireless media including satellite TV have become the source of new imagery about better living even in the little villages in the country side of Ethiopia. Moreover, new technological advents which have infiltrated the small hold farmers have already claimed a position in the rural landscape imposing the supremacy of knowledge based modernity (ways of mobility, improved technological tools, chemicals for soil or pesticides, and bioengineered seeds). Even though these are the required desires from development proponents, the association of everything 'modern' and technological as a symbol of success and power induces a new behaviour towards local values hence intensifying the pressure towards urban standards of living and the reorganization the physical space. On the other hand, according to the Ministry of Education of Ethiopia, the gross enrolment rate (GER) for primary education in 2012/13 was 124.9%. Universities are also expanding rapidly. In the last 10 years alone, the number of universities has grown from 2 to over 34. The Ratio of enrolment of Science and technology studies in universities to social and humanities sciences in 2012/13 was 74:26(MoE) – showing a clear industrial direction of the country. Moreover, Technical and Vocational Education and Training colleges (TVET) are made the main pillars in the structure of Ethiopian education system.

The cultural perception of water bodies: Based on interviews and discussions with inhabitants living around water bodies on all study sites, it was possible to conclude that the longstanding perception of large water bodies as the abode of spirits is fading away. Concurring to theories - growing secular education, satellite TV and the increasing economic benefits from water bodies have been indicated as main reasons for the change of attitude. It was also possible to observe that the older socio-spatial pattern which used to leave water fronts for the poor and segregated inhabitants is shifting dramatically making these sites the most expensive locations in cities. Both in cities around Lake Zeway and Lake Tana, informal settlements which claimed the least desirable sites of waterfronts are now facing resettlement due to appreciating prices. However, Due to pollution and flooding challenges, the land value of river banks in Addis Ababa is still the least (EiABC 2011) which allows rural migrants and the struggling lower income groups to appropriate it informally for various small scale economic activities.

Conclusion

There are overwhelming indications that shows the traditional pattern of settlement is being challenged and the new is emerging. The rapid urbanization will soon engulf the fertile valleys, river basins and sites around lakes following the development of infrastructure and large and small scale agricultural and industrial developments. Rapidly increasing appropriation of the lake shores for small scale irrigation, markets, and resort developments with associated informal development of habitation around lake Langano, Lake Abaya and Chamo, Lake Awassa, Lake Tana, Lake Zeway and Lakes in Bishoftu; increasing investments on hydropower generation

and large scale irrigation projects with considerable density of workers habitations on the lowland basins of major rivers; and increasing informal appropriations of dangerous river banks for habitation and agricultural production in major cities like Addis Ababa have been observed as indicators of new territories for denser urban formations in Ethiopia. Obviously, these formations need to be guided with utmost care. Lake Haromaya, which dried up 2011, and the increasing siltation challenges of lake Awassa and Lake Tana due to the change in their catchment area which is believed to be caused by excessive deforestation and growing urbanization are also examples which alarms the danger of leaving the course of change unguided.

What make this phenomenon of change extraordinary and complex is its speed due to rapid urbanization, its mode of development which is predominantly informal, and most importantly - as it was discussed above – its growth in an urban and architectural tradition which lacks a historical experience of handling the complex relationship between water bodies and the built environment. Hence, formulating policy framework to guide development on such sites and developing comprehensive spatial designing guidelines need to be a priority. In both cases, the target should be to strike the balance between conservation of natural processes and development processes; and to accommodate informal bottom-up strategies with formal top-down processes. By their nature of complexity and the time scale they require to mature, the formation of cities as socio-spatial and socio-political assemblages shall always be taken as an open end processes which adapts and responds to emerging realities. Hence, relevance and resilience shall be taken as the two fundamental concepts in formulating policy and implementation strategies to guide these emerging urban formations on sites of ecological fragility. The resilience of any formation lies in its intrinsic relevance and at this age of environmental, economic and political uncertainties, the relevance of any formation lies in its resilience.

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CONCEPTS OF URBAN DEVELOPMENT FOR "SAVA AMPHITHEATER" IN BELGRADE THROUGH XX AND START OF XXI CENTURY

Dragana MECANOV, Projmetal Company, Serbia

1. Introduction

Modernist ideas about Sava amphitheater has a long tradition throughout the XX and early XXI century.

Sava amphitheater on the right bank of the Sava River and the central zone of the functionalist concepted New Belgrade on the left coast, certainly represent the two most important myth for urban planners and architects in Serbia.

Those myths are important as the twentieth centurie's ideas about the humanization of space settlements, and as important as the struggle for civil rights and freedom, and a better life for the working class. Experts were most involved in those sites in the second half of the twentieth century. However, at the beginning of XXI century, they are the subject of plans, urbanistic insittutions, institution for heritage protection, housing institutes, etc.

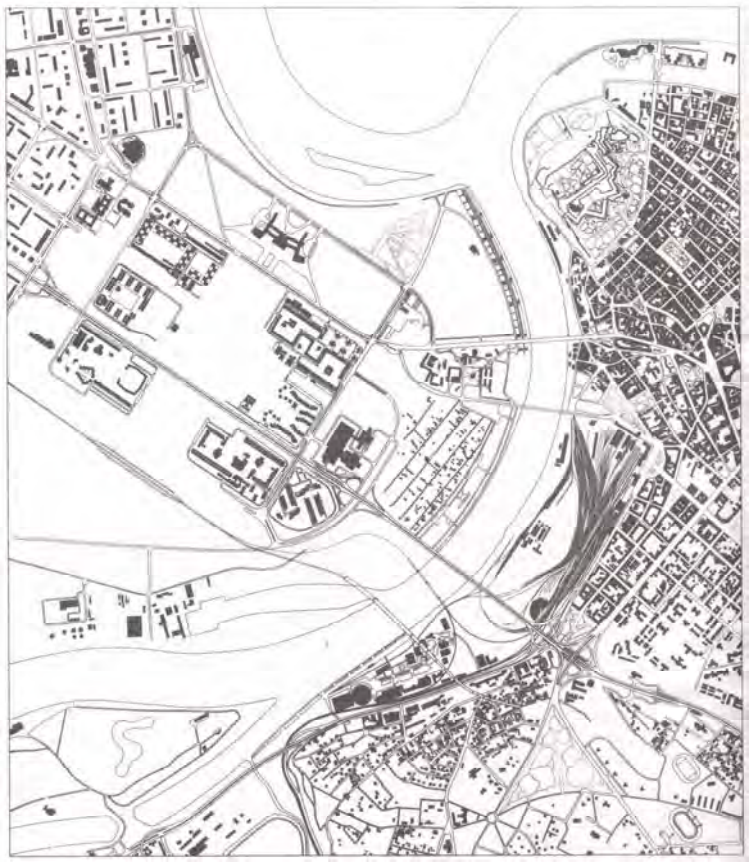


Figure 1. Wider environment, the map of Belgrade is opossible to seeing the territory of New Belgrade and Sava amphitheater at the part where the railways. The map is from the early 70-ies of XX century.[i]

The Sava River during the previous centuries was the border of the great powers, and later of Austria-Hungary and the Ottoman Empire. For this reason, zoning maps from the past show that its shores were not settled or urban resolved. Only in the period between the two world wars urban development idea for territory on the left bank of the Sava river begin to emerge. After the Second World War, a huge, decades-long effort, the implementation of New Belgrade planned and designed according to the principles of the Athens Charter of 1933. For few decades, New Belgrade was under construction like other functionalist cities, such as Brasilia and Chandigarh.

However, "the year 1975. Novi Beograd .... based on the principles of functionalism, but showed extreme weakness[ii] In the mid seventies, the Planning Institute of Belgrade have begun the discussion and a very serious analysis and preparation of projects for urban location Sava amphitheater, on the right bank of the Sava. "What is important in the whole concept ... is the first appearance of embryos of the traditional streets in Belgrade urban practices in the form of diagonal cuts on the east side of the building complex and a free-shaped pedestrian area between the building and the large convex shape".[iii] It further states that "these details were of great help during talks on starting a research project on alternative models of the city ..."[iv]

2. Concepts of Urban Development for "Sava amphitheater" in Belgrade through XX century

The seventies of the twentieth century, in Yugoslavia is mentioned as the period of the highest standard, however, and intense borrowing. If you pay attention to the intensity of housing construction, and other functions, industrial and public buildings, it is easy to conclude that the period of the seventies of the twentieth century, was the period with the highest volume of realization in the field of architecture and urbanism. Such intensive development have carried along countless activities in the local-level institutions such as the Urban Planning Bureau, and the notable work of the scientific institutions that are engaged in research in the field of housing. Among them we should mention extensive research performed at the Center for Housing Institute for Materials Testing IMS in Belgrade. Thanks to their hard work and numerous other factors and contexts, residential architecture of the second half of the twentieth century has a number of advantages and qualities.



Figure 2. The central zone of Belgrade, and display of spatial organization - map from 1976.[v]

During this period, the urban analysis of the location of the Sava amphitheater have emerged, an approximate area of two hectares. Synthesis of the research were published bu the professor Milos Perovic, one of the participants in this process, in part, "The experience of the past“ (on serbian „Iskustva prošlosti“).[vi] In relation with the numerous elements which influenced the defining concepts of the Sava amphitheater, Perovic explains and substantiates the historical argument: "Contemporary Urbanism rejected the basic constituent elements of the traditional city, but at the same time did not succeed for them and form a proper replacement, thus creating a gap between urban and human scale in which was completely unknown in the history of the city over the several millennium“.[vii]

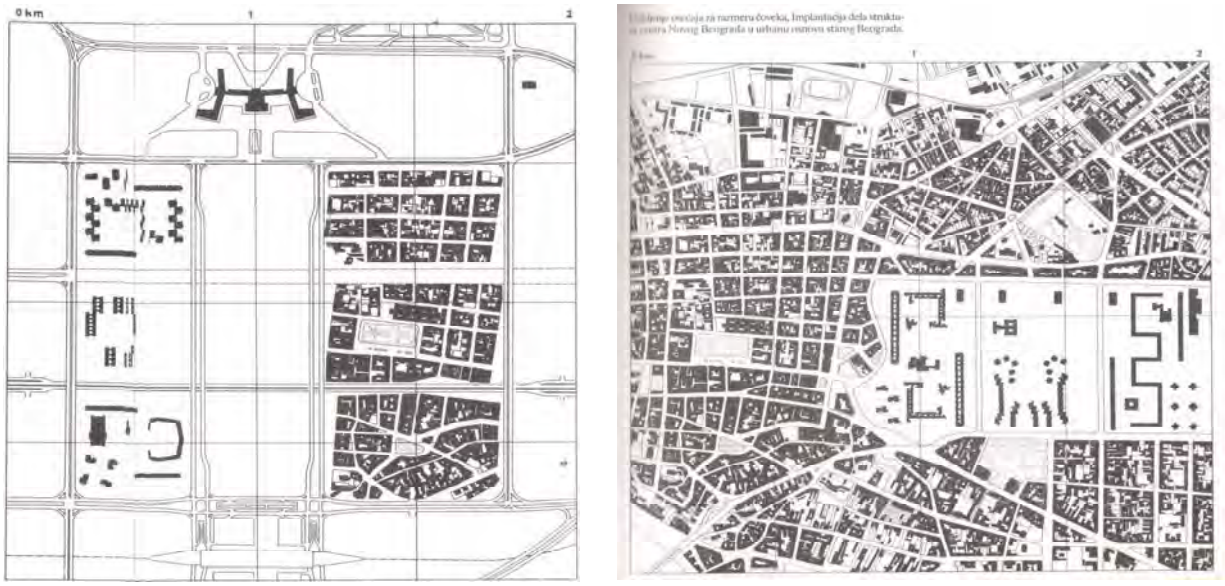


Figure 3. Comparing city blocks of New Belgrade in relation to dimensions much smaller city blocks in central Belgrade.[viii]

Today, at the beginning of the XXI century, when there is definitely a historical distance in relation to the seventies of the twentieth century, the theme of urban concepts for locations in Belgrade can be analyzed and investigated as a historiographical issue, and can be used historiographical methodology. "With the distance of several decades, when the emotions related to urban and artistic avant-garde of the twenties already belong to history, and with incomparably better knowledge of the functioning of the urban system than the one that existed at the time, it is very difficult to accept the argument that was rejected traditional context of the city“.[ix]

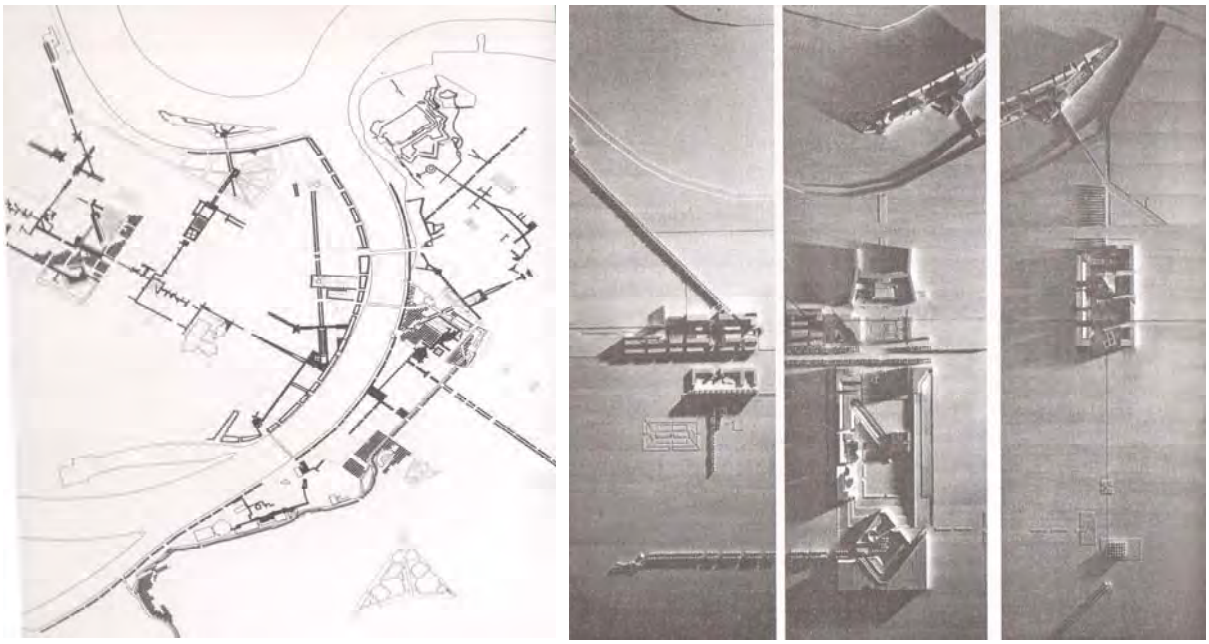


Figure 3. Walking or pedestrian trajectory; Focal points and romantic elements.[x]

One should take into account that the urbanism have equally concerned both engineers and experts with degrees in humanities such as sociologists, economists and so on. Common to all of them is that the working methods used visualization, diagrams, and models - alternatives and alternative solutions. In its interpretation of the concept of urban models for Belgrade, prof.Perović explains three models.

"The first alternative, called Model A, represents a historical tissue of the Belgrade; the other alternative or Model B, represents new settlements, built in the post war period in the spirit of the Athens Charter; and a third alternative, presently undeveloped grounds on which future anticipated intensive construction".[xi]

The third model is C. "The C represents a synthesis of thinking which are based on these master plans with their very prominent traditional values and the latest technical achievements in the field of traffic and technical infrastructure".[xii]

These models were basically urban systems, and beside the concept, they have included the ways of thinking about the density, the regulation, the dimension and many other parameters. Regulatory Plan was made in the mid 70s for most of this site was conceived as a Model C.

In a similar fashion, the principles of operation of the central urban area were based, and Sava amphitheater was one of the imagined locations. "Urban planners allocate several principles - the first principle is related to the attractive power of the city center, the second objective is to achieve a more compact construction in the city center. Compactness is base to allow the concentration of activities. The third principle is to increase the intensity of use of the terrain in the city center without disrupting its natural structure or inherited character. The fourth principle is to achieve balance. The fifth principle is to increase the accessibility of the city center and the activities that the center has by means of public transport and individual vehicles."[xiii]



a. b.

c. d.

Figure 5: Regulation Plan of the 70s. Surfaces intended a) predominantly trade b) mostly business, c) predominantly trade and business, and d) objects of social standards[xiv]

It should be noted that the basic parameter which planners are operating - "density housing, although its true meaning and effect of the population have not been clarified."[xv]

Indeed, due to the constant changes in housing policy and somewhat frequent changes in the economic situation, and the socio-political system, it can not strictly say that housing in the city center have any advantages in relation to housing on the outskirts of Belgrade. However, a little research on several topics was recently done, which partially touching this matter. Themes are done in her doctoral dissertation[xvi], and, among others, those issues were discussed:

- Whether the type of construction (which is associated with the density and object level) can be linked to the location on the territory of the city, in terms of relations between center and periphery, or old parts in relation to the New Belgrade

- Whether the type of construction can be linked to social segregation and structure of these settlements, etc.

One notable fact is that in the second half of the twentieth century, the military establishment had a higher standard in a residential housing than the civilian population, as well as a higher percentage of the housing stock in New Belgrade.

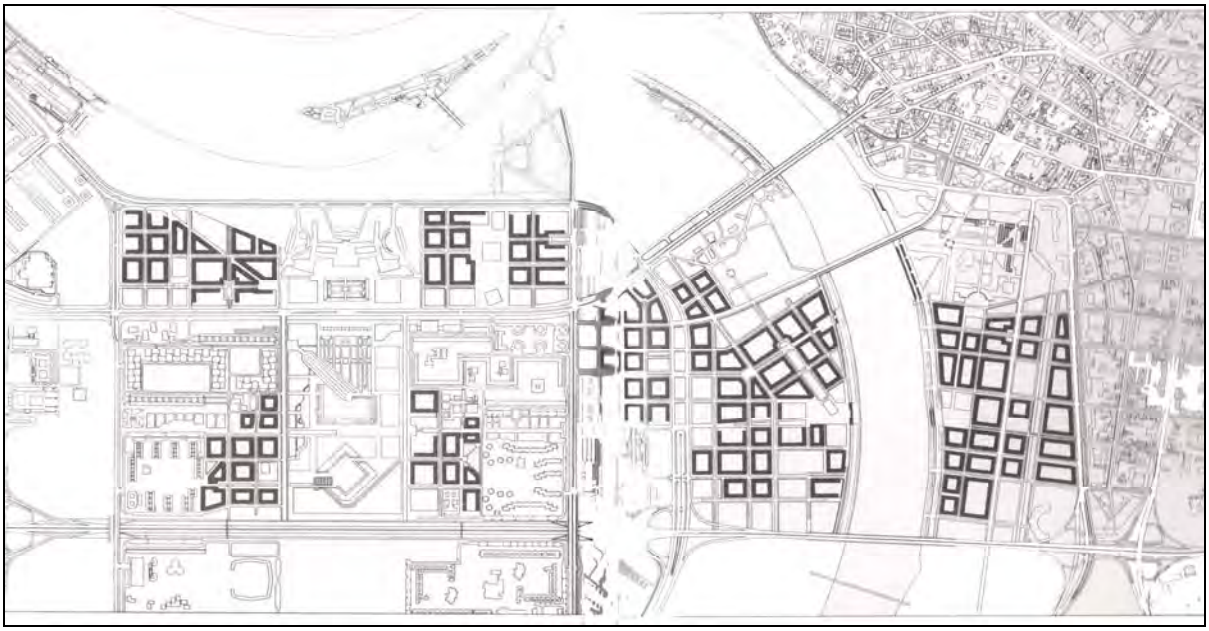


Figure 6: Regulation Plan, showing the area intended primarily for housing.[xvii]

„Unlike New Belgrade and its central part, the Sava amphitheater, filled with railway installations, after the war planners and designers evidently have not paid enough attention. In 1946. Nikola Dobrovic have published, along with the text on the directions of the future development of Belgrade, a draft regulation in this area. According to Dobrović proposal, Sava amphitheater should be a large city park filled with objects of republic institutions. "This was a vision for the Sava amphitheater by Nikola Doborvić, who was considered the Demiurge New Belgrade, and one of the most important architects of the twentieth century in Serbia." More than two decades later, this zone is only marginally considered in some designs of the participants of the General Yugoslav competition for arranging stretch between Kalemegdan - Slavia Square. The 1975th, when it seemed that the railway will be completely dislocated from this area no later than 1978, with the help of a publication filled with sketches and photographs of models, it is proposed to locate a complex program of cultural, banking, science, tourism and housing in these spaces and spaces to other side bank of the Sava river.“.[xviii]

Role models for the former conceptual orientations that are implemented in the construction of the center of New Belgrade is not difficult to identify. "It is primarily found among the most famous achievements of urban modernism, namely: one of three highly influential exhibition project Le Corbusier, the cities which, in his opinion, meet the needs of modern times, the project radiant city - *La Ville Radieuse* from 1930.godine , and project Lucio Costa to Brazilia, the new capital of Brazil from 1957“.[xix]

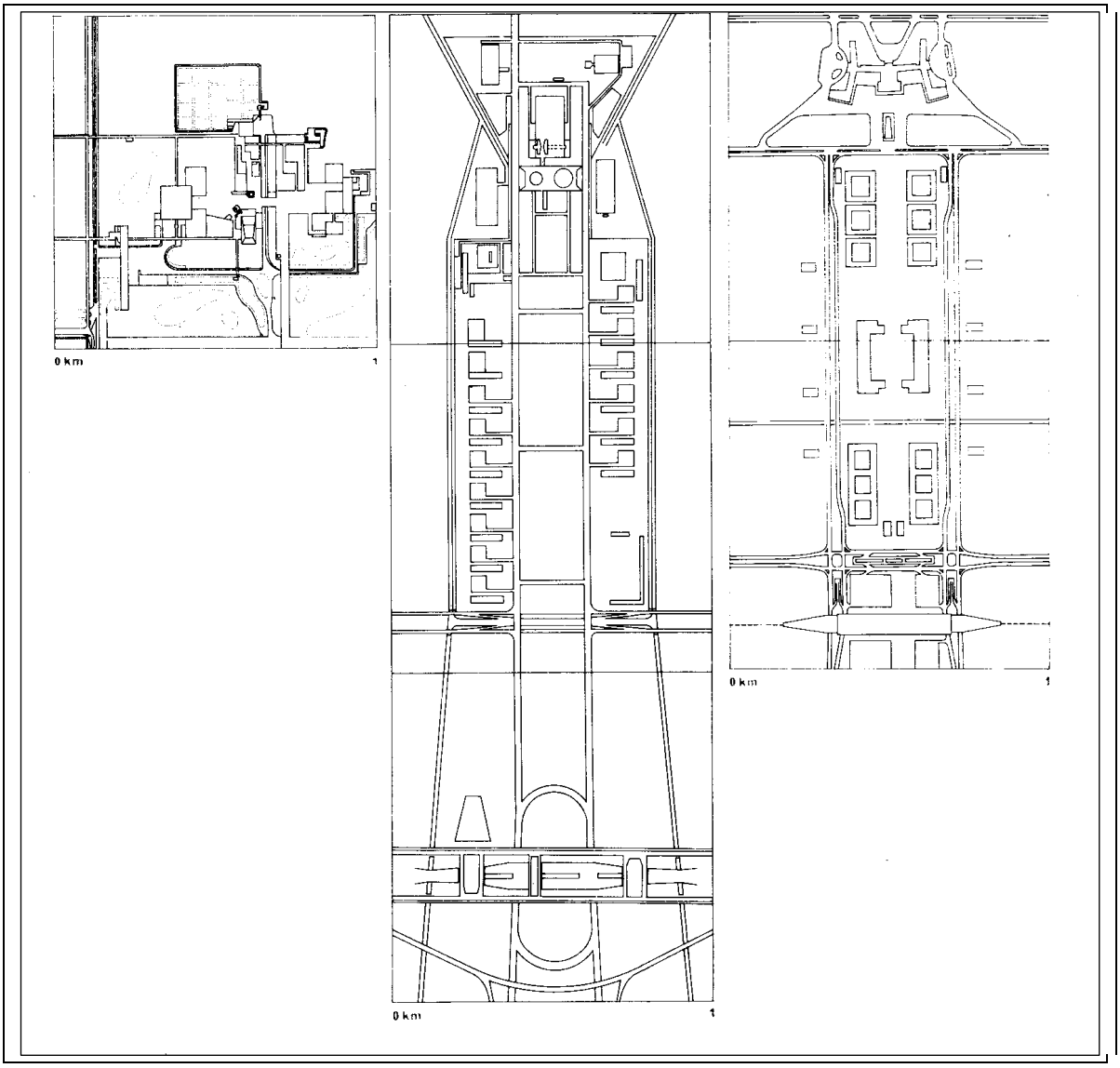


Figure 7: Administrative centers of Chandighar, Brasilia and New Belgrade. Comparative views in the same scale.[xx]

„Both models have a number of common traits. Le Courbisier project of the radiant city have represented one of the basis for the formulation of attitudes Athens Charter. Costa's Brasilia is a true example of an academic consistent application of the Athens Charter in a project to build a new city, and this primarily means that the overall context of the city reduced to four types of activities (housing, work, transport and recreation) and that they are strictly mutually isolated“.[xxi]

It further says: "The loss of contact between planners of New Belgrade progressive line of development CIAM also represents a loss of contact with experiments and studies of the structure and growth of the modern city, and to some extent represents the loss of contact with progress in the field of profession“.[xxii]

Irrespective with the plans that have been analyzed on the basis of sources presented in the section "The experience of the past," another concept deserves attention. Architect and urban planner Branislav Jovin during the 70’s of XX century, a have spent a couple of years as a head of the Commission for the implementation of the subway system in Belgrade. As is well known, Belgrade is today one of the few European Capital of which there is no subway system, but public transport is performed by buses, trams, and to a lesser extent, urban

rail.

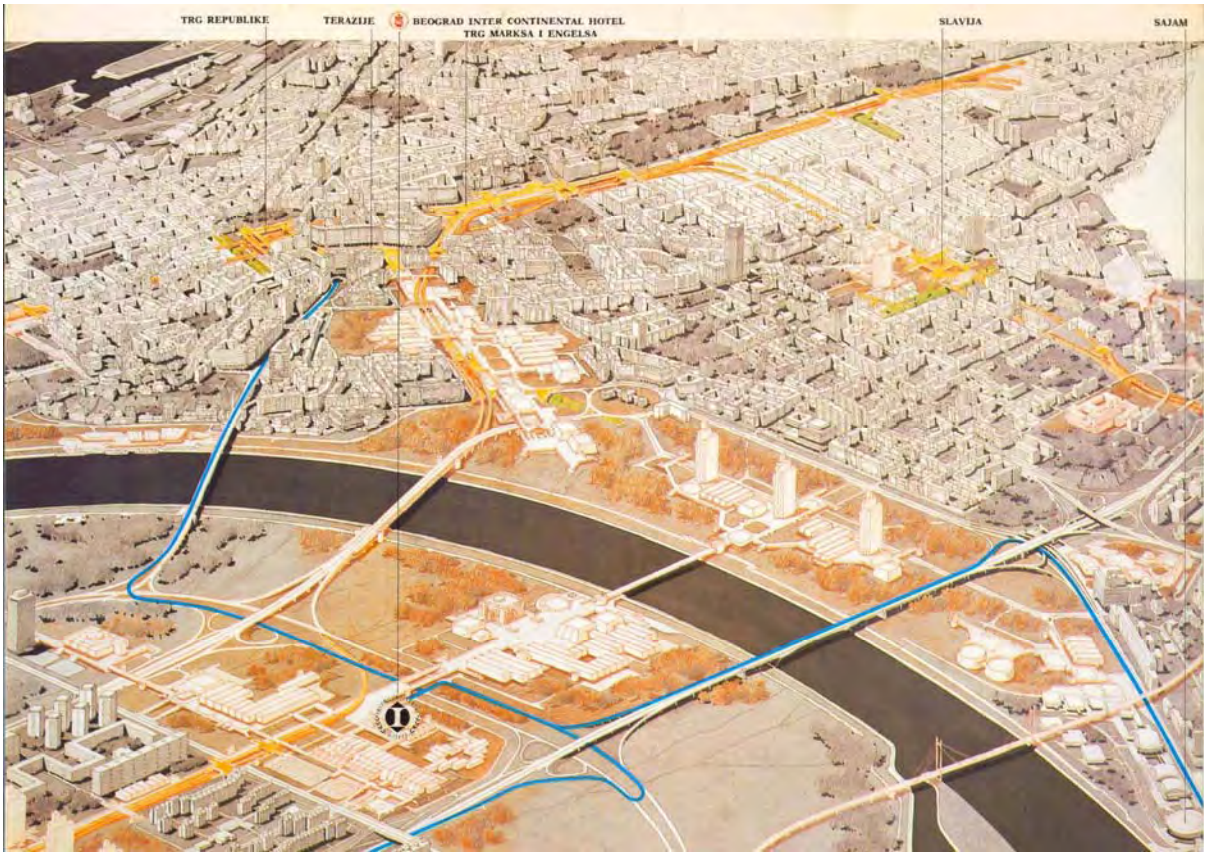


Figure 8: Branislav Jovin, conceptual solution locations Sava amphitheater in the context of transportation - subway system.[xxiii]

Among other things, it can be concluded that the attitude towards the Sava amphitheater is eternally open topic for architects and urban planners in Serbia.

From all the plans for the urban solution one common characteristic can be concluded. All of them are based on well defined relation to modernism. In this sense, different concepts of it:

- Support. Support the idea of CIAM, or

- Deny, or

- Reviewed, or

- Reinterpreted by contemporary ideas, and current contexts.

Such powerful influence of modernist urbanism on the location of the Sava amphitheater can be interpreted as the strong influence of modernism to the great protagonists through the education system, or professional maturation.

"The construction and development of the city are cyclic and open processes that occur in waves. In the first phase, always the most essential building facilities are development...". [xxiv]

The beginning of the XXI century has brought with it the information revolution, increased exchange of information, which have caused some new phenomena in the social and economic relations. It is estimated that due to the large amount of available information and their rapid flow, most important skills to be - their selection. In the context of the former Yugoslav republics, where Belgrade was the regional center in many ways, the end of the twentieth century, unlike other European countries, bringing a civil war with many casualties. The beginning of the XXI century brings transition, but today it is known that it is futile, and that many citizens are unhappy with unsuccessful privatization processes. In terms of urbanism, Belgrade in the late twentieth century witnessed the rise and unplanned

construction of new unplanned settlements, as well as the transformation of the original forms of modern architecture.

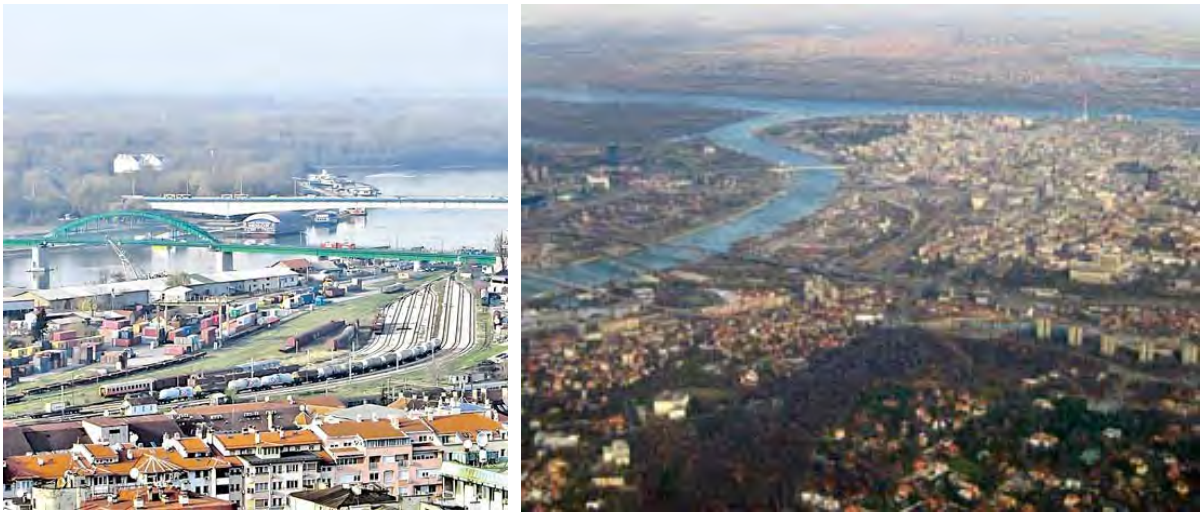


Figure 9: Photos of Sava amphitheater location from the bird's perspective.[xxv]

Epilogue big plans during the second half of the twentieth century is unrealized area. An economic, and thus instability in all other fields, political, economic, legislative, social, etc. have greatly contributed to this.

During a political campaign in the mid nineties of the twentieth century, a project called "Europolis" were promoted. Along with the previous concepts, this was fully based on replacing a rail traffic to a new location, as it was not conducted any previous and the new railway station has not been finished.

2.1 Concept for "Sava amphitheater" on start of XXI century

In recent years, there are new ideas and concepts for the location of the Sava amphitheater.

Intensive and creative development of architecture and urbanism, this and past year was continued to markets in populated countries such as Brazil, India, and the Middle and Far East. Near to us, in contextual more understandable Europe, however, there are not so many big investments, urban whole is a little slower implemented, cities are slowly changing, but there is an impression of greater influence public opinion in urban change and interventions. One of the events that marked the previous year, there were protests in Taksim Square in Istanbul, against the demolition Gezi Park, and the realization of a commercial shopping center on this important city location. Gezi Park itself, is the park as it exists in every European city and the wider public space, a place where people meet and a place of the free movement of people of all ages, and minority groups. One of the main tendencies of the postmodern, in this part of Europe at the beginning of the XXI century, the disappearance of public space, or creating a pseudo-public space within commercial buildings malls. In ancient times, the decisions were made at the Agora, in the Middle Ages witches were burned, in the new century led her away ships on time of great discoveries, the modern era began with the struggle for human rights. Now that space is in some sense has been replaced by social networks, as well as the squares crisis - deepens. Due to the development of the market over time to a greater extent develop pedestrian streets, arcades such new forms, which have the function of gathering and retention, but rather the flow of goods, people and capital.

Shopping centers are trying to imitate urban centers, retain customers longer, and not as short as possible, but at least participate in the vicinity. Such an example - the transformation of public space that belongs to everyone, in a pseudo-public space that really belongs to consumerism and consumer subculture, realized in several shopping malls in New Belgrade,

as well as in the old part of the city, and its suburbs, and plans are in the latest concepts "Sava amphitheater".[xxvi]

In this part we will mention the actual response to an amendment to the zoning plan. One of them is related to the concept of urban planning. "Previous founders of legislation in the field of planning, design, construction and management of the space of the second half of the twentieth century until today, did not notice the fatal errors that result from unsustainable" 2D "education, and then applying the legalising unsustainable" 2D "terminology. This undeniable fact clearly shows that the application of the legalising "2D" terminology has been a consequent "production" speculative "2D-patents"."[xxvii]

Implementation of new plans and projects in the Sava amphitheater has yet to be followed in the coming years.



Figure 10: Competition solution for Block 42 is planned to present the main bus station of the location of the Sava amphitheater, relocate with the right to the left bank of the Sava River, on the outskirts of the historic axis imaginary center of New Belgrade. [xxviii]

During this year, in order to relocate functions from the current territory of the Sava amphitheater, in order to facilitate the free area for a new purpose, an urban and architectural competition for the new main bus station and railway station in New Belgrade was announced. 54 solutions were received. According to the master plan of Belgrade, a relocation of the current main bus atanice is planned, from the territory of the Sava amphitheater, to New Belgrade. With this relocation, the territory of the Sava amphitheater will become free for the new content. Also, the block 42 is part of a historical concept, an imaginary axis of the center of New Belgrade, from SIV, to the railway station in New Belgrade. One of the solutions [xxix], have accepted inherited urban matrix, the idea of modernity and sustainable development, and reinterprets them in a contemporary way. What is interesting, is a project that provides a lot of flexibility, and significant green space, it qualifies as rewarding solution in terms of interpreting the planning documents.
"This approach and understanding of problems ... articulate and affirm an integrative" 3D "ecourbanism and eco-space (ecoregional) planning as a viable basis for the integration, development and affirmation of" 3D "theory and pragmatic, in the field of planning and management of the urban and environment space. And, it is based on the principles ekoreciprocity between social needs and activities of the local community and highly-construction, low-construction and landscape-architectural physical ("3D") structures, objects or artifacts within the framework urbanosredinskog residence (village) and environment habitat."

3. Conclusions and recommendations

Definitely, the proposal for the realization of this important city locations such as the Sava amphitheater cannot be created in one breath. Also, it is not possible to determine the final or

long-term picture of the development of these locations. The process of planning these locations lasts for decades, with discontinuities due to different circumstances.

Construction or development of an urban territory with central functions of public purpose is a cyclical process. Physical realization of the blocks is not the end of its development. It is expected that over time, the potential of this location yet to be opened, and presumed.

"Sava amphitheater" for the citizens of Serbia and the region as important as the parks and squares for citizens of other European countries – a material artefcat - an evidence of the presence of European avant-garde movements, urban attitudes, cultural space and cultural awareness in the capital of Yugoslavia during the twentieth and beginning of the XXI century.

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[i] Source if illustration :
Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 184.

[ii] Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 7.

[iii] Ibid. 10.

[iv] Ibid. 10.

[v] Source if illustration :
We are 25 years away from "Serbian Manhattan" - Destiny of Belgrade on water, Sava Amphitheater, Europolis [Internet, web portal] Ekapija
http://www.ekapija.com/website/sr/page/571071/Od-Srpskog-Menhetna-nas-deli-25-godina-Sudbina-Beograda-na-vodi-Savskog-amfiteatra-Varo%C5%A1i-na-vodi-Europolisa
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[vi] Perović, M. (2000), Iskustva prošlosti, Beograd: Plato

[vii] Ibid., 89.

[viii] Source if illustration :
Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 62, 93.

[ix] Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 89.

[x] Source if illustration :
Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 186, 188.

[xi] Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 89.

[xii] Ibid., 128.

[xiii] Ibid., 140.

[xiv] Source if illustration :
Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 226-227.

[xv] Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 145.

[xvi] Subject of my PhD thesis (still in progress) is „*Spatial organization of residential housing realised in belgrade, in period between 1947th and 1980th year, in precast industrial systems*“, (original, on serbian „*Prostorna organizacija stanova građenih u Beogradu od 1947. do 1980.godine u prefabrikovanim industrijalizovanim sistemima*“, Belgrade: Faculty of Architecture, Belgrade University.)

[xvii] Source if illustration :
Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 224-225.

[xviii] Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 153.

[xix] Ibid., 153.

[xx] Source if illustration :
Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 157.

[xxi] Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 153.

[xxii] Ibid., 167.

[xxiii] Source if illustration : private collection

[xxiv] Perović, M. (2000), Iskustva prošlosti, Beograd: Plato, 13.

[xxv] Source if illustration :
We are 25 years away from "Serbian Manhattan" - Destiny of Belgrade on water, Sava Amphitheater, Europolis
[Internet, web portal] Ekapija
http://www.ekapija.com/website/sr/page/571071/Od-Srpskog-Menhetna-nas-deli-25-godina-Sudbina-Beograda-na-vodi-Savskog-amfiteatra-Varo%C5%A1i-na-vodi-Europolisa
(downloaded at July, 2014.)

[xxvi] More information about newer ideas for the location Sava amphitheater is possible to look at the link http://www.urbel.com

[xxvii] Ćerimović Velimir, (2014), *Predlog za izmene i dopune Zakona o planiranju i izgradnji*
[Internet, web portal] Papigus, founder: Velimir Cerimovic,
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[xxviii] More information about this Competition solution possible is to look at the link
http://europaconcorsi.com/projects/261504-AZPML-Alejandro-Zaera-Polo-and-Maider-Llaguno-Architecture-Inigo-Arrien-Pablo-De-Sola-Montiel-Block-42
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Consultants for traffic: Hidroprojekt Saobraćaj doo, Belgrade | Serbia
(Source: private archive)

[xxix] Ibid.

Right to adequate housing and right to balanced environmental: a false conflict – the case of Vila Acaba Mundo (Belo Horizonte - Brasil)

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Brazil

Synopsis: This paper discusses the possibility of regularization in areas of environmental protection. It will present the case study of Vila Acaba Mundo, a slum in the city of Belo Horizonte, Brazil. Its occupation dates back more than 60 years, however there are some springs and two streams that cross the area.

INTRODUCTION

The illegal land occupation by families with low income generates a very commom conflict in Brazil. Historically, the poorest have always been excluded from the formal city, requiring illegally occupying of perferic areas, including hillsides. Insecure tenure penalizes those families who are already in a situation of social vulnerability. The illegal occupation, therefore, remains as the only alternative for access to housing, because they can not afford the high costs of formal housing market and the governmental solution is not sufficient.

Given this reality, the instruments of regularization has been widely discussed in Brazilian legal system as a possibility to include those areas in the legal city. These instruments have been used not only by lawyers but also by urban planners, and even by the communities themselves.

On the other hand, the ecologically balanced environment is also a fundamental rigth, constitutionally guaranteed. It was commom to think that there was a conflict of interest between the regularization of housing in these areas and environmental protection. However,

this conflict is only superficial, since the protection of the environment is directly linked to a systematic protection of other rights.

It will present a case study of Acaba Mundo Village, a slum located in the city of Belo Horizonte, where there are two streams in addition to water sources, which should be preserved, but also there is a history of more than 60 years of occupation and an intense social mobilization around land tenure regularization. This paper possibilities to discuss the advances and limits of regularization in this area, discussing the centrality of water protection in the cities without, however, fail to meet the established social demand

1) The case of Acaba Mundo[1] Village

The Acaba Mundo Vila is a small slum located between Mangabeiras, Sion and Belvdere neighborhoods in the South-Central area of Belo Horizonte, these three districts are the most prestigious areas of the city, under great pressure from speculation.

There are two versions about the origin of the Village. The first reports that in the late 30s, the occupation of the area was made by people from the surrounding cities of Belo Horizonte looking for work, these people have found in the adjacent forests and streams of the region a form of immediate subsistence. The second version mentions that the occupation of the area would have occurred due to the demand for labor with the installation of Mining Lagoa Seca in 1940. Indeed, it is possible to infer that the two processes influence the onset and development of the Acaba Mundo Village and its surroundings. The name of the slum refers to the fact that in the beginning she was very far from the city center without access to urban services and infrastructure.



Acaba Mundo Village. Image from: http://portalpbh.pbh.gov.br/pbh/contents.do?evento=conteudo&idConteudo=31223&chPlc=31223. Date of access: June, 23rd – 2014.

1 The translation of the slum´s name would be: The End of the World Village

Incidentally, it is noteworthy that this was the catalyst of urbanization of Belo Horizonte, a city that was planned and built to be the capital of Minas Gerais not foresee which inhabit the city workers who would compose the workforce of the new capital, leaving the they thus irregular occupation of hills to the edge of town.

This phenomenon identified in the state capital, reflects the process of Latin American urbanization, mainly directed to the maintenance of capitalist interests, denying the poor informality in housing. The process of informality in Brazilian urbanization reaches all sectors of society, the richest (with irregular settlements, the classic example being the horizontal condominiums, called closed condominiums), the poorest, who live in villages and slums of the urban periphery .

Furthermore, the brazilian legal system also contributed to the reproduction of urban informality while the doctrine and jurisprudence consider the right to property still purely individualistic way; and the absence of urban planning laws - or their existence based on flawed technical criteria - has played a key role in the consolidation of illegality and segregation, fueling inequalities caused by the real estate market.

The slum was much larger than it is today, extending for over 5km, however, with time, the pressure to his expulsion resulted in shrinkage while the formal city progressed to their region. Today, the village has about 370 families (about 1,400 people) 1, all very poor, who live mainly in the informal economy.[2]

The residences are generally well evaluated by the residents, who recognize that now is much improved compared to the past tense situation. It is estimated that 95% of homes in the Village are masonry buildings and 91% are destined to housing, having, in the remaining ten (10) bars, two (2) deposits and recycled cardboard, three (3) social projects, than dwellings for other purposes, such as car washes, manufacturing salted, carpentry, church, daycare, community center, unclogging stoves, restaurant, appliance repair, groceries, building materials store, among others. However, although there is a steady improvement on the infrastructure and construction methods, the Village World Ends contrasts with the view of mansions and buildings of medium to high class present in your surroundings.

The history of the village is marked by constant insecurity of tenure of its residents. In the '70s and '80s, for example, several houses located in present-day Uruguay Avenue were demolished. According Efigênia Martins, former community leader, one of the most organized

2 Data from: http://portalpbh.pbh.gov.br/pbh/contents.do?evento=conteudo&idConteudo=31223&chPlc=31223 Date of acces: June 23rd - 2014-

attempt total removal of Vila happened in 1983, under the excuse of risk of tragedies suffered by the rains. However, the Government and the alleged owners of the land they encountered a mobilized community, intense process of organization, unlike the situations faced with the residents of the houses of Av. Uruguay, previously removed. As already reported, the village is situated in one of the most valued areas of Belo Horizonte, and insecurity of tenure is a fact that drags to today.

It is noteworthy, that are located in the Village World Ends various sources of Sub Basin Stream of Acaba Mundo, which composes an important basin that provides water to the whole metropolitan area.



Image from: http://www.agbpeixevivo.org.br/nascentesurbanas/index.php/nascentes-rib-arrudas/sub-bacia-corrego-do-acaba-mundo Date of acces: June 23rd – 2014

The springs of Acaba Mundo Village are very close to the established residences there and end up getting vulnerable to misuse, as the flow of sewage from households or even deposit of waste. As can be seen, for example, the aerial photo of the three east of

Street of Carvalhos:



The thesis wrote by SILVA (2013), clearly demonstrates the constant presence of springs in ares of slums in the city and Belo Horizonte, as transcribed this excerpt:

> The basin of a river and consists of many small streams that define, in turn, numerous watersheds. Although part of the main course of a bowl or some of its tributaries have been channeled, and common to find, in the higher portions of the basin, these small streams in natural bed. Where I found them in Belo Horizonte, outside parks or catchment areas were occupied by slums. This finding can be illustrated by mapping the movement of the slums and the current position they occupy in the municipality, the hydrographic sub-basin in which they operate.

Situations like this always resulted in a heated debate on the one hand the need for environmental conservation and the protection of other property, both constitutionally recognized rights in the Brazilian legal system. Let's see what the Federal Constitution of

1988 says about both topics:

> Article 6: The social rights are education, health, food, work, housing, leisure, security, social security, protection of motherhood and childhood, and assistance to the needy.
> (...)
> Article 225: Everyone has the right to an ecologically balanced environment and the common use and essential to a healthy quality of life, and both the Government and the community shall have the duty to defend and preserve it for present and future generations.

This situtation demonstrate a current debate on two themes constantly overlooked in policy of urban planning in Brazil: slums and urban water. Only in Belo Horizonte there are about 700 km of waterways across the municipality: 300 km station in environmentally protected areas - parks and catchment areas for water supply; of 400 km inserted into the urban fabric, half of water watercourse is piped natural and half in bed. (Aroeira 2010)

The social pressure for regularization, in a seemingly contradictory discourse, would be separated from a required environmental awareness and protection. However, as noted by Silva (2013), from the theories of Karl Marx and Henri Lefebvre, there is nothing purely social or purely natural, especially when referring to the city, there is no way to separate these two factors, as we can see from the statement that follows:

> If we think of the city as this socionature and her apply the principles of natural regulatory processes, and the further downstream we must retrieve it and consolidate its territory. Thus would ensure the integrity, independence and interdependence of the members of the urban system socionatural microsystems, taken as watersheds. Therefore so obvious, why not and the prevailing option in public administrations? In the wake of this question and find that the city and its contradictions, tensions and conflicts.

2) Aspects of Land Regularization

Given the situation of irregularity that prevails in the urban Brazilian territory, is being

sought by both private sector and by public initiative, motivated by various interests, some regularizing informal areas of cities. This is called Regularization.

The concept of land regularization has a broader sense, which should encompass both regularization of the land in question as promote the urbanization of the area to be regularized by integrating it into the formal city. The text of art. 46 of the Federal Law n. 11.977/2009, which boasts about the Minha Casa, Minha Vida - PMCMV and Regularization of Settlements Located in Urban Areas, extract it:

> Article 46. Land Regularization is the set of juridical measures, urban, environmental and social aimed at regularizing informal settlements and title to their occupants, to ensure the social right to housing, the full development of the social functions of urban property and the right to an ecologically balanced environment.

However, the interpretation of this article, as well as all other standards that relate to urban organization, must be interpreted in consonance with the Constitution and with the Statute of The Cities(Federal Law 10.257/2001), the main regulatory framework regarding the Brazilian urban law. Such that the right to housing can only be understood in accordance with an idea of social function of the city. The adequate housing needs to guarantee full citizen access to the city.

Even internationally, the politics of land regularization is gaining prominence. The concept of Regularization is complex and it needs to be understood broadly, comprising more than just the formalization of property, as well as demonstrates Edesio Fernandes:

> It should be said that while the regularization policy has been the most frequently adopted in the international context to address the widespread problem of urban illegality, the term has been used in many ways, with different meanings by different international agencies and researchers. The physical implementation of regularization programs implies the improvement of infrastructure and the provision of public services, and its formulation requires a heightened cultural sensitivity.

It appears therefrom that the policies and projects of land regularization has basically two objectives recognition of some form of tenure security to occupants of the slums and the

socio-spatial integration of such areas and communities in the wider context of the structure and urban society.

Precisely in this sense, we indicate an advancement of Brazilian law that is explicit in the Law No. 11.977/2009: the right to adequate housing is not incompatible with the right to an ecologically balanced environment, but the protection of the environment is part of the very concept of regularization, as demonstrated in the transcription of article 46 from the Law nº 10.977/2009.

4) Conclusion

Thus, we see that after the enactment of the refered Law, the debate that splits the recognition of social rights - such as housing - and environmentally balanced use of urban space is replaced by an another interpretation, which recognizes the city includes what used to be called natural. Situations like the one we described from Acaba Mundo Village, must be guided by a principleof manteining the residence of the inhabitants on the spot, avoiding forced evictions, as well as environmental awareness and conservation in an integrated manner.

The regularization in areas of slums and with other elements of environmental interest, such as water springs, shall require, legally, a conciliatory treatment that allows the integration of local people into the formal city, at the same time that guarantees the right of the current and future generations to the ecologically balanced environment, reaffirming lefebvrian thesis that the urban space is a social space.

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Waterfront's revitalization - an innovative component of the Territorial Capital

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ABSTRACT. Messages for a new urban development policy were given since the beginning of the present century, focusing the attention much more on the urban transformation than the urban growth. At the same time, the concept of *Territorial Capital* was undergoing a transformation, from spatially immobile factors of development into the competitive potential of the territory. The cognitive evolution of *Territorial Capital*, referring it's outcomes to the city, brings that concept close to the urban *genius loci*. How does the innovative concept of *Territorial Capital* refer to the contemporary practice in spatial planning and the waterfront's revitalization, conducted by the public sector in cities? Does it reflect the transformation in urban governance, which Harvey describes as the path *from managerism to entrepreneurism*? The paper presents the outcomes of a limited research, starting from the taxonomy of the components of territorial capital, proposed by Camagni, concentrating on the center of his innovative cross. The research study analyzes selected waterfronts' revitalization strategies and their outcomes, along with the urban spatial policies and their recognized practice on elaborating patterns of design for waterfronts. The paper summarizes the results of conducted analysis and finally brings conclusions of the study, submitting preliminary responses to the research questions.

Introduction

Attractiveness and local competitiveness are qualities of a vital, vibrant and livable urban space (Couch *et al.,* 2003; Wagner & Caves, 2012). On the basis of the classical theoretical model of competitiveness by Porter (1990) as well on the results of the application of that theory to urban environment, presented by Storper (1997), Malecki (2002), and Kitson (Kitson *et al*., 2012), attractiveness is the crucial determinant to induce the revitalization' process in a declined urban space.

Attractiveness and local competitiveness depend on factors, which are not only found in the material world but also in the relational capital and the learning capacity, both expressed by the territory (Camagni, 2002). Results of research and analysis of the determinants of urban competiveness, focused on integrally generated determinants, give a reliable base to build on the strengths, *bottom up*, reaching up to the endogenous capital. That approach is widely recommended for the revitalizing strategies (Birch, 2012).

Territorial Capital - the innovative approach

The concept of *Territorial Capital* was proposed by OECD in the first Territorial Outlook (2001:15). Notion of territory accents the active role of space. Notion of capital highlights the

role of assets (and supply). The concept of *Territorial Capital* that proceeded from spatially immobile factors of development into the competitive potential of the territory is based originally also on the idea of *milieu innovateur* (Bramanti, 1998).

As argued by Bramanti with Miglierina (1995) and by Malecki (2000), the territorial organization is an essential component of the process of techno-economic creation, whatever the specific kind of *innovative milieu* would be. That local approach (*bottom up,* grassroots or endogenous development) opens the perspective to reproduce the concept to any geographically delimitated urban proximity (urban place). The spatial analysis that incorporated the concept of endogenous development was the theoretical basis for the concepts of social capital (Putnam, 1993) and relational capital (Camagni, 1999). The urban context and the urban dynamics were the objects of researchers exploration on the specific territorial assets (Crevoisier & Camagni, 2000).Territorial understanding of the placed based urban economy, that described Crevoisier (2004) was supplemented by the research on milieus and local development cultural resources (Camagni *et al.,* 2004). The evolution of the concept was enriched by Camagni (2008).He proposed taxonomy of *Territorial Capital* consisting 9 groups of assets. The five of them, marked by *b, e, i, h, g* form the *innovative cross* (Fig.1).

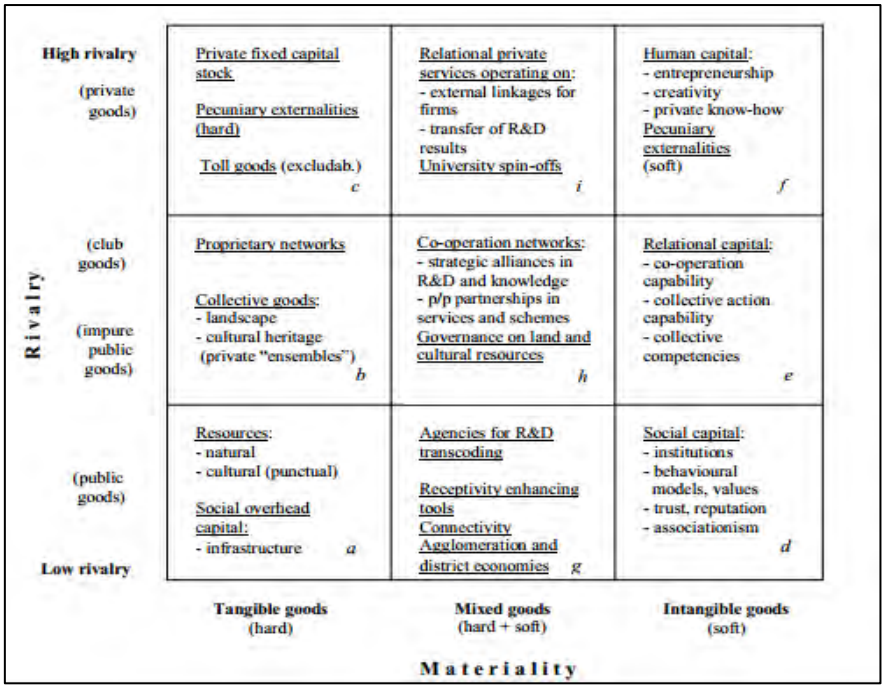


Figure 1: The theoretical taxonomy of the components of Territorial Capital, after Camagni (2008:34).

The concept of *Territorial Capital* expanded widely including more intangible and mixed assets. The beauty of a townscape, the quality of urban design, local synergy, informal networks, governance factors, operational schemes and interdependencies have been recognized as territorial dependent. This assets are intangible but evident perceptible, for example by the quality of the spatial organization and architecture (Rykwert, 2000) or city' livability (Wagner & Caves, 2012).

That comprehensive approach to territory's capital is close to the urban *genius loci* as well to the classical 4. personalized recollection and engagement with a geographic location, also known as *the spirit of place,* that is described by Gordon Cullen (1971).The proposed

taxonomy also brings to mind the concept of *urbanity* (Zijderveld, 2008), especially the *sense of place* in a 21c' city of *indeterminate urban spaces* valuated by *informal actors* according to the Post-Fordist, cognitive-cultural economy (Groth & Corijn, 2005).

The discussion on *Territorial Capital* flows parallel to the transformation in the urban governance. That change, predicted and described by Harvey (1989a) as the shift *from managerism to entrepreneurism*, is evidently noticeable in the socio-economic urban structures of the late, Post-Fordist capitalism. Entrepreneurial approach to the urban development, whatever to think about it, is consistent with the territorial outlook, presented by OECD (2001) and the territorial approach of the European Union (2011). Competitive advantage of a city, analyzed and evaluated according to the concept of *Territorial Capital*, besides the strengths of long-term accumulation, reveals the weaknesses caused by *the spatial myopia* and by inability to capitalize the intangible assets. Looking from the perspective of the post-structural approach of new economic geography, the waterfront' spatial complexity and the exceptional economic attractiveness of a waterfront form a conceptual and managerial gap. That was already noticed in the study of Tallin' waterfront transformation delivered by Feldman (2000). Similar critical conclusions on municipal waterfront management in the Post-Fordism phase were given in the report edited by Moretti (2013).

Waterfront – paradoxes of the phenomenon

Indisputably, urban waterfront has a unique value and poses an intangible emotional power, coming from the metaphysics of the water-land interface. That was deeply analyzed and inspiringly described by Paulet (2006, 2007).

The waterfront is a major factor in the development of a city. Spatial organization of a waterfront steers the space production on the water's edges, according to the main features: connection to the water and complexity (Marshall, 2001). But that unique realm for urban development *retrieved frontier of conventional development process* (Malone, 2013:2).
Re-organized waterfront changes the image of the city. Best and well known example in Europe is Bilbao, where the new waterfront's spatial organization transformed the city bringing a durable revival. Boston city renewals, started by large public-private waterfront transformation, Liverpool Merseyside, London Docklands or Shanghai are the largest and most spectacular, hence best known examples of top-down approach (Marshall, 2001). Examples show that revitalization could be the long term result of the spatial waterfront re-development, but as well a new spatial organization of a waterfront may deliver new urban space bereft of *urbanity. 'New spaces old problems'* that concise remark placed in "Devil's star", a book by Jo Nosbø, the internationally acclaimed Norwegian crime novelist, refers to the transformation of Oslo' waterfront district of Bjørvicka. That top-down, property-led transformation, conducted under emblem of revitalization has been criticized thought the evident momentum of the architectural concept of the new Opera & Ballet house, ingeniously located by the sea.

However waterfront revitalization often occurs at the problematic interface *in-between:* private/public, port function/urban environment, heritage/new investments etc., there are '*a lot of evidence collected in diverse cultural, political and economic settings*

to proof the revitalizing phenomenon of waterfronts' (Hoyle, 2000). Regarding the results of the comparative report edited by Moretti (2013), projects of smaller scale or less attractive for the international capital, like revitalizing of the river banks area in Bratislava or Pärnu, seem to be an approachable vehicle to collect the innovative territorial capital for the city, by the urban knowledge accumulation (Camagni, 2002). The municipal authority is confronted with the demand for conducting the complex transformation of the waterfront. As well the urban community is. Then, theoretically, the process of collective learning and accumulation of the relational capital may start (Camagni, 1991; Maggioni & Nosvelli, 2005).

But yet, how Feldman (2000) argues and Moretti (2013) supports, the short–term public operation on waterfront is preferred, following short-term interests, from one election to the next. Municipal authorities do not wish to engage in visionary projects, usually long term. Revitalizing effect of the waterfront re-development may be gained preparing very wise spatial planning to avoid the homogeneity, keeping the waterfront as the *space of flow,* by reaching out to the bottom-top approach that brings public interest and involvement, at the same time upgrading the social capital (Davoudi & Strange, 2008). But in post-socialist cities the relatively long separation from the water befell a different context of spatial planning for waterfronts in compare to western cities. That difference has been recognized by Feldman (2000). Upon that she argues on a non-economic basic precondition to waterfronts revitalization in post-socialist cities. No economic temptation? Considering the explanation of motifs underlying the re-organizing (re-development) of waterfront in western cities, that ware given by Harvey (1989b), Marshal (2001) and Malone (2013) her presumptions seem paradoxically relevant: waterfront's regeneration projects have focused basically on the great scale, for '*Blue business, related to water, is a tempting alternative to Green business, referred to new golf court'* (Marshal, 2001).

Revitalization – innovative urban scheme?

Since the beginning of the present century, messages for a new urban development policy were given, focusing the attention much more on the urban transformation than on the urban growth (Hall &Pfeiffer, 2000; European Union, 2004). Transformation by renewal of the urban fabric or place-recycling has been integrated with the process of social transformation, formatting the western cities of late capitalism as well as the post-socialist cities of central Europe (Węcławowicz, 2002).

Propriety-based (placed based) and people-based strategies of revitalization form a contemporary set of schemes, which are creatively adapted and developed, according to local urban culture, challenges, capabilities (potentials, assets), local governance and available, adopted urban know-how (Węcławowicz, 2013). Revitalization may be considered as a holistic and participative approach to urban renewal, derived from a long evolution of urban transformation's concepts. By the term it is called '*the third phase of urban renewal*' (Carmon, 1999).

Process of learning is crucial in that approach to planned urban revitalization. Assuming innovation is a function of learning and creativity, model schemes of urban revitalization have to be taken as a base, not for replication but as a capital of knowledge, to be utilized to develop the endogenous, unique capital of a city. Hence, considering the implemented

urban revitalization program as the learning process' result, it is an innovative local scheme. By that, it may be not only regarded as a component of the relational capital of a city, but primarily as a mixed good - asset indicated in the center of the *innovative cross*, which Camagni proposed. Crevoisier argues a city always tends to be a privileged place for creating something new (2004:375). Innovation, what was noticed by Bramanti (1998) is synonymous with overcoming and change. Therefore an evident experience in revitalization proven by achieved change (transformation) of a declined urban space into a livable and vivid urban space, which has been successfully planned by the municipal authority, should be evaluated and recognized as territorial asset of the city. According to the theory and practice of urban regeneration (Couch, 2000; Couch *et al.,* 2003) these operations of enormous complexity may be classified as *partnerships in schemes* and *governance on land and cultural resources*, therefore be placed in the center of the *innovative cross* of the *Territorial Capital*. Assuming, the theoretically examined specificity of waterfront results with its extraordinary 'sensitivity', capability to reflect the local approach to spatial re-organization and urbanity, the development of intangible and mixed assets of *Territorial Capital* may be evaluated by the quality of the waterfront' revitalization scheme.

Presented result of the limited theoretical studies is the base of putting a general question about the applicability of the innovative *Territorial Capital* concept as a perspective to the research on process of revitalization in cities. Attractiveness and competitiveness are desired attributes of revitalized urban structures as well the cognitive categories of studies on the geography of innovative economic territories. Although the similarities seem promising, especially for the prospect to enrich the methodology of urban planning and evaluation, the innovative concept of *Territorial Capital* is relatively recent. That brings to the question about the reception of an academic theory. How does the innovative concept of *Territorial Capital* refer to the contemporary practice in spatial planning and waterfront's revitalization, conducted by the public sector in cities? Does it reflect the transformation in urban governance, which Harvey (1989a) describes as the path *from managerism to entrepreneurism*?

Empirical research studies

The research was conducted by studies on two cities, that have been chosen to the criteria of: geographical location by main Polish rivers (Vistula and Odra), with a relatively easy access to urban know-how (capital city of a region, with an experience in international cooperation in planning) and respected experience in planned revitalization of urban areas in decline, that could have been accumulated by the municipal authorities. According to those criteria Cracow (capital of Lesser Poland region, located by the Vistula River) and Szczecin (capital of Western Pomerania region, located by the Odra River) have been chosen.

The reception and the practical implementation of the concept of *Territorial Capital* were examined by the analysis of two, currently valid plans:

- the development' strategy of the city,
- the study of the conditions and directions of spatial development, which is, according to the Polish legislation, the only obligatory spatial plan of the city's territory.

Additionally, a survey addressed to planning officials on the municipal and regional level has been conducted. The main intention was to investigate the *Territorial Capital* concept' position in the spatial planning practice of the urban planning professionals. It was also designed to research on the waterfront' spatial re-organization planning utilities of the intangible, innovative elements of that concept. Therefore a set of 4 waterfront' revitalizing samples has been prepared, to be analyzed and evaluated by the responders, in order to demonstrate the assigned level of importance of the *innovative cross'* assets. Waterfront revitalization strategies in both cities were analyzed by the operations planned and by observation of the results of implemented plans. Therein revitalization programs for both cities were analyzed theoretically and practically (by field work), from the perspective of waterfront spatial re-organization.

Case: Cracow



Figure 2: Panoramic view of Cracow's waterfront, Vistula riverbank in the city center (image credits: Radosław Drożdżewski).

Experience in integrated urban renewal of deprived areas, followed by programmed revitalization has been gained since 1993, when the Kazimierz Action Plan was started, as a European Union, ECOS Founded Project, carried out by the Cities of Cracow, Edinburgh and Berlin (Mühlbauer, 2007).

The valid Revitalization Program for Cracow (RPC 2005) contains 8 declined *areas of interventions* as well 3 'global tasks'. 3 of them are located along the river Vistula's embankments. One of the global task (River Parks) is virtually connected with re-organization of the waterfront of the city that, including the main Vistula River, focuses on the five smaller rivers. Hence, the *opening the urban life to the water* (RPC 2005:64) is an important objective of the program, which was prepared using the comparative utility analysis and SWOT analysis. Although no one of the numerous 'flagship project' is focused on revitalization by utilizing all the assets capitalized in the complex space of the city's extensive waterfront, the renewal of Vistula embankments is progressing, step-by-step (Fig.2).

Cracow Development Strategy was adopted in 2005 and steered in 2013 to be up-dated. The concept of capital - social, relational or territorial, was not used, the asset management as well. Analysis of the plan does not confirm that it was built on already gained and foreseen to be developed urban know-how, experience in programming of revitalization, local governance etc. Revitalization is one of the development tasks, addressed to deprived areas and historical heritage (part. IV, p.17). The re-organization of waterfront is planned

to develop the river transport (par. V, p. 19), improve flood protection and the revitalization (economic revival) of 4 districts. The revitalization of the Vistula River banks (part V, p.24) is foreseen to be achieved by implementing a metropolitan project: *Revitalisation and management of the River Vistula's embankments.*

The Study of the conditions and directions of spatial development for Cracow (Study for Cracow, 2003/2010) delivers no evidence of application of the territorial capital concept. The idea of revitalizing of declined urban environment is recognized, but expressed by the wording, for the revitalization of declined areas is implemented in that plan as an instrument of physical regeneration of the urban fabric.

Case: Szczecin



Figure 3: Panoramic view of Szczecin's waterfront organization during the Final of Tall Ship Races 2014 (image credits: D. Mliczyńska-Hajda).

Experience in integrated urban renewal of deprived areas that was later on followed by programmed revitalization, has been gained in Szczecin since 1991, when the programming of the complex renovation started. It was conducted by a team, supported via 'Umbrella' UN project, by an experienced Dutch volunteering consultant (Kulpa-Jarocka & Mliczyńska-Hajda, 2006).

The valid Revitalization Program for Szczecin (RPS 2010/2014) was prepared utilizing also the SWOT analysis. Revitalization is planned in 15 declined areas. The waterfront revitalization is objective of the transformation of Śródodrze area, and partly the objective of *Dąbie* and *Columbus Street* areas. However the widely recognized in Poland results of urban renewal that had been achieved in Szczecin in late 90. of the 20c hardly seem to form a distinct local approach to the urban revitalization, the spatial reorganization of waterfront is in progress, partly by the public operations and partly by the investments of the private sector (Fig. 3).

Szczecin Development Strategy (to the year 2025), was adopted in 2011. Analysis of the Strategy shows a limited but noticeable influence of the territorial capital concept, by references to the intellectual capital of the city and the assets of urban relational capital. Also the social capital, as asset to enhance the cooperation of actors on variety of fields and goals, has been included, for utilizing it to *'break the stereotypes about inability to act creatively in Szczecin*' (p.52). Revitalization is noticed as an important task that should be addressed to the problem of brownfields. Waterfront or riverbank spatial re-organization is considered as (preliminary) material asset for tourism development and recreation. However the material historical heritage, valuated as an asset together with the location

by the river and nearby the sea, is expressed when the mission of the urban development is defined (p.41), the quality of landscape (townscape) is not directly noticed in the Strategy. The Strategy is built up with no noticeable correlation to the accumulated urban know-how and experience gained in programming of revitalization, co-operation in urban governance etc.

The Study of the conditions and directions of spatial development of Szczecin (Study for Szczecin 2005/2012) uses the element of the concept of territorial capital – social capital, in the analysis of the spatial development conditions of the city (Vol. I, p. 55). The concept of revitalizing of the declined urban environment is recognized and incorporated as a 'challenge' for the '*possibility of limiting downtown nuisance related to pathologies of social life, and the increase of touristic attractiveness and the sense of personal security'* (p.5). The presented approach is relatively far from 'building on the strength' or assets development. Concentration on deficits to limit the gaps or damages (nuisances) is the leading purpose. That is even more obvious, when analyzing the applicable part of the Study, dedicated to the directions of spatial development (Vol. II, sec.5), nevertheless that the waterfront of Odra's islands has been there planned to be 'revitalized'.

The survey addressed to planning officials employed on the municipal and regional level has been conducted in May 2014, with the intention to investigate the *Territorial Capital* concept' position in the spatial planning practice of the urban (Szczecin) and regional (Western Pomerania) professionals. The survey was carried out in parallel, in the two public offices of planning, urban and regional level, using the same electronic questionnaire. The numbers of survey responders in both groups of professionals are the same.

The acquaintance with the concept of Territorial Capital was declared by 12% of responders in the urban planning office and by 87% in the regional planning office. In both groups the concept was most of all indicated as useful for analysis and evaluation. The application in conceptual planning was assessed as moderate, while in programming as the least useful.

The survey included question on the issues of waterfront spatial organization, explored from the cognitive perspective defined by the innovative concept of *Territorial Capital*. Responders, according to the innovations in taxonomy proposed by Camagni (Fig.1) were asked to indicate not more than 4 key groups of assets (total 9), that are crucial factors of different, sample spatial operations at the waterfront. The result in two groups of professionals appeared different. In regional planning office, the average indication of a group of asset consisting the classical box of territorial capital (in the taxonomy marked by *a, c, f, d*) was 4 times higher than the average of the group that consists the goods of innovative cross of mixed goods (in the taxonomy marked by: *b, e, g, h, i*). In urban planning office, the average indication in both groups appeared to be the same. Assets located in the center of the innovative cross (*h*) - cooperation networks, PPP in schemes (for instance urban revitalization), governance on land resources – were indicated as always crucial for spatial operations at the waterfront. While in the regional planning office that group of assets was indicated for that 2 of 4 spatial re-organization of waterfront' 4 samples that obviously needs intra-regional co-operation according to the legislation.

Conclusions, preliminary answers and remarks for future research

Waterfront' revitalization schemes are recognized more as vehicle of spatial re-organization and instrument of urban marketing then as the induction of process of coherent economic urban revival by asset' valuation and development. Limited practical recognition of the innovative concept of *Territorial Capital* that was evidenced during the survey may be one of the reasons.

The practical recognition of the utility of the *Territorial Capital* concept was noticed in one of the two analyzed urban development strategies. However according to the result of the survey it may be assumed that the methodology of that strategy has a minor influence on the local practice of the urban planning.

Although the space for innovation in urban spatial planning is limited by legal regulations, the analytical and diagnostic component of a plan may implement available and useful ideas (notions). Coming from that perspective to the results of a comparative analysis of the survey and both Studies, the concept of *Territorial Capital* may be seen as of margin influence on urban planning. The process of urban spatial planning self-restraint to land use planning, that has been noticed by Davoudi & Strange (2008) should be taken into account in further studies.

Analyzed revitalization programs show no direct linkage to the concept of *Territorial Capital* neither by treating the declined urban areas as assets nor by assuming the evident (observed) achievements in revitalization as intangible assets (urban know-how) available to be developed and used for future operations.

The evidenced approach to revitalization is much more the 'problem to solve' than 'assets to develop'. In terms of the conducted empirical research there is no enough evidence to proof the pre-assumed innovative aspect of these revitalization schemes. In that context the waterfront revitalization should be further examined, possibly by investigation on factors involving the spatial integration of the stressed by Hoyle (2000:415) attributes: *the sense of place, the scale and an appreciation of interdependences.*

The result of the survey supports the positive preliminary answer to question about the applicability of the innovative *Territorial Capital* concept as a promising perspective to the research on process of revitalization in cities. The further empirical studies should take into consideration the evidenced minor practical reception of that concept. Adjustment of the methodology will be the precondition for further empirical research on how the innovative concept of *Territorial Capital* refer to the contemporary practice in spatial planning and waterfront's revitalization. Already gained results of the research lead to the conclusion of irrelevance or separation (from both practical perspectives). Assuming the shift in urban governance, *from managerism to entrepreneurism*, has not been already executed in the post-socialist cities, the irrelevance may be explicable. But to evaluate that hypothesis, a further empirical research is necessary.

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Social Approach in Increasing Access to Safe Drinking Water and Sanitation to the Urban Poor: Lessons and Challenges from Nairobi City and Sewerage Company, Kenya.

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1. Abstract

Improvement and accessibility of water and sanitation services is a major concern globally. In Kenya, most of the urban poor cannot afford the initial required fee for piped water connection. Against this background, in 2011, the Kenyan government received $300 million credit from the World Bank's International Development Association (IDA) to increase access to water and sanitation services in fast-growing cities and towns in Kenya under the Water and Sanitation Services Improvement Project – Additional Financing (WASSIP - AF). As a result, a social connections program with an innovative micro – financing model of improving access to affordable drinking water and sewerage services among the low income people was initiated. A social connections program allows households to access micro-credit for water connection, and to repay the loan in installments together with the monthly water bill. Averagely, the cost of connecting water to a household in Kenya is about KShs. 8,215 (about US $ 94). This amount is usually paid to Water Service Providers like Nairobi City Water and Sewerage Company (NCWSC). The initial capital includes a non-refundable commitment fee (US$ 29), deposit for water meter (US$ 29), and costs of piping and fittings (US$ 36). This explains why the majority of households opt to be served by water kiosks and boreholes, for which they pay up to ten times the tariff charged by NCWSC in other parts of the city. Most households rely on water sources more than 100 meters away. Moreover, due to the high initial connection costs, more often than not, some consumers illegally connect water resulting to a contribution to Non-Revenue Water. Besides reducing the cost of potable water to households, this initiative is bound to respond to Kenya's new constitutional demand that provides right to safe water and sanitation for all citizens, which means water and sanitation service providers, must also focus on underserved communities.

This research paper examines the gains made by the social approach in increasing water and sanitation services among the urban poor in Nairobi, Kenya, lessons learned, challenges arising and proposes recommendations for scaling up in other urban areas for other future interventions.

2. Background

Unplanned low income settlements and informal settlements typify most African Urban areas. These settlements are characterized with high population that is synonymous with low income levels, low and poor service coverage and deficient or inefficient urban planned infrastructures.

Provision of water and sewerage services in these informal settlements is largely dependent on mostly unregulated private water service providers who impose exorbitant charges leading to further marginalization of the urban poor. Bakker (2010) postulates that in many cities across Africa, reliable access to a networked water supply remains extremely limited. Moreover, the few who can draw from municipal supplies cannot completely rely on these sources for all their needs due to intermittent supplies, and instead turn to informal alternatives such as water vendors and illegal connections to make up the difference.

Provision of water and sewerage services to low income urban areas has been largely challenging in Sub- Saharan Africa. WHO/UNCEF (2012) observes that over 40% of all the people globally who lack access to drinking water live in Sub- Saharan Africa. Most governments, local authorities and water utilities in this region are either unable to cope with rapid urban growth that result to flourishing and sprawling informal settlements. This situation is even more exacerbated by the inability of water and sewerage services' utilities to maintain existing infrastructure in the informal settlements mainly due to high operational costs that cannot be sustained by revenue collected from services rendered. Africa Ministers Council on Water (AMCOW) (2011) acknowledges that water tariffs are insufficient to cover the operating cost of most utilities. This in effect, undermines the network expansion. The water and sanitation infrastructure of many cities in Africa is therefore stressed beyond their capacity and infrastructure investments have not kept pace with the rapid urban population growth. Against all these odds, the economies within Africa remain focused on achieving the Millennium Development Goal target no 7 C which envisages halving, by 2015, the proportion of the world population living without sustainable access to safe drinking water and basic sanitation.

3. Contextualizing Research Problem in Nairobi City and Nairobi City Water and Sewerage Company

Nairobi with an estimated population of 4.5 million people at night and 6 million during the day is the largest city and the capital town of republic of Kenya. Population growth coupled with a rising demand of labour force in both formal and informal sectors has led to proliferating of informal settlements within the city. Kenya's annual informal settlements growth rate of 5% is the highest in the world and it is likely to double in the next 30 years if positive intervention measures are not put in place (UNDP, 2007). Affordable Housing Institute (2005) observes that, Kibera, which is among the nine informal settlements that blemish Nairobi city is the largest

urban informal settlement in Africa. The other eight large informal settlements are Soweto, Riruta, Kawangware, Mathare, Githurai, Korogocho, Murugo/Ngumba and Uthiru as shown in the map below.



Fig. 1: Location of various settlements in Nairobi

Source Gerheim (2007): Map of Kenya indicating informal settlement in Nairobi

According to the 2009 government of Kenya population census, it is estimated that 60% of Nairobi City population live in informal settlements. This translates to an estimated population figure of 2.7 million people. Most of these settlements suffer from constraint water and sewerage services with a majority of household sourcing water from private water suppliers/vendors with limited or no access to sanitation facilities despite the fact that the Kenya Constitution, under article 43 on the bill of rights, holds that provision of water services in adequate quantities is a right. The Kenya government commitment to realize this is outlined in its current economic blue print, the Vision 2030, whose social pillar promulgates the

government's aspiration to ensuring improved and increased accessibility to both safe water and sanitation services beyond present levels to all by the year 2030.

Administratively, Nairobi city falls under the jurisdiction of County Government of Nairobi. In line with newly established devolved governance system and constitutional requirements, provision of water and sewerage services is a function of the county government. Besides this constitutional requirement, water and sewerage services operations in Kenya are currently anchored in Water Act 2002 which provides for separation of water management from provision of water services. The diagram below illustrates the current water sector institutions as envisaged in the water act 2002[i]

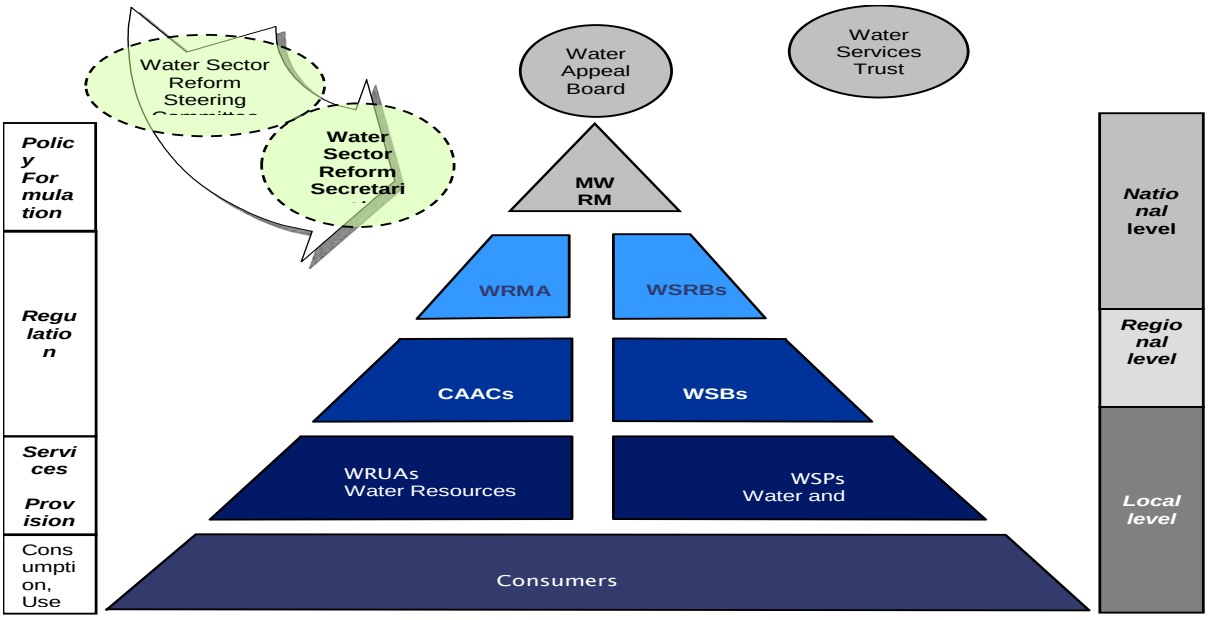


Fig. 2: Kenyan Water Institutional Framework as per Water Act, 2002

Nairobi City Water and Sewerage Company is owned by the County Government of Nairobi but operates autonomously with revenue collected from water and sewerage services rendered, exclusively ring-fenced for maintaining and expanding service provision. Further, the Water Act provides for the establishment of a licensee and a regulator who require Water Service Providers (WSPs) like NCWSC to fulfill certain minimum requirements aimed at improving service delivery. Among these requirements is the progressive extension of water services in the informal settlements. However, right to water and sewerage services is not simply a matter of writing the appropriate laws and policies. It is also necessary to implement such laws and policies effectively.

NCWSC, with support from World Bank and Non-Governmental Organizations, has embarked on an ambitious set of participatory initiatives aiming to improve the depressing state of water and sewerage access in the informal settlements within the city of Nairobi .

3.1 Rationale of Nairobi City Water and Sewerage Company's Social Connection Policy

The constitution of Kenya article 43(b) holds that "Every person has the right to safe drinking water". In response to this constitutional requirement, Nairobi City Water and Sewerage Company developed a social connection policy to enhance water and sewerage services in the Informal settlements and low income areas within its area of jurisdiction. This policy focuses on improving access to clean safe and in adequate quantities at household level in informal settlements and finds anchorage on five objectives namely:-

1. Increase access of affordable water to the poor
2. Increase Nairobi City Water and Sewerage Customer base
3. Reduce Non- Revenue Water
4. Improve environmental sanitation and hygiene
5. Increase revenue collection

The implementation of the policy provides for subsidized 'first time' water and sewerage connections for the people living in the informal settlements. A first time connection subsidy is preferable to a tariff subsidy because the latter would only be beneficial to people who are already connected, and not the poor. In addition, a first time connection subsidy is one-time, while the recurrent funding requirements of a tariff subsidy can become a strain on utility operations.

The current initial connection financial capital requirements for domestic water is KShs. 2,500 (US$ 29) non – refundable survey fee and similar non refundable amount for sewer connection where applicable; meter deposit of US$ 29 which is refundable. It should be noted that these rates do not reflect the entire cost of connection since customers make their own arrangement for purchasing pipes and fittings for connecting to NCWSC's network. Therefore initial water and sewerage connection fee is a bottleneck for the poor to access the services. The table below shows the effect of connection fee on low income households compared to other households.

Relative Income Level	**Area within Nairobi**	**Average Monthly Income (KShs.)**	**Equivalent Average Monthly Income in US$**	**Water Connection fee (US$ 29) as % of monthly Income**	**Water and Sewerage Connection fee (US$ 58) as % of monthly income**
Very low income	Huruma	5,000	58	50	100
Low Income	Umoja	30,000	345	8	16
Middle Income	South C	150,000	1,724	1.7	3.4
High Income	Lavington	500,000	5,747	0.5	1

Source: Social Connection Policy for Nairobi Informal Settlement (2011)

Despite the a foregoing, NCWSC's tariffs are not only the cheapest in the region but also very affordable especially when compared to the cost of water purchased from private water vendors. For instance, the average cost of one meter cubic of water sourced from water vendors is KShs. 250 or 2.9 US$ compared to KShs. 15 or US$ 0.17 and KShs. 18.71 or US$ 0.215 for NCWSC's charges for water kiosk operators and domestic consumers respectively. However, due to low water network coverage in the informal settlements in Nairobi, most people source their water from the private vendors where they pay more than ten times the tariff rate. Indeed according to Osinde (2007) the per capita coverage in Nairobi's Informal settlement is very low and the demand outstrips supply. The utility supply to informal settlement is very limited and where it exists there is no adequate supply available as piped water is supplied based on equitable distribution programme.

The social connection policy addresses these constraints and took measures to ensure that water and sewerage services are available and affordable in Nairobi informal settlements and low income areas.

To ensure the availability of funds for actualization of the policy, the company puts a side 0.5% of its monthly water collected revenue into the informal settlement social connection fund account. The social connection fund subsidizes 'first- time' connections for households, kiosks and water yard points serving the poor living in the informal settlements. The fund is also used for infrastructure development in the informal settlement. In addition, NCWSC, in partnership with a microfinance bank, K-rep Bank, has put in place credit facilities which enables residents living in informal settlements and low income areas to gain access to services. With the funds provided, the beneficiaries are able to meet water and sewerage initial capital connection fee and thereafter make repayments in installments while paying their monthly bills.

3.2 Case Study: Improving Water Access in Kayole Soweto (*Maji Mashinani* Project)

Kayole Soweto Settlement which is situated in Embakasi Division, Eastern part of Nairobi was created by transfer of poor people who illegally lived in City Centre occupying parcels of land owned by the then City Council of Nairobi. The landlords have allotment letters given by the defunct Nairobi City Council now the County Government of Nairobi, hence issues of land tenure does not arise. Administratively, the settlement is divided into nine zones namely; Muthaiga, Central, Shauri Yako, Bahati, Muoroto, Kibagare, Gitau, Muungano, and Mzesa. Each zone has a village elder who oversees the general administration on behalf of the community, the Chief and the Assistant Chief. The population of these settlements is over 90,000 distributed in 2200 plots, each with an average of five households.

Under connection policy, the consumers of Kayole Soweto settlements are being connected to the network, and the cost recovered over an agreed period of time as part of the monthly bill.

The financing of social connection costs are made through a loan arrangement with K-Rep bank, a microfinance bank working with Global Partnership on Output Based Aid (GPOBA) to provide subsidy. The loan is used to pay for all connection costs, install household connections to qualified individuals on credit who have paid 20% (KShs. 1,643 or US$ 19) commitment fee. Upon completion of the connection and evaluation of outputs, the OBA (Output Based Aid) subsidy is released to reduce the high cost of water connections to the informal settlement residents.

The company continues to extend services to the informal settlement and other low income areas as an obligation to service delivery to all. Adaption of use of new products, technology and solutions to improve on efficient and effective service delivery such as Maji Voice, Pre-paid

Token Meter dispensers and Jisomee (self-reading) meter products have been brought on board. The latest of these is the *jisomee* meters that was introduced in the field in June 2014 and by end of July 2014, an average of 260 or 43% of the 603 households that have been enrolled in the product were giving credible self- meter readings. This shows an impressive uptake of such initiatives.

3.3 Financing Mechanisms of the Social Connection Policy

The financing of social connection fee in informal settlement is funded through a loan arrangement with K- Rep Bank under the bank's special product *Maji ni Maisha* (***Swahili phrase meaning water is life)*** loan program. Under this arrangement, prospective customers from informal settlement pay an upfront connection fee of ksh 1,643 or US$ 19 per household as 20% equity contribution, while the balance is funded by the loan and subsidy. Nairobi city and Water Company enters into the loan agreement with *K – Rep* Bank on behalf of the customers at a negotiated interest rate and recovers loan repayment installments through its billing systems spread over 60 months. The table below illustrates the total amount required per household connection, total connections actualized in the project and the total amount ploughed into the project both through loaning and equity contribution.

Project Summary		
Item	**Cost (Kes)**	**Notes**
No. of connections	2,200	*No. of plots connected*
Connection cost per HH	8,215	*NCWSC connection fee +Meter deposit + pipes and fittings*
Total connection fee payable by consumer group	18,073,000	
Financed by:		
Customer payment up-front	3,614,600	*Equal to Kes 1,643 per HH as 20% Equity*
K-Rep bank loan:		
Principal	14,458,400	*Loan finance under the Maji ni Maisha program*
Interest	2,490,760	*Capitalized at 16% rate of interest p.a.*
OBA Subsidy	8,225,504	
Monthly fee payable per HH to achieve break-even sales over 5-year loan period	66	*Resulting amount payable by HH per month over 5-year loan repayment period*

Table 2: Total Connections Achieved, Equity and Loans to Kayole Social Connection Project

3.4 Project Impact

With an estimated population of 90,000 people, Kayole Soweto residents before the initiation of the project sourced water from vendors and privately owned boreholes within the informal settlement. Residents are now able to access quality water as opposed either lack of or borehole water which is of questionable quality.

The average price of a 20-litre container was ksh 5. However, due to the price inelastic demand nature of the commodity, the price of similar quantity at times shoots to up to even ten times during the times of scarcity. With an average daily consumption of 200 litres of water per day per household, the average daily expenditure per day is ksh 50 translating to an average expenditure of ksh 1,500 on assumption that all other factors (e.g water scarcity) remain constant.

By enabling low- income households to afford the upfront costs of water connections through credit facilities and a subsidized 'first time' connection, the project envisages 100% connection to all 3,000 household within the area by 2018. Since the projects inception in 2011, Nairobi Water and Sewerage Company has laid a total of 27 km of water service line, tapping 2,070 connections which translates to 94% of the targeted 2,200 household units by 2013. Basing on the average water billed volume per household; averagely the monthly expenditure on water per household is ksh 400. This implies that, each household has a potential of saving ksh 1,100 per month, an equivalent of US $ 12.5.

Besides the monetary savings realized, residents save time since water services are within the informal settlement. On the other hand, the company's revenue has increased with an average of ksh 808,000 per month translating an average annual increase of ksh 9.7 million (US$ 112,745).

An average the 2,070 connected household are supplied with an average monthly supply of 23,110 M3 and billed for, monthly average of 21,500. This has resulted in a low Non-Revenue Water index of about 7%. The average monthly billing for the 2,070 connected residents show that on average each household consumes 10.4 M3 per monthly which is within the minimum threshold for domestic consumers. Furthermore, incidents of water conflicts that were prevalent due to scarcity of privately owned water kiosks are hardly witnessed or not witnessed at all, since residents draws water within the proximity of the house.

4. Challenges

Achieving sustainable delivery of safe water and sewerage services in urban areas in developing countries like Kenya is a huge task. Fast growing population quickly outstrips the available infrastructure. To balance the population growth with expansion of the capital intensive water and sewerage appurtenances within and without the informal settlements is indeed a daunting endeavor. The situation is even more exacerbated by strained volumes of water resources in the country. The United Nations classifies Kenya as a water scarce country with annual renewable fresh water per capita at 647 cubic meters against the United Nation's recommended minimum of 1,000 cubic meters.

5. Conclusion

In the context of expanding urbanization, rapid growth of informal settlements are rising level of urban poverty. It is essential that water and sewerage utilities develop cohesive policies for water and sewerage services in the informal settlements with the beneficiaries. Commitment of utilities working together with informal settlement communities and a clear demonstration of how the policies impact on their lives, produces vibrant programmes of work that reap results. The case demonstrated above which addresses the initial capital costs hurdles can be replicated in other informal settlements in Nairobi or any other parts of Kenya or indeed worldwide with some customization.

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[i] Kenyan Water and Sanitation legal and institutional frameworks are currently being reviewed in line with the two levels of government (National and County).

WATER SCARCITY AND WOMEN'S FOOD PROVISIONING WORK IN IBADAN, NIGERIA

OLUFEMI, Olusola, Canada

OJO, Olajide, Nigeria

ABSTRACT

Women's food provisioning work within and outside the home is threatened by water scarcity. Women's triple role (productive, reproductive and community managers) revolves around water availability and accessibility. Women are involved in reproductive and productive work pertaining to food procurement, processing, preparation, distribution and serving in the public and private spheres. Water scarcity seemingly relates to availability (quality and quantity), accessibility (economic, physical, affordability, cost, and distance) and agency (institutional capacity). Women in Ibadan, Nigeria are guided by three R's when using water: *reduce use, ration use and recycle used water*. This paper develops a preliminary understanding of water scarcity challenges among women in the city.The paper contends water scarcity threatens women's food provisioning work, livelihood and food security. The paper adopts the concept of ecofeminism/ethic of care to explain women's experiences. It suggests capacity building of women and local actors involved in water provision, regulatory guidelines for sinking of wells and boreholes and a multi-agency collaboration to improving water supply and distribution.

INTRODUCTION

Women as water users and livelihood managers are disproportionately affected by water depletion and scarcity. Water scarcity is the lack of access to adequate quantities of water for human and environmental uses (White, 2012). The human right to water indicates everyone is entitled to sufficient, safe, acceptable, physically accessible and affordable water for personal and domestic use. These five core attributes represent the foundations for water security yet they are widely violated (UNDP, 2006). It is estimated that by 2025, 2.7 billion people will face water scarcity (UN, 2003). Presently, 748 million people are water insecure out of which 173 million rely on untreated surface water. If current trends continue, there will still be 547 million people without an improved drinking water supply in 2015 (WHO/UNICEF, 2014). Inspite of the progress made regarding the Millennium Development Goal (MDG) drinking water target, 43% of people living in Sub-Saharan Africa still use unimproved drinking water sources[i] (WHO, 2014). The roots of the water crisis can be traced to poverty, inequality and unequal power relationships, uneven distribution and flawed water management policies that exacerbate scarcity (UNDP, 2006).

In developing countries like Nigeria women are responsible for supplying water for the household and agricultural activities of their families and communities as a result of traditional gender roles. Women live day-to-day with water anxiety and stress of water scarcity. Access to safe and clean water remains the Achilles' heel for majority of women in their efforts to be water and food secure. "From fetus to birth, from bucket to basin, from field to table, from socio-cultural through corporeal to material domains, women's water security has never been more profound and their water burden continues to impact on their livelihoods" (Olufemi, 2008; 2013: 91). Nigeria is one of the 25 African countries that will experience economic water scarcity by 2025 (UNEP, 2000). Presently about 48% of the inhabitants of the urban and semi-urban areas and 39% of rural areas have access to potable water in Nigeria. Poor planning, inadequate

funding, insufficient relevant manpower, haphazard implementation, and lack of a national policy for water supply are all factors contributing to water scarcity in Nigeria (Federal Republic of Nigeria, 2000). Ibadan residents experience serious water supply problems such as dry taps in virtually every part of the City and children and women searching for water is rife (Adetunji and Odetokun, 2011). About 9.4% of the Ibadan city population depends on pipe-borne water, 20.5% on boreholes, 41.4% on wells, 22.9% on streams and 5.8% on springs (DMS, 2010).

This paper argues water scarcity is a threat to women's food work and livelihood in Ibadan, Nigeria. It argues men and women are positioned differently in caring practices that relate to water scarcity and food work. The paper adopts ecofeminism and ethic of care as a conceptual framework and suggests inclusion of women in water management and decision-making, and the use of low cost water technologies in water scarce communities.

CONCEPTUAL FRAMEWORK

Water scarcity is "the point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully" (UN-Water, 2006:2). Robbins, Hintz and Moore (2010) identified three different kinds of scarcity namely hydrological, techno-economic and perceptual. Water scarcity could also be dynamic, absolute, relative, a social construct or manufactured (Robbins, Hintz and Moore, 2010; UNDP, 2006; UN-Water, 2006). Water scarcity concept (FAO, 2006) is ambiguous and complex as it implies several dimensions namely:

- Scarcity in availability of freshwater in acceptable quality;
- Scarcity in access to water services;
- Scarcity due to lack of adequate infrastructure.

The Millennium Development Goal in 2000 (Table 1) aimed to halve the proportion of people without sustainable access to safe drinking water and basic sanitation between 1990 and 2015. Inspite of the progress made regarding the Millennium Development Goal (MDG) drinking water target, 43% of people living in Sub-Saharan Africa still use unimproved drinking water sources (WHO, 2014)**.**

Table 1: Water Access in the MDG

- **MDG 1**: Access to water for domestic and productive uses (agriculture, industry, and other economic activities) has a direct impact on poverty and food security.
- **MDG 2**: Incidence of catastrophic but often recurrent events, such as droughts, interrupts educational attainment.
- **MDG 3**: Access to water, in particular in conditions of scarce resources, has important gender related implications, which affects the social and economic capital of women in terms of leadership, earnings and networking opportunities.
- **MDGs 4 and 5**: Equitable, reliable water resources management programs reduce poor people's vulnerability to shocks, which in turn gives them more secure and fruitful livelihoods to draw upon in caring for their children.

- **MDG 6**: Access to water, and improved water and wastewater management in human settlements, reduce transmission risks of mosquito-borne illnesses, such as malaria and dengue fever.
- **MDG 7**: Adequate treatment of wastewater contributes to less pressure on freshwater resources, helping to protect human and environmental health.
- **MDG 8**: Water scarcity increasingly calls for strengthened international cooperation in the fields of technologies for enhanced water productivity, financing opportunities, and an improved environment to share the benefits of scarce water management.

Source: UN-Water, 2014; WHO/UNICEF, 2013.

Water scarcity has driven people to rely on alternatives and unimproved water sources. Access to water is a problem in Ibadan as well as several other urban cities and towns in Nigeria. The resolve to using locally manufactured bottled or sachet water such as Eva, Nestle, Pure water, or Dana is increasing. The existential well-being of humans is threatened when there is water scarcity. Physical water shortage, institutional failure and lack of institutional capacity are observable in Ibadan city and most Nigerian communities.

Ethic of Care

Women's environmental ethic of care seemingly is to protect and preserve environmental resources. Women's inputs and actions are recognisable on issues relating to biodiversity, climate change, environmental sustainability, environmental injustice, depletion and degradation of water resources, poisoning and pollution of water bodies. Women's familial role and food work involves using water for domestic, economic, cultural, spiritual, agricultural, industrial and commercial purposes.

Ecofeminists focus on women's relationships with nature, the connections between the domination of women and the domination of nature, and the role of women in solving ecological problems (Sachs, 1997). Ecofeminism implies "the ideologies that authorize injustices based on gender, race and class are related to the ideologies that sanction the exploitation and degradation of the environment" (Sturgeon, 1997:25). Ecofeminism tends to "essentialize nature itself and consider nature to encompass all ecological aspects of the environment as well as natural (biological) human needs and capacities" (Momsen, 2004:111). Ecofeminism focuses on the role of patriarchal society for degrading both the natural environment and the social condition of women (Robbins, Hintz and Moore (2010).

The relationship between women and the environment has often been echoed in the cliché Mother Earth or Mother Nature and this has often given women an added responsibility to *care* for the environment and its resources which includes water. Care-focused feminism is a branch of feminist thought, informed primarily by ethics of care developed by Carol Gilligan and Nel Noddings is critical of how caring is socially engendered to women and consequently devalued. Care-focused feminists regard women's capacity for care as a human strength which can and should be taught to and expected of men as well as women (Tong, 2009).

Women are diverse, and some men exhibit equally strong tendencies to care, it is not readily apparent that care ethics is solely or uniquely feminine. Care ethicists agree that women are positioned differently than men in relation to caring practices, but there is no clear consensus about the best way to theorize sex and gender in care ethics (Sander-Staudt, 2006). Held identifies Sara Ruddick as the original pioneer of the theory of care ethics. Ruddick's (1980)

article “Maternal Thinking” was the first articulation of a distinctly feminine approach to ethics. Ruddick (1989) uses care ethical methodology to theorize from the lived experience of mothering, rendering a unique approach to moral reasoning and a ground for a feminist politics of peace. Ruddick explains how the practices of “maternal persons” (who may be men or women), exhibit cognitive capacities or conceptions of virtue with larger moral relevance. Ruddick’s analysis, which forges strong associations between care ethics and motherhood, has been both well-received and controversial (Sander-Staudt, 2006).

Care is “a form of labor, but also an ideal that guides normative judgment and action, and she characterizes care as clusters of practices and values” (Held, 2006:36, 40). Women develop an ethic of care, a morality of care and responsibility, whereas men develop a morality of right (McCullough, 2010). Gilligan, (1982:164) notes “…the ethic of responsibility relies on the concept of equity, the recognition of differences of need”. The ethics of care has developed as an influential feminist approach to moral issues...it especially values carrying relations between persons and social contexts (HCWSC, 2005:73).

Women have the virtue, competence and responsibility to ‘care’ because of the gendered assigned roles and their feminine nature of mothering or maternal instinct. Care as labour is evident as women interviewed in Ibadan respond to the need and demand for water in their productive and reproductive work. Water-providing role has long been engendered and associated with women and girls in different social locations and many cultural settings. The next section discusses the findings from the case study.

CASE STUDY

With urbanization, increasing population, and sprawling communities in Nigeria (170million people; 36 States, 774 local government areas), water recycling, rationing and sharing continues unabated among women. Women resort to acquiring water from unimproved sources such as unprotected wells, burst pipes and stagnant puddles of rain water along the road (in potholes). Wells, boreholes, local streams and rivers are unsafe because of their proximity to septic tanks. Ponds, rivers and streams double up as commercial (car wash), domestic (drinking, cooking and laundry) and personal hygiene (bathing, toileting) spaces. Consumption of untreated water results in schistosomiasis, onchocerciasis, diarrhoea, and gastrointestinal illness. Other water borne diseases are cholera and typhoid fever.

Ibadan, the case study, is located approximately 128km north east of Lagos and 530km Southwest of Abuja, Nigeria’s capital city. Ibadan, the capital of Oyo State, Nigeria and it has 11 local government areas (Figures 1&2). Study locations include twenty one purposefully selected areas that span three local government areas namely Ido, Ibadan North and Ibadan North West with a population of about 562,890(Figures 3&4). Less than 30% of the population have access to safe and clean water supply in Ibadan. Water supply is inadequate in terms of quantity and quality; and unevenly and ineffectively distributed. Access to safe and clean water eludes most women and the physical, emotional, economic toll of water scarcity is unquantifiable.

This pilot study adopts a qualitative design approach. Qualitative interviews (face-to-face interviews) and observations were used to obtain information and data for this study. An interview protocol was designed and administered among 50 women in these locations. Most of these women work in the informal sector and live in a patriarchal hegemonic cultural setting. The intent of the qualitative research is to understand the water scarcity situation as it impacts on women’s food work and livelihood in the private and public spheres. This includes reproductive and productive work relating to food production, procurement, processing,

provision, and distribution. Data was collected in April/May, 2014 and computer was used to analyse the data obtained using frequency tables and GIS to do a spatial analysis.

Figure 1: Locational context of Ibadan, Oyo state, Nigeria

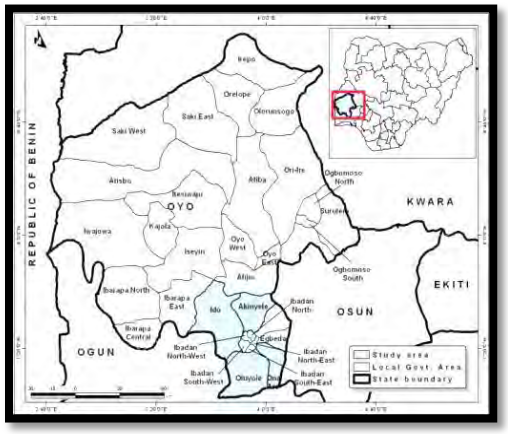
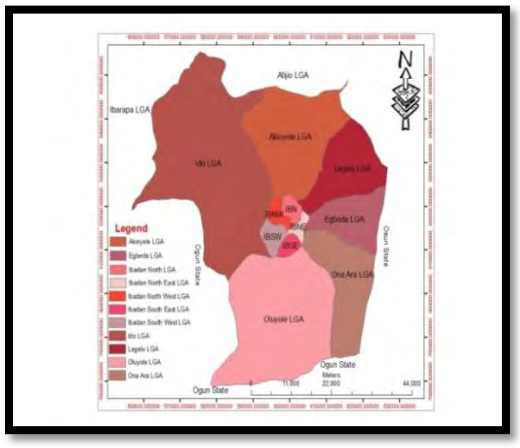
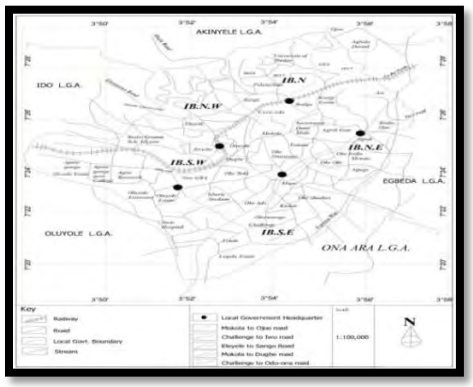


Figure 2: Ibadan region



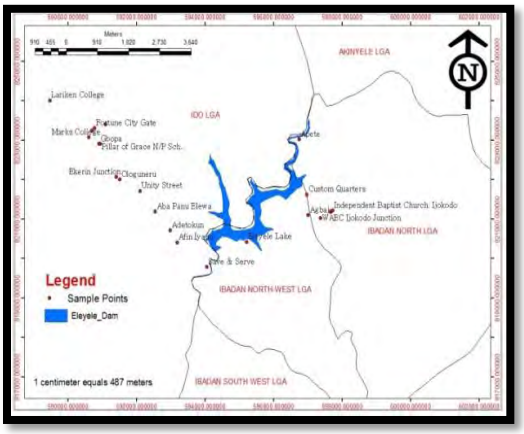
Source: Authors' Fieldwork

Figure 3: Ibadan Metropolitan Area



Source: Authors' Fieldwork

Figure 4: Locational map of study area



Source: Authors' Fieldwork

Eleyele River and Waterworks are located in the study area. The Water Corporation of Oyo State is responsible for maintaining the Eleyele water works which supposedly supplements Asejire waterworks/dam (located in the outskirts of Ibadan) in processing, treating and distributing potable water to Ibadan city and its environs. Ironically, most household taps in the study area have remained dry for years while government policy claims potable water provision to the citizenry.

A respondent indicates:

> "…presently treated water is limited and the available water is pumped directly to the city centre where residents enjoy occasional water supply".

It is not uncommon to find collaborative projects by the State government and International agencies that provide water through boreholes as part of the MDG initiative (Photo 1).

Photo 1: MDG Borehole in the study area



Source: Authors' Fieldwork

These projects are perceived by residents as a fire brigade approach to adequate water supply in the study area because the boreholes cease to function after the commissioning day. There is a Public Private Partnership effort supported by World Bank to supply potable water in the study area (Photo 2). The Oyo state government provided the facility while it was being managed by the host community and the residents pay a token to procure potable water.

Photo 2: World Bank Water Project in the study area



Source: Authors' Fieldwork

FINDINGS

About 60% of the women interviewed were between 16 and 45 years old while 12% were below 15 years old. 64% of the women have a tertiary (diploma, undergraduate or postgraduate) level of education while about 16% and 20% have only elementary and secondary education respectively. 28% of the women were students (in high school or college), 36% were traders in the informal sector (Table 2).

Table 2: Profile of Women in Ibadan

Age	**Number**	**Percentage**
<15	6	12
16-30	14	28
31-45	16	32
46-60	14	28
Total	50	100
Educational level	**Number**	**Percentage**
Primary School (Elementary)	8	16
Secondary school (High school)	10	20
Ordinary National Diploma (OND)/NCE	17	34
Higher National Diploma (HND)/BSc./BA	8	16
Post graduate	7	14
Total	50	100
Occupation type	**Number**	**Percentage**
Civil servant	9	18

Teaching	9	18
Trading	18	36
Student	14	28
Total	50	100
***Income in Naira (₦) per month**	**Number**	**Percentage**
No income	14	28
≤ ₦30000	11	22
₦30001- ₦60000	18	36
₦60001- ₦90000	4	8
₦90001- ₦120000	3	6
Total	50	100

*US$1= ₦162 [₦30000 (US$185) and ₦120000 (US$740)] (April, 2014).

Source: Authors' fieldwork, 2014.

Women traders include grinders (women who grind pepper, beans, and other food items; Photo 3); small scale food entrepreneurs; those who work in restaurant/canteen or Bukaterias-'Buka' (Photo 4); bean cake sellers('Àkàrà'); grocery or provision sellers and cassava flour ('Gàrí'-processed cassava) producers. 18% of the women were civil servants and another 18% were teachers. In regards to monthly income 28% of the women have no income (the students), 58% earn about ₦60000 (US$370) or less, 8% earn above between ₦60001 and ₦90000 (US$555), and 6% earn above ₦90000 per month. About 60% of the women were married with an average of three children each.

Photo 3: A Woman Grinder at work



Source: Authors' Fieldwork

Photo 4: A Roadside Buka/Food Canteen



Source: Olufemi, 2013

Water provision

Water is provided by individuals (86%), neighbours (6%) and private water tankers/vendors (8%). 82% and 14% of the women rely on wells and boreholes respectively while only 4% rely on government for water supply. Neighbours are residents who sometimes locate free borehole water point outside their property where women and children fetch water for free (Photo 5). Women meet with disappointment when the water house owner fails to pump water due to erratic power supply.

Photo 5: Borehole water point outside a house



Source: Authors' Fieldwork

92% travel a distance of less than 100m to access water while 8% travel more than 150 metres. Women travel less distance to fetch water in this urban community. This is an indication of improved water provision through self-reliance and less dependence on government. Water supply through the government is seemingly non-existent. It should be noted that distance traveled to access water and women's experience is different in rural areas; it could be more than 2 km of trekking one way to water sources.

Women's experience cannot be generalised regarding time spent obtaining water. While 4% of the women effortlessly turn on the tap where water is piped to the house from borehole or well about 96% of the women spend more than an hour to access water. Water points are located within the compound through a tap or manual water collection from the well; while other women go to neighbours houses or the neighbourhood to access water. Seemingly there is still better access now when citizens take it upon themselves to dig boreholes or wells compared to the last 10 or 20 years when citizens wait on government water services.

Water use and availability

Women use water for a myriad of activities both in private and public spheres. In the private sphere, women use water for reproductive activities like raising children (pregnancy, breastfeeding, weaning) ; laundry, household cleaning ; food and meal planning, cooking and serving food; drinking; washing dishes, personal hygiene, preparing children for school, packing lunches and gardening. In the public sphere, women use water for productive activities which include peri-urban and backyard farming or community gardening, community food activities (wedding, funerals, festivals or other cultural engagements) (Photo 6); food processing, preparation and provisioning. Women's use of water in the private and public spheres overlaps. Women's triple role (productive, reproductive and community managers) revolves around water availability and accessibility.

Photo 6: Women involved in Community Food Work



Source: Olufemi, 2013

Water utilization depends on family size-number of children (families with young children, school-aged children use lots of water), number of wives. Water use increases with family size and frequency of cooking and domestic food work. Water utilization depends on the scale of food work especially the women who use water to process foodstuffs like cassava and those who use water in their restaurants or Bukas. About 56% of the women use less than 150litres of water daily while 44% use more than 150 litres of water daily. The 25 litres keg was used to ascertain approximated litres of water used, daily or weekly. Women are very conscious of the fact that water is relatively a scarce resource and this guides them in reducing, rationing and recycling water use for most domestic chores and food work.

When wells run dry or water is unfit for consumption especially during rainy season or when there is no electricity to pump water, faulty pumps, high maintenance costs etc. about 66% resolve to purchasing water from water vendors. The cost of buying water during these periods varies. About 36% and 26% of the women spend between ₦1000-₦3000 and above ₦3000 on water respectively while 38% of the women do not spend any money on water.

Except when there is not enough rain or flooding or during the dry season, individually sourced water is always available most of the time because most residents have wells or boreholes or rely on neighbour's wells and boreholes and women can access water through these channels.

WATER SCARCITY

Most women interviewed resort to alternative sources when there is water scarcity. About 20% of the women buy water, 42% rely on their neighbours, and 18% source water from the Church (Table 3). Women who obtain water from church (trek or take public transport) which is about 2km away from their residences. They obtain water free from the church; the only cost is the transport fare. Other measures taken during water scarcity include trekking long distances to get water, waiting long hours queuing for water where it is available, relying on rain water (during the rainy season) and putting money aside to buy water when it is scarce.

Table 3: Access during Water Scarcity

Water access	Number	Percentage
Always available	8	16
Buy water from water tankers/vendors	12	24
Neighbours	21	42
Church	9	18
Total	50	100

Source: Authors' fieldwork, 2014.

86% of the women interviewed indicate they often rely on rain water during water scarcity while 14% do so less often. During the dry season (November to March) it is not uncommon for the wells to dry up and this is usually a very testy period for water search on the part of women. Water quality is impacted during the rainy season (April to October) when water from some wells get muddy and women have to use alum to clear the muddiness.

From personal experience:

> "…Due to water scarcity three of us shared a bucket of water for our daily bath…During the dry season, when the stream ran dry, we struggled to save water used for washing clothes to flush toilet" (Olufemi, 2004:428).

There is also a correlation between water and fuel scarcity. When there is no electricity to pump water into storage tanks, or pump water from wells, most of the women interviewed expend a lot of money and energy to access water. Some of the women buy fuel (petrol or diesel) for their generators (if they have one) or draw water manually from these wells if depth is not very low. Due to the erratic nature of power supply there is a lot of time, cost and energy wasted by women to access water for food work inside and outside the home. In the study locations power supply is available for about 6 hours every two days and off for one day, this comes to approximately 30 hours of power supply every week.

Women queue long hours waiting to obtain fuel from the gas stations to power generators and in turn pump water from wells or boreholes during fuel scarcity. The cost of fuel increases during these times (market volatility). In some cases women contribute money to buy fuel for their generators to pump water. Cost is also expended on purchasing containers, drums and bowls to store water. There is both human and physical cost involved by women when accessing water during scarcity. Hidden costs during water scarcity include buying credit to make phone calls to neighbours to arrange to obtain water from their residence, spending extra money to purchase water, emotional and physical stress from walking and searching for water. Women exert their

sweat equity in the pursuit of obtaining enough and required water in the quantity and quality needed.

Work

In regards to the impact of water scarcity on women's productive work about 78% indicates stress from walking, fatigue, reduced productivity, limited assimilation at school, difficulty in reading, and lateness to work or school (Table 4). UN-Water/Africa (2006:122) report indicates "…The time spent fetching water results in low school attendance for girls, limited income-generating opportunity for women and increased levels of food insecurity". Searching for water during scarcity takes a lot of time away from other productive activities for women. An estimated 200 million hours are spent each day by women globally collecting water for domestic use and this is time not spent working at an income-generating job, caring for family members, or attending school (WHO, 2004; 2010). In Photos 7 and 8 children are drawing water from a well and women's early morning water run respectively.

Photo 7: Children fetching water from a well



Source: Authors' Fieldwork

Photo 8: Women carrying water



Source: Authors' Fieldwork

Table 4: Water Scarcity and Women's work

Work impact	Number	Percentage

Extra stress from walking	8	16
Difficulty in reading due to fatigue	8	16
Tired before work	2	4
Lateness	9	18
Reduced productivity	7	14
Tired and affects assimilation in the classroom	5	10
No impact	11	22
Total	50	100

Source: Authors' fieldwork, 2014.

14% of the women indicate water scarcity does not have any impact on food provisioning work while 86% indicate water scarcity has tremendous impact on their food provisioning work, for example, women who use water for processing and production of cassava flour "Gàrí" (Photo 9).

Photo 9: Women processing Cassava into Gàrí



Source: Authors' Fieldwork

Most women indicate water scarcity limits their food work. Due to lack of enough water available for cooking women have to ration water for food preparation, have limited water for cleaning up, reduction in food sales and multiple or re-use of water (recycling water for other uses) for other purposes like household cleaning, saving laundry or used dish water to clean drainages/gutters or flushing toilets among others. Reproductive and productive work is severely impacted when there is water scarcity. Families sometimes resolve to eating out and leaving some of the domestic chores undone until there is enough water to carry out these activities. Some household members seemingly patronise food vendors or street food hawkers and also buy bottled or sachet water to drink. The sachet water costs about ₦5 per sachet and it is easily accessible on the streets.

Excerpts from some of the women interviewed are seen below:

> "…I buy water about 40 litres of water at ₦20/25litres jerry can from a nearby commercial borehole. Sales are reduced when there is water shortage because of irregular power supply. When power is off water cannot be pumped, my business turnover is reduced, we had to rinse pepper (pepper, tomatoes, onions) once instead of twice" (A food grinder and married mother of four).

The married mother compromises the safety of her consumers by rinsing the pepper once. Most of the women reuse the same water severally during the course of the day to rinse peppers brought for grinding.

> "…When there is power cut I walk longer distance to get to where there is generator to pump water from borehole and the case is even worse when there is fuel scarcity, when I had to wait for longer hours on the queue for water. As a result I sometimes get late to school, tired and it affects my school work anytime I go in search for water" (11 year old Student).
>
> "…I spend a lot of money buying water from tankers, who supply us with water every week, but we had to ration water when the water tanker/vendor does not have water to sell to us. Water scarcity limits the amount of food we prepare for sale daily and our profit" (55 year old restaurant owner).

Farm productivity is also impacted when there is water scarcity and this subsequently affects the prices of produce when it gets to the market. Water scarcity sometimes increases the cost of food stuff (market women have to sell produce at high costs) and it also increases the cost of prepared food in restaurants or 'buka' (women are mostly involved in these food enterprises) and household food budget. When there is fuel scarcity, farmers spend more money transporting their produce to the market and the costs are added onto the price of food stuffs. Most women are triply impacted by water scarcity because they are small scale farmers, market traders/food entrepreneurs/Buka owners and wives/mothers.

Health

About 88% of the women indicate that water scarcity, search for water, carrying water on the heads or manually drawing water from wells impact on their health (Table 5). The women complained of fatigue, headache/pain and neck pain. About 60% of the women experience mental and physical stress very often from water scarcity.

Table 5: Water Scarcity and Women's Health

Health impact	Number	Percentage
Fatigue	22	44
Head ache/pain	16	32
Neck pain	6	12
No effect	6	12
Total	50	100

Source: Authors' fieldwork, 2014.

Carrying water in a large container on heads is more likely to have severe health implication to women and girls. The most common health problem is backache and headaches. Water scarcity presents with some water-borne illness among the women interviewed. About 46% of the women have experienced typhoid, 22% have experienced diarrhoea and cholera while 10% have experienced gastrointestinal illness (Table 6).

Table 6: Water-borne Illness experienced by Women

Type of Illness	Number	Percentage
Diarrhoea	11	22
Gastro intestinal	5	10

Cholera	11	22
Typhoid	23	46
Total	50	100

Source: Authors' fieldwork, 2014.

Water scarcity threatens women's food work and livelihood in relation to physical, economic and personal well-being in Ibadan and other water scarce communities. Water scarcity, in terms of economic (time and cost in obtaining water) or physical (not enough water) or environmental (natural phenomena, floods, drought) and/or artificial (human, institutional barriers, poor governance, lack of political will), affects all aspects of human development, particularly health and productivity of women in Ibadan.

IMPROVING WOMEN'S ACCESS TO WATER

The domesticity of women's labour in caring, nurturing, and providing existential sustenance in the private sphere through chores that involve water also extends to the market economy where women prepare food for sales (livelihood) in the market, Buka, streets or restaurants (public sphere). However, if the ethic of care is embedded and embodied in the feminine it is seemingly devaluing when in their food provisioning work women have to experience loss of productive time, energy, education and health due to water scarcity. Water scarcity in Ibadan and other communities is systemic problem induced by ineffective planning, poor governance, and inadequate infrastructure. Women linked water scarcity to government insensitivity, poor public policy and management.

Water scarcity as it relates to availability (quality and quantity), accessibility (economic, physical, affordability, cost, and distance) and agency (institutional capacity) threatens women's food work and consequently food security in water scarce regions and specifically in Ibadan. The water insecure are the food insecure. *Women in this study are guided by three R's when using water: reduce use, ration use and recycle used water*. Women's practical and strategic water needs can be met by easing their responsibility of care through:

- Sustainable water provision, availability and access
- Developing low cost water technologies
- Engaging women in decision-making issues relating to the use and availability of water for food provisioning work.
- Building capacity among women, local businesses, micro-enterprises and the informal food sector in water management to improve productivity.

To secure sustainable water for life and livelihoods and reduce the burden of women's food work in water scarce communities, planners should work with women and men to develop appropriate water management strategies to minimise unevenness and disparities associated with water scarcity; and promote equality and equity among the genders in water access. Planners should:

- Develop By-laws relating to land use, zoning or building code for location of boreholes and wells.
- Develop regulatory procedures that guide private or communal sinking of boreholes and wells.

- Revise and improve existing water management structures.
- Review and improve local water governance.
- Review planning and policy measures relating to spatial distribution of water.
- Collaboration with formal and informal networks, women's and homeowners' association/Landlord-Tenant associations, Faith based Organisations.
- Develop watershed planning and management guidelines.

The Local Governments (Agency) in the study area should:

- Provide communal water storage facilities.
- Provide testing points to ensure water safety.
- Facilitate rain water harvesting.
- Regulate truck and commercial water providers/vendors.
- Installation of solar powered treated well/boreholes by government, community development associations and individuals who can afford.
- Provide free or subsidized health intervention for women who present with water borne illnesses.

CONCLUSION

In Ibadan, women are more involved in care practices that relate to water scarcity because of their socially engendered roles. Cognisance has to be taken of the different needs and use of water by men and women as well as the care ethics of being a female. Women and men are positioned differently in caring and water scarcity impacts men and women differently. Seemingly it is the female moral duty, responsibility and obligation (due to biological and socially constructed gender roles) to care and nurture in the private and public spheres. Improved water access will reduce women's food work burden and women (and girls or their children) can spend the free time on other productive activities and have improved health and well-being.

The relationship of women with their environmental context as it relates to water scarcity and the moral responsibility of providing water to maintain the reproductive and productive work is unquestionable. In cities like Ibadan water scarcity is a threat to women's food work, and girl child's health in the public and private spheres. Water is essential for food work and food security. It becomes imperative to secure water and food sources sustainably and responsibly for existential survival and sustenance of future generations. The inability (natural, physical, economic) of all people to access safe, reliable, undisrupted water and food sources through appropriate and normal channels for life and livelihoods leads to insecurity. Since "*Women play a central role in providing, managing and safeguarding water"* (The Dublin Principle number 3, UN, 1992) *(italics, authors' emphasis),* it is imperative to develop water management and governance strategies to reduce the burden and risk women face in search of water.

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[i] **Improved** water sources include: piped household water, public standpipe, borehole, protected dug well, protected spring, rainwater collection; and **Unimproved** water sources include: unprotected dug wells, unprotected spring, surface water, vendor-provided water, tanker truck water.

Ways of integrating water and land management at the urban-rural interface

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Brief synopsis

Land use and water demands are characterized by dense interdependencies across the urban-rural interface. Joint research on Sustainable Land Management takes an integrative and trans-sectoral perspective, tackling these urban-rural linkages and bridging disciplinary boundaries. Several research projects provide examples for modes of integrative land and water management and hence for advancing planning instruments and governance approaches at the urban-rural interface.

Key words

land management, water governance, functional governance, land use conflicts

1 Background: Linkages of water management and land management

Water management is shaped by and evokes complex urban-rural interlinkages. In many cases, urban regions are reliant on the supply of drinking water by their rural surroundings in order to cover the own market. At the same time, waste water is transported from residential areas to rural surroundings due to the location of centralised wastewater treatment plants far from the city centres, the discharge of treated wastewater into surface water or the irrigation of agricultural land. Besides the interfaces of demand and supply, water basins do not take urban-rural boundaries into account, with the physical boundaries of water basins being hard to define. Recurrent flood events in Europe highlight the aspect of upstream and downstream riparian and point out the necessity of a large-scale approach, in particular.

Land use demands and resulting questions of sustainable land management are strongly connected to water supply and water management. On the one hand, water availability determines types, intensity and patterns of land use. On the other hand, housing development, agriculture and nature protection are main drivers influencing the quantity and quality of the resource water (Moss 2004, 87). Thus the interplay of water management with spatial planning, agricultural policy and environmental policy needs to be considered adequately. Integrated water management represents an approach that bears in mind large-scale interactions in an interdisciplinary and multi-level way. The adoption of the European Water Framework Directive (WFD) in 2000 advanced the integrated approach and emphasised the relevance of multi-level and cross-sectoral governance. Governance is employed here “as a collective term for new modes of governing which extend beyond hierarchical forms of control” (Moss 2004, 86). Further, “water governance refers to the range of political, social, economic and administrative systems that are in place to develop and

manage water resources, and the delivery of water services, at different levels of society" (Rogers and Hall, 2003, 7; according to the definition of the Global Water Partnership). Rogers and Hall specify that an "effective governance of water resources and water service delivery will require the combined commitment of government and various groups in civil society, particularly at local/community levels, as well as the private sector" (2003, 17). The WFD ought to be a good approach for effective governance, combining two different policy styles: 'command-and-control' and the interactive, negotiation based approach (Moss 2004, 89).

But at the same time, institutional challenges exist in implementing the WFD. Although water authorities tend to approve a more integrated approach of water management in general, not all are open to new forms of governance, e.g. "practising a pro-active communication policy with the affected parties" (Moss 2004, 92). Pahl-Wostl et al. point out that „many problems in water management are more associated with governance failures than with the resource base" (2010, 571). Moss identifies 'misfits' of water management and defines them as "mismatches abound between the geographical extent of an environmental resource and the territorial scope of the institutions affecting its use" (Moss 2012). Institutions are "systems of established and embedded social rules that structure social interactions" (Hodgson 2006, 18). Bakker at al. (2008) analyse 'governance failures' in water management. Thus, a misfit between territorial boundaries and functional interaction can be identified.

For handling misfits of water management, Moss stresses that "overlapping social, economic, political, and physical spaces […] requires paying less attention to the structure of an authority responsible for managing a river basin and far more to the interactions among the multiple organizations affecting water use within a basin" (2012). "Assessing the adaptability of existing institutions to pressures for change cannot be limited to determining straight fit or misfit. It entails, rather, identifying areas where fit or misfit exist, […], and exploring how the shifting context of an implementation process way contribute to increasing or reducing the scope for greater institutional fit." (Moss 2004, 93)

A further approach towards coping with current challenges of water management is to consider the adaptive capacity of management systems that determines the efficiency of governance: "Adaptive management is here defined as a systematic process for improving management policies and practices by systemic learning from the outcomes of implemented management strategies and by taking into account changes in external factors in a pro-active manner (Pahl-Wostl et al. 2010, 573). Huntjens et al. stress that "higher levels of policy learning lead to more advanced adaptation strategies" (2012, 75; cp. Huntjens 2011). Also Pahl-Wostl et al. emphasise the importance of learning in multi-actor settings (2010, 573; cp. Pahl-Wostl et al. 2007). Further, they accentuate context-dependent integrated solutions as a prerequisite for spatial and institutional fit (Pahl-Wostl et al. 2010, 572).

However, Moss (2012) refers to the growing body of literature that highlights "problems of poor collaboration between water and land-use planning". Research has so far mainly focused on sectoral aspects or on subspaces of governing water or land use, e.g. coastal areas, river catchment areas or flood management. Also, urban-rural interactions, though playing a crucial role for integrated regional supply chains, have been scarcely considered, as an analysis of concepts and instruments of regional development and spatial planning shows (Repp et al. 2012). The established dichotomic view of urban and rural seems to be one reason for that.

Against that background, the paper provides an analytical approach to a better understanding of problems in water management integrating other water-related objectives. For researching institutional settings, the analytical approach of fit, interplay and scale (Young 2002) is supplemented by the perspective of urban-rural interactions. The perspective on urban-rural linkages enables the integration of functional interactions that are necessary to cope with physical flows like water. The better understanding of flows and institutional settings bears potential to advance the discussion about functional governance as a promising approach for handling land use conflicts.

The second chapter will explain the analytical framework. Challenges for governance at the urban-rural interface are presented in chapter three. In chapter four, current challenges of water management are outlined. Building on that, innovative solutions on how to cope with governance gaps will be presented in chapter five, taking two case studies as an example. Finally, implications for governing urban-rural interactions are discussed in chapter six.

2 Analytical framework

The analytical framework of this paper refers to the approach of institutional fit, interplay and scale, as applied by Young (2002). He uses the framework to analyse environmental regimes and human-environment-interactions. Besides some weaknesses like the overlapping resp. incoherence of the three dimensions (cp. Vatn and Vedeld 2012), the approach allows for a systematic identification of institutional gaps as drivers for land use conflicts.

The dimension fit deals “with congruence or compatibility between ecosystems and institutional arrangements created to manage human activities affecting these systems.” (Young 2002, 20). In short, misfits (or mismatches) are incongruities between environmental problems and regimes. The dimension interplay refers to the cooperation of institutions. Young differentiates interplay between institutions (horizontal interplay) and among institutions operating at the same level (vertical interplay) (2002, 23). The third dimension, scale, describes the “level at which phenomena occur in the dimensions of space and time” (Young 2002, 26). Spatial scale regarding political science refers to the local, national, and international level. Temporal scale points out the time horizon of institutional processes.

Adopting the approach of Young for the paper’s purposes, it is specified by categories of governance, as they were employed by von Haaren and Moss (2011). The classification of categories of governance and the dimensions fit, interplay and scale is presented in Table 1. Although this classification might be ambiguous with regard to practical relevance (cp. Moss 2012; Vatn and Vedeld 2012), it proves helpful for the analytical discourse.

Table 1: Classification of analytical dimensions of governance (own source based on Young 2002; von Haaren and Moss 2011)

fit	interplay	scale
object	constellation of actors	scope of activity
aim orientation	modes of governance and instruments	time horizon
	institutional resources	

In order to qualify the analysis of institutional gaps with regard to the context of urban-rural interaction, the matrix is added by this perspective. Thus the urban-rural perspective is correlated with the classification presented in Table 1. Table 2 presents the final analytical framework and exemplifies the analysis. The dichotomy of the categories urban and rural is explicitly used in order to expose expected differences of water management in urban and rural areas. This helps to identify institutional gaps that are determined by the functionality of flows.

The analytical framework (cp. Table 2) will be tested by two case studies. The first case study, derived from the project ELaN, analyses water management in the German counties (*Bundesländer*) Berlin and Brandenburg. ELaN focusses on the stabilization of water balances in this metropolitan region due to technological innovations in water management combined with nutrient management. In particular, the reuse of treated wastewater is analysed. The second case study is situated in the Ruhr region and is part of the KuLaRuhr project. KuLaRuhr provides integrated solutions for the structural transformation of the region that was considerably shaped by the mining industry. One focus lies on the restoration of the Emscher river that was used mainly as an open sewer system for more than a century.

Both projects presented below are part of the German funding measure “Sustainable Land Management”, financed by the German Federal Ministry of Education and Research (BMBF 2008). The funding measure comprises 13 joint projects within Module B, working on the development of innovative system solutions for sustainable land management in different regions in Germany. “Land” within the context of the funding measure calls for a broader understanding besides the meaning of soil and land area. According to Davy (2010, 89f.) the subject matter comprises land as territorial value, use value, existence value and exchange value. Due to the high variety of involved actors and complex interactions one main aspect of research refers to handling complexity by inter- and transdisciplinary methods (cp. Klein et al. 2001). Public actors, companies or civil society actors are seen as starting points, nuclei, and development partners for the implementation of sustainable solutions in land management.

The projects are ongoing, with final results being expected in 2015.

Table 2: The analytical framework of fit, interplay and scale within the context of urban-rural interactions (own source)

fit		**interplay**		**scale**	
object		**constellation of actors**		**scope of activity**	
urban: drinking water, environmental services of water resources	rural: drinking water, environmental services; water-related products like wood and food	urban: urban policy and administration; engineers (waterworks)	rural: local land owners; regional policies; EU agriculture, environment and rural development policy; WFD; associations (lobby groups)	urban: administrative units	rural: administrative and functional units; from county level to local level up to site scale

aim orientation		**modes of governance and instruments**		**time horizon**	
urban: sanitary environmental engineering services for the public; flood protection; recreation; transport	rural: water protection, balance of water, supply of drinking water; securing food and wood production; flood protection; recreation; transport	urban: EU regulations and urban statutes, compulsory connection; cost recovery	rural: financial incentives and compensations; EU-regulations	urban: long-term investments in technical infrastructure	rural: long-term timetables of WFD and FD; annual decisions on agricultural production
		institutional resources			
		urban: sanitary environmental engineering mostly cost recovery	rural: diversity of stakeholders with different, sometimes competing resources: strong agricultural lobby vs. nature protection with less financial resources		

3 Challenges for governance at the urban-rural interface

The pronounced intensity of challenges related to land and water at the urban-rural interface has been exemplified above. The question remains what these challenges arise from and how they can be adequately addressed. For that purpose, we first intend to provide a brief clarification of the nature of urban-rural linkages and what they are constituted of.

However, a clear definition of urban-rural linkages has not been agreed upon yet. Rather, an array of terms, among them urban-rural linkages, interactions or interrelations, are being used synonymously (ESPON 2005; Haase and Tötzer 2012; Stead 2002; Tacoli 1998). To date, there have been very few studies that analysed urban-rural linkages from a comprehensive perspective, taking interlinkages between sectors into account. Stead (2002) authored one of the first studies that provided a systematic compilation of the dimensions of urban-rural linkages. However, characteristics and spatial implications of more complex linkages like intertwined energy and material flows or knowledge linkages have not sufficiently been considered yet. Moreover, the dichotomic terminology implies the existence of two different categories, also finding their expression in various attempts to develop typologies of space according to urban and rural categories (e.g. OECD 2011). This ambiguity has not only shaped the perception of spaces considerably but has also influenced

essential categories of the governance setting. The predominant practice of separate instruments for 'urban' and 'rural' subspaces impedes a comprehensive approach that accounts for the actual interdependencies at the urban-rural interface.

These linkages, however, depict manifold challenges for governance modes at the urban-rural interface. Repp et al. (2012) provide an assessment of dimensions of these urban-rural linkages and the existing governance setting in Germany as part of research on Sustainable Land Management. The role of urban-rural linkages in shaping spatial development processes has recently been emphasised by policy makers at different scales (OECD 2013; BBSR & DV 2012).

It becomes apparent that this largely path-dependent governance setting is not adequately prepared to deal with 'new' and complex challenges related to land and water management, e.g. fluctuations between aridity and heavy rainfall events through climate change. Moreover, the urban-rural interdependence of processes connected to the water cycle and of water requirements for land use, households and economic activities face a fragmented regulatory landscape. This situation can be attributed to three major gaps that hinder an interlocking of the existing governance modes: First, this is a lack of interplay, reflecting trans-sectoral approaches. While trans-sectoral modes could allow for a sufficient flexibility to deal with complex management problems, competences for governing water and land remain fragmented, being organised mainly along disciplinary boundaries. With regard to the characteristics of the German planning system, this implies that comprehensive planning and sectoral planning – for transport, waste disposal, nature protection sites, among others, - while being obliged to ensure a reciprocal information process (*Gegenstromverfahren*), operate largely independently from each other in the phase of policy design.

Second, the dependence of governance competences on administrative entities hinders trans-boundary processes that account for linkages across these institutionally defined boundaries. This refers to both the dimensions of fit and of interplay, encompassing a lack of congruence between land and water related spatial processes and institutional regimes as well as between institutions in a horizontal way. This is particularly relevant for urban-rural linkages that do per se extend beyond these entities. For example, while a significant number of cooperation arrangements has been developed at different spatial scales and in different organisational forms, in most cases they remain informal instruments without a sufficient long-term character or legal competences. This inadequate coverage of urban-rural spaces has thus also evoked quests for more targeted governance modes, both at EU level (e.g. Integrated Territorial Investment as a new mode of targeted cohesion policy; EC 2014) and on national levels (e.g. BBSR 2012), as well as by OECD policy advisors (OECD 2013) in recent years.

These spatial linkages also emphasize the third gap of vertical/multi-level interlocking, with competences being not only tied to administrative entities but also to different – often hierarchical – spatial scales, ranging from the municipal to the EU level and beyond to international agreements. This situation thus seizes the dimension of scale and the dimension of interplay in a vertical way at the same time. It can be exemplified by the situation in Germany, with planning guidelines regarding sustainable spatial development being developed on national and regional levels. Municipalities, however, conclusively decide on a number of aspects regarding their territory. This may lead to a weakened implementation of these general guidelines, e.g. when it comes to balancing space for

housing or commercial development and for the protection of open space and environmental services like groundwater recharge. Another example is provided by the implications of the water framework directive WFD that has been issued at EU level but requires implementation at subsequent spatial scales. Its alignment to river basins, constituting functionally defined spatial entities, however, requires both transsectoral and transboundary cooperation, as outlined above.

As the analytical framework that has been developed in the previous chapter shows, these three gaps can be attributed to an array of constellations of scale, fit and interplay with regard to interactions along the urban-rural continuum.

4 Challenges of water management

There is a high diversity of studies that analyse challenges of water management (e.g. Bakker et al. 2008, Rogers and Hall 2008, Pahl-Wostl and Kranz 2010, Huntjens et al. 2011, Borgström et al. 2006, Folke et al. 2007). The adoption of the WFD and linked problems of implementation advanced the discussion about institutional gaps. In the following, challenges of cross-sectoral and functional governance in water management are outlined, referring to the study by von Haaren and Moss (2011). They analysed water-related institutions in Germany in order to define potentials but also challenges of cross-sectoral cooperation. They compared the following institutions: water management, environmental protection, agriculture and spatial planning. The results of this analysis will be shortly summarized according to fit, interplay and scale (cp. chapter 2.2).

Regarding the fit of water-related institutions, the results show that the objects and the aim orientation differ considerably. Whereas water management focuses on a relatively narrow object like water protection and sanitary environmental engineering, the objects of nature protection and spatial planning are more comprehensive. In contrast, the objects of agriculture are primarily economically oriented, increasingly reflecting also the relevance of ecosystem services over the last decade. The evident differences of objects and aim-orientation evoke challenges of integrated water protection. In particular, conflicting aims between land management and water management foster problems of fit. Spatial planning can take the chance to assume an integrating and moderating function for a comprehensive sustainable development. A stronger consideration of ecosystem services might help to improve cooperation and minimize conflicts.

Regarding the interplay of water-related institutions, the results show unequal constellations of actors that obtain different competences and are subject to different constellations of power. The dominant commercially oriented actors in agriculture are in contrast to state institutions that implement aims of water management, nature protection and spatial planning. Furthermore, agriculture is supported by a powerful lobby. While water management and nature protection dispose of strong lobbies, too, they are not as powerful as agricultural associations. Besides these unbalanced power constellations, the coexistence of governance modes fosters the lack of interplay between water management and water-related institutions. In general, the character of governance modes tends to shift from regulative decision making towards processes of negotiation and participation. However, the aims and their implementation often remain sectoral. Also do the effects of implementation differ: Whereas agriculture exerts influence with financial incentives without adequately reflecting other land use demands, water management, nature protection and spatial

planning mainly operate through legal regulation. Correspondingly, agriculture has better access to financial and human resources than spatial planning and nature protection.

Finally, regarding the scale of water-related institutions, the results show divergent time horizons for planning and implementation. Water as well as nature protection are determined by stringent, long-range time horizons of the EU. Sanitary environmental engineering organizes long-term investments, being strongly economically driven. Agriculture is strictly oriented toward the programming period of the CAP. As opposed to this, the preparation process of regional development plans is not limited in time and predominantly demand-oriented. Furthermore, the decision-making authorities are institutionalised on different levels. In particular spatial planning is institutionalised weakly, with the strongest competences residing at the local level. One main problem of scale lies in the implementation of measures being tied to sectoral and administrative boundaries. To sum up, the institutional analysis shows current divergences in fit, interplay and scale. In particular von Haaren and Moss (2011) point out challenges of an integrated approach to bring together current status and the definition of aims.

The following examples will provide some evidence on how these governance challenges are being addressed by selected approaches on sustainable land management at the urban-rural interface of land and water.

5 System solutions for an integrative land and water management at the urban-rural interface

5.1 ELaN: Institutional settings for reuse of waste water: The example of Berlin-Brandenburg

5.1.1 Project background

The research project ‘ELaN – Development of integrated land management through sustainable water and resource use in North-East Germany’ aims to develop a spatially differentiated and sectorally integrated perspective on the transition of both wastewater and energy systems at the interface of renewable energy and wastewater disposal technologies. The Berlin-Brandenburg region is confronted with various challenges in land and water management as well as in energy management. Against this backdrop the ELaN project is exploring ways of implementing the use of treated wastewater as an integrated, multi-purpose solution for these various challenges. Firstly, the spreading of treated wastewater is supposed to help to stabilize the region’s water balance. Secondly, the irrigation of biomass crops could contribute to meeting the regional demand for biomass, thereby minimizing conflict over land use, and to reducing dependence on imports and fluctuating prices. Thirdly, the projects aims to develop sustainable forms of land use for problematic sites, such as degraded fenland and former irrigation fields. Fourthly, the recycling of nutrients from wastewater and its use for the production of a fertilizer (MAP – magnesium ammonium phosphate) is not only supposed to establish new regional material cycles but also to enhance regional economic development. Fifthly, the ELaN project explores ways of reordering the relationship between the city of Berlin and its rural hinterland by reconfiguring the demand and supply side of energy supply and wastewater disposal. Finally, the development of new forms of land use, water management and infrastructure connectivity facilitates more participatory modes of local and regional governance.

5.1.2 Challenges and system solutions

The aim of the ELaN project is to interlink water infrastructure and energy infrastructure in theory and practice, thus reconfiguring regional infrastructures in Berlin-Brandenburg. This implies an analysis of the institutional status-quo of water management in this region.

The analysis shows that global debates on liberalization and privatization have also affected the institutional structure of water management in Berlin-Brandenburg. During the 1990s several municipalities, mostly larger cities, privatized their water utilities. The case of the Berlin Water Company (BWB) is the most prominent example. BWB was partially privatized in 1999. The secretive nature of this process as well as rapidly rising water fees led to massive dissatisfaction, public protests and, ultimately, the political decision to re-municipalize BWB in 2013. Re-municipalization is occuring also in other German infrastructure sectors, especially in the energy market (Matecki and Schulten 2013). In particular, wastewater disposal is a core responsibility of German municipalities. The regulatory framework is set by regulations on the European level, such as the EU Water Framework Directive or directives concerning urban waste water treatment, on the federal level, such as the Water Resources Law (*Wasserhaushaltsgesetz*) and the regional level of the *Bundesland*, such as the Brandenburg Water Law (*Brandenburgisches Wassergesetz*). The main actors of wastewater treatment and disposal are, however, the over 400 municipalities in Brandenburg (Naumann 2014, p. 55f.). Municipalities are free to mandate their own municipal enterprise (*Eigenbetrieb*), one of the 80 municipal federations (*Zweckverband*) or a private operator for wastewater disposal. The supervision of wastewater utilities is the responsibility of local water authorities (*Untere Wasserbehörden*), which are part of the public administration of the 14 administrative districts (*Landkreise*) in Brandenburg.

Also the energy sector in Brandenburg is affected by institutional changes. These include the establishment of new municipal or re-municipalised energy utilities, efforts for the decentralization of energy planning and provision as well as different forms of civil society involvement (Becker et al. 2012). The installation of new energy facilities for windfarms, biogas plants and solar farms has often provoked local conflicts over the use of land (Becker et al. 2012). It is indicative that the government of Brandenburg has introduced “acceptance and participation” as one of four pillars to its Energy Strategy (MWE 2012). The governance of the energy sector also involves different scales of regulation. The European Union and its directives on services in the internal market has been a major driver for the liberalization of European energy markets. The German federal government applies European directives via national regulation, but has also introduced its own Renewable Energy Sources Act (EEG) to promote renewable energies. The *Bundesland* Brandenburg has formulated its own “Energy strategy” (MWE 2012) and supports the development of regional energy concepts at the level of administrative districts (Naumann 2014, 57f.). At the local level there exist numerous energy cooperatives as well as bio-energy villages (Becker et al. 2012, 46ff.).

The idea of ELaN is for innovative wastewater and energy infrastructures to advance more sustainable forms of water and land management and to promote new forms of cooperation between cities and the surrounding countryside, particularly relevant for Brandenburg given its high degree of spatial disparities. Nevertheless, the idea to connect wastewater and energy infrastructures through the use of treated wastewater faces difficulties, which crucially limit the wider implementation of wastewater reuse in the region.

In particular, the intent of a new approach to urban-rural linkages, mediated by infrastructure systems, confronts major challenges. A common approach for managing water and energy infrastructures between the city of Berlin and the surrounding region of Brandenburg is only slowly evolving (Infrastruktur & Umwelt und Beratungs- und Servicegesellschaft Umwelt 2011, 19). Currently the Joint Spatial Planning Department is working on a spatial planning concept for energy and climate protection for the Berlin-Brandenburg region. However, up to now plans for integrated regional development for utilities which serve cities and regions with energy and wastewater services are absent in Brandenburg. At the local scale the major challenge revolves around enrolling the different elements of water reuse in one location, i.e. the availability of wastewater, existing pipes, suitable land and demand for biomass (Kröger et al. 2012). This illustrates the complex relationship between cities, as sites of the production of wastewater and of the use of energy, and the countryside, as (potential) sites of the use of treated wastewater and the production of energy crops.

The missing urban-rural interactions are also attributed by huge institutional asymmetries between the regulation of wastewater disposal and of energy supply. Except for a few multi-utilities in Brandenburg both sectors are strictly separated regarding the provision of services. The political responsibility for each sector is also divided between the Ministry of Environment, Health and Consumer Protection (for wastewater disposal) and the Ministry of Economics and European Affairs (for energy). While there are (still) considerable subsidies and other incentives available for renewable energy facilities there is no such programme for innovations in the wastewater sector.

Further challenges are the strict prohibition of spreading treated wastewater for reasons of groundwater protection by the institutional and legal framework in Brandenburg, missing economic incentives for the use of treated wastewater and less acceptance of new forms of wastewater disposal[i].

5.1.3 Discussion/Conclusion

The project aims to provide answers to local challenges pertaining to land management, energy supply and wastewater treatment and use in the Berlin-Brandenburg region. In exploring new spaces for innovation within the context of existing regulations on wastewater it represents an example of “governance by experiment” (Bos and Brown 2012). Following Bulkeley and Broto (2012), attempts to reuse treated wastewater in the region can be regarded as a threefold experiment: a) a governance experiment based on (temporary) exemptions from existing requirements, b) a socio-technical experiment starting in the “niches” of former irrigation fields and degraded fenland and involving new modes of wastewater disposal and social learning and c) a strategic experiment in which future land and water management is being discussed in “living laboratories”.

The regional experiences presented in this paper have revealed that nexus approaches require a reordering and strengthening of urban-rural linkages, including an institutional framework that is capable of reaching beyond existing administrative borders. Water, energy and land management are not inherently bound to the territories of municipalities, counties (Landkreise) or Länder, yet most regulations which govern them certainly are. Reshaping the infrastructural relations between the city and the countryside will thus need governance structures and procedures capable of spanning cities and surrounding rural areas as well as encouraging cross-sectoral integration. One example could be the transfer of the model of urban multi-utilities (*Stadtwerke*) to the regional level (*Regionalwerke*).

Finally, the study shows that the transformation of wastewater and energy infrastructures is often a highly conflictual process. The local benefits of infrastructural transitions, as many local energy conflicts in Brandenburg illustrate, are not equally distributed. Hence, participation and local acceptance will be crucial issues for future efforts to reconfigure infrastructures.

5.2 Restoration of an open sewer system: The example of the Emscher region

5.2.1 Background

The Ruhr metropolitan region (North Rhine-Westphalia, Germany) has been shaped by structural change following the decline of the mining and heavy industry that have long been characteristic for the area. This transition has led to new infrastructure challenges (logistics, transport, water and energy management) and demands new strategies, but at the same time offers new opportunities for sustainable development of the region, including technical, societal and ecological progress. The joint project KuLaRuhr is contributing to the development of strategies of sustainable land, water and energy management and to improving the attractiveness and quality of life in this urban region.

One of the prime infrastructure projects in the Ruhr area is the conversion of the Emscher system. For more than a century, the river Emscher and most of its tributaries were concrete channels and open waste waterways transporting the sewage of more than 2.5 million people. Due to the end of coal mining in the Ruhr metropolitan region which is associated with a significant reduction of subsidence caused by mining it now will be possible to convert the open sewers into underground culverts and to transport the collected wastewater to central wastewater treatment plants. In a large scale project, streams in the catchment are now being restored by first building underground culverts, followed by reconstructing the channel bed and the streams' riparian environment. The conversion of the Emscher river system is a project spanning across decades and facing many challenges. Apart from transportation of sewage also access water originating e.g. from heavy rainfalls has to be collected and discharged efficiently to prevent flooding. Accordingly, the ultimate goal of this conversion process is to upgrade the Emscher region significantly through projects extending well beyond the river itself (www.eglv.de). KuLaRuhr contributes to analysing the effects of the Emscher restoration on biodiversity and ecosystem services and to sharpening strategies for future restoration efforts.

5.2.2 System solution

The conversion of the Emscher river requires the involvement of a variety of stakeholders interests that are directly affected by the status of the river, in rural as well as in urban areas in the Ruhr region. Federal state governments, municipalities, local residents, investors, water suppliers and representatives of nature protection are to be taken into consideration. Also the aspect of upstream and downstream riparian is to be recognized adequately. The institutionalization of the regional water board "Emschergenossenschaft / Lippeverband" aimed at bringing together this diversity of interests, moderating the discourses and organising the sets of measures. Multi-level governance is the main approach for handling this complexity and existing governance challenges.

Led by the regional water board "Emschergenossenschaft/Lippeverband", the "Emscher Future" Master Plan has been developed in continuous dialogue with neighboring cities and

districts, with industry and business, the relevant government authorities and many other organisations and institutions (www.eglv.de). The Emscher Future Master Plan led to a harmonized understanding of aims, procedure and time horizon of the Emscher restoration project.

As a result of the planning process, the river is now being restored along an 80-kilometre stretch in the middle of Europe's biggest conurbation, demanding for an investment of 4.5 billion euros. Consequently, it is one of Europe's biggest infrastructure projects. The restoration is mainly composed of three steps: First, centralized wastewater treatment plants have been constructed. Second, more than 400 km of underground wastewater conduits are being built, of which 220 km are already completed. Finally, the ecological quality of the Emscher and its tributaries is being improved by remodeling the channels and floodplain areas (www.eglv.de).

The effects of this revitalisation on the ecological quality of the Emscher system can be measured with a wide variety of parameters. For instance, benthic invertebrates (small organisms living at the bottom of a river) are reliable indicators of water quality and habitat quality. The restored stretches are now step by step recolonised by sensitive organisms, depending on their dispersal ability (Stemplewski & Sommerhäuser 2010, Winking et al. 2013, Winking et al. 2014). Several of the restored stretches in the Emscher tributaries have already reached good ecological potential, the quality target for Heavily Modified Water Bodies, such as urban rivers.

5.2.3 Discussion

While a large proportion of the Emscher tributaries have already been restored and their ecological quality is constantly improving, the Emscher itself still needs to be revitalised. Technical challenges remain, but the Emscher Future Master Plan succeeded to achieve a common understanding of aims and approaches between the various actors and stakeholders. The ecological results are already promising, but time is required to allow for a river ecosystem to develop, including the colonization with organisms and the establishment of ecosystem processes.

6 Conclusions and future prospects on governing urban-rural interactions

The further development of Young's approach of fit, interplay and scale, considering also urban and rural perspectives, proves to be very helpful for the analytical discourse of functional governance for land and water management. The dichotomy of the categories urban and rural is explicitly used in order to expose expected differences in urban and rural areas. This helps to identify institutional gaps determined by the functionality of flows.

Institutional gaps become apparent regarding the management of the resources land and water in an integrative way. They are caused by misfits of land management requirements and administrative boundaries as well as by missing interplay at vertical and horizontal scale. Although integrative approaches like the WFD play an increasing role, territorial and sectoral perspectives still dominate governance settings for land and water use.

Both case studies taken as examples in this paper, show the necessity of an adequate consideration of urban-rural interaction on a large scale, in order to provide system solutions that match current land management challenges. They thus provide a contribution to

advancing planning and governance towards linking so far mostly unconnected thematic fields, like governing the restoration of river basins or re-using sewage water in an urban-rural context. They point out challenges of functional governance, and highlight approaches coping with governance gaps at the same time. Main aspects of functional governance are the flexibility and openness of administrative structures for trans-sectoral cooperation developing context-dependent integrated solutions. Institutionalised structures, like the „Emschergenossenschaft/Lippeverband", can take a coordinating and moderating role. Public participation, institutional learning as well as the access to and the distribution of knowledge are urgent prerequisites for functional governance from a multi-level perspective.

Urban-rural linkages, in particular, constitute an essential spatial framework for tackling these dimensions and developing a functional perspective on land and water management. In that regard, urban-rural linkages do not represent interactions between two distinct subspaces but the result of dynamic interactions in regional contexts that are simultaneously influenced by global interdependencies. Moreover, urban-rural spaces are not only linked through flows of goods and people, but also through flows of information and knowledge as well as of land use demands and power constellations. However, character and consequences of these urban-rural linkages are only partly known, mainly with regard to uni-dimensional aspects, while more complex linkages have not been adequately grasped so far.

To conclude, the perspective of functional governance enables a more integrative, adaptive and thus sustainable use of resources, in particular regarding mobile resources like water. Nevertheless, functional governance has to take established administrative structures and their competences and institutional embeddedness into account. In consequence, the recombination of governance instruments is one key aspect of sustainable land management with regard to trans-sectoral and trans-boundary perspectives on functional linkages in space. The integration of implications of urban-rural linkages in designing governance settings enables an evidence-based consideration of processes of flexible adaptation and recombination.

The further development of the analytical approach, applied in this paper, will contribute to specify the concept of functional governance. It will reflect on the capacity of functional approaches and on interfaces between functional and territorial governance.

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[i] The facilities of the ELaN project for spreading treated wastewater on the fenland site have been damaged several times. There is clearly a need for a broad public debate on a “wastewater transition”, comparable to that on the energy transition in Germany, in order to improve acceptance.

Politics and Processes of Sea-Megaprojects in the Arab Gulf Region
The Pearl Island in Doha, Qatar as a case of study

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Keywords: Sea Megaprojects; Arab Gulf Region; Rapid Urbanization; Dubaization; Resource City; Urban Sustainable Development.

Abstract

In the last 20 years urban development in the Arab Gulf Region has boomed as the combined result of increased oil revenues, diversification of the local economy away from oil and its byproducts, increased immigration flows, and geopolitical transformations (Al Buainain, 1999; Bagaeen, 2007; Elsheshtawy, 2008a; Rizzo, 2013). Gulf governments and their agencies - along with members of the ruling families who sit at the same time in ministries and in boards of private companies (Ponzini, 2011) - have been the main players to fund and implement urban megaprojects - i.e. large, themed urban-projects (Rizzo, 2013).

The large scale, sea-reclaimed urban development is the most popular urban typology to have been adopted in Gulf capitals (Koolhaas et al., 2007; Jackson & Della Dora, 2009; Ouis, 2011). As the result of their increasing popularity in Dubai, sea-reclaimed megaprojects have started to be exported outside the Gulf Region – a trend that Elsheshtawy (2010) has called “Dubaization”. In this paper we discuss the biggest, sea-reclaimed urban megaproject in Qatar, The Pearl, to analyze politics and processes of water developments in the Arab Gulf Region and question their socio-political sustainability.

1. Introduction: Background, Research Question, Relevance & Methodology

Arab countries of the Persian Gulf Region are emerging as important economic and geopolitical hubs. Their substantial oil and natural gas surpluses make them important actors and partners to reboot troubled Western economies (Seznec, 2008; Bahgat, 2009; Spencer & Kinninmont, 2013: 49). “[Estimates] from the consulting firm McKinsey show an accumulation of oil income in the Gulf Cooperation Council (GCC) countries at $2.4 trillion by 2010 and $8.8 trillion by 2020” (Seznec, 2008: 97). It is estimated that a large share of this wealth will be invested outside the GCC “and where better than in shares in the major financial institutions of Wall Street, which have suffered seriously from their

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less-than-wise investments in subprime mortgage paper" (Ibid.: 97).

Also, due to their geographical position and large financial resources (the result of oil revenues) Gulf countries have managed to become important global transportation hubs for international passengers between the West and Asia and beyond it (Henderson, 2006; O'Connell, 2006). "This region is also leading the world in aircraft orders as $60 billion has been invested by just three airlines with $27 billion ordered in 2005 alone" (O'Connell, 2006: 94). Tourism is one of the pillars of some regional economies such as Dubai's. This latter city has *de facto* set the standards for economic diversification for other neighboring oil-dependent economies (Henderson, 2006: 91). "[In Dubai] decisions about tourism were made against a background of falling oil production and a keen sense of the urgency of economic diversity" (Ibid.).

Furthermore, Arab Gulf countries, such as the small emirate of Qatar, have proven to be determinant to redraw the future of post Arab-Spring countries in the Middle East and to further geopolitical cooperation between the Gulf and the West. To this end, the creation of Arab-based satellite news channels such as Qatar's Al Jazeera has contributed to extend the sphere of influence of once geopolitically, peripheral Gulf countries (Seib, 2008). Philip Seib has labeled this phenomenon the "Al Jazeera Effect" - a term that in his view "encompasses the use of new media as tools in every aspect of the global affairs, ranging from democratization to terrorism" (Seib, 2008: IX). However, Rasha El-Ibiary (2011: 200) explains better that the "Al Jazeera Effect" is all but a push for democracy in the Gulf because first and foremost new, Arab-based, all-news channels fail to scrutinized Gulf countries' home-policy – these latter are often characterized by the lack of basic civil rights (such as freedom of expression) although promoting democratization abroad. For her (Ibid.: 202) Al Jazeera is nothing more than a tool to protect Qatar from Saudi influence and to project Qatar into the world stage. Therefore, "perhaps counter-intuitively, the Arab uprisings have so far have resulted in the Gulf Cooperation Council and Western countries working more closely together" (Spencer and Kinninmont, 2013: 49) rather than re-compose disagreements within GCC members (e.g., between Qatar and Saudi Arabia[2]).

In the last 15 years, all the factors highlighted above have contributed to re-shape the economic profile of Gulf countries and to fuel rapid demographic, economic, and urban growth in their capitals. In particular in Doha, the capital of Qatar, between 2004 and 2010 residents have more than doubled – from 400 to nearly 800 thousand inhabitants - while, according to World Bank database[3], in 2011 alone Qatar GDP grew by 18.8%. To cope with this extraordinary growth, and similarly to other neighboring Arab capitals (e.g. Dubai, Abu Dhabi, Manama), Qatar has embarked in a massive modernization of its urban

[2] See recent unilateral withdrawal of Saudi, Bahraini and Emirati ambassadors from Qatar over allegations of political interference. Muslim Brothers' leaders are openly supported by Qatar and broadcasted in Al Jazeera programs, and their speeches often called for democracy in the absolute monarchies of the Gulf region.
[3] See http://data.worldbank.org/indicator/NY.GDP.MKTP.CD.

infrastructure through government-led urban mega-projects (Rizzo, 2013). In particular, since the completion of Burji al-Arab in Dubai in 1999, off-shore, sea-megaprojects (i.e. large, sea-reclaimed, developments) have become a popular urban typology in the Arab Gulf Region. This model, in recent years, has been fully exploited by Dubai in order to multiply development opportunities for luxury resorts by the waters of the Persian Gulf (e.g., the Palm Trilogy, Dubai Marine, World, the Universe, and Hydropolis) and exported in other emirates of the Gulf such as in Abu Dhabi (e.g., Saadiyat, Lulu, and Yas islands), and Qatar (e.g., Airport City, The Pearl, and Lusail City) (Ouis, 2011) and, according to Elsheshtawy's (2010) *Dubaification* theory, beyond the Gulf.

While reporting on Gulf's last decade urban development (section 2) and the explosion of the Sea-megaproject phenomenon in this region (section 3), in this paper we will try to answer two main questions, i.e.: what are the politics and processes that facilitate the emergence of sea-megaprojects in the Arab Gulf Region (section 4)? And, in the case of The Pearl, what are the observable social impacts, amongst the many other types of impacts caused by sea-megaprojects (e.g., environmental, economic, etc.), caused by sea-megaprojects (section 5)? This analysis is based on fieldwork observations, students' course work, and a critical analysis of available documents we gathered between 2010 and 2013 during our tenure at Qatar University. In the conclusions (section 6), we will advocate for the need, for local decision makers and planners, to work more on regenerating Gulf's existing, fragmented urbanism rather than continuing to replicate capital-intensive, sea-megaprojects.

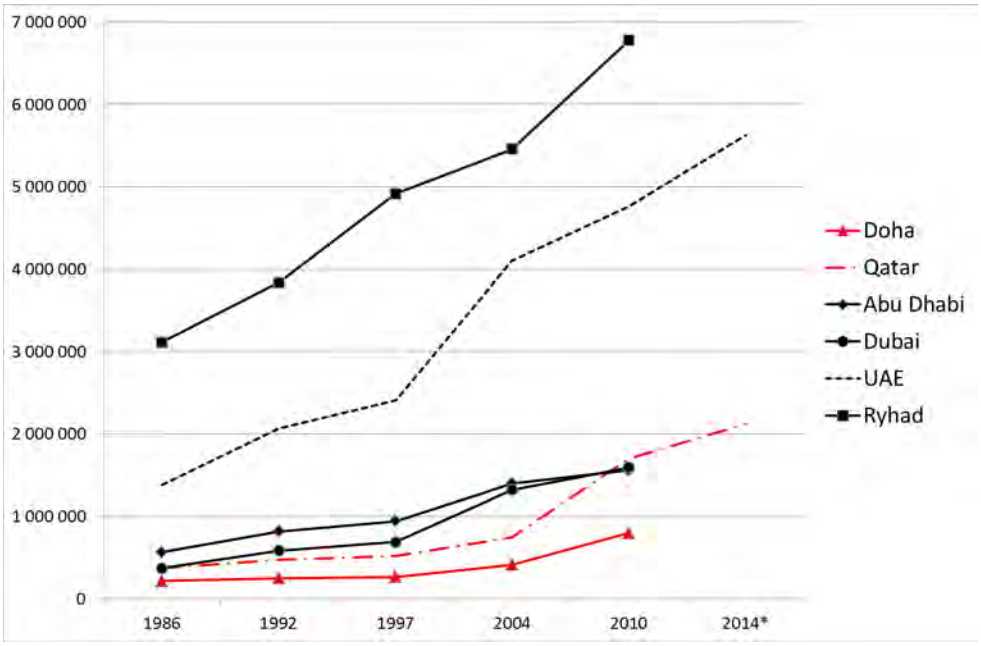


Figure 1. Comparison Gulf Cities Population (source: Citypopulation.de, * estimations).

Table 1. Urban and urban-related Sustainable Development official documents in the UAE and Qatar (in brackets year of publication).

	Visions	***Strategies***	***Indicators***
Abu Dhabi	UAE Vision 2021 (2013) Abu Dhabi Environment Vision 2030 (2012)	• Abu Dhabi Economic Vision 2030 (2008) • Abu Dhabi 2030 Urban Structure Framework Plan (2007)	Pearls Rating (2010)
Dubai	UAE Vision 2021 (2013)	• Dubai Strategic Plan 2015 (2007) • Dubai Strategic Plan 2020 (ongoing)	-
Doha/Qatar	Qatar National Vision 2030 (2008)	• Qatar National Development Strategy (2011) • Qatar National Development Framework (ongoing)	GSAS/QSAS (2010)

2. Instant Urbanism and Megaprojects in the Gulf

While international literature on Qatar and the Gulf Region is still in the making (see recent attempts by Koolhaas et al., 2007 and 2010 with Al Manakh and Al Manakh Gulf Continued), a number of academic essays and articles published by Gulf-based researchers (Riad, 1981; Elsheshtawy, 2004 and 2008a, Nagy, 2006; Pacione, 2005; Ponzini, 2011; Rizzo, 2013; Rizzo, 2014) have attempted to sketch dynamics and impacts of rapid urbanization in the Gulf Region.

The oil industry has brought a dramatic change that has altered forever the natural (marine and desert ecosystems), physical (cities and infrastructures) and socio-economic (consumption patterns) balance of Gulf countries. Before the exploitation of oil in 1950s, the Arab Gulf economy was mainly based on daily fishing, seasonal pearling, and sea-borne trade with other countries facing the Persian Gulf (e.g., Iran, Trucial States, etc.) (Riad, 1981). However, although oil-fueled economic development has affected locals' lifestyle, it is worth noting that it has not managed to re-shape with the same pace the socio-religious values of the Gulf (e.g., status of women, patriarchal hierarchy, etc. – Riad,1981: 8 and 10) towards Western ones (e.g., democracy, human rights, and civil society).

Several terms have been used to label the recent extraordinary urban growth of Arab capitals of the Persian Gulf. Bagaeen (2007: 174) described Gulf cities with the term "instant urbanism" to differentiate it from Western, long term urban evolution. This is for instance the case of Dubai, Abu Dhabi, and Doha which have all transformed from small port cities to sprawling metropolitan areas in just two decades (Pacione, 2005; Ponzini, 2011; Rizzo, 2013) (Figure 1). The urban pattern and demographics of the Gulf have gone through dramatic changes from scattered small settlements towards ever large "virtual city-states" (Riad, 1981: 20). While the size of the typical Gulf settlement was previously influenced by the amount of fresh water available, geographical location in respect to pearling grounds, accessibility to

inland trade routes towards other settlements of the Arabian peninsula, and political/tribal alliances to secure stable trade, with the advent of the oil industry in the 1950s it become the availability of safe, public jobs and modern infrastructures (e.g., electricity, water supply, sanitation, etc.) to determine the size of Gulf capital cities (Riad, 1981:11). Riad (1981: 7) has labeled this transformation with the term "petro-urbanism" which, according to him, "... undermined, with unparalleled suddenness, the roots of an ecosystem [the Gulf's one] which reflected a perfect adaptation to an environment many generations old".

Recently, the term "Dubaization" or "Dubaification" (Elsheshtawy, 2010: 250) has come to the foreground of academic literature to describe cities emulation of Dubai's urban megaprojects agenda – this latter being a pervasive process that, as shown by Choplin & Franck (2010) for Khartoum, Sudan and Nouakchott, Mauritania and by Haines (2011: 160), is not restricted to Gulf capitals only. In Qatar, for instance, "The Pearl", a gigantic oyster-like manmade island with luxurious residential areas inspired by Venice and Southern France's riviera, reminds of Dubai's "Palms". In particular, since the completion of Burji al-Arab in Dubai in 1999, off-shore, sea-megaprojects (i.e. large, sea-reclaimed, developments) have become a popular urban typology in the Arab Gulf Region.

In addition to this, ambitious development plans drawn up by government agencies (table 1) have resulted in more constriction opportunities and thus attracted flows of expatriate workers to the Gulf to contribute to them. Very schematically (Nagy, 1998; Rizzo, 2013): cheap labor from South Asia (mainly from India and Pakistan) has been employed in the labor-intensive construction industry while South-East Asians (mainly from the Philippines and Indonesia) are occupied in the lower service sector; Arabs from the Middle-East have expanded the capacity of the government in the education and other government sectors, while Westerners have provided consultancy for the design, implementation, and management of the newly built, or soon to be implemented, infrastructures. As a result of this trend, the Gulf has become location for a very ethnically-diverse population-base made of temporary workers (Nagy, 2006) which, in the case of Qatar and the UAE, outnumber nationals 5 to 1 (Figure 2).

3. Islomania and Splintering Metropolis

Pernilla Ouis (2011: 60) deploys the term "Islomania" (introduced by Durrell in 1953) to describe Dubai's "…strategy to create attractiveness in a rather barren environment". The island typology is instrumental to, at the same time: diversify local economy away from oil-exports, to strengthen government rhetoric on national identity, and as a powerful tool to allow "economic, religious, social and cultural segregation" (Ibid.). As Jakson and della Dora (2011: 311) suggests, artificial island are the latest evolution (after gated developments and communities) of the western desires for "enclosure, isolation, possibility for control, miniaturisation, etc" (Ibid.: 2088).

At the same time, artificial, sea-reclaimed islands embody the ambition of the local elite to secure political power and social support despite its ruthless breakdown on opposition groups and democracy advocators. This is done by referring simultaneously to tradition and modernity (ibid.: 65). The shape of the Gulf artificial islands often relate to traditional Bedouin sea-trade communities' heritage[4] such as a palms, pearls, sails, to underscore, perhaps in a caricature-fashion, the Gulf identity. At the same time, the technological process to build the islands and the infrastructures they host relate to modernity and to attractive (when compared with the past), prosperous lifestyles. The leader is portrayed as the guarantor of this deal (i.e. Gulf tradition and modernity), thus is position and leadership is secured (Ouis, 2011: 67).

Artificial islands are not a new phenomenon (Jakson and della Dora, 2009: 2091), however, Dubai's type of islands are different because of their scale (a megaproject scale), the exclusionary practices they entail (controlled access, exclusive lifestyle, etc.), they are immediately recognizable from top (for international tourists and businessmen coming by airplane), but absolutely invisible from ground (where the locals live) (Ibid.: 2091-2092). The sea-megaproject model, in recent years, has been fully exploited by Dubai in order to multiply development opportunities for luxury resorts by the waters of the Persian Gulf (Figure 3). The Palm trilogy (i.e. Palm Jumeirah (2006), Palm Jebel Ali (2008), and the under construction Palm Deira) are perhaps the world most known and emulated sea-megaproject in the world. Other endeavors include Dubai Marina, established in 2003 and currently developed with Hotels and residential towers, The World (2008), an artificial archipelago in which each island replicates the shores of a country, the Universe (construction postponed), a cluster of island stretching from Palm Jumeirah to Palm Deira, and Hydropolis, an underwater resort that should have been opened in 2006 but due to financial problems has been postponed ever since.

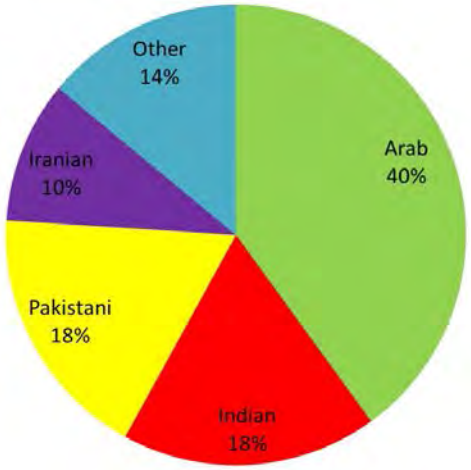


Figure 2. Qatar's population ethnic background (source: CIA World Factbook 2014).

[4] Many of the Gulf citizens have a Bedouin background but other sizeable, although often downplayed, groups are the Ajam (Gulf Persians) and Abd (descendants of African slaves), see Nagy, 2006: 129.



Figure 3. Dubai's Sea-Megaprojects (from left to right): Palm Jebel Ali, Palm Jumeirah, The World archipelago, and construction works for Palm Deira (Google Earth, 2014).



Figure 4. Doha's Sea-Megaprojects: to the North Losail City, Up-Centre The Pearl, Down-Centre West Bay, to the South the new Hamad International Airport (Google Earth, 2014)

Also neighboring emirates have adopted the sea-megaproject typology to fuel hopes for economic diversification towards real estate and tourism and to brand their cities. Most notably, Abu Dhabi, UAE capital city and arguably the richest emirate of the Gulf, has recently funded the works for Saadiyat Island, Lulu Island, and Yas islands. The more modest emirates of Ras Al Khaimah and Sharjah (both members of the UAE federation) have also worked on sea-megaprojects (e.g., Al Njoom Island in Sharjah and, amongst others, Dana, Al Marjan, and Saraya Islands in Ras Al Khaimah), although in smaller scale and we much weaker financial foundations. Abroad similar endeavors are sought by Qatar (e.g., Airport City, The Pearl, and Lusail City) (Figure 4), Bahrain (e.g., Durrat Al Bahrain, Durrat Marina), and Kuwait (e.g., Green Island).

In their investigation of the contemporary "splintering metropolis", Graham and Marvin (2001: 222) call megaprojects "secessionary network space" i.e. a bundled, high-end, mega-urban development that is secured from the influences of poorer groups. In The Pearl "... security, urban design, financial, infrastructural and state practices … [are deployed to] … separate the social and economic lives of the rich from those of the poor" (Ibid., 222). The very shape of the se-megaproject is conceived to be detached from the rest of the city. However, while in the western world this secessionary space is produced by the interplay of international real estate capital and planning and design consultancies (Ibid., 223) in Qatar instead is the State to provide the financial resources for it.

4. The Murky Politics of Megaprojects in the Arab Gulf Region

From a political economic point of view, Gulf Cities in general deploy the "...the political and economic engine of [mega] urban development projects..." to compete for Foreign Direct Investments (FDI), skilled labors, and international tourists (Ponzini, 2011: 251). A typical Gulf Megaproject is a government-funded, large, integrated urban development characterized by a specific theme (e.g., ancient Arab City, Global City, Mediterranean Riviera City, etc.) and a dominant function (e.g., sport, business, residential, etc.). More in general, in Asia since the 1980s "developers began to realize that great opportunity lay in building integrated megaprojects" (Shatkin, 2008: 391) since each function (residential, office, etc.) feed into the other, thus amplifying market profitability. Successful megaprojects developments in cities such as Singapore have represented for oil-rich Arab rulers a model to diversify their economies and modernize their capital cities. However, in the case of Gulf cities, finance for these projects has been largely provided by the State through oil revenues. In the case of oil-poor Dubai, emirate's finance has been integrated with funds from oil-rich neighbors (mainly Abu Dhabi and Saudi Arabia - Bloch, 2013).

However, as Ponzini (2011: 252) has pointed out for Abu Dhabi, large scale projects are neither a new formula nor immune of uncertainties and unbalanced effects – e.g. in 2009 Burji Khalifa in Dubai had to

be bailed out with Abu Dhabi's money in order to be completed[5]. Megaprojects in the Gulf Region see the participation of a limited number of actors - usually government's linked companies - and their implications are never discuss with the public. In Qatar, just like in Abu Dhabi, "...the separation between public and private sectors [...] is practically non-existent because the actors have key positions in public decision making and in the management of private companies"(Ponzini, 2011: 254). This situation prevents the participation of Gulf States' inhabitants in decision making and, we argue, furthers the rift between governments and their citizens and between them and the expatriate community. At the moment these fractures are filled with petrodollars to buy political consensus of nationals - i.e. the logic of the Rentier State, whereby "access to the states' goods and services is exchanged for the political submission of its citizenry" (Spiess, 2008: 247) – and strict visa-sponsorship regulations for expatriates. According to Friedman (2006: 28), "The price of oil and the pace of freedom always move in opposite directions in oil-rich petrolist states". This "First Law of Petropolitics" implies that "the pace of freedom really starts to decline as the price of oil really starts to take off (Ibid.). The recent uprisings in countries that have recently run-out of oil such as Bahrain, suggests that the current economic contract between government and people will survive as long as oil and gas wells will be running. Beyond that point, we argue, a renegotiation of power and the *status quo* elite will be unavoidable.

In a recent special issue on Qatar, the Financial Times reported regional analysts' worries over government's lack of capacity to deliver the massive developments plans to undertake. "Qatar is enormously wealthy but it doesn't really have the wherewithal in government yet to manage the process in ways that are directly linked to its own ambitions [...] without the software, the hardware is not going to work properly" (citation in Financial Times, 2011). Little coordination of public and private agencies in absence of a comprehensive urban master plan is, in facts, one of the main problems of Qatar as pointed out in the recent (2011) National Development Strategy document[6]. For instance, while in the country there is an oversupply of hotel rooms and luxury residences, government-planned, high-end projects continue to be delivered (though at a slower pace) - e.g. while Qatari Diar is working on a 38 square kilometre Lusail City for 450,000 inhabitants and workers, Mshereib Properties (a subsidiary of QF) is about to deliver a 35 hectare redevelopment project in the central district of Mshereib, and UDC (a private consortium recently bailed out by the government) has already completed 50% of The Pearl - a 400-hectare manmade island for 41,000 "international residents"[7].

Thus in absence of democratic participation and with little coordination between public agencies, megaprojects in the Gulf are in many cases foreign to and disconnected with the local urbanism. In Qatar

[5] In 2008 Emaar, a private conglomerate participated by the Dubai Government, risked nearly the bankruptcy over the construction of the world's tallest building which was then completed with capitals offered by Abu Dhabi's ruler (Sheik Khalifa Al Nahyan).
[6] See Qatar National Development Strategy http://www.gsdp.gov.qa/portal/page/portal/gsdp_en/nds
[7] Citation from The Pearl website - www.thepearlqatar.com

for instance, by analyzing Doha's satellite pictures over a long period of time El Samahy and Hutzel (2010: 187) detected a prevalent pattern of disconnected urban/non-urban areas throughout Doha metropolitan area.



Figure 5. Reclamation Work for The Pearls: October 2003 (Top-Left), August 2004, January 2005, November 2005, April 2006, January 2007 (Bottom-Right).

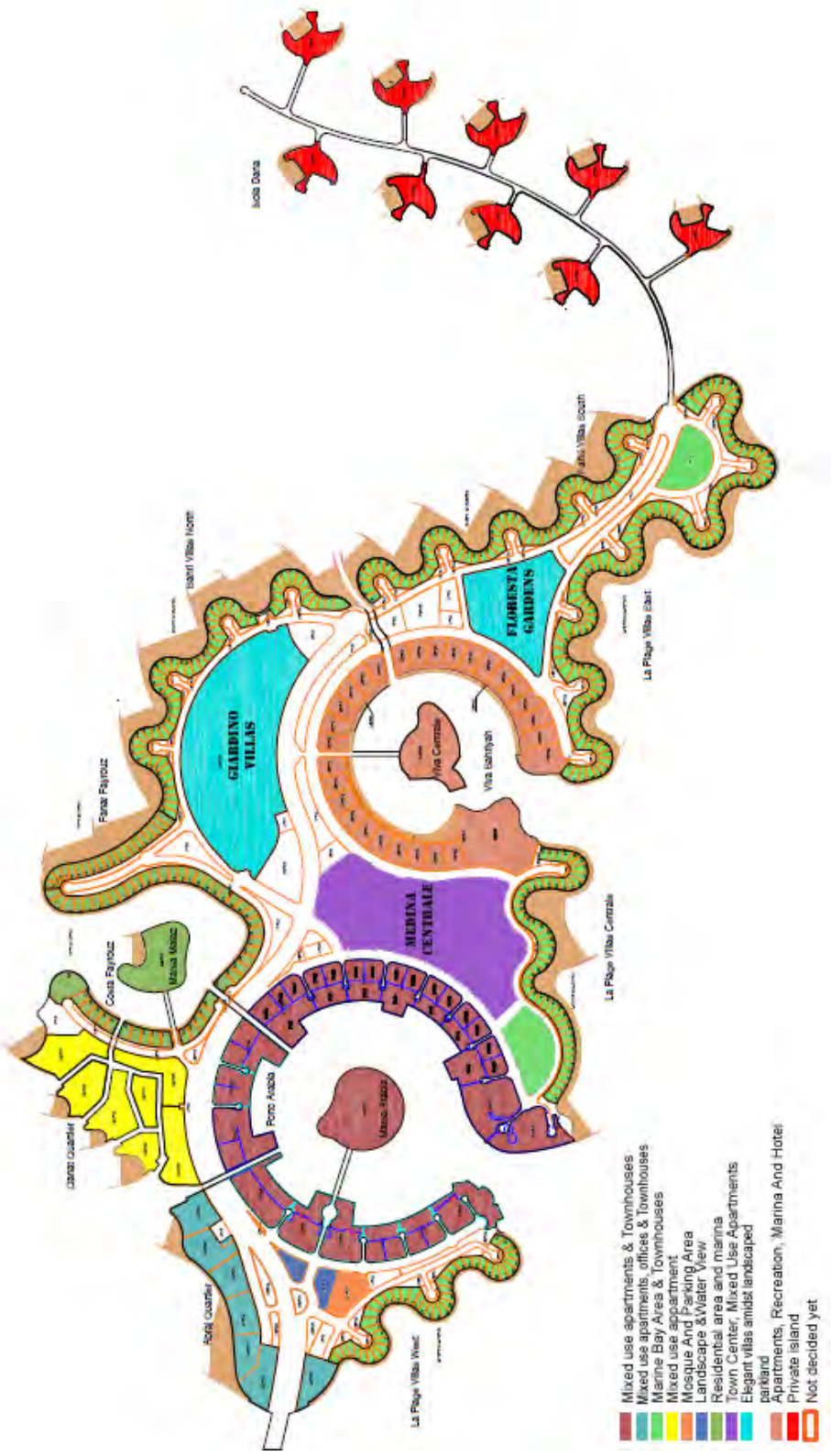


Figure 6. The Pearl: Land Use Plan.

5. The Case of Study: The Pearl Island in Doha, Qatar

The works for the manmade island *The Pearl* started in October 2003 (figure 5) with the aim to deliver "…unique, true freehold investment opportunities in a safe, relaxed, friendly and exclusive environment"[8]. Located to the North of Doha, this 400 hectare mega-project, with an estimated cost of 16 billion euro, is owned by the United Development Company, a consortium of private investors which in 2011 had to be bailed out by the government, as a result of the prolonged global credit crunch and lack of investors and residents. Two big artificial bays, 5 five-star hotels, 18,000 luxury villas with private beaches, and apartments themed up with references from the Arab Maghreb to the Mediterranean Riviera will be home to up to approximately 41,000 residents (Figure 6). The rich "international residents" will be served with some of the best international retail chains such as Cavalli, Yves Saint Laurent, and Rolls Royce and five star restaurants such as Gordon Ramsay's Maze.

The Pearl reconnects with Qatar's past on a symbolic level: the pearling industry and its product become a powerful brand to name the project and to shape the development. Similarly in Dubai, Burj al Arab, arguably the most popular hotel in the region, mimic Gulf sailing boats that can still be seen anchored in many of the ports in the region, while the Palms relate to the Bedouin, nomad economy (Ouis, 2011). However, the relationship between The Pearl and the sea is characterized by developments that attempt to reproduce Euro-Mediterranean cities such as those in France's Cote d'Azur or in Arabic/Spanish cities in the western part of the Mediterranean (Morocco and Spain) (Figure 7 and 8). In this respect, it seems to us that a post-colonial attitude towards urban development is recognizable in the Pearl. Ouis (2011) argues that a similar attitude can be found in the Palms where the very form of the development (that is separated from the city) encourages exclusionary practices such as liberal alcohol usage rules, liberal dress code, and so forth. Interestingly in The Pearl, the previous free policy on alcohol products has been reversed on the grounds that it created embarrass to Qataris and was not well tolerated by local conservative clans.

However, the project has raised concerns due to the environmental impacts related to the closure of part of the shallow waters surrounding the shell-like island for the reclamation process. Despite the reinsurance of the developers[9], like in the case of the Palms project in Dubai (Darmaki, 2008), this project

[8] Citation from The Pearl website - www.thepearlqatar.com

[9] Retrieved in early 2014 from ThePearl.com website (recently deleted): "Maintaining a healthy marine life is of the utmost importance to the developers of the Pearl-Qatar. Following the initial Environmental Impact assessment in 2003 it was agreed along with the government of the State of Qatar that a twice yearly detailed monitoring process would take place, testing the water quality, the sea bed, the coastal morphology and the marine life. Monitoring is carried out in February, during the winter season and in September, during the summer season. The monitoring processes are completed by scientists from an international environmental testing organization. These experts monitor the water quality, sediment quality and invertebrate benthic fauna by taking samples and analyzing the results. The sea grass beds, other marine life, reefs and stone revetments are monitored using video-

will probably destroy the seabed and much of the remaining coral reef with unquestionable heavy-impacts on the marine fauna.



Figure 7. Porto Arabia (render) (source: The Pearl Advertising material).



Figure 8. The Pearl: main gate development (source: The Pearl Advertising material).

recordings and the coastal development is monitored by comparison of satellite photos. As well as the twice yearly environmental monitoring, the UDC Environmental Affairs Department also carry out tests on the sea water quality every two weeks. This is an important practice as it ensures that the sea water is not being affected by the construction work on the island. Testing the water every two weeks ensures that should any pollutants be detected in the water they can be traced easily and dealt with quickly. Making sure minimal damage is done to the environment and helping to avoid similar incidents happening again."

Moreover, while legal concerns about the legitimacy of off shore sea-megaprojects in the hot area of the Persian Gulf Region have already been raised (Kelman, 2006), on the ground that a modification of a nation's shoreline may give reasons for future territorial disputes, it seems that the current global economic downturn is the major factor for the slowdown of such developments (*The Pearl* was scheduled for completion in 2013, although given the current economic constraints it is unlikely it will be finished before the end of this decade).

While economic and geo-political considerations are cyclical and to a certain extent affected by extra-Gulf dynamics and global economic trends, in the next paragraphs we will try to characterize the social impacts of The Pearl by distinguishing between residents, visitors and workers (table 2).

Residents

There are not available statistics about demographics and income of residents at The Pearl. On a qualitative, empirical basis we have found that most of The Pearl inhabitants are professionals who are on a temporary residence visa sponsored by local government agencies and western companies operating in the country. Rents for a two-room apartment in Porto Arabia can be as high as QAR 15,000/month (about € 3,000/month) and usually are covered through housing allowances from the employer. In the least development sectors of the project a two-bedroom can cost € 2,000/month, therefore, still unaffordable for the South-Asian workers community in Doha. Also, many units are owned by Qataris as holiday apartments for weekends. Apartments come with parking garage, 24h maintenance, Climate controlled, chauffeur, swimming pool, private beach (were possible), and spa included.

Visitors

On a typical weekend Porto Arabia, the nearly completed urban core of The Pearl, is flooded with crowds of Qataris and Western expatriates strolling the promenade by the marina and stopping by cafes and quality restaurants. Also, top-brand shops (e.g., Ferrari, RR, Armani, etc.) and high-end services (e.g., banks, flight carriers' exclusive ticket office) for this local elite contribute to strengthen the perception of a VIP enclave for few. Limousine services and boat taxis allow visitors in and out the island. Also abundant parking space is localized at a short distance from the core. Interestingly, the local mass transit network (mainly used by workers and low wage expatriates) does not cover this area. A main gate to the area is patrolled by private guards that have the power to control the access to the artificial island.

Table 2. Observed groups and characteristics (source: Qatar University student's surveys, 2012)

Groups	Ethnicity	Gender	Activity	Visibility	Access to the Area
Residents	Qataris, Arabs, Elite Expatriates	Mainly male single expats and families	Permanent and Temporary Living	Visible everyday	Own vehicle
Visitors	Qataris, Arabs, Elite Expatriates	Mixed	Shopping, Dining, etc.	Visible mainly at weekends	Own vehicle, Taxi
Workers 1: Construction	South Asians (India, Pakistan)	Male	Building and Infrastructure Construction	Not visible	Private buses
Workers 2: Maintenance	South Asians, South-East Asians (Philippines, Indonesia)	Male	Cleaning, Reparations, etc.	Visible	Private mini buses
Workers 3: Services	Arabs, Eastern Europeans, South Asians	Mixed	PR, shop keeping, Cooking, etc.	Visible	Private mini buses/cars, Taxi

Workers

There are at least three types of workers in the area:

- *construction workers* (mainly from South Asia) that are usually invisible to the users - they are brought in and out, day and night to the island by private, obsolete buses provided by the developers. Their income (as low as few hundreds dollar a month, if they are paid on time which is not usually the case) will never allow them to live or shop in The Pearl. Construction workers often live kilometers away from the development in shared barracks provided by their employers (these latter local sub-contractors of Western and Arab developers).
- *site maintenance workers* (mainly from South East Asia) in charge for small reparations, cleaning, and other services - they are visible to the users and access to the area with small buses provided by their employers. Again their salary does not provide them with the opportunity to live or use the complex. They usually rent old apartment shared units in the centre of Doha.
- *Shopkeepers and PR workers* (a mix of East Europeans, Arabs, and other English proficient workers) that directly provide services to the users. Usually they cannot afford to live in the area. Their salary is much better than those above mentioned worker groups. They may live in better shared apartments by their employers located in the centre of Doha or around the old airport area provided.



Figure 9. Typical transportation vehicles in Doha (from Top left): mini buses for service workers; Workers buses (source: The Guardian); Taxi; Private cars.

6. Discussion and Conclusions: are Sea-Megaprojects a Sustainable Urban Typology?

The cumulative effects of the Gulf's "instant urbanism" and Qatar's geopolitical aspirations have produced ambitious urban transformations in Doha. This is the case of The Pearl, an off-shore, sea megaproject under construction since 2004. Building upon our fieldwork observations we sought to shed some light in the politics and processes that facilitate the emergence of sea-megaprojects in the Arab Gulf Region and to analyze their manifestations in the specific context of The Pearl. What we have found is that sea megaprojects in the autocratic monarchies of the Persian Gulf Region are a new forms of city making in which few actors, often powerful families who are at the same time policy makers and business stakeholders, steer government revenues and replace market forces to quickly transform Gulf cities in global hubs (Ponzini, 2011).

Furthermore, our brief analysis of The Pearl has highlighted the some social groups, usually wealthy locals and expatriates are overrepresented in the area despite being a tiny minority if we look at the overall number of people living in Doha. Ethnicity is a powerful constraint in the Gulf, where job permits

are assigned according to the country of origin and sometime religious belief (see Nagy, 2006). This mechanism becomes visible when we look at the way different groups' access to the island (figure 9): only residents and visitors come by private car or taxi while workers usually are brought in by private buses. It is worth noting that no public bus stop is located in or around the island.

Although our analysis has focused on socio-political issues of sea-megaprojects in the Arab Gulf region, in light of current global trends such as climate change, volatile oil-price, and social unrest in the Middle East, we argue that the sea-megaproject typology is not sustainable - neither in the Gulf nor in other global growth centers of the Middle East. While at the moment, social strains and freedom of speech are minimized by a generous redistribution of the country's oil/gas wealth among nationals (see Friedman's (2006) First Law of Petropolitics), it is in the interest of Qatar, particularly in light of the recent Arab uprisings in the Middle East, to put in place a better planning system that is capable to re-tune uneven urban development.

We therefore stress the importance for local decision makers and planners to work more on consolidating Gulf's existing, fragmented urbanism rather than continuing to replicate capital-intensive, sea-megaprojects. In Doha there are plenty of areas in which urban regeneration is needed: e.g., urban areas comprised between the B and C rings; the areas around the old airport; central areas around Mshereib redevelopment; many of the town centres outside Doha. From an academic point of view, while this thesis is corroborated by the findings of other local scholars' analyses (e.g., Adham, 2008; Elsheshtawy, 2008b), we think that Gulf academia, that is in charge to shape the next generations of Gulf planners, should put more emphasis in their study programs and design studios on urban regeneration projects. Also, more research on urban regeneration opportunities in the Gulf is needed to rebalance the current speculative and highly unsuitable urban trends. If we go through the database of Qatar National Research Framework website (the main agency that funds scientific research in Qatar) we find that very few projects aim to study the existing city and the opportunities of regenerating it.

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Participatory experiences for the environment in Reims 2020

Irene Rossetti

Synopsis

Political projects and participatory practices observe and define the urban space, mixing urban and regional planning. In urban policies for a French city, Reims, on social, environmental and sustainable renewal, we find out potential and criticality to develop approaches towards a new strategic planning in Europe.

1. Reims territorial framework

The Master's thesis *How to live together* dealt with the city of Reims (France) and its strategies aimed at defining the *Reims 2020* political plan, that drove to a master-plan about land use and trim of Port Colbert, a former industrial suburb. More recently, the frame analysis approach has added a new perspective to the research, within the PhD in Territorial Planning and Public Policies in IUAV (Venice, Italy).

Reims is located in the area called *Bassin Parisien*, receiving a significant influence from the French capital, which is 130 km away, at one-hour distance by TGV. Reims is also close to the border with Belgium and Luxembourg, 180 and 160 km from their capitals, a strategic location in commercial, touristic and economic streams.

1.1 Reims through the ages

Reims, due to its favorable location, had a pre-Roman origin with the name of *Durocortorum*, meaning "round fortress" (*Histoire de la ville de Reims*, 1864): the center of the city has indeed a visible elliptical shape (Figure 1) and distinguishable ancient walls. Its origin is recognizable by the *forum* square, while the *Saint-Remi* cathedral remains a symbol of the city, because it was the



Figure 1: Reims portrait (1635), M. Moreau, engraving

French kings coronation site from 987 to 1825. During the Second World War, the town was awarded the Legion of Honor, after the destructions that included the cathedral and other important buildings. In the next decades a strong reconstruction commitment led to the complete regeneration of the urban fabric. The historical frame and the economic specificity, marked by the extensive production of champagne throughout the region, help to define a strong identity of the city and of its surrounding territory.

Reims and the other G10 (ten cities association for the regional development) cities, all with Roman or Medieval foundation, can be defined as “water towns”, remaining until the nineteenth century in the state of small Venice (Guilherme, 1983). They are used to waterways and water transport: the pathways follow the banks, heavy products are transported by boat, thanks to the presence of canals, ditches and fittings to domesticate the swamps and create cultivated lands, like floating gardens.

For centuries, the city of Reims has been protected behind its various belts. Based on the Vesle river, the city had a special relation with its water: it was a large cultivated and very productive area with circulation through channels to transport tools and crops, as we can see in other French cities. The Vesle is a quiet hydraulic system, it protected and valued the outskirts of the urban core, while, inside the blocks, large properties developed gardens.

The Vesle is a minor river running between two major ones: Marne and Aisne, the first on the south and the second on the north of the region, tracing two important paths for commerce and communication with the Seine and the French capital. This is one of the reasons why Reims, more than other cities in the same region, grew as a chief town.

1.2 The role of the water

The French law of December 6th 1964 established the water management in its natural setting around six major French watersheds. It promoted, within each basin, water management assigned to a water agency. The French law of January 3rd 1992 and the Rio Declaration on Environment and Development of June 14th 1992 confirmed the role of water as a common national heritage. According to 1st article of the Act in section 210.1 of the French Environmental Code:

> *Water is part of the common heritage of the nation. Its protection, enhancement and development as a usable resource with due respect to natural equilibriums are of general interest.*

The French law on water and aquatic environments promulgated on December 30th 2006 defines the legal framework for water management in France. It creates conditions for a ‘good ecological water status’ by 2015, according to the European Directive of October 23rd 2000. The priority given to the fight against pesticide residues is reaffirmed and plans of

action are announced. Sustainable exploitation of natural resources implies a full knowledge of their renewal considering risks such as floods and droughts.

The hydrographic network of the Champagne-Ardenne region, generally oriented east to west, includes the Seine and its tributaries, the Aube and Marne, its sub-tributary Aisne, and the Meuse as major rivers, with a relatively dense network of canals. The Marne and the Aisne flow around 25 km far from Reims, which is crossed by the Vesle. With its 140 km length, the Vesle enriches the territory extended as an artificial channel, the *Canal de l'Aisne à la Marne*.

The city looks at its countryside and surroundings as land for urban development. The countryside looks at its city not as protective or direct exchange system, but at worst as a whole threatening, at best as a foreign body in its territory. The entire urban life and the whole rural economy were based once on the water, while today the Vesle is partly 'buried' under the Reims highway. Agricultural world is no longer entirely dependent on water; water is even regarded as a danger, for example in vineyards. More and more people work and live in the city, whose urban limits are therefore loosened, while accesses are not enough treated, as borders and relationship with the landscape.



Figure 2: Territorial authorities, from *Ile de France* to *Reims Métropole*, *How to live together* (2013)

1.3 "Pays Remois" and the G10

The region is composed of about 2,000 municipalities, which have implemented various forms of associations and institutions over the decades, aimed at the harmonization of the territory and its adjustment to grant possibilities of growth to all the involved members. These organisms are structured in different levels (Figure 2), from the point of view of strategic planning (*Pays Rémois*, *Reims Métropole*), of governance system (G10, CD2R), and of specific urban policies that the French call *politiques de la ville* (Chaline, 2011).

The *Pays Rémois* is the area extending for a radius of about 30 km around Reims, including 134 municipalities and 16 inter-communality. Created in 1998 as SIEPRUR

(*Syndicat Intercommunal d'Etudes et de Programmation de la Région Urbaine de Reims*, Intercommunal studies and planning trade union of Reims urban region), its function is to draw up inter-territorial plans which provide basic guidelines for local planning. CD2R (*Conseil de Développement de la Région Rémoise*, Development council of Reims region) is the organ allowing the coordination of plans: it is an instance of local participation of civil urban and rural society representatives, consulted on the occasion of projects promoted together with teams of urban planners.

The G10 was created in 2005 by the association of 10 cities for a total of about 500,000 inhabitants, following a period of demographic decline that had forced the municipalities to cooperate. It aims to draw shared strategies of mutual solidarity in the urban and regional development; for this reason, other cities have been added since 2008. G10 is a form of public participatory governance, aiming to sustainable development of the territory. It consists of five committees: business-economics, education-teaching-research, mobility, sustainable development, cultural tourism.

2. Reims 2020

Due to its location and history, the city of Reims elaborated a political project whose main objective is to enhance and provide new development targets for the city, under the name of *Reims 2020* (*Reims 2020*, 2011).

A central aspect of the work *How to live together* was to demonstrate how, through an inter-scalar approach to the territory, to its weaknesses and its strengths, it was possible to develop policies aiming to civil coexistence, by strengthening the inter-communal network on multiple levels. *Reims 2020* is an exemplification of this commitment, as it largely consists in a broad process of participation, involving citizens' awareness of the concept of 'proximity' (Figure 3). Proximity – significantly present in the French urban planning tradition as an

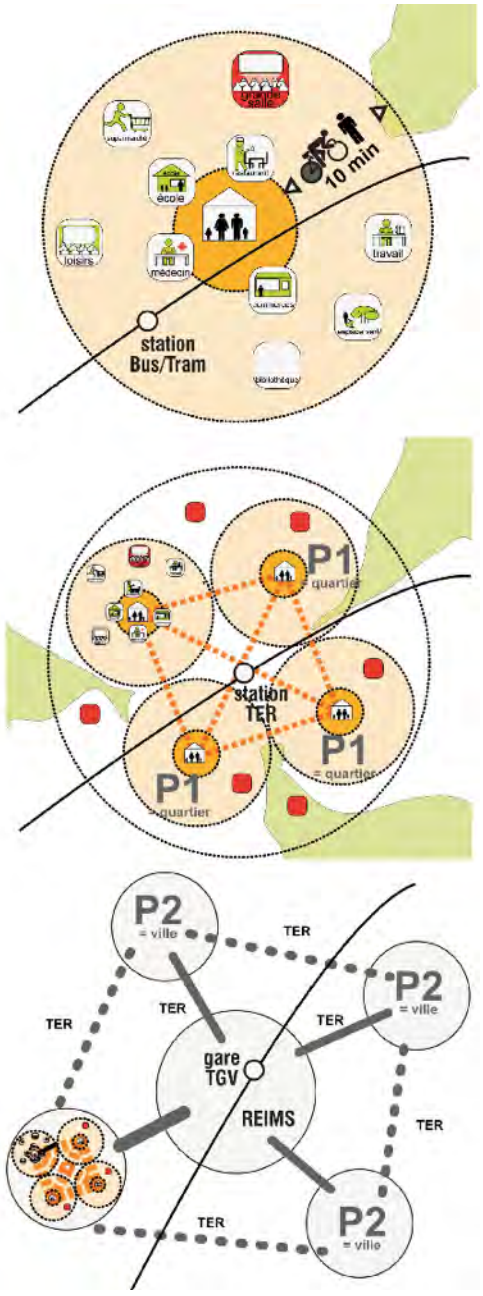


Figure 3: Proximity city, *L'Expo* (2010), team Devillers, *Reims Métropole.*

interpretation of the social representation (Moscovici, 1989) – discerns a set of public and private functions, recognized as being of public interest, thus identifying the principals in the area, in the case of large cities neighborhoods as well as in small towns. Three teams have been chosen with a *marché de definition* (project definition announcement): Bruno Fortier, Christian Devillers and Philippe Panerai, all the three awarded with a *Grand prix d'urbanisme*, the yearly French award for urban planning.

With this political project Reims has set, as other cities did in the country, a goal for the next decade to give new life to the flows of population, economy, tourism, attractiveness and social environment, to ensure progress towards the future, to reach the critical mass of sustainable metropolis in Europe.

2.1 2020

A subtended frame (Schön, 1994) deals with the year as a fixed term to achieve a state of competitive development, as it happens in France and specifically in Reims. Since the early years of the last decade, several studies have been conducted on the global transformations. Among them, the 2005 American public report *Mapping the Global Future* was edited by 25 international experts who estimates for the decades to come, in terms of economics, resources, governance and safety. The resulting data underline the progress of some countries, China and India above all, compared to Europe and the United States, by fixing symbolic and not empirical crushing dates in terms of economic and social development. The response to the trend, perceived in terms of social problems in a process of collective definition (Blumer, 1971), led to a specific action plan in Europe: the 'Europe 2020 strategy', born in 2010, proposed the definition of common objectives about employment, education and innovation to the countries belonging to the European Union, as well as the revitalization of the economy itself. The EU translated these aims into a strong encouragement to research, allocating up to 80 billion euros with projects such as *Horizon 2020*.

Similarly, a new programming of public policies has been promoted in many cities of France, in a sort of re-framing of resources allocated to promote social activities and businesses which includes the aim of stimulating social cohesion, even on the larger territorial scale we call metropolis.

2.2 Reims Métropole

The self-conscious collective effort to re-imagine a city in Europe, on a urban region or a wider territory, brings a deeper and complex 'spatial planning' (Healey, 2001), so to consider the metropolitan scale in the contemporary city life. Metropolis are a great theme, which has

assumed a greater significance in France since decades, considering its complex and ever-living structure of administration and governance bodies: territorial, regional, municipal and so on. Among the many existing entities, a French law in December 2010 gave birth to the so-called *métropoles*, similar to metropolitan cities suggested by the Italian legislative decree 267/2000, but not widely implemented in Italy. The *métropoles* were designed as large urban communities, with an inter-municipality of more than 400,000 inhabitants. This role has been given to large urban agglomerates to promote the national growth, reducing the separation between city and countryside and the trend toward centralization of large cities (Destot, 2013, president of the *Association des Maires de grandes villes de France*). With the exception of Paris, Lyon and Marseilles, who benefit from a particular statute, *métropoles* are created without special requirements when the municipalities involved in the area give their consent, and their representatives are elected by universal suffrage. Territorial alliances are thus created with the mutual benefit deriving from the shared resources of the urban and rural communities associated. At January 1st 2015, 10 new *métropoles* will be added by the law: Nice Lille, Bordeaux, Toulouse, Nantes, Rouen, Strasbourg, Grenoble, Montpellier, Rennes and Brest.

The territoriality of Reims, with its 280,000 inhabitants, is therefore a *communauté d'agglomeration*, despite the political momentum in recent years to obtain a prime location on a national scale, with *Reims Métropole* administration. The city of Reims and other six municipalities nearby (Bétheny, Bezannes, Cormontreuil, La Neuvillette, Saint-Brice-Courcelles and Tinqueux) have joined together in 1964 to form an urban district named *Reims Métropole* since 2004.

What we might call the 'frame *métropole*' thus identifies the line of control the administration wanted to exert. The fight for the involvement of Reims among *métropoles* is not yet finished: to defy the fate of the cities entitled to such status, there is the think-tank *Droit de Cité*, created by Jean-Michel Jacquet, architect and urban planner, and supported by a rather large group in the area of Reims, in order to establish Reims as the fifteenth French *métropole*.

3. Methodology

The Master's dissertation *How to live together* followed specifically the *Reims 2020* participatory practices and their outcomes in an early *ex-post* analysis.

The research focused on the study of planning tools and actors in France (Verpraet, 2005), as well as the stratification of administrations and local authorities responsible for their definition. This study created the opportunity to learn what practices and planning policies

(Crosta, 2009) are settled by the administrations, with which participatory processes and citizens' involvement to define a project on a territorial scale like *Reims 2020*. Urban planning is a technical but also deeply political activity, where styles of debate and argumentation are very relevant, and for which the information has a crucial power (Forester, 1989). This case study has been chosen for its public encouragement to social and environmental values through participatory processes.

During the year and half of thesis research, it has been possible to reconstruct the path of previous activities, through semi-structured interviews with those who were involved in the early steps of the process. Some members of the promoting *Reims Métropole* have been involved, to learn about the efforts undertaken and the results achieved or anticipated, through some open questions allowing to broaden the content of interviews. Later, with a group of citizens involved in the process of participation, a focus group based on a collective interview has been carried out. This allowed to introduce issues, while a group interview cared of the assessment of the group dynamics in relation to the involved issues.

Once data has been collected with this policy analysis and the consequent study of deliverables projects, the research drafted a master-plan for a neighborhood of Reims. Since the process defined strategies on a bigger scale providing for new homes, offices and spaces public, the master-plan aimed to synthesize what kind of space could be planned in an area such as it is. This was achieved by carrying out further interviews with some stakeholders close to Port Colbert, such as the Chamber of Commerce and some retailers. This was also functional to understand how this political project involved the participation of local citizens and businesses, mostly about the change of use of the neighborhood and the consequent increase of population in the area.

4. Participatory processes

With the political project *Reims 2020*, Reims therefore defines its first goal in terms of proximity, an issue that concerns many aspects of urban life: identity, mobility, services to the citizens, remembering the natural and urban landscape's features that characterize the city and the Champagne-Ardenne region. *Reims 2020* stands out for its participatory processes, implemented through various forms of citizen involvement for a comparison with the land and with the projects developed by the municipal administration, especially *Reims Métropole*.

Participation is here declined in forms of meetings as in the creation of perceptual maps by the inhabitants themselves accompanied by professionals, with a result explicitly aiming at consensus building (Susskind, McKearnen & Thomas-Lamar, 1999). *Ballades urbaines* (Figure 4) in the city have been organized to drive citizens on some paths, with the company

of experts and professionals of *Reims 2020*: in the city center by walk and bike, in many districts by boat and bike, in the countryside by bus and then walking. Many inhabitants were thus allowed to observe the city in a different way, trying to imagine those spaces in the future. They could express their needs about green spaces, nature, transportation, sociability of public areas and so on, as they did for Port Colbert.



Figure 4: Snapshots of participatory events for Reims 2020 in 2009, from *A l'ecoute des habitants et du territoire* (*Reims Métropole*).

The great involvement, as a solemn ceremony, winds towards building a consensus that legitimates the choices made, in some cases, immediately (for example the tramway project and the main squares renovation). The investment from the institutional point of view is expressed through the strong communicative expression that is leading the way, collecting the consensus through harmonious comparisons. This, in a ladder of participation (Figure 5; Arnstein, 1969), would recognize the good attempt of crossing the line between the tokenism and the citizen power, while citizens are also consulted and appeased by persuasive means of effective communication. So professionals and experts joined the public administration proceeding through role-playing (Innes & Booher, 1999), in which participants play out scenarios and take on different roles. This approach is much like the cooperative role-playing games to build consensus. In a re-framing process, it is possible to keep a careful check on the proposing entity's interests that are not in contrast during boards of companies and citizens: for the most of part, they appear finally resolved in finding a common ground, because the aims have been suggested and processed by many stakeholders on many territorial and political levels. In this way, plural interests merged into a single dialectic, underlining the founding principles (Forester, 1989).

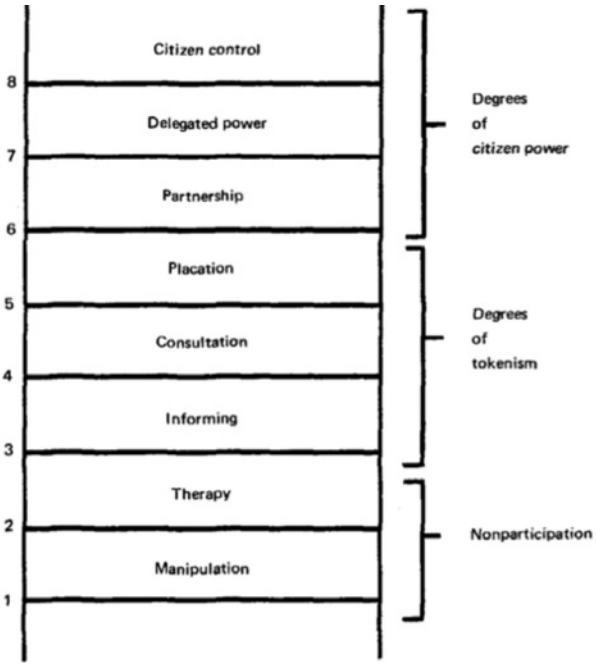


Figure 5: Ladder of participation, Arnstein, S.R. (1969), Journal of the American Planning Association, no. 35, p.217

In fact, the primary objectives of the policy

are the strengthening of the existing resources, such as the city center, the neighborhood identity, the network mobility, places of culture and universities, not to mention the involvement of businesses, industries and suburban places, that is the countryside and agriculture.

3.1 Saving and improving natural resources

Weakened by agricultural, industrial and urban pollution, Reims water resource deteriorated, even maintaining its generally good quality.

Reims agglomeration is an island in the middle of a suburban area consisting of natural agricultural crown bounded by the remarkable landscapes of Reims country. This space extends over 15 km around the city, covers 42,000 hectares and includes 48 municipalities. This natural perimeter embracing the horizons of Reims agglomeration is known as the *Grand Parc de Champagne,* in *Reims 2020* (Figure 6)*.* Its destination is to become a theatre for environmental initiatives, as well as a territorial showcase, thanks to the citizens involvement. A green belt around the city aims to preserve agricultural and viticultural lands, which are pillar of local wealth, from urban sprawl, and to fix landscape benchmarks while improving their accessibility. Forests, vineyards and the *Coulée verte* make a network of parks and woods throughout the country Reims, equipped with shaded bike paths promoting migration of biodiversity.

The creation of the *Grand Parc de Champagne* is an opportunity to properly increase the sustainability of the water. Again, the Federal dimension appears as a structural element of the port. The strategy will aim to both protect existing resources and enrich the field in quality and quantity. Encourage more respectful of the soil and water farming practices, judicious use of fertilizers and pesticides, rethink storm-water management and mesh networks by multiplying devices of water re-infiltration. These are some of the



Figure 6: Projects for environmental development: landscape, nature and water, (*Envie de nature, besoin d'agricolture)*, *Reims 2020*

tracks of the Grand Park Champagne, as a green lung of the urban area.

3.2 Port Colbert

Specifically, the Master's dissertation research led to the redesign, in terms of the master-plan (Figure 7), a Reims district: Port Colbert, interested in the *Reims 2020* process of defining the former peripheral neighborhoods to retrain. This area, now involved in the expansion of the city, has to relate with some residential areas with urban gardens, renovated some decades ago and still carrying the signs of the industrial age. Port Colbert holds many productive activities, largely neglected, but located in an area that has great potential from a naturalistic point of view. The presence of water, with the Vesle and the dock, is associated with the so-called *Coulée verte*, the green belt already designed and partly built along the canal as a natural pattern. The district, observed through the eyes of citizens, permits to practice a urban renewal, to make it habitable and socially attractive with housing, assuring the ownership to a community around green spaces. Among the designers involved, Bruno Fortier designed a master-plan for a large scale on the district, with the anticipation of thousands of new residents and employments.



Figure 7: Master-plan of Port Colbert, *How to live together* (2013)

3.3 Translation timings

What are the consequences of this political project in terms of urban planning? Although it was structured with planimetric representations to define the interventions and accompanied by images allowing to imagine their consequences, they haven't the same legal regulations as regulatory plans, such as PLU (*Plan Local d'Urbanisme*, town planning) or SCOT (*Schéma de COhérence Territorial*, territorial planning). *Reims 2020*'s projects, drafted by the three *Grand prix d'urbanisme*, need translation tools in planning regulation. This translation involves a necessary time for technicians inspections, that can change requirements and intents proposed at the beginning in *Reims 2020*. It triggers a conflict between what we might call 'theory' (everything that has pushed and led to the political project) and 'practice', materially headed by technical specialists. There is a difference in declination of values between theoretical and practical needs of project, because the second ones show

themselves only at a closer look. Thus analytic questions arise such as geological and about constraints, that had not been previously considered in a proper way, involving the adjustment of upstream intentions. One proof of this is the update to the PLU, a sort of variant carried out in January 2014, in which it is possible to check how some *Reims 2020* projects won't be put in place for the foreseeable future. The time and the hierarchy of planning instruments, therefore, help to define a rather complex framework of action, giving way to those interventions shared by the *communauté d' agglomeration*.

4. Conclusions

We can detect from these comparisons how the administration substantially focused on the *Reims 2020* political project from the point of view of spatial, political and economical development. At the same time, citizens told about their involvement and the opportunity to personally intervene in the public choices, acquiring the role of "expert citizens" and "everyday makers" (Bang, 2005). The process has been assessed in a critical and positive way as a whole, though leaving behind some issues related to consequences on the Reims urban planning in next years and decades. As participatory processes should assure, the citizenship has to be ensured about the operational part of the process. This is possible when the participatory question is affordable, otherwise the process can't be put into effect.

Globally observing the participatory process and considering the consequences of the political project in an *ex post* analysis, it is possible to describe this urban policy with its forcing the inhabitants involvement with the purpose of building consensus, which easily puts on the sly many contradictions among the citizenship interests. Considering the Arnstein ladder, *Reims 2020* has some characteristics leading to the degree of citizens power, mostly in terms of partnership with the administrations, who aim to conduct the public policies. Involvement, mediation and negotiation are very common in institutional processes in France, as the *débat public* shows.

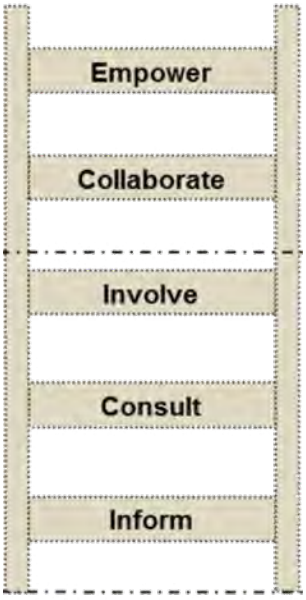


Figure 8: Ladder of participation (2000), IAP2

Contradictions of consensus building are always present, being part of the structure of top-down participatory practices. Many critics followed the Arnstein ladder, as many did and still do for the French habit to *concertation* (a word that can be translated as public consultation, mediation or negotiation). More recently IAP2 (International Association of Public Participation) translated the ladder into a shape where the crossing limit between participation and non-participation is called 'involvement' and 'collaboration', to

the highest level, 'empowerment' (Figure 8).

There is a very tight connection between participation and *concertation* or public consultation (Bobbio, 2004), but what we can definitely affirm with the *Reims 2020* experience is that participation in a vehicle of involvement, that can be led and driven or easily let assume its shape in autonomy. Public consultation is a bigger process that utilizes this vehicle for its good, for bigger benefits for the stakeholders who search for empowerment.

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Bringing Voices Together to Create a Waterfront Vision

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ABSTRACT

For decades, the small city of Albany, CA struggled with deeply divided opinions about its waterfront (107 acres of privately-owned, under-developed land, adjacent to 88 acres of public land). Proposals for private development, public funding, special elections, and zoning changes were some of the factors that swirled around the property that faces the San Francisco Bay.

Following a contentious local election that pitted "park devotees" against those intent on economic development, the Albany City Council decided to address the issue with a comprehensive and inclusive process intended to confront tensions, seek long-term solutions, and build a framework for shared decisionmaking. A critical component of the process would be the collection and analysis of quantifiable data as well as qualitative information that a skeptical community could trust.

The process — *Voices to Vision (V2V)* — included a multi-faceted approach to community education and engagement that ultimately involved one of every ten Albany adults. Along with standard public outreach methods — such as a widely-publicized website and on-line surveys — a 20-page, fact-filled magazine devoted to the waterfront was mailed first class to every Albany address, ensuring solid background information prior to participation. To design the most appropriate process for this particular city at this particular time, more than 80 one-on-one interviews with stakeholders/residents were conducted. The actual engagement included nearly 50 highly-interactive, facilitated community sessions (with one skilled facilitator for every 20 participants and activities that provided quantifiable data.)

Voices to Vision resulted in a clear community vision with recommendations for new zoning and land uses, and provided the city with development guidelines (height limits, preservation areas, expected revenues to support city services and schools). Less than a year later, an unexpected proposal was introduced by the landowner — one that stretched the boundaries of previous proposals and varied significantly from the community vision.

This paper will show how *Voices to Vision* prepared the community for new challenges, and guided the city through an education process. Thus, when residents of Albany were presented with yet another proposal for waterfront development, they demanded an innovative, inclusive, and informed process. This included structuring and facilitating a new kind of city-wide conversation — taking into account percentages of land available for income generation (taxes) and land devoted to the public — which most importantly moved the discourse from a framework of "parks vs. profits" to one of necessary trade-offs for the common good.

While the particular issues and nature of the engagement process were designed specifically for residents of Albany, the style of the education and engagement could have far reaching impact on how other cities tackle waterfront decisionmaking and participation — ensuring strong community involvement and a lasting vision.

Background

The city of Albany, California — home to about 17,000 residents — is situated on the eastern shore of the San Francisco Bay. Its presence on the Bay is framed by 190 acres (88 publicly-owned and 107 privately-owned), much of which is landfill and borders an interstate highway.

For four decades, the waterfront had been the focus of a bitter tug-of-war between those who hope to see commercial development at the privately-owned portion — currently used as a racetrack — to maintain and/or increase tax revenues to the city, and those who favor transforming the parcel into a public park (open space). Over the years, numerous proposals were put forward by both private developers and the landowners — who sought to maximize the use of the property and its breath-taking views.

The discord over the waterfront was intensified in 2005-6 when, in the wake of yet another developer-driven proposal for the site, a slate of "pro-park/anti-commercial development" candidates was elected to the City Council. To complicate the situation, the racetrack, Golden Gate Fields (GGF), had been experiencing a significant decline in attendance which decreased its tax liability to the city. Once widely considered the most important local business, the racetrack was now seen by many as an impediment to the potential for the property (for either park or commercial development). The possible closure of the track and subsequent bankruptcy in 2009 appeared, to some residents, as an opportunity to turn the property into a large public park; others felt the lack of public funds to purchase, transform, and maintain the land, and the need for replacement tax revenue, should be at the forefront of waterfront decisionmaking.

With the future of the site in question, and the contentious nature of the issue at a fever pitch, the new city council decided to be proactive. [As a result of a 1990 ballot measure, (Measure C), — the approval of Albany voters would be required for any plan that differed from the area's 1990 zoning (allowing only: park and recreation facilities; utilities; commercial recreation; restaurants and bars; marinas; boat-launching ramps; non-residential parking; and waterfront- and sports- related commercial sales and services)].

In March 2008, the city of Albany hired Fern Tiger Associates (FTA) to conceive, design, and facilitate an appropriate process to educate and engage residents in the hope of developing a shared vision for the future of the waterfront (and possible next steps). By selecting a firm that specialized in public engagement (rather than land use planning), the City signaled its commitment to an authentic process of community participation where perspectives, ideas, and goals would be shared and analyzed as opposed to reacting to a fully-formed plan or proposal.

"There's been a lot of grand-standing in Albany about this issue and not enough people being open and really listening to one another. We realized we needed someone to hold a mirror up to the community and say, 'Here's what we're seeing," explained one council member.

Albany Decides to Engage the Community

To address the concerns of Albany residents, reflect their values, and acknowledge previous community processes, FTA began by conducting a comprehensive study of the city's history and character, as well as the dynamics of earlier waterfront planning processes.

FTA staff reviewed a wide range of environmental, technical, and historical reports produced over the last 50 years as well as press clips; campaign materials; and verbal anecdotes. This research, along with observation of City Council, Waterfront, and Planning/ Zoning committee meetings, provided insight into how community attitudes and perspectives impacted discussions about the waterfront over time.

A major focal point of this research was a series of 80 in-depth, one-on-one, in-person interviews with Albany residents (opinion leaders, community and business leaders, elected

officials, city staff, and individuals with a history of involvement with the waterfront, as well as regional stakeholders). The goal of the interviews was to gather perceptions about the city and the community, and to understand how the issue might be framed to ensure participation beyond the "small core of those already opinionated about the issue." FTA needed this information to inform both the outreach strategy and the design of an appropriate participatory process.

FTA strove to ensure that interviewees represented an even mix of perspectives and sought to understand how the waterfront figures into the lives of Albany residents. Again and again, FTA heard that Albany is a close-knit community and that its small-town ambiance and high-performing schools are what makes Albany unique and what keeps real estate prices high.

As for the waterfront, some envisioned the site as a regional park while others were more concerned about the need for tax revenues and feared a large tract of open space would be costly to purchase and expensive to maintain. *"We have an incredible opportunity to have a great park and a shoreline that's publicly used, available, and open,"* said one resident, while another said, *"If the racetrack closes, we're going to need to replace those revenues. We can't afford to have that land become 'just' open space."*

Still, many saw the opportunity for something between the "poles" of total open space and extensive development: *"It's a beautiful site that has the opportunity to offer many things to many people."* The goal of this phase was to conceive a process that could find common ground, and to avoid past experiences which reinforced divisions in the community. FTA wrapped up the research phase with a clear sense of the complex history of Albany's waterfront planning; a strong understanding of the mix of perspectives and roadblocks to effective communication and participation; and insight on misinformation spread over the past years. It was clear that FTA needed to address some key issues in order to ensure a respected and well-attended process:

History of Conflict / Lack of Trust. Previous efforts to consider the future of the waterfront resulted in significant polarization. Each side viewed the other as inflexible and unwilling to consider other perspectives. Some felt that, because "pro-park/anti-development candidates" won the contentious 2006 election, there was little hope for productive exchange.

Widespread Misinformation. The waterfront had been a hot button issue for several decades, during which time a range of supposed "facts" had been disseminated. In part, these disputed facts stemmed from the informal ways that information spreads in a small city, as well as the politicized nature of the facts. From interviews, FTA knew that Albany residents lacked solid information about both the possibilities and the challenges of the site.

Fear that the Voices of "Outsiders" would Dominate the Process. The interviews revealed that over the years, non-Albany residents appeared to dominate waterfront decisionmaking. There was also a concern that outspoken residents and special interest groups would monopolize one or multiple sessions and thus inordinately sway the ultimate direction of the process.

Community Participation: A "Block-by-Block" Approach

To set a tone of professionalism that would ground the process, FTA branded the process *"Voices to Vision,"* which captured the goal of gathering input from many voices and moving toward a shared vision.

To launch the process and to counter widespread misinformation, FTA produced a 20-page tabloid-sized publication that was mailed to every Albany address. The publication featured rich, easy-to-read, fact-filled text; photographs; and graphics that covered the environmental, land use, economic, historical, and regulatory issues that might affect waterfront development in Albany. It offered articles dealing with the history of the site and the purpose of the *Voices to Vision* (V2V) process, and "at-a-glance" information presented in tables and maps. A glossary

of important terms and a comprehensive set of frequently asked questions were also included. The publication reflected the information needs of an educated and engaged audience.

FTA also developed a website dedicated to the process. It included ways for users to ask questions, to register for V2V activities, and to share comments. An evolving list of questions submitted by the community (with answers) was posted on the website.

To counter concern about non-residents dominating the process, V2V was designed to engage only residents, who were organized into "micro-neighborhoods" of approximately three square blocks. Each micro-neighborhood was assigned a particular date and time for their session[1]. The delineated neighborhoods were shown in a centerfold map in a publication mailed to every household. Postcards reminding people to "register" for the sessions were hand-delivered to each address a few days prior to sessions[2]. All sessions were held in welcoming and familiar public spaces (community center, schools, library).

The neighborhood approach was a good fit with the small-town spirit of Albany. Though more complicated from a logistical standpoint, meetings in public spaces felt more "open," in contrast to the most recent private developer-run sessions which were held in private homes.

To participate in *Voices to Vision*, residents needed to RSVP through the website or the *Voices to Vision* phone line. Thirty-eight sessions were held in a six-week period. On the days prior to the sessions for each neighborhood, *Voices to Vision* flyers were hand-delivered to each address in the zone.

Encouraging Participation. Outreach in the weeks leading to the sessions was extensive: banners at the Community Center and at major intersections; posters on the windows of businesses and schools; and a model of the waterfront (scale of 1":200') was at the Community Center. Guided tours were made available. Outreach was also done through schools, and some sessions were for high school seniors.





Voices to Vision Community Sessions

The two-hour sessions encouraged residents to "think big," and understand site constraints; to learn from the activities and from each other; to know how their input would be used; to be comfortable stating their opinions; and to enjoy the session.

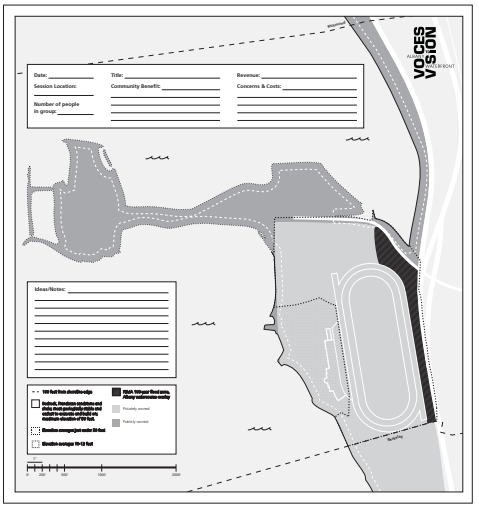
To accomplish this, a series of exercises were developed to engage residents, well beyond what typically happens at community meetings. The major emphasis of the session was "The Albany Waterfront Game" where participants worked with a large-scale map of the site to think proactively about possibilities. Unlike previous developer-led processes, there was no development plan to react to.

Voicing Visions. Over the course of six weeks, 38 community sessions — identical in format — were facilitated. The sessions ranged in size from less than 10 to more than 50 participants.

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1 *If residents were unable to attend the session in their neighborhood, they could arrange to attend another session.*

2 *The RSVP process allowed FTA to ensure one-time participation by Albany residents, and to ensure sufficient space, facilitators, and supplies for each session.*









Residents of Albany planning for their Waterfront future at "Voices to Vision"

The community sessions were comprised of six parts, with the Albany Waterfront Game taking the majority of time:

- Icebreaker (The Best Thing About Albany)
- Envisioning Albany 10 to 20 years into the future
- Reviewing the Albany Waterfront (The Facts)
- Your Personal Drive for the Waterfront
- The Albany Waterfront Game
- Group presentations by participants

Facilitators used a script to ensure that all sessions were as close to identical as possible.

Creating a Vision for the Waterfront. The core of each session was an exercise where participants created their vision for the Albany waterfront. The group was split into small teams to explore what they'd like to see at the waterfront, as well as the ways in which various uses could provide benefits to the city and community.

To form teams, each person selected from five "driver" cards — each with one "theme" (open space; ideal for families; economic development; regional asset; racetrack remains at site) — the card that he or she viewed as the most important factor driving the future of the waterfront. Small teams of 4-6 people formed, based on who chose the same card.

Each team sat at a table with a large waterfront map showing the 190-acre site (delineating ownership, some geotechnical aspects, site features, and setbacks). Each table was given a "game box" with 56 playing pieces. Each piece was color coded and proportioned to the 1": 200' scale of the map. Pieces represented different land uses (e.g. hotel, housing, open space) and included information on building type, acreage required, height, and potential tax revenue.

Each table group discussed the opportunities and constraints of the site, including environmental and aesthetic impacts, community benefits, tax revenues, and challenges of different land use options. If the group came up with a land use not covered by the colored game pieces, there were blank pieces they could use for "bright ideas" (which were recorded and noted). There were enough "open space" pieces to turn the entire site into a park.

Participants talked about where on the site any development and open space should be located and placed the appropriate game pieces on the site map.

Each group then named their idea and listed community benefits and estimated total revenue generated — based on information noted on the game pieces. At the conclusion of the session, each group presented their plan to the other table groups. Careful notes were taken

by facilitators and written directly on each map as the solutions were presented. A photograph was taken to document each map.

Analysis of Phase One. At the conclusion of Phase One, there was a wealth of information to analyze, including 199 rendered site maps showing concepts for the waterfront produced by more than 600 Albany adult residents, about 100 Albany High School seniors, and a handful of non-Albany residents, as well as demographic and session evaluation information. Each site map offered a unique perspective and rationale. While the ideas reflected many differences, there were common themes that emerged related to: the amount of new dedicated park/open space; favored uses; tax revenues; and acceptable locations for site development.

- Nearly all participants wanted to increase open space at the waterfront — to varying degrees. About 62% had maps with 72 acres or less of new dedicated park/open space; non-residents favored more open space; youth opted for development and "things to do."
- More than 85% of attendees placed a hotel at the site; most favored a 3-story, eco-boutique-style hotel/conference center on an 8-acre site (generating about $700,000 in tax revenue) rather than a 10-story hotel/conference center on 5-acres (est. $1.4M in gross tax revenue).
- High end retail/restaurant was the second most favored use and the only other use that a majority of Albany adults placed on their maps. This use was shown to require a minimum of 250,000 sq. ft. in order to generate sufficient regional draw. This use would require a minimum of 24 acres and generate approximately $1,050,000 in gross tax revenue.
- Retail was most favored by youth (70%) and least favored by non-residents (25%).
- Other sought-after uses focused on education-oriented (non-taxable) uses. About 30% of adults and more than 65% of youth favored a museum or aquarium.
- Housing generated much discussion — with many residents having difficulty envisioning how housing at the waterfront could be integrated into the life of the city.
- Residents were uninterested in developing offices at the site.
- About 11% chose to preserve GGF, long term — either for continued use as a racetrack or for a strategic rehabilitation of the structure for another use, such as an outdoor theater. Some of the solutions that retained GGF indicated a phased plan, maintaining the racetrack for a few years. (None of the non-residents chose to retain GGF.)
- About 80% of the maps included at least one "bright idea," including water recreation, alternative energy production to power waterfront development as well as other parts of Albany; a velodrome; ice rink; mini golf; marijuana farm; and regional campground.
- About 60% developed the site to provide between $1 million and $3 million in tax revenue, but used far less land than what GGF currently uses.
- Seventy percent of participants created maps with uses that generated at least $1.4 million in tax revenue; nearly 50% generated maps with tax revenues of at least $1.7 million; 30% selected uses that generated $2.3 million. Twenty-five percent of participants created maps with up to $700,000 in tax revenue; 6% of Albany adult participants created maps that did not generate any known tax revenue.
- Regardless of the initial "driver," the solutions were often more similar than different.
- Thirty-eight percent of participants preferred development at Fleming Point; the current site of GGF was favored by approximately 35%. Of those maps showing high end retail/restaurant uses, more than 60% placed this use on the current GGF site.
- Access was an important topic of discussion, with many ideas emerging about ways for Albany residents and non-residents to get to the waterfront and ways that Albany's pre-existing commercial districts could be connected to Albany's commercial districts.

More than 90% of Phase One participants indicated they liked working in small groups. They appreciated the specially-designed tools and the creative approach to participation; they felt their opinions were heard and recorded. But 10% noted that despite working in very small groups, they still felt their voice was not as strong as others at their table. Based on these comments FTA developed the format and tools for Phase Two.

Phase Two Community Sessions

Prior to the design of Phase Two community sessions, FTA created and analyzed an on-line survey which gathered additional information and clarification of some terminology.







Phase Two Sessions: 10 identical sessions held over one weekend.

FTA's analysis of the nearly 200 maps created in the Phase One sessions provided the data to develop a set of six "conceptual site scenarios," which reflected the range of community thinking and framed the activities of the Phase Two sessions. A list of desired environmental/ sustainability parameters was also developed and expected to be implemented for any proposal.

The design of the Phase Two sessions enabled participants to discuss topics as a group (of six per table), but also to provide input as individuals.

Ten Phase Two sessions were held over one weekend. Again, residents could only participate in one session. The format and activities of each session were identical, with the exception of the slightly longer introduction for those who had not participated in Phase One. Each session began with a presentation of the results of the first phase.

After a brief description of each scenario, the facilitator handed out the six "conceptual scenarios," one at a time: large-scale color maps (1": 300') and a bulleted list indicating the acreage of new public open space added in each scenario, the amount of built development (if any), as well as a description of features and related tax revenue information.

Participants discussed and reviewed each scenario as a table group. Then, they "weighed in" as individuals; each person was given a deck of cards; each card listed a specific attribute of that scenario (e.g. "Hotel fills need for locally-based visitor accommodations.") There were also blank cards that could be used to note attributes not mentioned. Working alone, participants dropped each card into one of three color mugs at their table (green = pro; red = con; yellow = neutral) to reflect whether they thought that attribute was positive, negative, or neutral for that scenario. Additionally, participants commented on each of the six scenarios by answering a list of questions.

After placing the attribute cards into one of the mugs, participants filled out "Individual Scenario Worksheets," offering additional input about each scenario.

Every eight minutes, the facilitator gave a brief introduction to the significant characteristics of the next scenario and "attribute cards" for that scenario were given to each participant.

After eight minutes, cards and other materials were collected and the process was repeated with the next scenario map. When the exercise for the sixth and final scenario was done, participants completed the "All Scenarios Worksheet" which provided an opportunity to give additional, comparative feedback — after having reviewed all scenarios. Participants then indicated their favorite scenario, the one that best met their goals for open space and tax revenue.

Voices to Vision Phase Two Analysis. The various activities and exercises in the Phase Two sessions provided an extraordinary amount of quantitative data, as well as qualitative commentary. The conceptual scenarios and corresponding exercises were designed to understand the minimum amount of new public open space Albany residents would support. While many differences emerged, it was possible to analyze the information to generate a well-informed set of guidelines for the site. The key results include:

- While a small number of participants (11%) were satisfied with the addition of 19 acres of new, dedicated public open space, the majority (62%) supported projects that provide at least 72 acres of new open space. Five percent of participants would only be satisfied if close to 100% of the site was turned into dedicated open space.
- About 33% considered the development of the entire site as a park to be a positive statement, but only 10% felt total park development would be an appropriate use of the site.
- The majority (74%) considered restoration of wetlands to be positive; 76% supported a large area of pedestrian-only open space.
- Seventy-one percent of participants wanted to limit building heights to three stories; some indicated a willingness to go higher as a trade-off to gain more open space.
- Building on the site's southern portion was described as "best location for development."
- Fifty-eight percent of participants indicated support for a hotel (especially a one-to-three-story boutique hotel with conference center); hotel plus park was the most desired pairing.
- Thirty-six percent thought hotel and retail uses were appropriate.
- Forty percent of participants viewed garages negatively, but 32% supported parking structures as a way to gain additional open space.

ALBANY AND NON-RESIDENT PARTICIPANTS

A quick overview of the similarities and differences in opinions regarding open space, based on results of Phase Two sessions

Requirements for open space met with:	% Albany residents	% Non-residents
98 acres	5	27
87 acres	5	11
83 acres	29	36
72 acres	27	19
68 acres	24	0
19 acres	11	4

A quick overview of the similarities and differences in opinions regarding sufficient revenue to be generated from the site:

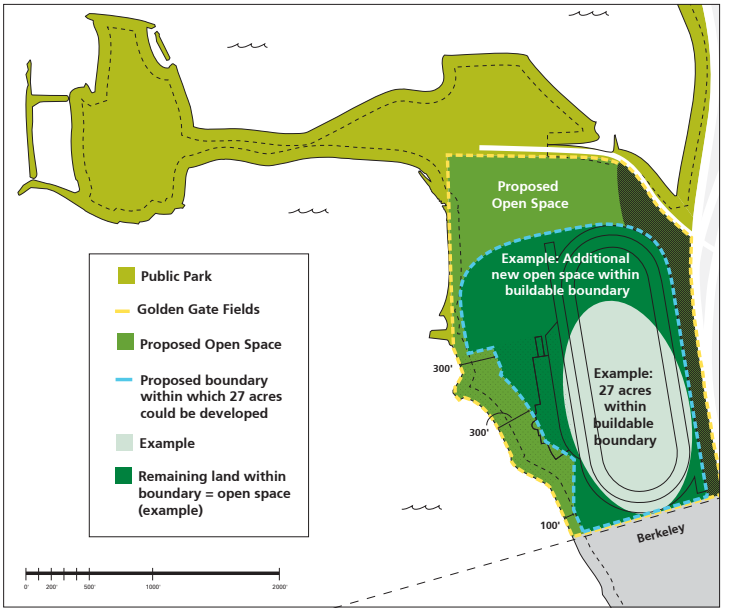
Requirements for revenue met with:	% Albany residents	% Non-residents
None	11	22
$700,000	13	11
$1,400,000	44	56
$2,100,000	6	0
$2,300,000	24	6
$2,600,000	2	6

A quick overview of the similarities and differences in opinions regarding a sample of site attributes:

Site attribute	"Positive" for % Albany residents (+/-)	"Positive" for % Non-residents (+/-)
Developing site entirely as park	34%	60%
Large area of pedestrian-only open space	76%	93%
Keeping buildings to 3 stories or less	71%	50%
Hotel addresses need for visitor accommodations	61%	28%
Restaurant with organic food	66%	38%
Potential for racetrack to remain functional long term	24%	12%
Developer funds significant portion of open space	70%	50%

- Roughly 66% thought eating establishments highlighting locally-grown, organic food would be a positive addition to the waterfront.
- Less popular uses for the site included mixed use (housing, office, retail); 44% did not support a functioning racetrack long term; fewer than 20% thought a racetrack and boutique hotel combination would be appropriate for the site.
- Nearly 70% of participants believed developers should fund a significant portion of the creation of new open space.
- Forty-four percent of participants indicated $1.4 million tax revenue from the waterfront site was the minimum acceptable amount; 24% wanted the site to generate at least $2.3 million; 13% were satisfied with tax generation of $700,000. Eleven percent of participants were comfortable without any tax revenue.

A Community Vision Emerges



With about one in 10 Albany adults voicing their ideas about the future of the waterfront, residents appeared to have garnered a newfound sense of hope about the waterfront. In evaluation forms, more than half said they believed that *Voices to Vision* would lead to a coherent sense of the future of the waterfront; and another 35% stated that they "hoped it would." Out of these discussions, and out of the "common ground" that residents found with one another, a vision (and a physical framework) for the future of the waterfront was articulated. It recognized the importance of the entire site (public land and private land.)
In summary, the Albany community envisioned: a waterfront that could be a model of environmental and economic sustainability, that supports a multi-generational community, small-scale, independently-owned businesses, and local arts, culture, and cuisine.

Site Guidelines. The 2010 report included site standards, design guidelines, and illustrative conceptual scenarios that indicated possible development opportunities that matched the desires of the community. The guidelines added two new uses (hotel and retail) to the existing zoning, with square footage and acreage restrictions — and the creation of, at minimum a 163-acre public park (including more than 75 acres within the now-privately-owned area).

With the goals of the community in mind, the recommendations focused heavily on balancing the desire for new dedicated open space with the concern for tax revenues, and were developed to simultaneously create a major public park and 27 acres of commercial and nonprofit development consistent with the community's values.

The planning and design guidelines reflect the community's desire to create a place that respects, protects, and enhances the waterfront while simultaneously acknowledging the importance of tax revenue to support the quality of life that Albany residents desire. The guidelines indicate the significance, potential, and challenges of the site, in relation to: its size (107 acres of currently private land adjacent to 88 acres of public open space); its location (at the edge of the Bay, bordered by two cities and a freeway); and the site's physical condition.

Underlying the guidelines, is Albany's strong commitment to create and enhance public open space at the waterfront; to acknowledge and support the broader regional plan to create a continuous shoreline park; to restore and improve the site's wetlands, marshlands, and other natural features; and to enable an appropriate type, scale, and quality of private development that reflects Albany's goals for economic and environmental sustainability, while simultaneously respecting the city's and the waterfront's uniqueness.

The development guidelines are divided into discrete but interconnected parts:

- ***Built Area and Dedicated Open Space:*** Describes the maximum amount of built footprint (including associated circulation, and parking) for any commercial development and suggests acreage intended to be dedicated for public purpose structures (e.g. museum, aquarium, amphitheater, interpretive center).
- ***Height Limitations***
- ***Allowable Uses*** (within "Built Area"): Defines specific building types and amounts of recommended commercial uses and open space to be allowed at the waterfront and notes restrictions related to uses and preferred characteristics.
- ***Site Design and Architectural Quality:*** Includes criteria and standards related to environmental sustainability, architectural design, site planning, and innovation.
- ***Financial Implications*****:** Highlights community expectations of developers.

Voices to Vision Revisited: 2011

Less than one year after the conclusion of the community engagement process and publication of *"A Community Vision for Albany's Waterfront,"* the owners of GGF — along with 20 other property owners — responded to a Request for Qualifications from Lawrence Berkeley National Laboratories (LBNL) for the development of its second campus (requiring up to 2 million sq. ft., plus parking). In May 2011, the GGF site was selected as one of six finalists. LBNL's process involved a competition-style effort to select one site out of the six finalist locations.

The owners of GGF (The Stronach Group) put together a development team and brought in a broad array of consultants to assist them in thinking about the LBNL project and site constraints, including the community-based recommendations of *Voices to Vision*, the need for a citywide vote; siting for LBNL's needs, geotechnical conditions, sea level rise, demolition/ construction costs, timing, energy usage; and more. Beyond LBNL's needs, the GGF team desired to develop additional private land uses that could be co-located on the site and which they believed would:

- be compatible with the Lab's operations (and also profitable for the developer)
- provide resources to fund (a portion of) necessary infrastructure development
- replace tax revenue to offset loss (LBNL, a public entity, would not be taxed)
- allow for publicly-accessible open space at the waterfront

The city of Albany contacted FTA because they felt that it would be important to ensure both a meaningful community process (rather than a developer-driven process) that reflected and respected *Voices to Vision* and careful consideration of opportunities and challenges associated with the proposal[3].

It was made clear to LBNL and to the owners of GGF that Albany's outreach and engagement process (unlike the processes at the other five competitive sites) would need to reflect the transparency, broad thinking, and well-informed activities and engagement set by *Voices to*

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Given the very recent completion of Voices to Vision, the GGF team agreed to reimburse the city for such a process and for the city to take the lead on a public information, outreach, and engagement process. The city in turn engaged FTA to conceive, design, facilitate, and lead all aspects of this effort.

Vision. But, now the community would need to review opportunities and challenges of a real project, demanding specific requirements (many of which had never been contemplated during *Voices to Vision)*.

Like *V2V, Voices to Vision-2 ("V2V2")* reflected a commitment to fact-based, neutral, and clear information that would be available to all residents. The process was kicked off with a letter from the City Council to Albany residents and businesses, along with a set of Frequently Asked Questions and a transcript of an FTA-conducted interview with representatives of GGF. The *Voices to Vision* phone number and website were re-established, offering information related to the new LBNL proposal.

Because LBNL demanded a very fast timeline, a 22-member Albany Waterfront Task Force was appointed by the City Council. FTA-facilitated six sequential 2.5 hour sessions with that Task Force over 11 weeks, followed by a citywide workshop with the City Council where the Task Force presented its individual and collective findings.

The mission of the Task Force was *"to ensure the collection, review, and dissemination (to the Albany community) of adequate, factual information and data related to potential development by the owners of the GGF site."* The Task Force structure provided the developer an opportunity to present the project and intentions in a public setting — enabling the city and the community to see and hear changes to their thinking and direction. With this in mind, the developers were regularly asked about new information. Experts were invited to Task Force meetings, as needed, (attorneys, City Manager, Superintendent of schools, economists, etc.). Each session focused on a single topic: site plan (including parking, heights, land uses, etc.); ownership; legal issues; California Environmental Quality Act (CEQA); entitlement processes; initiative process; environmental impacts; and economic and fiscal impacts for the city and schools. Additionally FTA hosted an architectural peer review of the proposal that resulted in important feedback and modifications to the site plan.

The Task Force process included preparation of extensive session packets related to each topic. Notes were prepared and disseminated following each session. All information was posted on the V2V2 website; meetings were open to the public and televised.

Based on the vast amount of information presented, as well as that which was requested of the developer and LBNL but never provided to the Task Force, at the conclusion of five Task Force sessions, FTA prepared a document summarizing *"what was known, what was thought, and what was still important to find out."* Armed with this data, Task Force members weighed in on their individual sense of "pros, cons, and opportunities" related to nine distinct (but interrelated topic areas) prior to a the sixth and final Task Force meeting.

The culmination of the Task Force's work was a presentation to the Albany City Council, which focused on the pros/cons/opportunities identified by the Task Force and a summary of open questions and missing information requested of LBNL and the landowners. It was clear that the Task Force's work was deliberate and thoughtful — working to understand an extremely complex project on a challenging site. What became clear to the Task Force was just how the land uses requested by LBNL impacted the community's fiscal concerns and its desire for open space (because of the large amount of acreage and construction needed for the LBNL plan); addressing LBNL's needs at this site affected fiscal desires of the community. (As a public agency, LBNL would not pay local taxes.) In order to address the community's fiscal needs, additional construction and development, beyond LBNL, would need to be considered. Decisions about land use on the adjacent property in Berkeley impacted Albany (and vice versa). Unanswered environmental concerns related to LBNL were of great concern to the Albany community.

While LBNL was the catalyst for the developer's proposal and might bring benefits to the community, it became clear that locating LBNL on this site posed many challenges — from timing driven by the Lab to loss of tax revenue and community control.

As in many discussions and debates about waterfronts, the overarching conversation focused on the "value" of open space and what a community should accept (regarding development, scale, height, traffic, environmental impacts, etc.) in order to get that open space, and how this impacts revenues. The Albany site is unique — not only for its spectacular views and location, but also for its singularly complicated and integrated components: a vote to approve any plan; the potential loss of tax revenue; private property moving into public ownership; the reality that the proposal would need to include more than LBNL in order to be financially viable; and the conversion of a site that had been the focus of community discussion over many years.

Ultimately, neither the Task Force nor the Council voiced support for (or rejection of) the proposal, and GGF was not selected as the future home of LBNL's second campus.

Conclusion

For the Albany community, *Voices to Vision* (and *V2V2)* was significant and successful in its ability to lead residents through a transformative process to revisit an issue that had been contentious and divisive for many decades. For about a year, residents were informed and engaged through innovative, participatory activities that led them to dream and discuss, while understanding real implications of those dreams on the site itself, in the city of Albany, and throughout the region.

Emerging from the V2V process with a newfound sense that compromise could be achieved in ways that did not water down aspirations nor diminish pragmatic goals, the Albany community quickly responded to a development proposal from GGF with the confidence that they deserved to be informed, heard, and respected in a comprehensive community review process. The city and its residents pointed to their recently developed Guidelines and questioned how the proposal reflected their carefully crafted vision. Indeed, the GGF team took the guidelines seriously and attempted (but were not successful in their effort) to create a development plan that respected the community's vision.

Voices to Vision — from start to finish over a two and a half year period — used principles of community engagement and authentic public participation to:

- build broad understanding of complex and interconnected issues;
- empower residents to give meaningful input and see how that input impacted outcomes;
- unite a community behind a common urban design vision for its waterfront;
- support Albany's policymakers, residents, employers, and employees to demand complete and accurate information in order to collectively and effectively consider the multi-faceted implications of a significant proposal for a major land parcel in their city;
- create trust, dialog, and a sense of common ground — while simultaneously addressing civil disagreement and discussion among those who may never fully agree, but who share a desire to productively participate in the civic life of their community.

At the start of *Voices to Vision*, Albany took a bold step and embraced an engagement process that was unlike any that had come before it — a process whose very nature would unfold over time. The results were palpable, deep, and multi-layered. As residents from neighborhoods across the city participated, they strengthened their relationships, coalesced as a community, and began to lay the groundwork for innovative urban waterfront design that would reflect their shared values.

Track 3: Economic, Leisure and Tourism Aspects

50th ISOCARP Congress Proceedings



Taghazout Bay: Setting Sustainable Development strategy with HQE™ sustainable planning certification

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1 Introduction

The contribution focuses on an original project and an innovative approach in coastal environment: integrated tourist resort of Taghazout, in Morocco both in urban and coastal area in a context of strong water constraints.

The aim of this paper is to introduce an example of an exemplary development and planning project that promotes a reasonable tourism development model encompassing socio-economic development strategy which is paying heed to preserving the environmental amenities of the area. This document will also explain how this concerted and comprehensive approach to sustainable development applied to Taghazout Bay is given credibility and catalyzed by the HQE™ certification for sustainable planning.

2 Project overview

2.1 Taghazout bay

2.1.1 Brief overview

Taghazout Bay is part of the Moroccan National Tourism Strategy 'Vision 2020', which is the extension of the 'Plan Azur' development strategy. Setting Sustainable Development at the heart of its priorities, the Resort design and development take into account the preservation of natural resources and the respect of the socio-cultural authenticity of host communities. As a seaside resort open on a rich hinterland within an exceptional natural environment, Taghazout Bay offers tourists tremendous experiences focused on Sea, Culture, Sports, Nature and Ecotourism.



Figure 1: Overview of Taghazout Bay Resort

The Taghazout Bay Resort covers an area of 615 ha in front of a coastal strip of 4.5 km of beaches of exceptional beauty. Blessed with a rich and authentic hinterland, Taghazout Bay

blends into the surrounding Argan hills and sand dunes. Developed through an integrated and sustainable approach, the future Resort will be composed of world-class hotels, tourist residences and high-end residential areas. Special emphasis will be placed on sporting facilities and leisure activities with the development of a beach club, a Medina (retail center) as well as golf, tennis, surf and football academies.

Located within the rural municipalities of Taghazout and Aourir - Agadir-Ida Outanan Prefecture, Taghazout Bay is at the heart of the golden triangle of the Moroccan Kingdom (about 15 km North of Agadir, 160 km from Essaouira and 230 km from Marrakech).

It enjoys optimal accessibility since it's located at less than 4 hours of major European capitals. The resort can be reached in 40 minutes from the international airport of Agadir and is connected to the motorway network through the A7, linking Casablanca-Marrakech-Agadir.



Figure 2: Location of Taghazout Bay Resort (Images by TerraMetrics)

Key figures

- Total area: 615 ha with an extremely low Land Use Ratio (9.7%)
- Number of beds: 12,376 beds, with tourist accommodation capacity of 7,446 beds
- 9 hotel units: one Golf hotel, four 5-star hotels on the seafront, two 4-star hotels on the seafront, one Surf Camp with its own Hotel, one Eco-resort (holiday village)
- Overall investment: MAD 11,5 billion (before tax) i.e. approximately 1 billion €.
- Achievement of the Touristic program by the end of 2018

In addition to the hotel offering, more than 500 units will be developed as Real Estate Residences for Tourism Promotion (RIPT), providing visitors with the opportunity to stay in front of the beach or near the Golf course.

Each facility will provide a special and differentiated experience to meet the needs of a diverse clientele.

2.1.2 Positioning and concept

Enjoying a special climate and exceptional natural wealth, Taghazout Bay is based on a «new generation» resort concept, offering a wide range of activities all over the year.

Taghazout Bay Resort has been designed around four major themes:

- Sport: Surf Camp with its academy, Golf academy, Tennis Academy, mountain biking (MTB), trekking, hang-gliding, water sports, etc.
- Discovery: authentic Morocco, innovative architecture, great vegetation diversity, etc.
- Nature: exceptional site, wadis, hiking, blue & green environment, etc.

- Sustainability: local culture valuation & promotion, integration of neighbouring populations, environmental performance as an integral part of the project, etc.

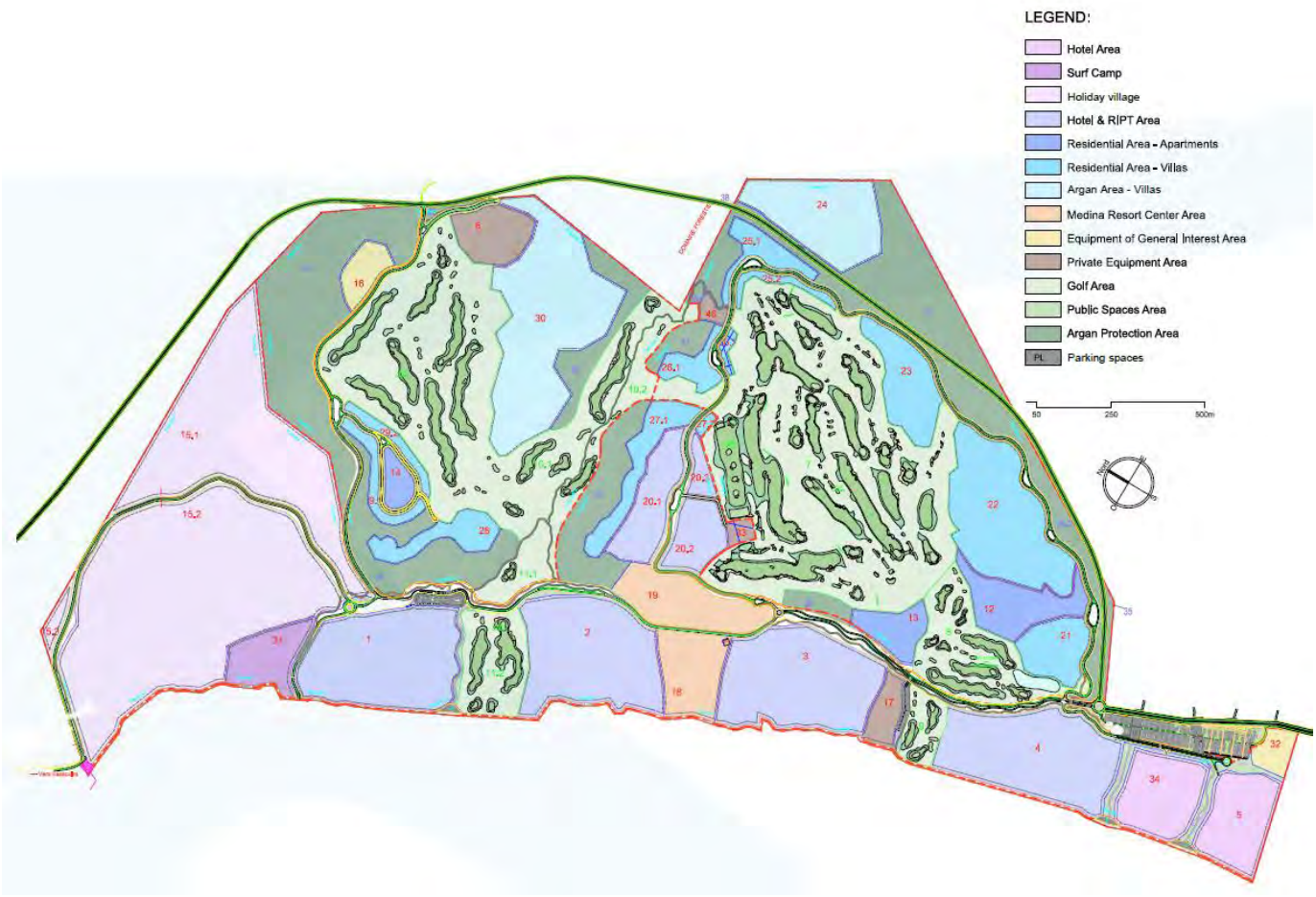


Figure 3: Layout of the Resort

2.1.3 Program and Timeline

To create the Taghazout Bay destination and its worldwide reputation, an ambitious development plan has been set up. The opening of the first accommodation and leisure facilities is scheduled for late 2014, while the completion of the overall touristic program is expected by 2017.

More specifically, the 18 holes Kyle Phillips golf course, which offers stunning views on the Atlantic, will be operational by 2013 and will promote Taghazout Bay as a leading golf destination. The opening of the Golf Hotel is slated to open in late 2014, as well as a portion of the Tourist Residence attached to it. The Golf, the Golf Hotel as well as the Tourist Residence will be managed by internationally recognized operators. The opening of the Surf Camp and the Golf Hotel will take place at the same time.

By 2015, a lively and dynamic area will be created at the resort with the opening of the Medina and the Beach Club. Hotels facing the seafront and the holiday villages will be operational from 2016. Regarding the residential program, it will last over ten years with the delivery of the first units in 2016.

Due to the overall size of the development plan, the operation is split into 3 major phases, representing the construction works related to 3 geographical areas (seafront, left and right sides).







PHASE 1

- Start of works: July 2012
- End of works related to roads and various networks: September 2013
- End of constructions: 2017

PHASE 2

- Start of works: September 2014
- End of works related to roads and various networks: September 2016
- End of constructions: ~ 2020

PHASE 3

- Start of works: September 2017
- End of works related to roads and various networks: September 2019
- End of constructions: ~ 2025

Figure 4: Calendar of the operation - realisation by major phases from 2013 till 2025

2.2 Key actors involved in the project

2.2.1 Developer

Developer: Société d'Aménagement et de Promotion de la Station de Taghazout (SAPST). Established in July 2011, SAPST is devoted to the planning, development, marketing and management of the Taghazout Bay Resort.

SAPST is a limited liability company owned by five prominent Moroccan shareholders:

- CDG Développement: 35%
- Moroccan Fund for Tourism Development (FMDT): 25%
- Alliances Développement Immobilier (ADI): 20%
- Sud Partners (consortium with Akwa Group on top of it): 15%
- Moroccan Tourism Engineering Company (SMIT): 5%

2.2.2 Local partners

Moroccan Government, Wali (Prefect) of the Souss Massa Draâ region, municipalities of Taghazout and Aourir, decentralised Government, investors.

2.2.3 Project team

Cap Terre (Assistance with Sustainable Development Project Management), INTERSCENE (landscape), Kilo (architecture).

2.2.4 Certification operator

Cerway is the operator of HQE™ certification for sustainable buildings and urban development worldwide. Cerway's mission is to bring about improvement by means of certification and to acknowledge the performance of professionals, buildings and territories with the goal of sustainable development.

2.3 Project's challenges

Resort development and tourism is one of the main levers of economic and social development of the country. Taghazout Bay being part of large national development program numerous challenges on different levels have been identified by the developer.

They concern among others economical, demographical as well as environmental issues:

- Demonstrate the viability and relevance of a new model of tourism development through an exemplary case;
- Avoid succumbing to the temptation of mass tourism and assert a qualitative and environmentally friendly positioning, as opposed to competing destinations that led to the artificialisation of a coastline of many countries;
- Establish a concerted and partnership approach which leads to a reasonable and attractive project benefiting the whole territory.

3 Setting sustainable framework trough HQE™ certification

This project is evidence of the overall management of an area development plan. SAPST implemented the national policy and presented local stakeholders with a choice of resource allocation, design and concerted development.

By engaging in an HQE™ Certification strategy, SAPST wished to valorise its efforts while ensuring the coordination and the control of the strategy was well-coordinated and controlled, and that most of the central and decentralised public stakeholders concerned by the project were mobilised both at national and local level. This will also help ensure that the project's objectives are maintained over time up to delivery of the site.

SAPST opted for the HQE certification for Urban Planning and Development (HQE UPD) for its unique approach:

- Wide field of application that is adaptable and flexible, depending on the type of project
- Establishment of a link between a project and the communities' expectations, taking upstream phases into account.
- Enhancing the link between area planning and urban resource allocation/design.

Besides appealing to the management system offered by the HQE UPD certification, SAPST intends to certify different components through a HQE Standard, in order to attest to the overall quality and durability of its construction. That's why all residential buildings and several service buildings are currently being audited and certified under the certification scheme for new buildings in construction.

Respecting the criteria of the HQE label, which focuses on four main fields (Eco-construction, Eco-management, Comfort and Health), allows on the one hand controlling the Resort's impacts on its external environment and provides, on the other hand, a healthy and comfortable interior environment for end-users.

3.1 Overview of HQE Certification for Urban Planning and Development

3.1.1 Objectives and scope of the application

The purpose of an urban planning and development project is to create spaces, functions, buildings, equipment and means of communication within a given area.

The HQE™ certification for Urban Planning and Development applies to any urban planning and development project regardless of its size, procedure, local context or its purpose: renewal or expansion, urban or rural, residential, for both large and small projects. It is intended for use by all urban project developers, all local governments, and public or private urban project developers.

Regardless of its characteristics, a sustainable urban planning and development project is intended to contribute to the following five sustainable development major issues:

I. Fight against climate change
II. Preservation of biodiversity, habitats and resources
III. Social cohesion and solidarity between locations and generations
IV. Development of the full potential of all human beings
V. Development dynamic in line with responsible production and consumption methods

For each project, they include and address the primary challenges of sustainable development on a local and global level, as identified by the United Nations Commission on Sustainable Development and incorporated throughout the world in sustainable development strategies and tools.

3.1.2 Certified characteristics

The HQE™ certification for sustainable planning is a project management tool without any prerequisites or performance assessment. The characteristics certified under the "HQE™ for Urban Planning and Development" concern thus the implementation of a Project Management System (PMS) allowing setting sustainable urban planning and development goals that are justified and consistent with the project's context.

To help project sponsors achieve these major issues, the PMS includes a list of 17 sustainable development themes divided in 3 larger themes (*see fig. 6 on the page 7*).

As a project management tool, the PMS contributes to the governance and execution of sustainable urban planning and development projects: the overall objective of the PMS is to manage the project's progress, by overseeing the analysis, programming, design, execution and hand-over processes, in order to make the best use of the sustainable development efforts performed by involved parties.

3.1.3 Structure of the Project management System

The PMS is the backbone of the sustainable development project which ensures its smooth and effective running. As a management and decision-making system the PMS includes:

- organisational mechanisms for steering, participation and assessment to be implemented throughout the project
- six key phases defining the execution milestones of the project

The PMS sets out specific requirements for each of six phases of the project. In some cases, these requirements are repeated at each phase since they relate to organisational and/or procedural issues.

For each phase described in this scheme, there are two types of requirements:

- Specific requirements, regarding concerns that are specific to the related phase
- Recurring requirements, which must be met, maintained and updated in an appropriate for each phase way. There are three dimensions to these recurring requirements: steering, assessment and participation.

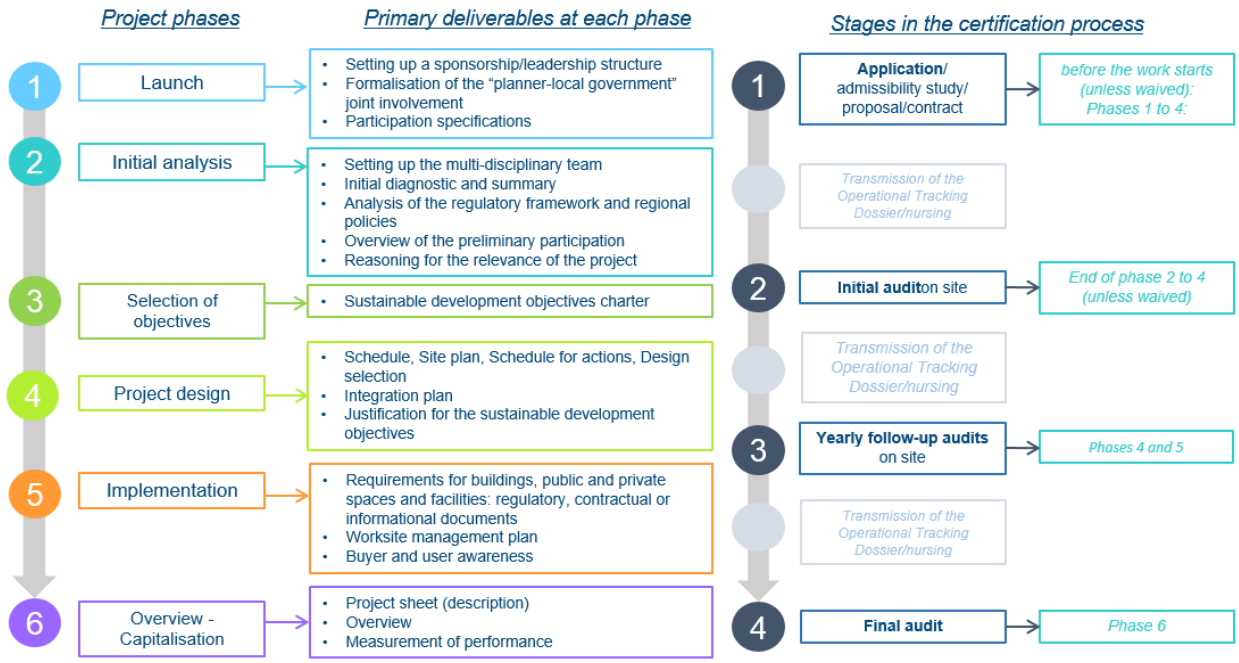


Figure 5: PMS structure and the certification process

The 17 themes result in a global, balanced approach to the various topics of sustainable planning, without subtle debates on weighting. It is essential to assess the performance of the urban planning and development project in terms of the major environmental, economic and social challenges.



Figure 6: 17 themes of the PMS

The 17 themes of sustainable development must be linked to the appropriate indicators as soon as their relevance to the project and the territory has been identified. So far, there is no global agreement in place for sustainable development indicators, although some indicators and methods are in fairly widespread use and new indicators are currently being developed for the common use (such as ISO 3720, etc.).

The purpose of the PMS is to provide and demonstrate the use of locally relevant sustainable development indicators, linked to the 17 themes and especially to the themes that are most important for the project, or to other challenges identified at the site and in the area.

3.2 Application to the Taghazout Bay case

As a developer of a large-scale tourist destination, SAPST is committed to proactively address Sustainable Development concerns to ensure environmental protection, viable economic growth and equitable social progress.

Taghazout Bay is the first pilot project to test the HQE™ certification for Urban Planning and Development at international level. By applying to this scheme SAPST seeks to achieve the following objectives:

- Highlight the actions led in favour of sustainable development in the framework of this project
- Continuously measure the performance achieved towards the issues and targeted objectives and improve when needed;
- Bring together all stakeholders around the same objectives of sustainable development
- Being a pioneer in the HQE™ certification at international level

In order to comply with the assessment scheme SAPST has commissioned a study on the development of concerned territory. The study focuses on the development of a connection area of 10 hectares in the municipality of Taghazout and 50 hectares in the commune of Aourir (Tamraght).

3.2.1 Compliance with HQE requirements

In order to answer to the requirements of the HQE™ certification for Sustainable Urban Planning and Development the SAPST has undertaken concrete measures. For instance, the SAPST has commissioned a study on the development of the two areas to connect to the interface requirements of the project and two common implementation.

This study focuses on the development of a connection area of 10 hectares in the municipality of Taghazout and 50 hectares in the commune of Aourir (Tamraght).



Figure 7: Municipality of Taghazout (on the left) and the commune of Aourir (on the right)

Current stage of the certification process of the Taghazout bay.

After the first audit in May 2013, the conduct of the 1st stage of the operation has been certified for the phases 1, 2 and 3 of the Project Management System (out of 6 phases). The following characteristics have been audited for each phase.

Phase 1 - Launch

- Motivations and expectations of local authorities / Stakeholders participation
- Commitment of the developer and authorities to the HQE certification

Phase 2 - Initial Analysis

- Diagnosis of sustainable development presenting strengths and constraints of the site
- Review of regulatory and territorial approaches applicable to the operation
- Suitability of the project for sustainable development (summary of evidence demonstrating project's suitability)

Phase 3 - Selection of objectives

- Summary analysis grid showing :
  - Thematic analysis of the initial studies related to each of the 17 themes
  - Prioritising the challenges
  - Transforming challenges into objectives
  - Identification of performance indicators to measure achievement of chosen objectives
- Sustainable Development Charter representing the commitment made by the developer (SAPST) and by the local government involved in the project and setting out the project's objectives

SAPST's initiatives for Sustainable Development are carried forward through 3 priorities broken down into 13 commitments, based on HQE's initial 17 themes. The table below shows the split of these commitments into 3 main HQE objectives:

Ensuring the Integration and Cohesion of the neighbourhood	Preserve natural resources and encourage the environmental and health quality of the development.	Promote a local social life and reinforce economic dynamics
•Commitment 1: Fostering project's landscape and urban integration •Commitment 2: Promoting the local cultural heritage •Commitment 3: Integrating the local population in the project •Commitment 4: Ensuring accessibility and secure traffic within the site	•Commitment 5: Preserving water resources •Commitment 6: Promote Buildings Environmental Quality •Commitment 7: Promoting sustainable behaviors and lifestyles •Commitment 8: Preserving and enhance ecosystems and biodiversity •Commitment 9: Preventing the risk of flooding and seismic risk •Commitment 10: Minimising disturbance related to the development of the station	•Commitment 11: Boosting the local economy •Commitment 12: Contributing to the training and employability of the local population •Commitment 13: Promoting social cohesion and contribute to improving the quality of life for local people

Figure 8: split of 13 commitments into 3 main HQE objectives

Overview of SAPST's main commitments

The following 13 commitments have been chosen by SAPST in the framework of the Taghazout Bay project as a result of the Phase 3.

SAPST has grouped these commitments into 2 large themes:

- Environmental commitments
- Socioeconomic commitments

Environmental Commitments

Commitment	Result
Promote landscape and urban integration project	• An extremely low plot ratio, low building heights and unobstructed view on the whole site • Respect of the public character of the beach and development of large access points • Absence of structures on the coastal strip • Preservation and development of continuity of access to hinterland villages
Preserve water resources	• Suitable landscaping with planting of native species requiring low watering • Reuse treated wastewater from the purification plant for watering parks and golf courses • Reduction of the environmental pollution risk via the use of labelled products for the maintenance of green spaces
Promote building's environmental performance	• Integrate renewable energy during construction and buildings use • Use equipment with low energy consumption • Use sustainable and environmentally friendly materials and equipment that are easy to maintain
Preserving and enhancing the ecosystems and biodiversity	• Minimize cleared areas and implement compensation measures (planting 40,000 tree seedlings including 20,000 argan trees) • Preservation of 80 ha of argan trees and the establishment of a cooperative • Develop green spaces that promote biodiversity and sustainable modes of travel
Minimise nuisance related to resort's development	• Reduce environmental impacts and nuisances related to the construction site (Waste Management, limiting noise impact, dust reduction, limiting discharges to the ground, consumption monitoring, ...)
Promote sustainable behaviors and lifestyles	• Anchor the eco-friendly culture among all users (tourists, residents, professionals ...) • Reduce the environmental impact of the traffic (soft modes of transport , local supply ...)

Socioeconomic commitment

Commitment	Result
Enhancing the local cultural heritage	• Respect and value cultural, historical and ethnographic characteristics of the region • Maintain and preserve the local know-how (argan oil, honey, saffron, ...) • Promote local crafts and encourage the development of local products
Integrate local population in the project	• Ensure the social integration of the project in the local context (invite women to work within the argan cooperative, establish a Fish Market, a craft village ...) • Involve local people to participate in specific animations • Develop regular communication and consultation with the local population and the elected officials
Stimulating local economic development	• Boost tourism and trade in the countryside by creating tourist circuits • Create economic activities areas in transition zones • Create opportunities for the economic development of local businesses both in the construction and operation phases • Create within the project sustainable income sources for local people
Contribute to the training and employability of the local population	• Priority to local employment both in the construction and operation phases • Facilitate access to training for local people through partnerships with vocational training institutions • Promote youth social inclusion via sport and dedicated school programs in sports academies

Promote social cohesion and contribute to improving the quality of life for local people	• Suggest tourist entertainment that valorises local traditions and promotes cultural rapprochement • Create public spaces promoting functional, social and generational diversity • Ensure the presence of local facilities and businesses essential for social life • Achieve socioeconomic projects in the station and in buffer zones • Create value from the development of the station to the local population (eg upgrading of sewerage in the municipalities of Taghazout and Aourir / construction of the bypass)

To make Sustainable Development an integral part of the project, SAPST undertakes to promote these principles among its stakeholders (shareholders, partners, suppliers, visitors, staff, etc.) through awareness raising actions.

Upcoming stages of the certification

Phases 1 to 3 of the certification process being already audited, yearly follow-up audits will be conducted for phase 4 (project design) and 5 (implementation). The phasing of construction works shown on the figure 4 indicates that the end of works is scheduled for 2017, the year of the final audit. Thus there will be three follow-up audits taking place on-site on 2014, 2015 and 2016 in order to guarantee the adequate deployment of SAPTS' sustainable strategy.



Figure 9: beginning of construction works (phase 4)

4 Conclusion

Through this case study, the paper highlights the advantages and limitations of international deployment of a dedicated management system as well as those of certification of coastal development projects, in connection with the contents and requirements of these systems in terms of governance and cross-thematic approach to social, environmental and economic issues, including water management.

Engaging for a certification of an urban planning and development project is proving to be useful for every responsible actor aiming at setting a sustainable strategy. Having a flexible and comprehensive tool taking into account local specificities turns out to be critical to the success of the project.

Among the strengths of the HQE certification that has been identified throughout various pilot projects establishment of a dialogue between planner and the local government is found to be essential. The management system requires a connection between the expectations of the local government and the development project, between regional planning and urban programming and design ensuring thus the cohesion among involved parties.

Being able to address various socioeconomic and environmental issues by setting priorities specific for a given project and selecting appropriate indicators is also a key success factor. Having no prerequisites or specific performance assessment allows a broad scope of application while promoting the recognition of the urban, architectural, natural and cultural heritage.

As a developer, the ability to certify the preliminary phases (project launch, analysis, justification and definition of the project's objectives), with certified recognition of the initiative throughout the project is important in order to highlight his commitment for sustainability and obtain visibility on international level.

Absence of common global indicators can be considered as being a difficulty when setting a sustainable strategy, especially for new emerging actors. However, having its own indicators suited for projects issues allows more flexible and accurate follow-up.

As for the Taghazout Bay resort, the developer and the local governance have been able to establish a new tourist development model in a concerted way thanks to the HQE™ certification. The program, the ground-plan and the design are fully consistent with environmental and socio-economic objectives, as well as the site and area’s challenges.

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDAŃSK

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ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

INTRODUCTION

The basic question faced by Polish Local Governments today is the sense of the use of the concept of smart cities in shaping the socio-economic situation of Polish cities, which are not as technologically advanced as Western European cities.

The recognition of the evolution model policy priorities shaping space such as sustainable development, smart growth and smart city is presented (Fig. 1). Smart growth is about how to integrate aspects of economic, social and environmental planning in accordance with the principles of sustainability, and by finding a compromise with the owner and the investors, the city, and the environmental activist on such development [Porter 2002]. The integrated planning in smart growth is focused on the inclusion of all available fields of knowledge during the procedure (*interdisciplinary*) of all participants in the process of planning (*public involvement*) using smart technologies (*ICT, green economy*) and the search for innovative solutions (*incremental innovation*). It is oriented to the prospect of achieving maximum unit value (*environmental, economic and social*) which allows some tenacity in promoting appropriate solutions (i.e. *responding to climate change*). Smarter city is the optimization of the urbanization process which is continuously being improved to achieve its full efficiency. [Bach Glowinska, 2014]

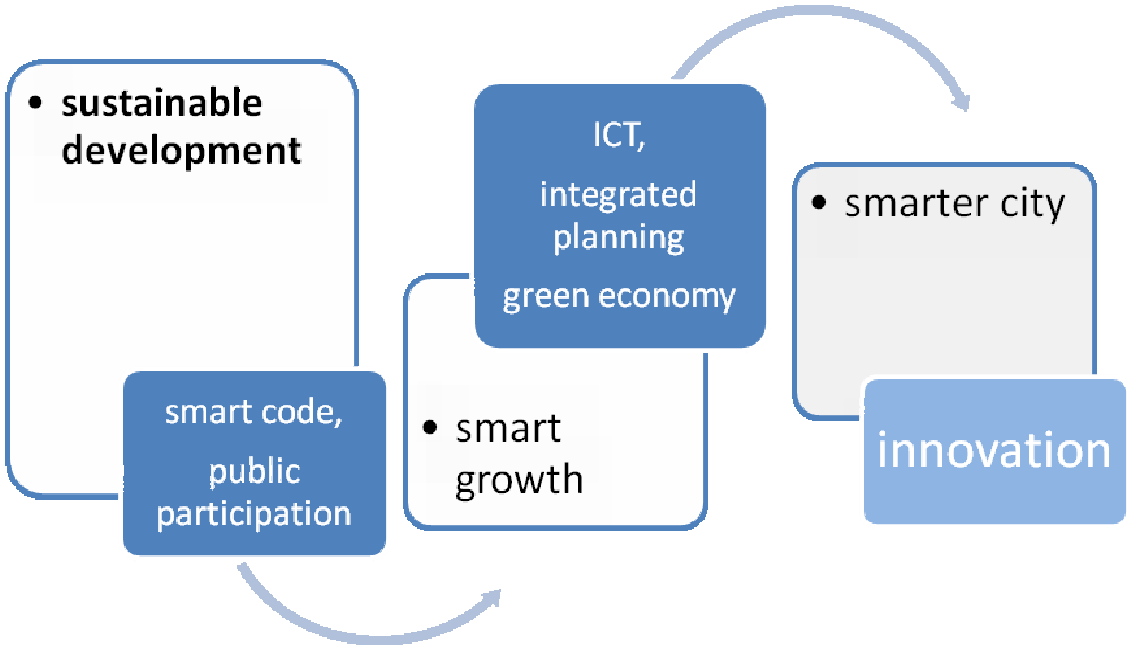


Figure 1 Recognition of the evolution in model policy
Source: Bach-Glowinska 2014

Focus on smart city comes in a pivotal time with agenda of localism in planning and openness to public debate on the kind of cities people want to live in. The key is to understand: (1) the consequences of smart technologies in shaping our city environments and (2) their importance and implications in our society. In term of political priorities, privacy and security and inequality citizens' right concerns took the leading roles. In term of urban (green) planning, understanding the perception of urban environment should be crucial in attempts to improve the quality of city life. The attempt to assess residents' attitudes to various aspects of city life was presented in *2012 Perception Survey* [Urban audit, 2014]. The European ranking of cities can be a useful insight into some aspects of perception in city life. The interesting is that respondents felt safer in their neighborhood than in city which was reflected throughout EU. Improving the city life performance can be achieved by understanding the importance of shaping the urban environment accordingly to support better health and wellbeing outcomes [Burton H. et al., 2010].

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

The better city life perception is what cities are all about, constantly, throughout the time… Urban planners can attempt to understand and improve city life by introducing the newest approaches in their city but which one is the most relevant in their case? The various attempts in planning are among the key agenda while undertaking comparative studies, sharing experience, exchanging good practice in designing or planning. The key issues which are analyzed are the actions supporting: better quality of life, transport systems' integration, accessibility of open space network, vibrant public spaces, water sensitive planning, education and other programs promoting active style of life.

SEARCHING FOR SMART SOLUTIONS: COMPARATIVE STUDY OF GDANSK AND GLASGOW

The comparative research Glasgow and Gdansk has been undertaken by Gdansk Development Agency in Jan 2014. The idea was to understand the issues connected with spatial planning and strategic thinking which can play a vital role in the move to low carbon.

PATHWAYS TO TRANSITION

The study was based on a series of comparative analysis considering similar but slightly other issues – differences are resulting from different profiles and history of the cities. In the case of Gdansk – the point of interest is expressed by well known *CITY OF FREEDOM and SEA of OPPORTUNITIES*. The idea is dominated by liberal approach and the citizens desire to be FREE. It builds on involving the sense of freedom and variety of choices as the main attractors in Gdansk. In contrast PEOPLE *MAKE GLASGOW* policy emphasises the approach through the lenses of activities, privileges and customs of Glaswegians. Which way of planning would be better for Gdansk in the move to low carbon?

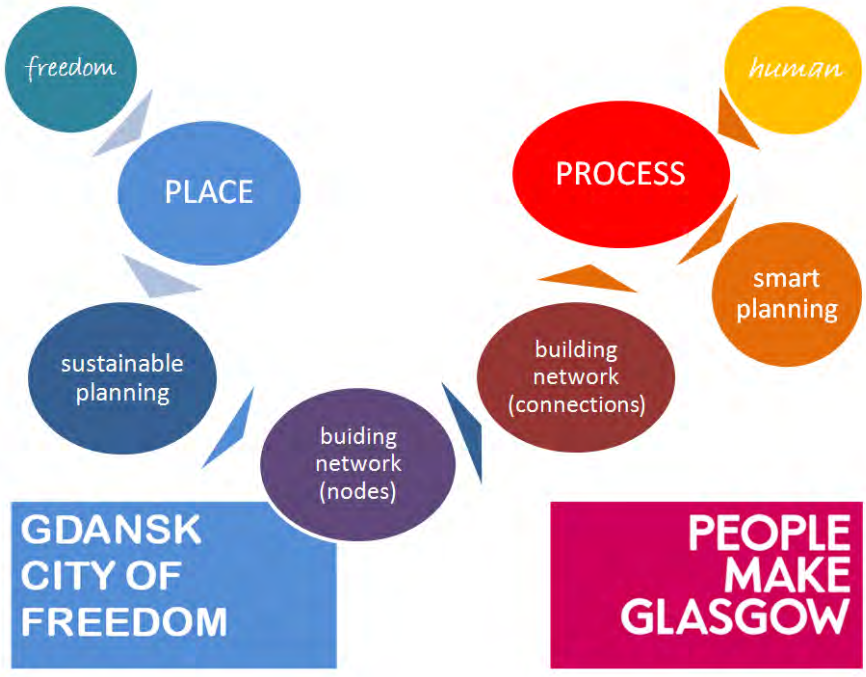


Figure 2 Gdansk and Gasgow priorities in shaping space
Source: Own study by Joanna Bach Glowinska

Do our cities follow similar path of development? The research aimed to transform our understanding as urban planners of socio-economic sustainability in advance economy of Glasgow and to identify relevant pathways to transition development in Gdansk.

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

METHODOLOGY

The experts from Gdansk Development Agency were asked to select the topics due to their personal interest in the studied area of planning. Their first choice was later redefined by study visit experience, by series of meetings with Glasgow City experts and by examining documents / strategies and their impact in city environment. They attempt to understand the strategies and other planning documents which aim at the socio-economic sustainability in advance economy of different city context. The following themes were selected: **smart community** (participatory activities, soft actions, guide on public involvement in planning); **smart environment** (green urban planning, water sensitive planning, open space network, accessibility to green spaces, priority in designations of new parks); **smart mobility** (soft actions); **smart governance** (open access to data, data management), **smart living** (pro-health policies, promoting health and wellbeing, social inclusion action, open space strategy)

The support from Glasgow was remarkable. The experts from Glasgow City and academics from Glasgow Urban Laboratory have written chapters about defining policies, strategies and about their experience in implementation of these pathways in Glasgow practice. Researchers from Gdansk University of Technology and Gdansk University have written chapters about the academic view on the conditions of Polish city environment. The comparative approach Glasgow Gdansk would be further developed this year in a form of a book "*Searching for Smart solutions: comparative study of Gdansk and Glasgow*" [Bach-Glowinska et al., 2014a]

WHY GLASGOW? WHY GDANSK?

The answer is not just the fact that both cities are the sea/ocean side location. The question should be: How do Glasgow and Gdansk attempt to achieve socio-economic sustainability after the suddenly introduced post industrial era to both cities in the early 90ties of last century? The shock therapy which was applied in Gdansk and Glasgow resulted from different reasons but it was very similar in time. Today, the postindustrial reality in Gdansk and Glasgow can be presented by some indicators (table 1).

Table 1. Selected indicators describing Gdansk and Glasgow in post industrial era.

	GDAŃSK and region Pomorskie	GLASGOW and South Western Scotland
Number of citizens	461 000	593 000
Number of citizens In metropolitan region	1.2 Mln	2.1 Mln
Area	262 km²	175,5 km²
Regional gross domestic product (PPS per inhabitant)	62.2% (2011)	88.9% (2011)
Regional Productivity in industry and services	72.8%(2010)	95.6%(2010)
Regional Employment in knowledge intensive services	34.2% (2012)	45.6% (2012)

Source: own study based on regional indicators by Eurostat, 2014

Therefore, the undertaken research was studied as a kind of comparative approach to socio-economic sustainability in advance (Glasgow) and emerging (Gdansk) economies. Gdansk experts were focused on strategic and planning documents which were supporting Glasgow policy in recent years. Their point of interest was the introduced smart solutions in city life based on Future Glasgow projects for which Glasgow was granted significant national funding in 2011.

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

Gdansk City is very open to introduce new ideas if they prove to be relevant to Gdansk conditions and can substantially improve residents' perception of city life. Gdansk is the leader in introducing the guidelines to local planning such as SLOW, STeR, KREM, STOPPa or the guideline in public participation etc. Gdansk undertook the comparative research on Gdansk and Dublin urban changes focusing on the methods in controlling urban sprawl [Bach-Glowinska et al., 2010] which resulted, among the others, with conclusion that smart growth and integrated planning are relevant to control suburbanization processes.

The *2012 Perception Survey* [Urban audit, 2014] interviewed over 41 000 people in 79 cities among Europe and it was used to set the scene for comparative study in Gdansk and Glasgow. It appeared that Glasgow respondents were less satisfied with streets and building appearance and cleanness which were below EU average. They were satisfied with availability of retail shops and noise level, mid to high ranked compared to other cities while concerning public spaces such as markets, squares and pedestrian areas, top ranking while considering green spaces such as parks and gardens, above EU average in satisfaction with cultural and sport facilities. The confidence in city's public administration (trust, the efficiency and the commitment to fight against climate change, green transport) was high above EU average in whole UK. Gdansk respondents were less satisfied with streets and building appearance and cleanness below EU average. They were very satisfied with availability of retail shops and transport, mid ranking compared to other cities while concerning public spaces such as markets, squares and pedestrian areas, below average while considering green spaces such as parks and gardens, above EU average in satisfaction with cultural and sport facilities. The confidence in city's public administration (trust, the efficiency and the commitment to fight against climate change, green transport) was far below EU average.

Gdansk and Glasgow research focused generally on the issues which can be done in a form of strategic / planning documents to achieve improvement of the residents' perception of city life. The necessity was to understand city environment, compare the way of planning in Gdansk and Glasgow, and finally to decide whether to follow the changes and transform.

CIVIC MINDED CITIES

After the experts refined their themes of topics it appeared that CiVIC minded city idea [Jordan 2012] suits the key points of their interest. Considering the acronym CIVIC: the first **C stands for Culture, I stands for Infrastructure Systems,** The **V stands for Vision**, next **I stands for Interconnectedness** which is how the city parts are connected to each other and how the city connects to its region and to the world and the last **C is for Capital**. The three main streams filled in with experts' topics in comparative study were as follows:

1. INTERCONNECTEDNESS IN INFRASTRUCTURE SYSTEM which was referring to climate change, water sensitive planning (open spaces in network system can become central to the identity, vitality by respecting the recreation areas in residential districts, keeping the desirable landscape unbuilt and open);

2. COMMON VISIONS IN CITIES: supporting change and promoting healthy and active lifestyle, sustainable development at every level, climate responsible strategies, educational programs and actions helping citizens to achieve positive change. Soft actions supporting transport system. Planning focused on human health and wellbeing, water sensitive planning supporting the essential ecosystem for recreation and sport;

3. SHARING CAPITAL: PUBLIC INVOLVEMENT IN PLANNING/ city identity issues, Capital of city means not only culture, but also citizens who understand the importance of involvement in planning as the responsibility for city life. Sharing capital theme occurred to be very important as the confidence in public administration was far below EU average in Poland and high above median in UK [Urban Audit, 2014].

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

INTERCONNECTEDNESS IN INFRASTRUCTURE SYSTEM

Water sensitive planning is the process of integrating water cycle management with the built environment through productive landscape; urban design, place making and urban planning [WSUD 2013] Smart network of open spaces in cities (rules for determining natural networks in identified cities, rules enabling the individual components of the system - whether natural values are always the decisive factor) strategic investments

GREEN INFRASTRUCTURE IN SMART CITY

The aim of the study was to compare the initial approach to the creation, use and management of green areas in both cities in order to raise standards of living, leisure and recreation of their inhabitants. The first part compares the elements forming the natural system of the two cities due to their environmental resources, including elements of anthropogenic and indicated their inclusion in the documents, studies and other official guidelines. It then discusses and compares the rules for creating natural system, in order to preserve its continuity and the function they perform; they are for the environment of the city.

The comparative analysis of Gdansk and Glasgow in the topic of the urban green areas showed significant differences in the general approach. Glasgow urban green areas are a vital part of the open areas of the city (open space). The strategy referring to interconnectedness was contained in a document supporting planning Planning Advice Note PAN 65 Location urban greenery. Every green area is assessed from the point of view of participation in the creation of a sufficiently high quality of open spaces network and accessibility ensuring the standard of leisure and recreation for city residents. In Gdansk, the problem of urban green infrastructure or urban greenery has been excluded from the strategic documents of this sort. Study of public spaces (SOPP) which was developed in Gdansk Development Office have not focus at the theme of open spaces, so currently there is no document of strategic nature, which sets a course of action aimed at reducing the number of inhabitants of the city who do not have accessibility to public green. Proposed new park designations are currently being studied. The study determines the priority of their implementation, in order to improve the access to green areas.

STRATEGIC INVESTMENTS SUPPORTING INTERNATIONAL SPORT EVENTS AS CATALYST OF WIDER URBAN TRANSFORMATIONS

Gdansk and Glasgow hosted the spectacular sport events: EURO 2012 and 2014 Commonwealth Games respectively. The strategic investments supporting these international events have implications on the city structure and economy despite the difference in allocated funds in both cities. The strategic investments were aimed at specific regeneration projects. If successful they can lead to spectacular transformation of wider urban landscape and can even occur to be a kind of catalyst project for the whole districts. Therefore the location in urban structure is of the main concern in case of strategic investments also considering its potential significance on city life. The organization of international sporting events is not just promoting the city but a chance for a project to be a catalyst of wider urban transformations. The impact on the urban structure was compared in case of two sport events: Euro 2012 in Gdansk and 2014 Glasgow Commonwealth. The study has lead to the main conclusions in such themes as sport infrastructure, mobility, urban regeneration and social aspects.

PGE arena was constructed in Gdansk which allowed to compact funding in one location to undergo the construction successfully. The scale of stadium posed the question of afterwards use (different than sport or cultural activities) if only limited number of the possible functions can be placed within the object. Local government hasn't yet got satisfactory answer to this question. Glasgow has dispersed locations of the sport objects which were smaller in scale. It allowed for better discounting in investments while putting greater organizational tasks in the coordination of construction and the task in future use of these objects – after 2014 Glasgow Commonwealth. The stronger pressure was put in setting the

after-event-purpose in the urban and social fabric. The pressure forced the need for perfect inclusion because only then Glasgow objects can properly serve the needs of residents. Available funds allowed both cities to undertake the most necessary improvements in their transport. Gdansk had to construct the key elements of the main road system, concentrating on improving hard location factors in city. Glasgow constructed the missing part of the road system. The idea of bus lanes were again consulted with Glaswegians with success of public agreement on their implementation. The interesting is that the main road system in Glasgow was designed after the Second World War and it was designed in Gdansk case in 60ties and 70ties of the last century. It took decades to implement the ideas…

Both Gdansk and Glasgow choose the location accordingly to the analysis within urban regeneration projects. The strategic investments (Old Letnica and Athletes Village) gave the real perspectives of achieving targeted results which were starting the social transformation in the districts. The undertaken activities focused on the public involvement in the organization of sport events (such as volunteer work in both cites, celebrating the phase of construction) and on getting public support for the strategic investments. The important was that the vision could be shared by website (www.legacy2014.co.uk). The diversity and spread of Sport facilities in Glasgow offered greater possibilities of after-use. They can meet the needs of a larger number of residents. Gdansk makes efforts to use the stadium for a wide range of activities: festivals, skating competitions, etc. The added value is the integration of residents with this location.

COMMON VISION IN CITIES

Vision: *climate responsible thinking which is resulting in changing everyday behavior, the promotion of sporty and healthy life style, city as supporter of these actions. In education the activities are towards social inclusion of everyone, city as supporter by making all public space open and inclusive to anyone, by setting the priorities in actions.* **Sports and Recreation activities as health and wellbeing factors** (regeneration of psychophysical strength): the accessibility and connectivity of sport facilities, variety of them for the residents of Gdansk and Glasgow.

PROMOTING ACTIVE LIFESTYLE

The World Health Organization (WHO) defines health as a state of physical well-being, mental and social well being and not merely the absence of disease or infirmity, are also international findings which say that health is a fundamental right of every human being and the wealth of society. "*Human health depends on many interrelated factors, among which are four main groups: lifestyle (about 50%share), physical environment (natural and manmade), and social life, work, study (approximately 20%), genetic factors (20%) of health services (10%). Among the important conditions for maintaining health are socio-economic conditions, and the greatest threats are poverty and low levels of education* "(National Health Programme 2007-2015 p.10) Around 2,000,000 people die in the world every year due to low physical activity according to the World Health Organization findings (WHO 2004 onwards). Recent studies indicate that the children born after 2000 may live shorter than their parents due to diseases of civilization, which is conditioned by low physical activity, resulting from a change in lifestyle and the development of modern (smart) technology. This happens for the first time in humankind history.

The number of people in Poland who are less physical active is increasing. It is estimated that only about 30% of children and adolescents and 10% of adults meet the physiological needs of the body. The basic reason for this is the low awareness of the needs of sport and recreation. Both cities have similar problems concerning the promotion of an active lifestyle. The problem is proper accessibility of open spaces and provision of the adequate infrastructure to enable active time spending in both Glasgow and in Gdansk. The designated areas should be interconnected by a network of cycling routes and walking system so that the residents could comfortably move and undertake various physical activities.

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

The differentiation of quality of life is inevitable. Although the large differences in synthetic index indicate that impairment of the structural units cannot be adequately compensated by other advantages. The number of districts arises with disparities in quality of life. It leads to the >polarization< of districts of Glasgow and, to a much lesser extent, in Gdansk. Such a phenomenon is disadvantageous not only for social reasons (one lives better or worse), but it can lead to a deepening of the differences between places of residence and, consequently, affect the whole city. Significant differences in quality of life imply for the social composition in structural units, and it has more direct effect on urban landscape. The range of activities is undertaken in Gdansk and Glasgow within the framework of urban policies. Improving housing conditions can be achieved by using activities aimed at ensuring the similar accessibility, quality open spaces. Parallel efforts are aimed at leveling social opportunities through education promoting a healthy lifestyle.

PATHWAY TO SMART MOBILITY – TRENDS IN TRANSPORT SYSTEMS

The rapid growth of cities carries a number of significant problems occurring both within their administrative borders and in their socio-economic region. The noticeable problems are those linked to urban mobility. As a result of urban sprawl urban transport, both public and private is not efficient enough to serve everyone in the suburban community. The use of smart technologies and smart governance in integrating transport systems should significantly reduce these negative effects. Can you imagine Amsterdam, Copenhagen, London, or Berlin without zones of reduced car traffic? without prioritization for public transport? or with no cycling policy? without any solutions in travel planning and mobility? Starting from the 90's the first transport-oriented strategies were created in Poland in accordance with the guidelines of international institutions (OECD and the European Conference of Ministers of Transport). The aim was to ensure a balance between the objectives of transport, social, and environmental protection. Today, greater emphasis is placed on smart solutions supporting direct contact with the passenger helping him in seamless travel.

Tabel 2. Selected indicators of Gdansk and Glasgow transport system

ASPECT	GDAŃSK	GLASGOW
Traffic Control System	TRISTAR	CITRAC (BIAS)
Preference for public transport	yes	yes
Railway systems	Train, suburban train (SKM, PKM), tram	Train, suburban train, metro
Methods of payment	toll ticket paper ticket electronic payment application system (mobile) call pay electronic ticket	paper ticket electronic ticket (metro) application system
City bike system	no	yes
The lenght of cycling routes	469,8 km	300 km

Source. own study by Krzysztof Maciasz

We are witnessing a suburbanization process in most of metropolis and its negative consequences on the quality of city life. Today we concentrate on smart technology as the solution of these problems. Smart technology aims to improve the access to information data and to optimalise the effectiveness of existing infrastructure.

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

Gdańsk and Glasgow are similar in size cities, but they have organized the transport systems differently. While in Gdansk tram subsystem can be considered as the backbone of public transport, in Glasgow bus subsystem is fully expanded. Both cities are promoting and investing in bicycle system, which is gaining more and more popularity among residents. The Investments in smart solutions improve the quality of life in resident's perception. It should be noted that smart solutions are climate responsible and aim at the reduction of environmental pollution. Transforming transport systems should take into account smart technology, which provides a number of valuable data information by synergy. Data can be further developed in order to facilitate the resident's mobility

PUBLIC SPACE: APPROACH IN STRATEGIC DOCUMENTS

Policies in cities concentrate on introducing the open spaces network with nodes of representative public spaces. Gradually a car is eliminated from the city centre and the reclaimed space is pedestrianized. Old transit city centres are transforming into a safe, pollution-free, attractive centre - a place for social networking, exchanging thoughts and ideas, in which healthy life style is promoted. This improves the quality of life and it can lead to increase the sense of identity in citizens. Both Gdańsk and Glasgow authorities understand the great importance of open space network. The comparative study identified the following aspects as important in public space approach (tab.3)

Tabel 3 Selected aspects of public space aproach In Gdansk and Glasgow

ASPECT	GDANSK	GLASGOW
definition of public space	Law on Spatial Planning and Development urban policy	PAN65 (Planning and Open Space by The Scottish Government
City policy	the study of the conditions and directions of spatial development of the city of Gdansk Startegia Gdansk 2030+	City Plan 2 - ENV 2 - Open Space and Public Realm Provision Future Glasgow International Financial Services District 2 + Tax Increment Financing + Business Improvement District +City Deals
public spaces on private land	limits	opportunities
Studies and Strategies	Public Space in City SOPP	Glasgow Open Space Strategy
Programs citywide **Selected cities' actions to improve the functioning of public spaces**	1. Guidance for public spaces; 2. Study of Young City landscape with particular emphasis on cranes; 3. concept of aesthetic regulations in city 4. The illuminated objects in Gdansk	1. DES 6 - Public Realm And Lighting; 2. DG/DES 7 - Public Realm And Public Art; 3. Getting Ahead of Change- Glasgow City Centre Strategy and Action Plan; 4. The District strategy (Regeneration Frameworks to be regarded as Supplementary guidance for the new Development Plan for Glasgow) 5. Part 3- Development and Design Policies: Retail and Commercial Leisure; 6. Glasgow City Of Light 7. Retail Strategy 8. Traffic and transportation strategy

Source: own study by Irena Romasiuk and Monika Rościszewska

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

Shaping public space can be done by upgrading the existing urban fabric, or the creation of a new one, which is connected by open space network with centre. However, the establishment of public space on private land in Poland is associated with the financial claim against city by the owner of the land. Glasgow can act differently - the city imposes a requirement to private investors furnishing of public spaces in accordance with the standards contained in Chapter ENV 2 - Open Space and Public Realm Provision - City Plan 2. The document obliges developers to implement public spaces during the private investment, according to the openly known indicators. If not, the investor is obliged to forward to the city's financial contribution dedicated for the maintenance and improvement of existing public space in the specified amount, which is a worthy to be introduced practice. It can be done in a form of new indicator to the new edition of "*Study of conditions and directions of spatial development of the city of Gdansk*", in which there are already requirements for the implementation of recreation green areas and necessary parking places for new investments.

As far the urban fabric is concerned Gdansk and Glasgow are different cities. The main dissimilarity results from the spatial structure of cities: Gdańsk is a ribbon developed one, and Glasgow - centric. There are waterfronts in both cities: by the river Motława and Martwa Wisla in Gdansk, and by the river Clyde in Glasgow. Furthermore, Gdańsk is located on the seaside (Gulf of Gdansk). The postshipyard areas are the important heritage in both cities. The important public spaces (in form of waterside boulevards) are located along the rivers both in Gdansk and Glasgow. So far only the waterside walkways are very well integrated within public spaces of Main city centre in Gdansk, because the posts shipyard area (Young City) is still under the revitalization project. The next phase of its implementation in Young City can be started as soon as the communication links are completed giving any accessibility to the area. The part of New Wałowa Street has been constructed recently so the investments can start now. Gdansk bought one of the shipyard cranes - the one which was carefully chosen based on the result of *Study of Young City landscape with particular emphasis on cranes*. Glasgow shipyard areas are located on both sides of the river Clyde where the revitalization project was implemented successfully (fig.3).



Figure 3.Glasgow, the modernized waterfront.
Source: Photo by Jaroslaw Wincek

The dominant functions of Glasgow waterfronts are focused on culture, sport, media and business. Two cranes has been preserved as iconic historical heritage. The need to improve the connections between the waterfront area and Glasgow city centre has been identified in the recent strategic programs.

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

SHARING CAPITAL: PUBLIC INVOLVEMENT IN PLANNING

Public involvement in planning is aimed to open innovation by developing a shared vision, which can balance of aspiration and achievable actions possible to provide by local government level, to plan the collaborative and inclusive processes needed for multisectoral cooperation, identify new ways to integrate development with natural systems, to guide communities and advise developers in the creation of sustainable places in cities.

STRATEGIC DEVELOPMENT PLAN AS A PLANNING TOOL FOR SOCIAL AND ECONOMIC DEVELOPMENT IN METROPOLITAN REGION

In 2008 Scottish Ministers established Strategic Development Planning Authorities for each of the four Scottish city regions. These structures are part of modernization of the Scottish planning system introduced by the Planning etc. (Scotland) Act 2006 (the 2006 Act). The important change was the replacement of structure plans by strategic development plans (SDPs).That allowed Ministers to designate groups of planning authorities as strategic development planning authorities (SDPAs), tasked with preparing and reviewing SDPs. The boundaries submitted by the SDPAs were set out in 2008.

City of Glasgow is the part of Glasgow and the Clyde Valley Strategic Development Plan Area, which comprises of the eight local authorities of East Dunbartonshire, East Renfrewshire, Glasgow City, Inverclyde, North Lanarkshire, Renfrewshire, South Lanarkshire and West Dunbartonshire Councils. The established Glasgow and the Clyde Valley Strategic Development Planning Authority (GCVSDPA) is a Local Government Joint Committee comprising of the eight local authorities working together on strategic development planning matters as required by law. The principal role of the GCVSDPA is to prepare Strategic Development Plan for the area. This process involves engagement through joint working and consultation with a number of key stakeholder organizations and the wider community. To support this process a Management Team comprising senior planning officers from the eight local authorities and a dedicated Core Team have been established. The Core Team is the standing professional staff whose role is to co-ordinate and integrates the planning work of the constituent local authorities in terms of formulating and monitoring long-term planning strategies and providing support to the local authorities on all aspects of Strategic Development Planning.

The key aim of the SDP is to set out a long-term Spatial Vision and related Spatial Development Strategy (SDS). This will determine the future geography of development in the city-region to 2035, which will support economic competitiveness and social cohesion, set within a sustainable environmental approach. It is about creating a quality of place by focusing on the continued regeneration and transformation of the city-region's communities whilst securing positive action on its key asset, its natural environment. It seeks to minimize the development and carbon footprints of the city-region, meet climate change emissions targets and above all, support a drive towards a sustainable low carbon economy. The SDP therefore provides the overall geographical framework of development within which the eight constituent local authorities will formulate their LDP and within which they will assess planning applications and proposals. It is also intended to provide the public, stakeholders and the development and investment industries with confidence that a consistent strategic planning approach to creating a long-term sustainable future for the city region is in place [GCVSDPA, 2012]. This allows for a rational spatial planning, as local plans must be applied to these requirements.

Strategic Development Plan for Glasgow and the Clyde Valley is very important for the development of the area but in fact it is different from the document regulating the similar issues in Poland. Provincial Spatial Development Plan Pomeranian (PZWP) differs not only in the spatial extent and procedure, but above all in fact that Polish document is not created jointly by all local government units included in the boundaries of the region. Therefore, the PZWP vision (the spatial location of individual elements and systems) is not jointly developed and agreed upon in bottom-up approach.

Despite the guidelines indicated in PZPW, local municipalities generally limit their creation to local plans only, forgetting about the neighborhood municipalities. For this reason the local plans do not take into account the external aspects. Therefore, the opinions and studies of local plans by neighboring municipalities do not result in the need to adapt to already planned development. Thus, this instrument does not meet its role and is just a formality. The result is dispersed investment areas, primarly of residential function in rural communities, and this in turn leads to the scattering of housing, suburbanization and spatial chaos. Thus, there is a clear need for legislative arrangement of the issue and the real inter-municipal cooperation. The functional urban zoning plans dedicated to metropolitan areas can be a chance to solve some of these problems. However, without deeper legal changes this tool may also prove to be insufficient, primarily due to the large generality of solutions and not enough legal binding with local plans.

Document GCVSDP is a clear and concise presentation of spatial policy in region. The interests of many stakeholders are a consensus achieved after the extensive and detailed public involvement. Programme of Action includes a list of actions required to implement the SDP and it shows which body (organization or representative) will be responsible for the implementation. Strategic Development Plans combine of two documents, namely strategy and development plan, allowing better planning changes with targeting of complementary activities. It seems that this type of solution could serve as inspiration for further exploration and development of similar solutions in Poland

PROCEEDINGS IN LOCAL DEVELOPMENT PLAN (GLASGOW) AND STUDY OF CONDITIONS AND SPATIAL DEVELOPMENT DIRECTION (GDANSK)

The city of Glasgow is interesting - from the Polish point of view - example of town planning in the form of a continuous process, which is cyclical in the rhythm of five years. The successive steps are carried out in the strategic planning process, starting from the vision and determination of objectives, by identifying problems, searching for alternative solutions and evaluates the consequences, through the choice of relevant solutions and finally developing a plan with its implementation and monitoring rules. This process is largely constrained by the restrictions of Scottish law. The law regulations in both countries determine the formal processes in preparing documents which shape spatial policy in cities, which is Local Development Plan (LDP) in Glasgow, Scotland and the study of conditions and directions of spatial development (SUiKZP) in Gdansk, Poland.

The recent (June 2014) process of preparing the City Plan 3 reflects current standards of planning and public participation in Glasgow. The study of conditions and directions of spatial development of the city of Gdansk began in 2004 - hence the cited activities reflect the standards ten years ago within the process of its creation. For that reason, a comparison of the two processes, especially coming from the conclusions may not be fair. The other is the character of the two documents. The study focuses on identifying the targeted shape of the urban structure, while LDP emphasis the organization of processes and activities that the city intends to carry out. The consequential need to change the frequency of actualization in case of both documents is different: the targeted urban structure (Gdansk) does not need to be verified as often as the proposals for actions towards its implementation. Constant questioning about city vision in Glasgow, adopted objectives and proposed solutions, proposing any changes in spatial policy - takes place in the course of evolution, not revolution, and are a response to changing conditions and needs of stakeholders articulated in the public debate. Measures of Glasgow related to the amendment of the LDP may be a hint on how to organize the evaluation process in Gdansk, to develop the spectrum of changes to improve the process of preparing a new document in Polish conditions.

Nevertheless, the planning as a continuous process covers in cyclic following consecutives: setting goals, the diagnosis of conditions and identifying problems, evaluation of proposals for action and the solutions adopted.

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

The main tool for spatial planning at the municipal level in Poland is SUiKZP. Polish law does not force the cyclical nature of the planning process. New Study is drawn up only when there is any political will to do it. Under the law restrictions City Council needs to evaluate the study at least once a term (Article 32: "*analysis of registry issued a decision to establish the location of a public investment and the decision to fix the building, as well as the current destination, land and land development and the state spatial order and the requirements for its protection*"). It is mandatory to take the analysis into account when preparing the study, as well as the changes in planning and strategic documents of higher order (i.e. the concept of spatial zoning of Poland, the province zoning plan or municipality strategy), which is a sufficient reason not to revise the study in case of the absence of political will. The law does not emphasize any need to analyze the impact of current policies or to revise the spatial development goals in city when preparing news evaluation study. Cyclical nature of the LDP in Scotland is regulated by law. Polish law does not impose such a requirement, but one can imagine that municipalities in Poland could pursue a similar model on the basis of good practice. It is difficult to assess whether the period of five years as the length of the planning cycle study would be optimal. Certainly, however, a study should be updated at least once of every two terms of government, which is eight years.

A key conclusion that arises from the analysis of LDP process is a big emphasis on the verification of main objectives in current LDP. This evaluation plays important role in the initial phase of a new LDP, in particular analyzing the impacts of city policies and proposals recognized in MS. Polish equivalent of MS could be recognized as a part of the study indicating the spatial conditions. However, Article 10 of Polish law precise these factors as the existing state of land use and it does not emphasize the need to analyze any impacts of current spatial policy - although, of course, such an approach would be a desirable and possible goal.

Scottish legislation situates the main part of the public debate at the beginning of the process of preparing the LDP - at the time of consultation MIR. This solution is appropriate and worthy using also in Polish conditions. The public involvement at the earliest possible stage is the chance to develop general guidelines to the study, which may be further in progress. The discussion on the assumptions to the study could strengthen the responsibility for city life in residents' perception, their identification with city policy and could facilitate the study provision. The organization of public discussion regulated by Polish law is focused on the solutions adopted in the study - at the end of the process of its preparation and such solution seems to be defective. Form of discussion or debate is more appropriate for the initial stages of preparing the document. The role of municipalities should be limited to distribute as widely as possible the document to the public and adopting public comments as it is in Glasgow case.

GEOSPATIAL INFORMATION SYSTEMS

In the twenty-first century information has become the most important and desired value. In a world dominated by the internet and the ubiquitous mobile devices is difficult to imagine life without the rapid and intuitive access to various data. One of them is widely understood as spatial information. It is nothing more than a collection of data related to their position in space. Combining these data with each other allows virtually unlimited research and visualization based on a data cloud. Geo spatial information has been used in local government units for years. The administrative decisions are taken based on the data analysis which is one of the decisive criterions and also while setting the development policy and strategy for city. Hence, it is understood that every municipality tries to invest more and more to produce, acquire and store data. The data presented by commercial entities (Google) and open systems (OpenSteetMap) cannot be as accurate, detailed and updated as the data produced by the municipalities for years. Smart society increasingly demands to share responsibility for where we live and how. The fundamental question arises in what way the data stored over years can be shared now for the good of all.

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

While analyzing Gdańsk and Glasgow it can be seen how important the part of their operation which is dedicated to GIS is. Both units have had huge collections of spatial data from their daily work objectifying any official decisions since years. However, the approach in cities is different while sharing GIS data outside (tab.4).

Tabel 4 GIS data In Gdansk and Glasgow

Aspect	GDAŃSK	GLASGOW
Municipal website	Interactive Open Plan Gdansk	Open Glasgow
data availability	Indirect data availability through a portal IPG Direct access through service WMS	Direct access through the ability to download data from the portal
Data Updating	Coordinating and Updating body (Information Technology Office of the city)	no coordinating body timeliness data placed in the portal

Source: own study by Mateusz Zuk

Gdańsk has opened almost all of its resources. The portal is easy to use as it can be used in intuitive way while reaching a range of information. Information Technology Office of Gdansk is responsible for the portal. The office ensures that the data are accurate and updated in a fixed time interval. Interactive plan of Gdansk gives the ability to locate each plot, building or zoning plan. The vector map or three other orthophotomaps can serve for primer. The available maps were produced during the last ten years, so it is possible to see the changes throughout this period. This way of presenting data is certainly convenient for anyone who does not need to deal with GIS data for a professional purpose. The problem arises when we want to use data for professional analysis as only four WMS services are available through the system today. Glasgow authorities have opened the resources in a different way. The Open Glasgow platform as the name suggests opened spatial data. The assumption was simple: the unlimited access to information for everyone allows the synergy effect of open innovation which will improve city life. At the moment more than 500 data sets are available which are covering various aspects of Glasgow life. Over fifty organizations opened their data resources - not only originating from City Authorities but also private companies and associations. The portal offers poor quality mapping - six primers based on OpenStreetMap system certainly cannot be considered as an innovative approach to visualizing such a rich database of spatial information.

There is no simple solutions considering the storage, governance and sharing spatial data. On one hand Gdańsk is offering a set of current and precise information about city urban structure, but offering no real access. Glasgow shares more than 500 sets of data; however, the fact that they can be published by virtually everyone begs the question about their accuracy and merit. The ideal solution could be meeting both approaches - ensuring anyone can have the opportunity to share public data resources while the acquired data meet the requirements for timeliness and value.

LESSONS LEARNED

Which attempt in urban planning would be better for Gdansk? Urban planning in our cities is fundamentally different from each other not only because the cities are different but the law regulations at national level differ. Considering the planning it should be noted first, that **Glasgow planning is focused on the activities, processes and Gdansk is planning the places/sites**. Paradoxically, if Gdansk intended to make a substantial and recommended change it rarely would be necessary to introduce any statutory changes. Gdansk being in a different legal reality so far had successfully developed the documents in a form of guidelines in situation of the lack of legal regulations.

ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

The overall suggestion resulting from the comparative study Gdansk Glasgow is to continue this approach, by developing i.e. public involvement guideline, open space guideline. The better solution was diagnosed in the achieved level of green areas accessibility in Gdansk. The suggested next steps for Gdansk compromise of: (1) know how and skills to be gained from Glasgow which could be a field of cooperation, (2) undertaking the recommended studies in Gdansk and (3) focusing on the recommended topics in other cities comparative studies.

DEVELOP KNOW-HOW AND SKILLS

- GLASGOW KNOW HOW and skills as the future field of cooperation
- planning activities/ processes instead of site planning
- connectivity and maintenance to improve city life quality
- proceeding of Gdansk Study (in the metropolitan context, the debate over the diagnosis of the current study to clear the propositions of actions, then suggestions as consultation results)
- public involvement guideline based on Glasgow experience

RECOMMENDED DOCUMENTS

- green strategy
- retail strategy
- public spaces strategy (in a similar form as *Getting Ahead* document)
- guidelines for the creation of City Functional Region (in a similar form as the strategic development plan of the metropolitan area in Glasgow shaped from the bottom up, to plan the collaborative and inclusive processes needed for multisectoral cooperation)

SCOPE OF COMPARATIVE STUDY IN OTHER CITIES

- Strategic and planning documents
- selected indicators identified as important to be compared with
- soft action introduced and proposed
- health and well being related activities and
- discover new ways to integrate development with natural system

CONCLUSION

The result of comparative research would be the initial proposals of implementation solutions for spatial development of Gdansk. The proposed range would be potentially possible to implement in Gdansk first (with city serving as laboratory) and then in other cities. Considering possible to achieve results, arising from the implementation of “cross checked” solutions it in can be a great opportunity for Polish cities, as far as their implementation will translate into a far-reaching benefits.

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ASSESSING PATHWAYS INTO LOW CARBON AND CLIMATE RESPONSIBLE GDANSK

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Office Building Concentrations and Waterfronts

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1. Introduction

Waterfronts in our cities are be examined in various aspects. These areas are situated on an edge of city, somewhere on a border between land and water. That edge location may generate many development problems. However, it could be also the main challenge, which provides valuable benefits. Waterfronts have been discovered as a potential area of urban regeneration and new splace-making by architects and urban planners in the 1960s (Marshall 2001). Until that time, waterfronts had been considered mainly as industry or ports. A separation and a lack of connections with other districts were main negative consequences of such waterfront developments. These issues have increased, when post-industrial use was closed. Therefore, old port redevelopments have been neglected for years in many cases. Fortunately, post-industrial waterfronts have occupied attractive locations, mainly near city centers. Limited land for new developments and real state requirements have caused return in way of thinking about post-industrial waterfronts. The potential of these areas has been discovered. Post-industrial waterfronts have become taken under consideration as attractive land for crucial city development. Representative investments have been located mainly in such area: offices, shopping malls, public spaces, luxuries residential areas. Therefore, waterfront redevelopments have become a significant part of new splace-making in contemporary cities. Post-industrial waterfronts give opportunity to create new urban structure during one investment process. It is a challenge for local authorities to create new district, which can improve the whole city structure, response for current needs and become representative part of the city. The waterfront revitalization means something more. These projects present a way of thinking about the city as a whole and its development strategy. Richard Marshall underlines that 'waterfronts provide not only us with remarkable opportunities for projects but also for ways of thinking about contemporary space-making in the city' (Marshall 2001). Many cities, especially world class, aim to use this opportunity to demonstrate their position. Therefore, urban waterfronts are often redeveloped into business districts - places where international and national capital can be located. These districts are seen as symbol of economic growth and high city position. That is the reason why local authorities use waterfront revitalization to create office building concentrations in their cities.

Our contemporary work milieu should be taken also under consideration. Because of shift from Fordism (manufacturing based) into Post-Fordism (service and finance based) economy, our work milieu is strictly connected with office buildings nowadays. Companies, mainly from financial and service sectors, are located in huge office buildings. The tendency to create clusters of many office buildings is also quite strong (Marcuse 2006). Consequently, new types of urban structures have appeared – business districts. These office building concentrations are new urban forms in spatial planning aspect, which started appearing in European cities in the 1970s and the 1980s. According to Saskia Sassen and many other researchers, business districts are relatively new urban forms, which are influenced be globalization process. Because of production decentralization and management centralization, some cities have become more important in global market than others. In the new hierarchy of cities, some of them have increased into financial centers of global economy. These cities are called global cities (Sassen 2001). According to the other city division, world class cities are places where world trade and production are controlen (Ben Derudder, Frank Witlox 2008). Despite of different city typologies, the world economy has created need for specific type of space in our cities - office building concentrations.

International companies mainly are located in these offices. Therefore, business districts are considered as a symbol of power, economic development and city position. Consequently, most of local authorities aim to locate such business centers in their cities. At the same time, the majority of business districts is considered as unfriendly and unconnected with other parts of the city urban forms. The issue of creating sustainable work milieu is getting more and more important. Nowadays, social aspect of office building concentrations is also taken under consideration, next to economic income and investor interest. The new work milieu should be more sustainable and friendly for users.

Peter Marcuse considers waterfronts and business district as 'soft' locations. He predicts that the globalization process has a significant impact on urban structures of our cities. The most susceptible urban forms, where this impact is more visible, are called 'soft' locations. These areas of our cities are 'new spatial formations' caused by global impact (Marcuse 2006). Peter Marcus confirms that waterfronts lost their shipping role long time ago. Nowadays, urban waterfronts are used for downtown service-orientated land use (Marcuse 2006). As Marcuse indicates 'waterfronts become amenities making CBDs more attractive'. In other words, business districts are preferable to be located in waterfronts because of land use, location and landscape advantages. The tendency to locate new offices in post-industrial waterfronts is quite strong in many cities. Therefore, putting together these two usages seems to be good solution to create new and astrictive urban tissue. Advantages of post-industrial waterfronts encourage new office developments. To locate business activities on urban waterfronts is a good solution for post-industrial area revitalization.

The main goal of the paper is to examine selected office building concentrations based on post-industrial waterfront: Canary Wharf in London and Aker Brygge and Tjuvholmen in Oslo. These two case studies are examples of post-industrial waterfront redevelopments according to city strategies. These districts are designed and redeveloped differently. British and Norwegian spatial planning establishments are various, therefore fabric urban structures are not also similar. These two urban developments have been managed differently and base on various origins. Results and current urban structures are also extremely different. Detailed analyze and discussion of two examples show various ways of waterfront development. Moreover, the comparison of these significant European capitals underlines useful tools and general rules how to redevelop waterfront into the successful office building concentration.

2. Putting together office buildings concentration and waterfront

United Kingdom and Norway are two European countries with various social, geographical and economic conditions. On one hand, their capitals are like a footprint of national mentally and requirements. On the other hand, London and Oslo are completely different than other cities and towns in their countries. Both cities have many international influences. Consequently, many international companies and foreigners are in London and Oslo. Therefore, the city images are less national, rather more cosmopolitan. Connections with other world class cities are even more important than with other cities in the same country. London is such typical example. It is even said that London is so independent city that cloud be located in any place on the world. It presents disconnections between London and other parts of the United Kingdom. London, next to New York and Tokyo, is called global city, what means that it is one of three main financial centers on the world (Sassen 2001). Canary Wharf is the new urban form in London created by global market. Therefore, London Docklands are like a symbol of power and position on the global market (Marshall 2001). The architecture style in Canary Wharf should be an icon of British success. Local authority in Oslo has had similar aspirations. Norway has been developed into one of richest country on the world since the oil sources were discovered in the 1970s. Results of these changes are visible in Norwegian cities, especially Oslo. Nowadays, the capital of Norway is more similar to other European metropolis. The city center renovation and new international company

locations are main reasons of the new image of Oslo. New high-rise office buildings have appeared, in which many significant companies are located. Also new luxuries housing and services have been built. Norwegian wooden house are not there anymore. However, mentally and traditional way of thinking still can be felt in modern urban forms.

2.1 Waterfront redevelopment process

In the first part of study, redevelopment plans of Canary Wharf in London and Aker Brygge and Tjuvholmen in Oslo are deeply analyzed. Canary Wharf used to be the dockland area in East London. The process of decrease of this area began in the middle of 20th century. Most of docks were closed in the 1970s. The symbolic year of dockland end was 1981, when last dock was closed. Many people, around 2% of British, lost their job. The governance decision to redevelop this area and create east center of London was initiated by Margaret Thatcher government (Butler 2007). That decision was motivated by overcrowded center of London and need for new land expansion. Moreover, land in Docklands were relatively cheap in comparison with other parts of contemporary London. The London Docklands Development Corporation (LDDC) was established in 1980 by the local Government Planning and Land Act (www.canarywhatrf.co.uk). The LDDC was an urban development corporation. The London Dockland redevelopment was a massive public-private investment. The main duty of the LDDC was 'bringing land and buildings into use, encouraging industry and commerce, creating an attractive environment, assisting in the provision of housing and social facilities to encourage people to live and work in the area' (www.canarywhatrf.co.uk). Its task was to secure regeneration of approximately 8 squares miles of East London called the London Docklands Urban Development Area. Because of the scale of investment, any singe actor could not manage and finance it alone (Marshall 2001). Margaret Thatcher government understood it. Therefore, the land ownership was transformed from public bodies (ports authority) into the London Docklands Development Corporation. In the other words, development control was taken from local authorities to LDDC (Marshall 2001). Redevelopment costs were provided by public and private sector. Moreover, LDDC was expected to investments but also delivering know-how. This solution was based on North-American systems. 8 square miles were charged by the London Docklands Development Corporation. Interesting and controversial for that time was decision to create Enterprise Zone on the Isle of Dogs. Tax allowances for next 10 years were offered for investors and developers. The London Docklands renewal based on the Canary Wharf Master Plan from 1987. However, single investments were established more on local development plans. The general idea for urban structure and architecture was not coherent with the British traditional Victorian architecture. It was more like a copy of the North American style of creating Central Business Districts. As consequence, mainly skyscrapers in postmodern style were built. Olympia & York, North American developers, proposed to build 10 million square feet office. The first significant office building was finished in 1991 – One Canada Square. At the same time other offices and services were appearing. What is more, many buildings are under construction even nowadays. Olympia & York Canary Wharf Ltd became an administration in 1992. Docklands Light Railway was other crucial investment in Canary Wharf, which was opened in 1987. It is said that until Jubilee Line was not opened, London Docklands were unconnected with other parts of the city. Jubilee Line provides fast and efficient connections with City of London. Because of many office building developments, an amount of employees in Canary Wharf was rising immediately. It was 7 000 persons in 1992 and 19 000 persons in 1998. At the same time over one hundred shops and restaurants appeared to support office. Moreover, various services, such as: leisure, sport, shops, were located also in Canary Wharf. Nowadays, Canary Wharf is managed by Canary Wharf Group.



Figure 1: The view on Canary Wharf in London



Figure 2: Public space i on Canary Wharf in London

Aker Brygge and Thjuvholmen are two districts in central part of the Oslo harbor. As post-industrial waterfronts border on Oslofjord. It was effective industrial area in Oslo until the 1970s. Unfortunately, the dockyards were closed in the 1970s because of the crisis. The decision of post-industrial waterfront renewal was done not so far. Local authorities made decision of Aker Brygge revitalization in the 1980s. The main goal was to connect this area with the Oslo center and open the city to the fjord. Consequently, the 'Fjord City' project has been established. It has been the big-scale revitalization project of harbor in central party of Oslo. The 'Fjord City' overlaps 225 hectares and is divided for 13 smaller projects. The length of harbor is approximately 10 km. The first 'Fjord City' project was designed in the 1980s and since that time it has been improved a few times. The long process of waterfront redevelopment in the Oslo center started in the 1980s and it has been ongoing until now. The Aker Brygge renewal has been the first step of the revitalization process. This district borders on the north with Oslo city hall area. The masterplan was established by Oslo municipality. The redevelopment was planned until 2000 and was divided for four smaller sections. Each stage has concerned one part of Aker Brygge regeneration. All sections were working independently during others renewal. For each section an architectural competition was done to select the best project, which had to be compatible with the masterplan for whole district and accepted by local authorities. The north part of the Aker Brygge was

redeveloped as the first one. Here old post-industrial buildings were revitalized and adjusted to commercial functions. The heritage protection was very strict and finally buildings have kept original shapes, facades and details. The shopping center project included the old gate renovation, what created the entrances to whole districts. All planned investments were built until the 1998s. Mixing various land use was established, therefore Aker Brygge is combination of offices, housing and services. A lot of attention was paid to create attractive system of public spaces, with high quality architecture and arts. Designing proper connections with Oslofjord was not forgotten. The port for yachts and motorboats was built. A water transport in Norway is quite significant, therefore the waterbus stop is also located in Aker Brygge.



Figure 3: Public space in Aker Brygge in Oslo

Tjuvholmen redevelopment process has been stared, when Aker Brygge was completed. Oslo municipality made a decision about renewal of Tjuvholmen in 2000. The materplan was selected two years later during international competition. The project 'Spectacular', designed by Nielsena Torpa, won. As a result, Tjuvholmen ownership was charged to company Tjuvholmen KS (60% investor - Selvaag Group, 40% architectural office - Aspelin Ramm). The process of redevelopment stared in 2004 and finished in 2014. The Tjuvholmen area covers 18 hectare, which is located on three islands. The renewal process was gradual. When one island was completed, the next one was taken under reconstruction. The land use structure in Tjuvholmen is mixed. However, each island has one dominative function, such as: office, culture, leisure. The Akerodden island, located on the north next to Aker Brygege, was finished as the first one in 2007. There mainly offices dominate. Next island is named Tjuvhomne, which is any artificial island. Housing and services dominate here. Holmen is the third island, where culture is main use. Modern Art Museum, designed by Renzo Piano, is located on Holmen island. Both cases – Aker Bygge and Tjuvholmen were redevelopment as public-private partnership. The whole development process was divided for stages, what made possible to use district step by step.



Figure 3: The view on Aker Brygge and Tjuvholmen in Oslo

Origins of Canary Wharf, Aker Brygge and Tjuvhoolmen are quite similar. Both of them were dockyard closed in the 1970s. Local authorities in London and Oslo decided to redevelop these areas into new representative urban tissues. Previous industrial use was dramatically changed. It was possible because land ownership belonged to one owner. Land locations were also very attractive – not far from city centers and next to water, what created opportunities to design representative part of the city. However, final revitalization results present different city visions and strategies. Both projects are like a footprint of city aspirations. Local authority in London wanted to create space presenting power and position of the city. Because of wish to be financial center, Canary Wharf is big-scale investment including mainly office buildings. Oslo also had an aspiration to be a significant European metropolis. However, Aker Brygge and Tjuvholmen are mix of metropolitan functions. Office buildings do not dominate in these districts. Also building scale is fixed to other urban tissues in Oslo. Unfortunately, it cannot be observed in Canary Wharf. The London Docklands neglects British architecture traditions and fallows the post-modernist style. Any references to history cannot be found in Canary Wharf. However, it is done in Aker Brygge. What is common in both cases, such big-scale investments cannot be funded only by public money. Any public-private partnership has to be done. Local authorities play the role of coordinator and investors fund and provide know-how (Marshall 2001). In case of the London Docklands, the local authority took care more for international investors, which could support such big investment. Less attention was paid to masterplan and graduated development. However, local authority in Oslo focused more on the project for whole harbor – 'Fjord City'. Next smaller masterplans were selected in international competitions. The long process of renewal was divided for separated stages, which were done step by step. Therefore, the redevelopment process in Oslo was well organized and clear from the beginning to the end.

2.2 Current urban structure

Canary Wharf is said to be one of the most important business district on the world. For sure it is significant place, where many global decisions are made. In economic point of view and London strategy to be global or world class city, Canary Wharf is successful development. Main goals have been achieved. However, when social aspect, human scale of architecture and connections with nearest neighborhood are taken under consideration, the success of Canary Wharf could be discussed. Approximately 16 million square feet of office and retail space is located on 97 acres in Canary Wharf. Approximately 105 000 people work in 35 office buildings and they can use 280 shops, cafes, bars and restaurants situated in four retail malls. Most of users do not live in Canary Wharf because not enough housing in and

around Docklands. Therefore, public transport plays crucial role in this district. People mainly move to and from other parts of London by two Dockland Light Railway and Jubilee Line. Train and metro stations, which are put together, create central point of the district. This station is the most important point in Canary Wharf supported by shopping mall. The transportation system is also supported by buses and taxies. However, the highest capacity is provided by metro and rail. Private public transport is completely moved out from Canary Wharf. The majority of streets is reserved only for pedestrians and cyclists. Therefore, attractive public space is created. Taxies and buses are allowed only on selected streets. Public space between buildings is mainly pedestrian area. Therefore, public space and transportation system seem to be organized properly in Canary Wharf. The main issue of Canary Wharf in urban planning aspect is enormous scale of buildings. High density and skyscrapers do not keep the human scale. Urban structure has been formed for companies and investors, rather than users. Skyscrapers do not create friendly environment for people. Moreover, Canary Wharf does not keep any relation with local context, history of place or other British traditions. It is typical cosmopolitan architecture and urban design. Such post-modern buildings can be located in any other world classy city on the world. Canary Wharf, as other business districts, is monofunctional. Consequently, there is almost no users during weekends. What is more, such business district functions as a citadel, because lack of connections with surrounded areas (Marcuse 2001).

Aker Brygge and Tjuvholmen seem to be successful development. It is not pure business district as Canary Wharf in London. It is more like office building concentration mixed with housing, service and culture. Two districts have been designed, which create one urban structure. Aker Brygge, located on 26 hectare, provides 383 apartment units for 900 habitants. 82 000 square meter office space is reserved for 6 000 employees. Whole is supported by 50 shops and 38 restaurants and cafes. According to Tjuvholmen masterplan, three islands are reserved for 1 200 habitants in 200 residential units. Whole creates multifunctional city center, representative and livable part of the harbor. Because of strict masterplan for Aker Brygge and Tjuveholmen, all buildings make uniform urban structure. Despite of various projects and architects, all buildings have similar size and uniform architecture style. The density of Aker Brygge and Tjuvholmen is quite high. However, human scale is kept and space is adjusted to people needs. What is more, a quality of architecture and public spaces is very high. The majority of buildings is modern but references to traditional Norwegian architecture still can be observed. For example, materials are mainly natural: wood, stone, brisk. Living near nature is something normal for Norwegians. It is easy to observe in other parts of Norway, where towns and villages are adjusted to natural landscape. Also relations and dependence on sea are quite strong. That is the reason why the majority of urban areas in Norway is opened to fjords. This tendency is also visible in Aker Brygge and Tjuvholmen. Buildings and public space are directed to Olsofjord. The border between land and water is sometimes difficult to define. An urban tissue is adjusted to natural landscape and create with it one structure. Strong will to design space for people, mainly pedestrians and cyclist, is quite visible in Norwegian splace-making. It is also done in Aker Brygge and Tjuvholmen. Public space between buildings is reserved only for pedestrians and cyclist. All cars are moved to underground roads and parking. A public transportation node is located near the main gate to Aker Brygge. Public transport is not allowed in districts. It is possible because whole area is not big and its length from north to south is approximately 700 meters. That is only 10 minutes waking distance. Of course, water transport is not neglected. Marine in Aker Brygge provides space for 125 yachts and motorboats. Also waterbus stop is located here, which is a part of public transportation system in Oslo. Malls and squarest, with attractive small architecture and design, create friendly and sustainable space for residents and visitors. Public space is supported by various services located in building ground floors, mainly restaurants, cafes and bars. Of course, public space is opened to fjord by proper landscape architecture design. Whole makes livable and friendly urban structure. Aker Brygge and Tjuvholmen present current and future Norwegian aspirations. On one hand, references to tradition and nature are kept. On

the other hand, open mind for modern architecture and new urban forms is used. That way of thinking helps to develop attractive and sustainable multifunctional waterfronts.

The trend to create office building concentrations is quite strong and many local authorities aim to locate such districts in their cities. However, avoiding basis mistakes and develop successful business districts is very difficult challenge. In case of Canary Wharf, economic growth has dimed social aspect and user needs. It has been done better in Oslo, where main aim was to create multifunctional district. Norwegians focused more on people, natural environment context and uniform character of architecture design. Consequently, unique district was design.

3. Recipe for successful office building concentration and waterfront

Two presented office building concentrations in European cities show two different methods of splace-making. Both post-industrial waterfront developments are definitely successful investments. Hoverer, they are successful in different ways. Canary Wharf is one of the most important business district on the word. Its success consists on being a word class financial center. However, user needs and human scale are neglected in this urban structure. It is like machine for earning money, not for human being. Aker Brygge and Tjuvholmen in Olso achieved opposite success. It is example of more sustainable place-making. The final result of waterfront development is more like multifunctional city center, not pure business district. General rules and tools of successful office building concentration developments are defined on examples of these two district redevelopments and its final results.

First category concerns a process of post-industrial waterfront redevelopment. Land conditions are the key to successful development. It is mainly post-industrial area. Therefore, land use change is relatively easy. Moreover, land ownership usually belongs to local authority, what makes a process of redevelopment easer. Post-industrial area often is big enough to locate there new urban structure. What is more, post-industrial waterfronts mainly are located in attractive locations, usually near city centers. Whole conditions are relevant for new developments. Next significant step is an investment process. Realization and whole investment usually takes many years. Because of a project scale (buildings, infrastructure, public spaces etc.), public-private partnership is necessary. Public funds are never enough to support such big and long term investments. However, the main role of local authorities should be coordination and care of proper development process and public interest. The main goal also is to prepare high quality and long term masterplan for whole district. However, some small corrections should be allowed during the renewal process. Step by step development seems to be also crucial. What is more, more detailed projects for singe investments should be also designed. In both case the new company, connected with local authority, has been created to take care of whole redevelopment process. Such company should be kept for later district management. That solution is quite popular in many European cities to provide proper management and keep district in good social and economic conditions.

Next criteria, with should be taken under consideration during office building and waterfront developments, is urban design. Well-designed urban space and high quality architecture are crucial. Architecture style should be associated with local tradition and place contexts. Otherwise cosmopolitan districts appear, which could be located in any city on the world. Moreover, unique spaces are preferred, because can be identified only with particular city. Supporting good architecture and attractive system of public space seems to be necessary. Public space between buildings should be designed for people, not for cars. So mixing squares, promenades and green areas between office buildings is a tool to create friendly and sustainable work milieu. Mixing various land use is also very important. It is necessary to create multifunctional district, not monofuncional business district. It cannot be forgotten that offices need to be supported by other use, such as: services, housing or culture. Keeping

people and making place more attractive for users are only main results of mix land use planning. Moreover, connections between our new districts and surrounding neighborhoods are easier to achieve. Otherwise new office building concentration area cloud be like a citadel.
The last aspect of waterfront redevelopment and creating office buildings concentrations is transportation system. Each metropolitan function concentration bases on An efficient transportation system. Such big concentrations of offices, services and housing generate significant people movements each day, especially in the morning and the afternoon. An efficient transportation system is crucial to provide fast transport for so many users at the same time. Therefore, each office building concentration should be based on public transport, such us: train, metro, tram or bus. However, train, metro and tram lines are preferable for these urban areas. The goal is to locate one important transportation node in central part of the district. It should be transportation node for each transport lines available in our district. That node should be supported by services and information system. Inter transport should be reserved only for pedestrians and cyclist. It makes possible to design attractive public space between buildings and avoid car traffic in so small areas. The water transportation system cannot be also neglected. Creating waterbus stop should be obligatory in district based on waterfronts. Moreover, any marines for yachts and motorways are also preferable.

4. Conclusion

Putting together waterfronts and office building concentrations is good solution for making new representative urban space. Such areas give many amenities, which are essential in office development. On the other hand, office building concentration provides many advantages for whole city. New workplaces for citizens and economic growth are only basic examples. Moreover, mixing offices with other use gives opportunity to create attractive multifunctional district in the city. Waterside encourages to design allure urban spaces between building, focused on pedestrians and their comfort. However, pure office use, inefficient transport, a lack of human scale are only basis risk of wrong redevelopment. Therefore, avoiding mistakes and repeating good solutions are one of a tool to develop successful urban waterfront. Offices building concentrations are one of the best use, which could be provide such investments to be successful.

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Detroit Riverfront and the Future City

Victoria Byrd Olivier, Detroit Future City, USA

In July of 2013 the City of Detroit filed for the largest municipal bankruptcy in U.S. history after steep population and tax base declines sent it on a decades long path toward insolvency. While Detroit was once synonymous with the giants of American auto manufacturing, and was a major location for the production of planes, tanks and munitions during World War II, the city's more recent association in the world's imagination has been with blight and despair.

With every disaster, economic or otherwise, there is the tragedy story and the recovery story. Part of the recovery story is the development of the Detroit Future City Strategic Framework which uses five planning elements (Economic Growth; City Systems; Land Use; Neighborhoods; and Land and Building Assets) to articulate a shared vision of Detroit's future, recommending specific actions and strategies to improve quality of life and fiscal sustainability. This plan addresses the often harsh realities the city faces, but the Detroit River and the city's waterfront represent a premier opportunity identified by the Strategic Framework. The Framework outlines several ways in which Detroit can work in new ways to use the riverfront to strengthen neighborhoods and the economy, and in turn use neighborhoods to strengthen the river.

Decline of Detroit and Rise of the Region

The rapid expansion of the auto industry fueled a growth spurt that made Detroit the fourth largest city in the United States in the 1940s, and by 1950, the population peaked at almost 1.85 million. Detroit was home to the most innovative, dominant industry in the world and people moved from all over the country to work at the Big Three auto companies: Ford, General Motors and Chrysler. But as population was peaking the decline in Detroit's dominance had already begun due to decentralization of plants to suburban and rural areas. Between 1947 and 1963, a net of 140,000 manufacturing jobs left Detroit. Despite these changes that occurred, Detroit remained reliant on the auto makers as its major industry.

As Detroit is the hometown of the auto industry, it is not surprising that public policies throughout most of the twentieth century encouraged a dominant car culture. The city and region invested more money in building highways that encouraged suburbanization, rather than maintaining and expanding a public transportation system. When African Americans began moving to Detroit from the American South in large numbers in search of work at automobile factories in the 1940s, tensions between white and black residents rose. These tensions continued to rise through the 1960s and more and more whites used the newly built roadways to leave the city.

Today, Detroit's poverty has been exacerbated by middle-class black families' moving to the suburbs to pursue economic opportunity, lower crime and an overall higher quality of life. Population figures released May 2014 by the U.S. Census Bureau estimates 688,701 residents remain. Many of these residents are poor with few other opportunities; although increasingly many new, young residents have moved to the city to seek opportunity in filling the gaps that decades of decline have created.

While Detroit's population is poor and mostly African American, the surrounding suburbs are mostly white and are among the richest in the United States. While the median household income within the city of Detroit is around $26,000, the suburb of Bloomfield Hills, for example,

had a median income higher than $150,000. Metro Detroit, which includes the suburbs of Wayne, Macomb and Oakland Counties, is, as Robert Reich notes, “among the nation’s top five financial centers, the top four centers of high-technology employment, and the second-biggest source of engineering and architectural talent.”

Detroit’s suburbs are not all sprawl, monotony and chain stores; in many cases they boast thriving downtowns with restaurants, bars, music venues, cultural institutions and street life. Additionally, and more importantly to families, they offer a wide selection of school types, and more efficient government with a high level of service. While the suburbs were also impacted by the US foreclosure crisis between 2006-2010 and suffered from vacancy, decreased property taxes and decreased local government funding, the hardship was not close to that seen in Detroit. Most suburbs have recovered in the past few years to the point where population is growing again. These ongoing stark contrasts have led to a deep social “city vs. suburb” divide, with the result that many suburban residents, while saying they are from “Detroit”, have often not set foot in the city in decades.

The Value Proposition

With the identity of the region shifting to “Metro Detroit” from the actual city of Detroit, the city’s leaders are faced with the large challenge of defining a value proposition. This value proposition could convince residents to stay in the city, businesses to relocate there and suburban residents to, at best, move back (or at least visit and spend money within the city limits). Detroit does has several competitive advantages including a distinct, architecturally significant urban environment, world class museums and cultural institutions, and the professional hockey, baseball and football teams that play downtown. While these are draws, they can often be “drive in, drive out” pleasures.

The state of Michigan has 11,037 inland lakes and 3,288 miles of Great Lakes shoreline, but the Detroit River stands truly unique in the state and Metro Detroit region. The river, which runs 32 miles from Lake St. Clair to Lake Erie, has a prolific history as a working river where more than 650 ships were built from the 1800s to the 1960s. In fact, the Detroit River was so busy that it was declared a public highway by an Act of Congress in 1819. Visitors enjoy the brilliant turquoise hue of the water and views of the skyline of Windsor, Canada, across the river. In addition, the river is as a cultural and historical landmark, the place where many slaves escaping their servitude via the Underground Railroad were finally be smuggled to Canada and freedom. However, the Detroit River is more than an aesthetic asset and historical landmark; it is truly a foundational asset for economic development, improved quality of life and neighborhood stabilization within the city of Detroit.

Creating Amenities and Increasing Accessibility

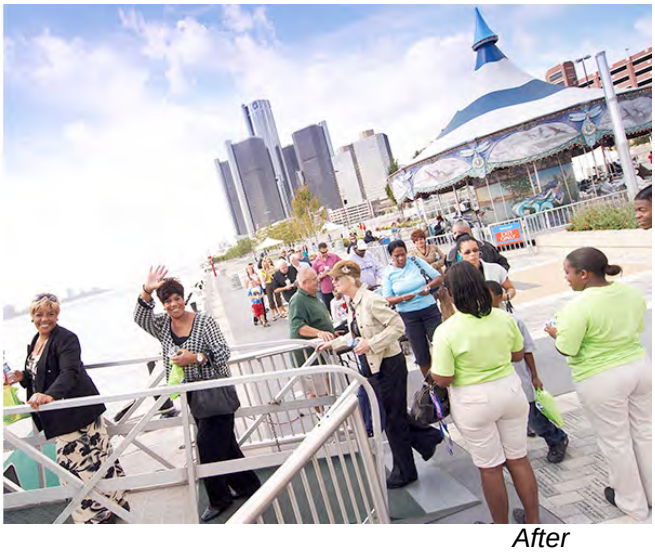
While Detroit has been fighting its overwhelming debts for decades, there has also been significant investment in the riverfront in hopes of putting the city on a path to recovery. Over the past 15 years Detroit’s waterfront has transformed from industrial and inaccessible to a nearly implemented vision of 5 ½ miles of riverfront property, extending from the Ambassador Bridge to Gabriel Richard Park and including a continuous RiverWalk with plazas, pavilions and green space.

The transformation of the riverfront was made possible by the contributions of three key partners who came together in 2003 to form the public-private partnership known as the Riverfront Conservancy:

- The City of Detroit: provided valuable riverfront land and significant infrastructure improvements
- General Motors: made additional investments into its downtown waterfront property that included the construction of the G.M. Plaza and the first half mile of RiverWalk
- The Kresge Foundation: gave its largest grant ever to a single project – a $50 million challenge grant that served as an economic catalyst to launch the Conservancy's efforts and allowed the Conservancy to leverage additional funds from foundations, corporations and the private sector

The first phase of the project comprised three miles along the east riverfront and is now 80 percent complete. The final construction phases needed to complete the east riverfront development project, and to fully connect the RiverWalk and its associated green spaces, plazas and parks, are currently underway. The RiverFront Conservancy continues to raise funds for construction, operation, maintenance, security and programming of public spaces along the Riverfront. It is estimated that public spaces constructed by the Conservancy draw 3 million visitors a year.





Rivard Plaza *Before* *After*

http://detroitriverfront.org/riverfront/after





Gabriel Richard Park *Before* *After*

http://detroitriverfront.org/riverfront/after

The infrastructure is nearly all in place for a thriving waterfront, but the RiverFront Conservancy has also recognized the need for coordinated activity and amenities to attract residents and visitors, and keep them coming back for an array of experiences. In 2013 the Conservancy partnered with Project for Public Spaces to complement the successful placemaking activities that had been occurring downtown, where there has been an intense focus on strengthening the city's core.



Sand volleyball courts for playing games, or just playing in the sand. Photographer: Victoria Byrd Olivier

While Detroit Future City is a comprehensive 50 year vision for the transformation of the entire city, as Kresge Foundation president Rip Rapson said in his opening remarks at the Placemaking Leadership Council meeting in Detroit in spring 2013: "Acts of Placemaking bring our aspirations into focus." Rapson continued:

> "They enable us to create an emotional bond with our community. When we're able to connect to a city or a neighborhood through an individual or shared experience of its public spaces, there's a magnetic pull. You want to stay committed. You want to invest. You want to build a future. These are the preconditions for civic transformation."

The use of placemaking along the riverfront, often through low-cost and even temporary physical infrastructure, was a way to produce relatively granular interventions that could be implemented immediately as more complex conversations occur around city-wide blight remediation and service delivery.



Relaxing on lounge chairs along the riverfront. Photographer: Victoria Byrd Olivier

Creating Connection to the River

G.M. Renaissance Center/Plaza

Until the creation of the RiverWalk, most of the waterfront in modern Detroit had been a "working place" or walled off by buildings that did not afford the public access. In 1971 that was exemplified when the Renaissance Center a futuristic, interconnected series of office towers located directly on the river was constructed. It was an ambitious urban renewal project meant to quell white flight and the latest solution for revitalizing the economy of Detroit. In design, and in practice, the Renaissance Center it became an intimidating fortress; a city within a city that accommodated only the workers within it.

When G.M. purchased the building in 1996 to serve as its new headquarters, the company embarked on a 500 million dollar renovation in which the G.M. Plaza was a major component. The section of the riverfront adjacent to the Renaissance Center was covered with a parking garage and covered roadway and has been reclaimed by a plaza featuring a granite world map, synchronized water fountain, and a grove of trees alongside the riverfront Promenade, which continues east and west along the Detroit River. The insertion of the five-story Wintergarden, a multi-story atrium featuring palm trees linking the building to the river, helps orient visitors by creating open views of the Detroit River and Windsor beyond and encourages them to continue to the G.M. Plaza & Promenade. The renovations effectively addressed building's original urban solitude and created a badly needed connection to the river.



Children playing in the G.M. fountain to keep cool. The Renaissance Center's Wintergarden is in the background. Photographer: Victoria Byrd Olivier

Cobo Hall

Cobo Hall, built in 1960 and encompassing a major convention center and arena, was once one of Detroit's premier sports and entertainment venues, but never had a unique, definitive focal point or connection to the riverfront. A recent 221 million dollar renovation provides a striking contrast to the current building; the renovation transformed the east elevation into a dynamic, transparent screen offering panoramic views of both the Detroit River and Windsor, Ontario. This facelift finally allows Cobo Hall to relate to and embrace the river, continuing the trend started by the G.M Renaissance Center to the east.



http://detroithistorical.org/learn/encyclopedia-of-detroit/cobo-center

Above is a 1962 view of the Detroit skyline with Cobo Hall dominating the foreground. Below is a rendering that features glass walls on the south end facing the Detroit River.



http://www.drcfa.org/cobo-center/renovation-updates

Joe Lewis Arena

The 20,058-seat Joe Louis Arena is home to the Detroit Red Wings hockey team, and is just west of Cobo Hall on the banks of the Detroit River. The structure is expected to be demolished after the Red Wings move to their new arena in the Cass Corridor neighborhood north of downtown in 2016. If the City of Detroit cannot find investors in the property Detroit taxpayers will be responsible for the estimated $6 million needed for demolition. Even though the arena sits amid a rebounding downtown and riverfront area, the 140,000-square-foot structure poses difficult development challenges. Primarily, the location is problematic: it is on a corner lot hemmed in by a parking ramp, an expressway and a loading dock area serving the Cobo Center. While the timeline, use and project scale for the property are uncertain, the orientation of any new buildings and public access to the riverfront should be of primary importance.



Joe Louis Arena site has prime waterfront location, but will be difficult to develop what experts say is a problematic riverfront property. Photographer: Victoria Byrd Olivier

Detroit Future City and the Riverfront

Economic Growth Element

Corktown Employment District is one of the seven employment districts identified in the DFC Strategic Framework. It is envisioned as a new entrepreneurial district and one of the City's most desirable Live + Make neighborhoods. Corktown is convenient for freight and people alike, providing access to the riverfront and the Ambassador Bridge to Canada. To realize the neighborhood's potential, investment should be coordinated closely with community leaders to promote new business and housing development. New investment should leverage projects underway for instance by connecting Corktown to Belle Isle, a treasured island park on the city's east riverfront, via the RiverWalk.

Land Use Element

The 50 year land use plan outlines a stronger, greener, and more socially and economically vital Detroit. It calls for a city

> "where neighborhoods feature a wide variety of residential styles from apartments to houses, and where residents are connected to jobs and services by many transportation options in a "canvas of green" that features stately boulevards, open green space, urban woodlands, ponds and steams and new uses of natural landscape to clean the air, restore ecological habitats, and produce locally sourced food."

The Strategic Framework uses "Land Use Typologies" instead of standard zoning to generate complete neighborhoods by prescribing densities and allowable development types. Green Mixed Rise neighborhoods is an example of a Land Use Typology that represents a unique way for Detroit to attract and achieve greater density by capitalizing on existing physical assets--such as the east riverfront and areas susceptible to flooding---while fostering a more symbiotic

relationship with the natural environment. The relatively high density of the Green Mixed-Rise neighborhood achieves a low cost to provide services.

Ecological landscapes are a development type for the Detroit riverfront including a mix of landscape uses: parks; greenways with walking and bicycling opportunities like the RiverWalk; marsh parks and blue infrastructure that filter stormwater before it enters the rivers. The ecological development type works within the Green Mixed-Rise neighborhood typology which encourages innovation within a water-based landscape.

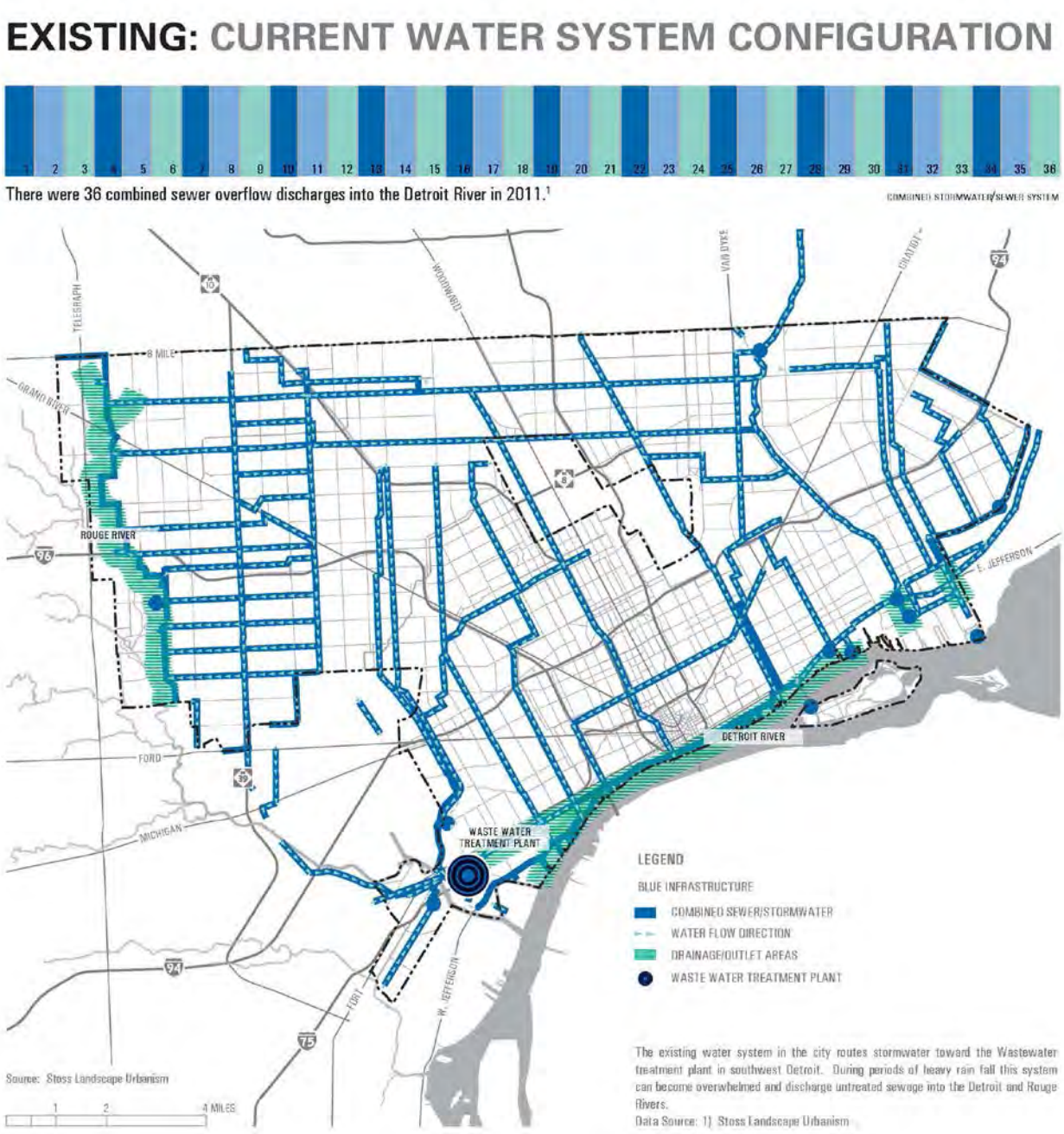
City Systems Element

The Great Lakes are the largest surface freshwater system on the Earth and contain 84% of North America's surface fresh water and about 21% of the world's supply of surface fresh water. The Great Lakes region continues to gain importance as the impacts of climate change increase. Detroit's strategic location in the region ensures the city's future desirability, along with the necessity to be a much better steward of this vital resource.

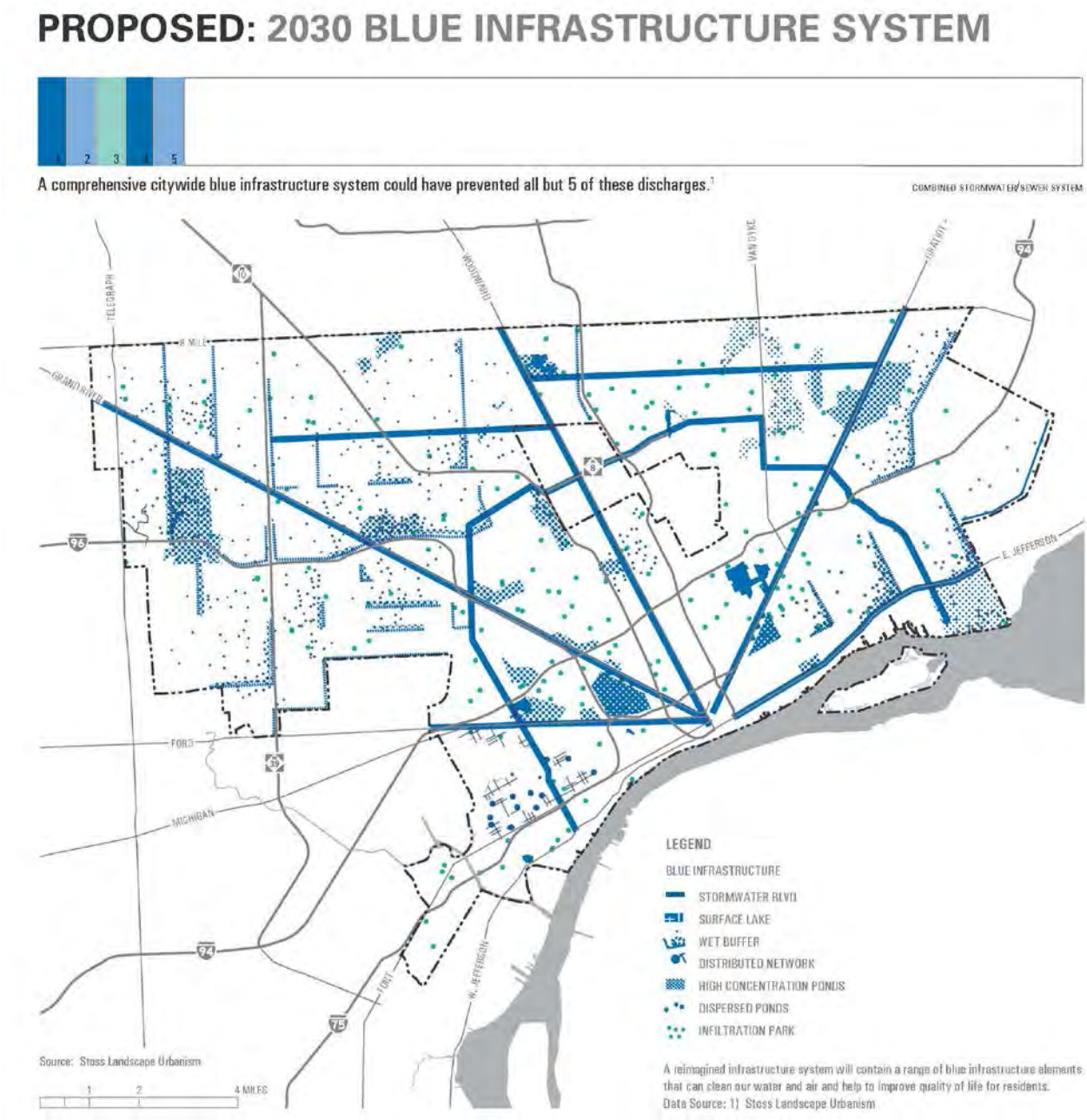
Across the Great Lakes, treatment facilities discharge significant sewage pollution every year because of insufficient capacity, aging infrastructure and outmoded approaches to water management. Detroit, like some other communities on the Great Lakes shoreline, uses infrastructure more than a century old that combines sanitary sewage and stormwater runoff into a single system. While raw sewage discharges from Detroit's massive sewer system have been reduced by more than half, the city is still the region's worst offender.

The Federal Government has required Detroit to have a plan for sewer system improvements that will significantly cut combined sewer overflows (CSOs). These plans are costly, and as a city in bankruptcy Detroit will struggle to finance these improvements. The city does possess one asset in dealing with stormwater runoff (one that is often viewed as a liability): 20 square miles of vacant land.

Implementing blue infrastructure networks could capture and clean stormwater runoff from all areas of the city and reduce the frequency and magnitude of CSOs. While the potential is great, there are a variety of challenges that must be addressed including training and education of employees so they are able to properly maintain blue infrastructure and a change in state policy allowing cities to use blue infrastructure to meet long-term control requirements. (Presently, hard infrastructure is the only accepted way to reduce overflows.)



There were 36 combined sewer overflows in 2011. Detroit Strategic Framework Plan (Pg. 186)



The comprehensive system proposed in this graphic would have prevented all but 5 CSOs. Detroit Strategic Framework Plan (Pg 187)

In March 2014 the U.S. Environmental Protection Agency announced the award of a Great Lakes Restoration Initiative grant totaling one million dollars to fund green and blue infrastructure projects in the Detroit Water and Sewerage Department's Near East Side Drainage District to improve water quality in the Great Lakes. The DFC Implementation Office will provide leadership to ensure coordination with the Strategic Framework and other new and ongoing green and blue infrastructure initiatives.

The first project will transform publicly owned vacant lots on Detroit's Lower Eastside into green space consisting of meadows, trees and other vegetation that will beautify the area and harvest rainwater for use in urban agriculture. In the process, the project will reduce the discharge of untreated stormwater into the city's combined sewer system by approximately 100,000 gallons during significant storms. The second project will involve installing green infrastructure at Detroit's Recovery Park which is a multimillion dollar plan for implementing a wide variety of green initiatives that will provide workforce development for those recovering from addiction or returning from incarceration. This work will reduce the discharge of untreated stormwater to the sewer system by approximately one million gallons during significant storms.

Neighborhoods/Land and Building Assets Element:

Detroit Future City works with many community development organizations to help them achieve their vision and align their neighborhood level initiatives within the Strategic Framework. Jefferson East, Inc., (JEI) works along the east side of Detroit, and particularly East Jefferson Avenue, which is the main thoroughfare along the river. JEI seeks to:

- Showcase the economic, cultural and historic assets of the area
- Attract new businesses and link existing business to economic development resources
- Transform Jefferson Avenue from a traffic filled route primarily serving residents of the eastern suburbs into a pedestrian-friendly, multi-modal environment that links neighborhoods to the riverfront while supporting economic development and business activity along its length
- Promote safety and security within the east Jefferson corridor.



Jefferson East Inc.'s neighborhoods: Lafayette Park; Rivertown; The Villages; Marina District; Jefferson-Chalmers http://goeastjefferson.org/

JEI's target area covers four of the nine neighborhoods that are adjacent to the Detroit River. In many cases this proximity has lead to new investment in high-rises and condos that attract high-end owners and renters. The graphically pleasing map Jefferson East uses to promote its area depicts a success that is not yet achieved in the most eastern district: Jefferson-Chalmers.

Jefferson-Chalmers is a unique riverfront community located along Detroit's border with Grosse Pointe Park. The neighborhood has many assets including 164 acres of riverfront parks, high-

quality historic housing stock, quaint canals that form residential islands, a historic commercial corridor along Jefferson Avenue, and many strong community organizations. However, according to the 2010 U.S. Census, in the past ten years, the number of vacant housing units in Jefferson-Chalmers has increased by 57%. There continues to be a lack of market activity, decrease in housing prices and an elderly population that often does not have the ability or resources to maintain their homes.



Scene of activity and well kept houses on the canal around Harbor Island
Photographer: Victoria Byrd Olivier



A vacant house surrounded by vacant lots on Ashland Street across from the houses that line Fox Creek
Photographer: Victoria Byrd Olivier

The Jefferson-Chalmers community's natural assets, including being Detroit's only single family waterfront community and having more boat slips than anywhere in the city, offer building blocks to neighborhood stabilization, one of Detroit Future City's 2014-2015 priorities. The

neighborhood's appeal to families can be its chief selling point as it seeks to attract new residents.

Given the local government's fiscal crisis, it is vital to identify alternative funding and/or community participation to make regular improvements to the neighborhood parks and greenways to help ensure their viability. Detroit Future City is partnering with The Greening of Detroit and community+public arts:DETROIT (CPAD) to implement four large, community-based public art projects combining vibrant visual art, engaging public performance, and expressive green infrastructure that can serve as model interventions for neighborhoods addressing unique challenges in addressing vacant lots and blight. While the Jefferson-Chalmers site has not yet been finalized, this project could serve as a focal point for the neighborhood's 164 acres of waterfront parkland. Once the creative infrastructure is installed, community capacity around programming and promotion of the site will be crucial to creating a sense of place in a manner that physical investment alone cannot accomplish.

While the neighborhood seeks to remain true to its original residential and retail character, its future lies in this integration with the "blue" and "green" economies – waterfront and ecology. As an illustration, during the summer months two operators conduct kayak tours through Detroit's Maheras-Gentry Park, out to the Detroit River and then upstream to the historic canals. Once participants finish their tour there is nowhere in close vicinity to eat a picnic or restaurant lunch on the river. There is currently one bar/restaurant with waterfront access, but has no infrastructure to accommodate those who are using the waterway. Jefferson East, Inc. has invested incredible capacity and innovation in occupying and programming the historic commercial corridor along Jefferson Avenue. This capacity and technical assistance would be essential for partnering with Jefferson-Chalmers neighborhood organizations in providing small business counseling, business attraction assistance and commercial renovation resources. Directing similar efforts to the areas around riverside parks and canals, combined with programming and marketing efforts, could greatly benefit these areas.

The Riverfront's Place in Detroit's Revitalization

Henry Ford was notable for saying: "We shall solve the city problem by leaving the city." And leave they did. Today Detroiters pick up the pieces from their proud manufacturing history and culture, and find new and innovative ways to think about the future, notably through the Detroit Future City Strategic Framework. Detroit's riverfront has been a bright spot over the last decade---a scene of revitalization that has complemented investment downtown and drawn in visitors to Detroit, even as press accounts have focused relentlessly on the city's struggles and blight. Looking forward stakeholders have exciting opportunities to continue targeted and collaborative planning around the riverfront so that all residents can benefit from this amenity and that it will be protected for generations to come.

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Exploitation of Living- leisure costal waterfront of coastal tourist cities ——take Haikou city and Sanya as comparative study cases

(Track 3. Economic, Leisure and Tourism Aspects)
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[Abstract] Take Haikou City and Sanya as comparative examples and try to make out how to improve the rational use and quality of the shorelines by studying the allocation, functional layout and forms of their typical living-leisure costal waterfront. With the advent of the post-industrial era and the growing concern for ecological protection and leisure life in China, coastal areas with unique conditions gained strong momentum. In recent years, coastal tourist cities have developed rapidly in China, especially the eastern coastal areas. With the proposed policy of “the International Tourism Island of Hainan”, cities in the eastern coastal areas of Hainan Province have got accelerated development. However, rapid construction not just help the economy grow, but brings trouble. Rapid construction not only accelerates the consumption of non-renewable coastal resources but also causes huge damage to the environment. While good news is that there exist cities which are developing in a healthy way such as Haikou and Sanya, both taking good advantage of their costal waterfronts in a proper way by sensible allocation their shoreline resources and rational development. So this article take Haikou City, one of the first built with sound urban functions, and Sanya, newly built while was well-known for excellent coastline as example and try to make out how to improve the rational use and quality of the shorelines by studying their typical living-leisure costal waterfront Haikou bay, holiday beach, Sanya bay and Yalong bay. Combined with historical data, field investigation and analysis, analyze for location, layout and form of them. Use the results of the analysis above to seek out the inner influence factors of location and its relationship with urban development process, built-up areas and natural endowments. Find out Rational layout development models by analysis functional layout and its locational relationship, timing of development and change of the land value. Classify costal waterfront in abstract morphology and study human activities and landscape visual effects of each kind to find the best type. At last provide advice on how to locate and develop living-leisure costal waterfront for the coastal tourist city using the results.
[Key words] Costal city, Living-leisure shoreline, Development and utilization, city of Haikou, city of Sanya

1. Introduction

With the advent of the post-industrial era and the growing concern for ecological protection and leisure life, coastal areas of China gained new momentum. Compared to the coastal cities as Dalian, Qingdao, and Xiamen, with a relatively long history of urban construction and big reputation, some newly developed coastal tourist cities gained rapid development in recent years at the expense of quick consumption of shoreline resources.

Except those been taken as production use and ports, quite a part of the shorelines were developed as living-leisure coastal waterfronts in order to significantly improve the charm of coastal recreation. However at the same time, rapid construction brings big impact on the protection of littoral coast. The world sees the question of how to take better use and sustainably arrange the function of coastline become one of the important issues, not only to the coastal cities in China but other countries which struggle in the rapid construction development process. Experience of proper ways could be of great meaning and reference to the construction of coastline utilization and urban function layout. Therefore, on the basis of summarizing the related literature, this article focuses on comparative analysis and summarizes relevant experience about coastline utilization of the two well-known cities, Haikou and Sanya, which are both located in Hainan Province of China, which was newly set as the international tourist island.

2. General experience and its influencing factors of coastal shoreline utilization

On the whole, the use of littoral coast affected by various factors from all aspects, especially from natural and artificial. In addition, the use of coastline, in some degree, profoundly embodies the urban development process of the city itself. The scarcity of the coastline resources makes it big issue of development for the coastal cities even the region. From the perspective of urban development history, cities in the early and mid-industrialization era, often used more as shipping and industrial use. As a result, littoral coastal areas often give priority to the locations of the heavy chemical industry and the requirements of ports development. Especially for the cities of China, which have long been developed in a way focusing on production than improve life quality. The situation leads to the fact that during a long time after the foundation of the nation, there rarely have cities newly developed to have a pleasant coastline for travel and living, except for those, which have a long history of basic function of leisure life, such as Dalian and Qingdao. Excellent case of the historic cities as well as the deviation of the urban construction guidelines after the founding of the nation provide evidence in pros and cons of the significance of thinking long-term and rational allocation of coastal resources. With the coming of the post-industrial era, a considerable number of waterfront area developed as production and harbor in western developed countries have on the trends to turn to public charming recreational use.

In terms of the existing research, the division of different kinds of littoral coast needs to take multiple factors into consideration. What's more, the spatial extent of coastal waterfront is significantly different from each other based on various research demands. The factors that influence the division of coastal waterfront types various from relative depth of coast, functionality, landscape to ecological factors.

The geography used to define the tidal line distance as the spatial extent of the coastline as taking contour interval of 200-500 meters outward the low water line as the boundary（Li Zhao 2001）and concepts as buffer zone and so on（Wang Zhen 2010）.The scholars in planning and design take engineering facilities such as coastal roads, a more realistic object, as defined markers. In terms of landscape and ecological factors, coastline should have a relatively wider range of spatial extent. Especially when it comes to coastal areas with the

landforms of hills, the determination of scope of the shoreline should take characteristics of the hilly landscape into consideration as well. In terms of the main influence factors of coastline for leisure life, in addition to gain a reasonable relationship with harbors and wharfs, we should have a good grasp of the properties of leisure life, focusing on natural and ecological conditions as well as micro-climate and landscape and so on. As during the German occupation period, the site layout of coastal living shoreline of Qingdao has taken full account of the climatic conditions in summer and winter and the wind and waves on the beach (Torsten • Warner 2011) Up to now, academia has accumulated a few research achievements from all aspects such as site selection, layout and morphological shape. Site selection takes consideration of demands of coastal shoreline development as well as the impact damage that may cause by development of littoral coast. The evaluation system has been proposed relating to lots of factors involving quantity, quality, capacity and availability (Jiao Sheng 2003). In recent years, increasing awareness and concerns for the ecological value make site selection of living-leisure coastal waterfront to avoid ecological destruction such as bird-migration, marine life activities (Traut AH 2004).

In specific development and utilization of coastline, the study not only involves the rational utilization and protection of natural ecological condition, but also involves the development mode, Landscape and many other aspects. Development modes are different as characteristics of the waterfront various. The old and single way of the old waterfront area, such as replacing function only and focusing just on external expansion, has been transformed into better one of composite development which focuses on internal space and functional reorganization (Jiao Sheng 2003). What's more, to better coordinate the relationship between natural and artificial duality, scholars have put forward a lot of micro-consolidation methods, such as fragments stitching, space refined, organic update and spatial relations between the bottom of the figure (Peng Yi 2009).Some coastal tourist areas, newly emerging, go on the way of integration development based on urban design (Chen Xi 2004). Scholars deconstruction landscape elements of waterfront from two angles: spatial and elements, proposing that the unique features of coastal city consists several elements, including physical outline of the seabed, streets along the seaside, island and ports (Shi Haitao 1995). There generally are several components of waterfront space. The waterfront commonly consists of water area, the boundary line between land and sea, greenbelt and hard landscape along the seabed, seems like three color rainbow belt lighting along the seaside of blue, green and grey(Pen Yi, 2009). In terms of Landscaping, costal waterfronts play an increasingly obvious role of maintaining regional unique natural landscape, protection and continuation of historical context (Wang Wei gong etc., 2005). Nowadays scholars discuss more from angle of ecological, regional culture and user hydrophilic, on design principles and planning methods. In addition to aesthetics, integrity and diversity, more attention should be paid to the natural, ecology and in the people-oriented principle of sharing and security (Zhu Xueyan 2008; Wu Xiaonan 2012). Ecological and sustainable development of planning methods have been put forward, proposing the point to create three-dimensional landscape and variety of hydrophilic space, constructing open and continuation space for a better passing on historical context, relying on the combination of transportation and the city and reasonable plant of banks to form ecological space with local characteristics(Liu Yang, 2009). Waterfront areas are of unique value in aesthetic and ecological field in the process of

building up urban landscape features. By making a combination of waterfront landscape elements, we can create a unique landscape and architectural style so as to construct features of marine culture theme of coastal cities (Hang Xiaoqiang 2012). All-round research results above provide a great reference for the study.

Under the background of maintaining rapid development in coastal areas of China, the orientation of international tourism island of Hainan province accelerate the speed of the process of the development of the eastern coastal areas of the island. This article mainly aims at comparison and induction analysis on the living-leisure costal waterfront of the two cities on the location chosen, layout and the pattern of coast shape, etc. The work sees its practical significance.

3. Costal shoreline utilization of the city of Haikou and Sanya and relationship with the overall urban

3.1 Characteristics of shoreline types and distribution

The city of Haikou stretches from east to west in ribbon group layout. Identically, its coastal shoreline stretches along the northern part of the city in ribbon group layout, including five types of shoreline utilization as living, production, tourism and natural ecology. There is a length of 136 km of coastline in Haikou city. The living and tourism coastlines are mainly located in the north of Binhai avenue (except Xiuying port), such as surplus marina peninsula, West coast, Haikou bay, Haidian island, Xinbu island and East coast. Coastlines of ports and production are mainly distributed in the Xinhai port, Macun port and Xiuying port. The natural and ecological coastlines mainly have a growth of mangrove in the Dongzhai harbor and parts of East coast. In a whole, the coastlines of living, tourism and ports lay in an interspersed way in urban construction development area having an characteristics of sectional general layout.

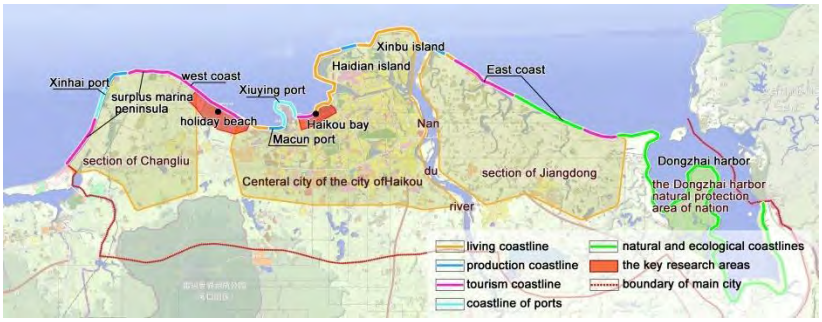


Figure 1: Distribution of coastline of Haikou city Source: drawn by author

Coastal shorelines are mainly located in the southern and eastern of Sanya, stretching out in ribbon group layout relying on natural resources and urban structure. There are mainly five types of shoreline utilization there, including living, tourism, natural ecology, ports and military. There is a length of 214.6km coastline in Sanya (Peng Yijing 2011). Living and tourist coastlines are mainly located in areas possessing excellent site view and traffic convenience, such as Sanya bay, Yalong bay, big & small east sea and Haitang bay. Coastlines of port and military, most of which are left over by history, distribute in Nanshan cargo port, Bao port, Tielu port, east side of Yalong bay and mouth of Yulin bay. Natural ecological shorelines locate in south of Tielu port, Jinmu angle, Luhuitou Peninsula , west side of Nanshan and west part of cliff bay. Tourist coastlines of Sanya alternates with natural coastline in layout and

the ports are far away from downtown, thus forming the good shoreline utilization layout mode.



Figure 2: Distribution of coastline of Sanya city Source: drawn by author

To discuss the types and distribution of coastlines, there mainly are two kinds of coastlines in city of Haikou and Sanya, natural ecology and tourism coast. There rarely have coastline types of industrial and only a few of port. There is a larger percentage in coastline of port in Haikou than that in Sanya because of earlier organizational system establishment so the ports in Haikou gained an earlier start. Xiuying port of Haikou, officially open port to conduct foreign trade transportation business since Chunxi reign of Southern Song Dynasty, is located near downtown, now takes the passenger and cargo transport between Hainan Province and the North Sea, Hai'an, Guangzhou and Shanghai. On the contrary, there are more natural ecological coastline and tourism coastline in Sanya. Different from Haikou, tourism and natural coastline are relatively mainly lay independently in Dongzhai harbor which is in the east of the city, the two kinds of coastlines in Sanya lay in mix-distribution throughout the city along the coast, providing a more diverse landscape.

3.2 The relationship between living-leisure coast and urban functions

According to distance to the downtown, two types of living-leisure costal waterfront are obtained, one is called "the close", adjacents to the center of the city and relatively the other is "the away". "The close" types are always in the areas with perfect city function, thus, the surrounding areas tend to develop into popular recreational living areas with mixed functions which can satisfy the need of daily leisure, such as Haikou bay and east part of Sanya bay. "The away" such as holiday beach, Yalong bay and Haitang bay usually, a few kilometers far away from downtown, have a poor daily accessibility. In spite of low satisfaction degree for daily leisure activities, this type generally develop into famous tourist resort with lots of hotels and facilities for tourism and business due to good conditions of landscape and environment, absorbing a large number of tourists at home and abroad.



Figure 3: Distance between living-leisure costal waterfront and downtown of the city of Sanya and Haihou Source: drawn by author

Table1: The classification and the corresponding functions of living-leisure costal waterfront

Name		Classification: According to the distance to the downtown		Classification: According to main function		Corresponding functions
		The close	The away	Public leisure	Tourism casual	
Haikou bay		●		●		mixed functions
Sanya bay	East part	●		●		mixed functions
	West part		●		●	Sports and recreation
Holiday beach			●		●	Sports and recreation
Yalong bay			●		●	Hotel Business、Scenery traveling

Source: drawn by author

"The Close" has advantages of location and environment so as to gain a rapid development. The surrounding plots often form a comprehensive region sometimes a new center with multi-functions as living, business, office, cultural recreation and green parks. Take Haikou bay as example, it lays close to commercial center of Haikou, recently the surrounding nurture a healthy and fast city construction. There are perfect public facilities system, including large hospitals like people's hospital of Hainan, medical college hospital, Hainan overseas Chinese middle school and exhibition center. Rich in commercial activities with developed field of large shopping malls such as RT-Mart, Commerce City Department Stores and Carrefour. There is a coastal city park in the east, covering an area of more than 70 hectares, not only provides citizens with daily leisure services but also provides tourist bus service of for visitors. Due to good location advantages, perfect service facilities and superior coastal landscape environment, "the close" type gained a real estate development of high grade and high-density.

The areas around "the away" costal waterfronts are lack of comprehensive urban functions, but have prominent dominant function. Tourist facilities account for high proportion with scenic spots, golf and high-grade leisure development. Yalong bay and Haitang bay relying on perfect beach resources and island scenic area, attract high-end coastal hotels cluster and perfect shopping and leisure facilities. They also developed sports like golf and leisure living by taking the advantage of micro hills around.

3.3 Factors for living-leisure costal waterfront distribution

Along with economic development, there is an increasing demand to improve the quality of life, development of living-leisure costal waterfront is gradually becoming a stance for transformation and ascension of shoreline function even represents the development of coastal cities. The selection of living-leisure costal waterfront is not only closely related to conditions of shoreline resources, including landscape, environmental capacity, water depth and resource carrying capacity, but also has something to do with spatial pattern which is formed during the urban development. At the same time, innate good location and the convenient traffic condition created artificially are of great importance to ensure the high popularity of the seaside areas.

3.3.1 Resource conditions of the costal waterfront

Good natural conditions of coastline, including beaches with fine sands and rich coastal

vegetation, are considered the basic necessary condition of living-leisure coastline. Most living-leisure costal waterfront of Haikou and Sanya possess beach resources of high quality, among which the sand conditions of Yalong bay is the best with fine white sand lasts to 1700m long. People can get a good view from Sanya bay by overlooking the Luhuitou park which is on the east of the bay and Tianyahaijiao scenic area on the opposite side. Yalong bay and Haitang bay are both so surrounded by mountains on three sides as to have extremely advantageous natural environment. Meanwhile, moderate water depth and safety of the coastal environment also contribute to implement leisure activities smoothly.

3.3.2 Spatial pattern and urban development

Haikou and Sanya are cities developed along the seaside possessing rich coastal resources which are put into utilization complying with the demand of the development. Holiday beach is located in the development axis connecting city center with the western section. In spite of its monotony, the unique location gained itself development of rich recreational functions of sports such as golf, bicycle venues as well as some holiday villa community development and high-end hotels. The length of coastline of Sanya bay is so long that the whole coastline was not built in a day. The east part was developed earlier to become a good place for citizens to do leisure activities for its convenient location. To meet the development needs, western part also began to develop, and as far away from downtown, gradually into tourist and leisure resort coastline with high-end hotels and sports leisure activities.

3.3.3 Good location and convenient traffic conditions

Innate location advantage of “the close” ones guarantees the public accessibility. As for “the away”, there’s a need to compensate inconvenient with construction the road and improve traffic conditions. Sanya has set up several shuttle buses to contact coastline from east to west. So is it with Haikou, a series of tour buses are also set up lining the tourist spots such as Haikou bay and holiday beach. And the means of transportation various from bus, travel lanes, bicycle to transportation on water. In addition, lots of hotels set up a contact free shuttle bus to the town.

Table 2: transportation of the living-leisure costal waterfront

Names		*Means of transportation*			
		The city public transport	*Bus travel lanes*	*taxi*	*other means*
Haikou bay		●	●	●	*water transportation*
holiday beach		●	●	●	*bicycle*
Sanya bay	*West part*	●	●	●	--
	east part	●	●	●	*Cruise Ship*
Yalong bay		○	●	●	--

Note: ● means accessible, ○ means inaccessible Source: drawn by author



Figure 4 holiday beach bus site



Figure 5 Haikou tour bus

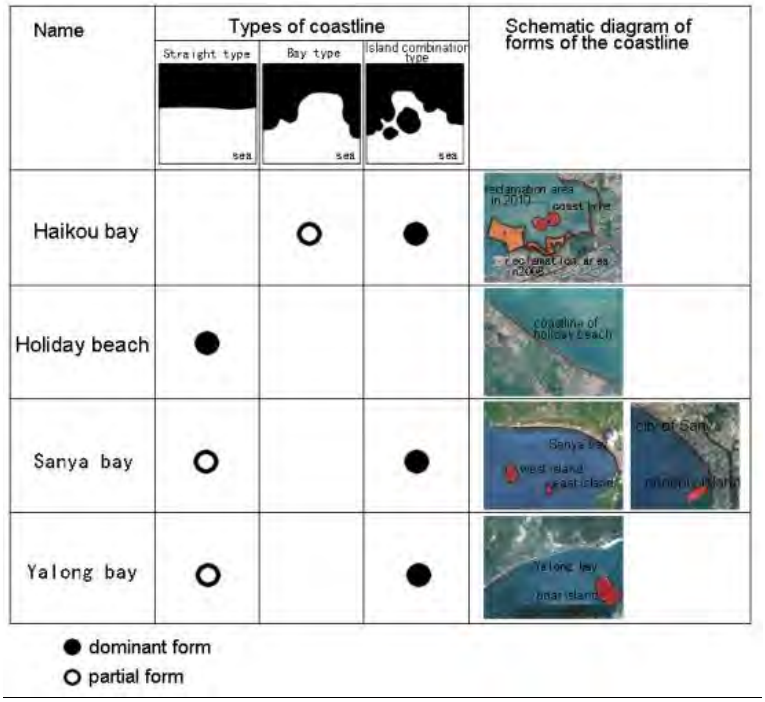
4. Characteristics of the development and utilization of living-leisure costal waterfront in Haikou and Sanya

4.1 Morphological characteristics

4.1.1 The main form of island-land combination

There are three forms of coastal shoreline ranging from straight type, bay type to island combination type (Hu Wei, 2005). Due to good landscape effect of bay type and island combination type, the two types are always chosen to construct as living-leisure coastline. The island can define scope of maritime activities effectively so as to increase safety of water activities. And reclamation islands can release the increasing pressure on land resource. Of all the living-leisure costal waterfront we studied, holiday beach is the only flat type while the others are all island combination forms naturally or artificially. It often avoid the entry of sea and choose shallow water area near the bay to construct artificial islands, so as to avoid the damage to ecological system, meanwhile with the aid of the gulf natural barrier, it can effectively slow down the sea wind damage and reduce the cost and difficulty of carrying out the work.

Table 3: characteristics of shape classification



Source: drawn by author

4.1.2 Island-land form opposite scenery

The distance between island and land influences interactive activities. It usually take 4km as standard to divide island combination type to two spatial pattern as interact space pattern and relatively independent space unit (Hang XiaoJiang, 2012). According to the actual inspection, besides the distance away from the mainland, the shape and size of the island also contribute to earn value of scenery site.

There is strong interaction between the island and mainland in activity and view sight in

Haikou bay. Then what's the detail relationship between the island and mainland? According to research, the island is about 1km away from Haikou bay. Width of the island ranges from 300m to 1000m, specific value of distance and width of island is less than 3 (hereinafter referred to the specific value of distance and width of island as specific value for short). There are three islands in Sanya bay, two naturally formed islands East Island and West Island and the artificial reclamation of Phoenix Island. From actual inspection, there is no direct link between the east or west island with the main land in Sanya bay neither in shore activities nor reasonable view communication. East Island and west island lies about 12 km and 15 km away from downtown and the width are respectively 900m and 1700m, correspondingly has 13 and 9 as the specific values. Relatively, the construction of the phoenix island broke the flat and drab coastline near downtown in Sanya bay. What's more, the construction of the seven-star hotel on island became new scenery of night Sanya. According to the study, Phoenix Island is only 1.5km away from Haiyue square, one of the famous squares in Sanya bay, the specific value is 1.25. Coastline of Yalong bay is free and stretching and the interaction within island and the land is obvious. Boar Island as overlook beauty from Yalong bay, can effectively define the safe scope of water sports. According to study, the distance between the island and land is about 1km and the specific value is 1.5.On the contrary, coastline without island can have a broader while dull and boring sight. Such as holiday beach, stretches out to a length of 6 kilometers, has a long but single form of coastline without island and appreciation of the landscape is low so as the utilization rate.

The comparative study shows that if it meets the conditions of island-land interact space pattern, that is the distance can enable the human eyes to have a good landscape, generally the distance is within the scope of 4km, and if the specific value is also less than 10, then there is big possibility to create varied island landscape effect and more water activities opportunities.

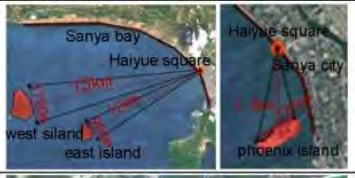


Figure 4: Overlooking the Phoenix island from Haiyue square



Figure5: Overlooking boar island from Yalong bay

Table 4: relations of living-leisure coastline and landscape effect evaluation of Haikou and Sanya

Name	Schematic diagram of distance between island and main land with of island	Effectiveness evaluation		
		Distance (km)	D/W	Visual effect
Haikou bay		1.0	1-3	good; opposite scenery
holiday beach		---	---	boring
Sanya bay		15.0	9	distant view
		1.5	1.25	good; opposite scenery
Yalong bay		1.0	1.5	good; opposite scenery

Source: drawn by author

4.2 The functional organization characteristics

4.2.1 The diversified functions dominated by the tourism function

The research found that one of the distribution characteristics of living-leisure costal waterfront is that the function location presents a different mixing ratio. The functions of hotels, commerce, high-end residential, golf, natural scenic spot and urban function are lay in a circular distribution along the seabed. The offshore areas are likely to be public space for coastal activities while the inland areas various due to different conditions of distance to downtown, landscape and resources, thus making different proportion of residential facilities and urban functions such as living function. And with the increasing distance from downtown, urban functions get an obvious reduce while proportion of hotels and high-end estate development increases to dominant status.

The function of “the close” type is relatively complex. The typical is Haikou bay, functional properties gradually become public from Binhai Avenue to the coast, the distribution presents the feature of circular distribution along the coastline. The perfect inland urban functions contribute to the rapid appreciation of coastal land in the west part in Haikou bay and attract high-end real estate and hotels agglomeration. In recent years, from 2000-2012, Haikou bay sees a high dense development of high-end real estate developments in the southwest of Haikou bay of no more than 50-60 hectares but the number of residence zones climbs to 30 already and the average volume rate reaches 2.3.thus causing some bad effects especially the cut-off of open space from the inner land. But the ribbon park along the seabed reduces the bad influence of private construction. The housing price within Haikou bay is much higher than the average price of 8000 Yuan/㎡ in downtown. The residential prices of Number 1 Haikou bay in 2012 reached an all-time high of 27000 Yuan/㎡.

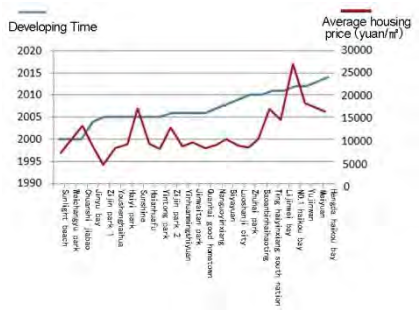




Figure 6: Development time and price of real estate in Haikou bay *Figure 7: Distribution of high-end real estate developments in Haikou bay*

Source: author check information from the website

The east and west parts went on two direction of development and eventually formed two different dominant function of coastline organization due to long length of Sanya bay. As has closer ties with the central city, the east segment formed the city function dominates recreation coastline based on the existing urban pattern. Compressing space for development coupled with the high price, making it difficult to attract high-end property and hotel projects. While with the flat open coast, good quality sand and low land prices, western part attracted hotels and high-end real estates, developing outspread from along the coast line to inland fast.

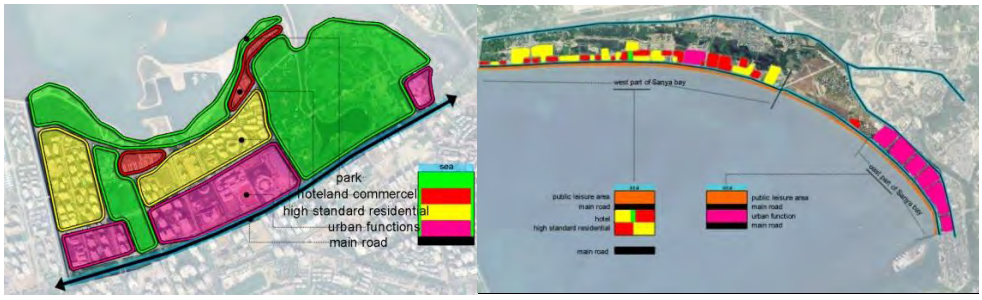


Figure 8: Function organization of Haikou bay and Sanya bay

The distribution characteristics of coastline of the away type is the same in the circular distribution, while obviously has fewer urban functions but significantly increased number of hotels. High-end commercial, golf tourism and leisure functions grow to dominant position.

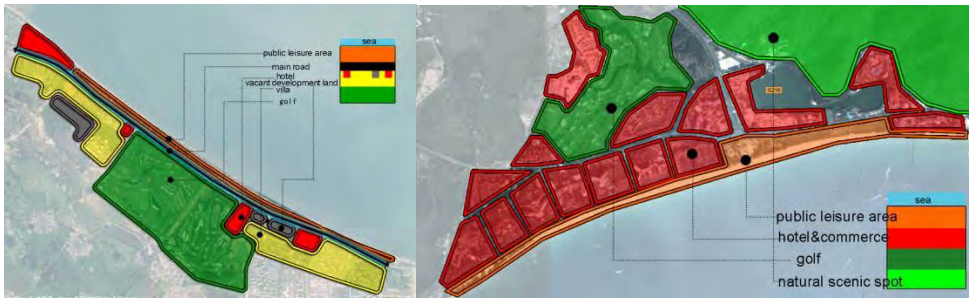


Figure 9: Function organization of holiday beach and Yalong bay

Table 5: basic information of living-leisure costal waterfront

Type	*Name*	*Number of independent hotels*	*Villa development accounted for the proportion of residential development（%）*
The close	*Haikou bay*	*6*	*0*

	east part of Sanya bay	*7*	*0*
The away	*west part of Sanya bay*	*32*	*50*
	holiday beach	*14*	*80*
	Yalong bay	*15*	*100*

Source: drawn by author

4.2.2 High density in sprawl of development sequence

Living-leisure costal waterfronts, adjacent to the central city, tend to develop in the order that start from the inland to the coast. Diversity functions can not only meet the demand of residents' daily life, but also the need of tourism. While the away type usually has obvious dominant function, has the opposite developing order. And good natural landscape and low land prices give priority to conduct low-density villas as well as tourist facilities.

5. Conclusion and suggestion

The amiable water season of tropical coastal city is long and there is more hydrophilic public space in living-leisure costal waterfront. Attracting landscape and pleasant climate are large appeal to tourism and high-end real estate development. However, shoreline development of temperate coastal city should not only be fully considered of advantages provided by the superior climate conditions, but should make a better use by thinking on the whole, from macro-level like the development direction and orientation of the city and the relationship with the city even the region, to intermediate level such as distribution of different kinds of coastlines, to micro-level like make clear of characteristics of morphological and functional organization.

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Waterfront Tourism: a way of development transition of Port Town

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Abstract: This paper bases on the *Yangzi River Mouth Tourism Resort Master Planning*. It will discuss the choice of way of urban regeneration for an elder port town that named Liuhe Town. The planning established main tasks of resort that is to create waterfront landscape and waterfront tourism projects. Meanwhile, there three relationships were considered by the planning. They are: the relationship between port zone and town centre, the relationship between resort zone and shanghai and the relationship between tourism projects and local residents life quality enhance. The Yangzi river mouth tourism resort is so special for Jiangsu province, because it is the first a resort that transform from port. This planning will study how to create a cultural-led tourism development under a situation of lack of landscape resource, in order to develop a sustainable tourism industry.

Keywords：Waterfront Tourism, transition of Port, The Yangzi River Mouth Tourism Resort Master Planning

1 Introduction

While the central government released the control of local land market since economic reform in last three decades, the style of property-led regeneration has been the most common principle involved in local development. The local government showed extremely enthusiasm on encouraging the private capital to investment in local land market that obtain a great amount of fund for resolving the problem of development fund short in local finance when the economic reform beginning. Of cause, this strategy worked effect on obtaining urban construction funding and progressing the Chinese commercial housing market. In early phase of economic reform, central government, local authorities and local residents won great benefits from property-led regeneration. However, it causes many negative effects on urban development. The most seriousness of all is the “Ghost Town” appearance. Because of the great benefit in finance aspect from land market, the local government paid high zeal on “new town” movement. This movement transited rural land-use into urban land-use that obtain great finance benefit from land market and change the urban landscape in very short time. However, this kind of land-based urbanization ignored the transition of rural people. Become of lack of emphasis on job creating and public service, the rural people, who lived the “new town” before, used not to be urban residents locally. Meanwhile, the migration affected less on filling such great amount of “new town”. According to report of *the New Urbanization of China*, there are more than 20 new towns.

Based the determination of solving this problem, current central government published “Brand New Urbanization” at the end of 2013 officially. The core aim of “new urbanization” emphasizes on “human’s urbanization”. The main idea of the new urbanization is improve the quality of urban construction that attract people to migrate to new town. There five main tasks are mentioned by the new urbanization policy. Firstly, it encourages rural people to be transited to urban residents. Secondly, it make a cohesion development between urban and towns. Thirdly, it improve the urban sustainable ability, enhance the job creating ability of urban industry. Fourthly, the integration of urban and rural development is believed as key to solve the gap between urban and rural area in current China. Fifthly, the reform of urbanization development mechanism requires new urban construction funding support system.

Based on these new requirements, the master planning of Yangzi River Mouth Tourism Resort responds this new policy in Town-Port coordination, tourism industry planning and spatial planning. The planning redefines the main function of Liuhe port that the port will no longer be a part of Liuhe new district. The redeveloped port could be the main attraction of Liuhe town’s tourism industry area and create jobs position for whole town, meanwhile, the new town centre could offer spatial and service support for workers who working in the resort that resolve lack of migration for new town and keep both vitality between port resort and new town.

2 Development Background

2.1 The Port Background

Liuhe town, named by Liuhe Port, is located at west side of Yangzi river mouth, north side of Liuhe River and next to Shanghai. Nowadays, it is affiliated with Taicang City and Suzhou City. In history, Liuhe port was a giant river port in Ming dynasty with trade and military duty. Frankly, it was the mother port of Zhenhe Expeditionary fleets. However, because the economic center of China moved to Shanghai from Nanjing at late period of Qin dynasty, the most of business trades were attracted to Shanghai that Liuhe lost its trade centre position in Yangzi river mouth. Worse, the Liuhe port deposited, therefore, Liuhe port and town has decayed since one century before.



Pic 1: the Position of the Resort

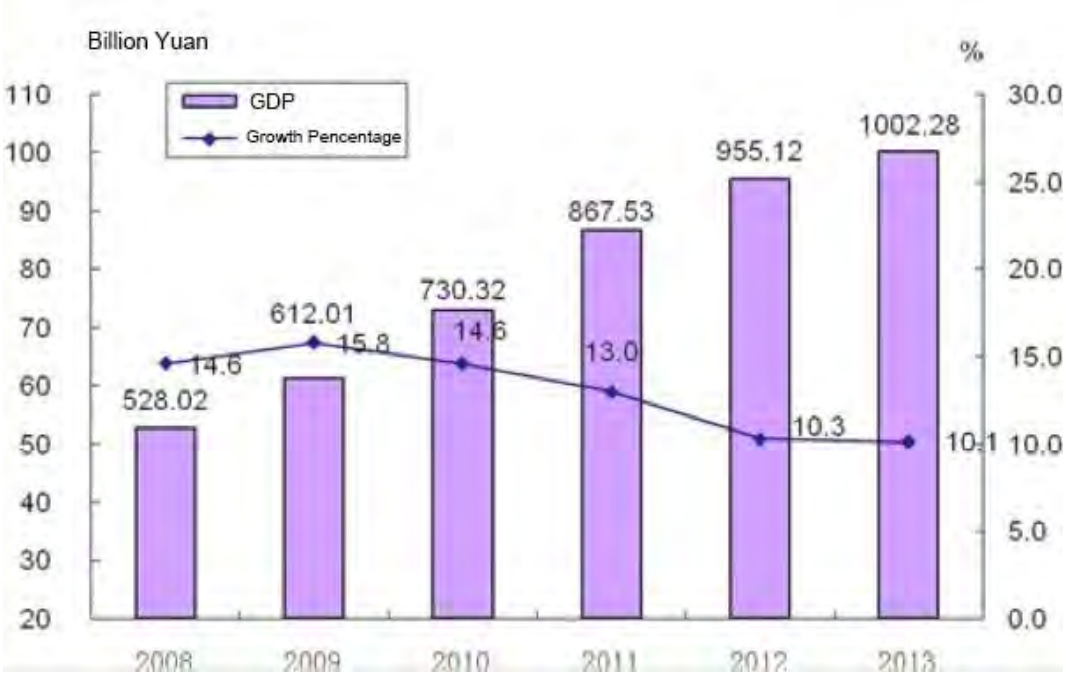


Pic 2: the Area of the Resort

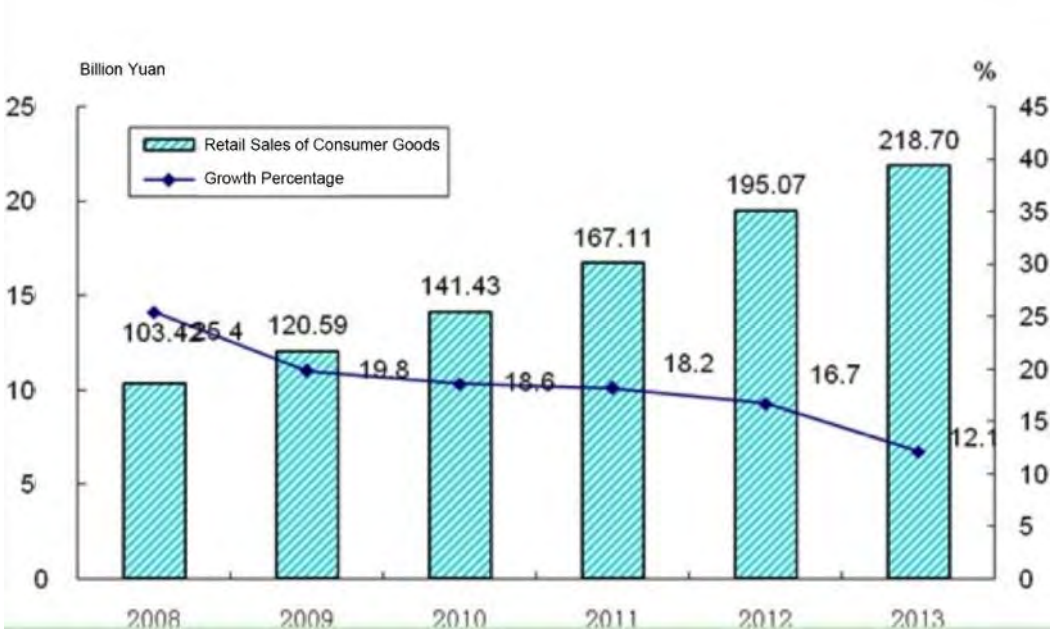
Since the People Republic of China period, Jiangsu province government dredged the Liuhe port and redeveloped the Liuhe port as the main base of ocean fishing for province level. After the new National Fishing Port was used in Liuhe, the amount of fishing trade reached seven tones in 2011.

2.2 Economical background

Because of the globe economic crisis and Yangzi River Delta area industry transition, Liuhe was attacked by an economic slowdown in recent five years. The GDP (Gross Domestic Product) growth rate decreased from 15.8% in 2009 to 10.1% in 2013. Meanwhile, the economic slowdown affected the local residents life quality as well. The growth rate of the Retail Sales of Consumer Goods declined from 25% in 2008 to 12% in 2013.



Tabel 1: the Economic Development in Liuhe (Source. Taicang Statistical Bureau, 2014)



Tabel 2: Retail Sales of Consumer Goods in Liuhe (Source. Taicang Statistical Bureau, 2014)

However, the most powerful tools which used to stimulate the economic development by local authorities, fixed assets investment, cannot work effectively. From 2008 to 2011, the fixed investment increased by 17 billion Yuan and the average growth rate was 17%. It still did not stop the trend of economic growth decline. After 2011, Liuhe local government cut the investment and re-thought the way of investment. The local authorities moved the sight and decided to adjust industry structure. In 2013, the investment on service industry increased 11%, 5% higher than figure of manufactory industries' growth rate. Meanwhile, local

authorities paid much attention on rural area development. The investment increased 19.5% and reached 16.8 billion Yuan.

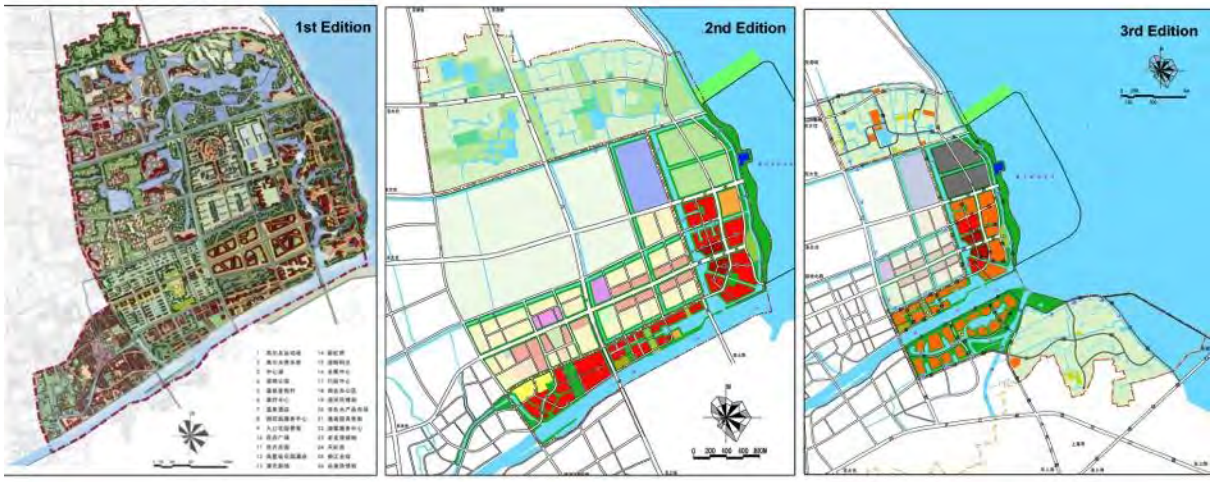


Tabel 3: Fixed Asset investment in Liuhe (Source. Taicang Statistical Bureau, 2014)

Therefore, the Yangzi river mouth Resort master planning is an attempt for transition of Liuhe economic structure, which responds for the new requirements from new urbanization policy.

3 Town Coordination

For responding the new urbanization policy and new economic development situation, the boundary of the tourism resort was adjusted three times while it was planning.



Pic 3: Three editions of the Resort Planning

From 2008, Liuhe local government began to new round of property-led development. The Liuhe Riverside New Town was constructed in that period. As a common method, the local government moved the office building to the new town for showing the determination and leading the development of the new town. Initially, local authorities hoped the new town could be the centre of administration, and offer business and living function. However, only a fishing port cannot offer enough job opportunities and administrational order cannot attract enough migration. The local authorities faced a reality problem how to filling with the land of new town.

Naturally, based on unique landscape and historic context, tourism was a logically choice for new town economic development. 2011, Liuhe government compiled the first edition the Yangzi River Mouth Resort Master Planning (the YRMR planning). In this edition planning, the boundary of resort included old town centre, riverside new town, port area and some rural areas. This planning divided four tourism function districts of resort that based on these four areas. Of cause, this ambition planning did not implement by Jiangsu Construction Bureau. Because the bureau claimed that the tourism resort should keep the natural landscape, this edition of planning included over due urban construction land. Meanwhile, there is too much property development in the name of tourism development, that why local authorities put the riverside new town into the resort. The bureaus concerned that could release a negative hint which encourage property development in the frame of resort if it passes this edition resort planning. Therefore, the construction bureau required Liuhe government adjusted the boundary of resort and then waited for approval.

The biggest change of the second edition of resort planning is the old town and riverside new town was removed from tourism resort. Because of the strict rules on ratio of construction land using in resort by China, that means the resort is no longer developed in property-led principle. Instead of it, the main investment will concentrate on tourism development. This edition planning focuses on digging the tourism resource in Liuhe, integrating the tourism service industry and facing the competition of tourism with surrounding towns. Therefore, this edition planning is new attempt for urban transition development. It tries to create a tourism industry cluster in order to liberate local government finance from a shackle of land market. That finds a sustainable industry development for urban transition.

The latest adjustment improved the connection between the resort and Shanghai city, and added the length of waterfront in the resort. Meanwhile, it reduced the ratio of construction land using of the resort. It moved out constructed fishing trading market from the boundary of the resort. As a planner, although, I still believe the fishing trading market could be an interesting attraction for tourist, local government may concern much more constructing cost problem. Therefore, there is a function division between the resort and town parts. Basically, the town area will offer living service and relevant public service, and the resort would be the flagship project for development of tourism that lead a transition of town's industry structure.



Pic 4: Planning Structure between the Resort and Town

This processing of three editions adjustment shows a game between local government and province government. For aim of GDP growth, local government hope to attract investment as much as possible, thus, there is strong requirement to put the rural area into land market under legal frame by local government. Meanwhile, for enhancing the performance of urban landscape, the local government used to need a fastest way to construct the new area of urban. Naturally, property-led development is the logical choice for local authorities.

However, province government concerns another problems, such as delivering the central government policy, protecting the social coherence and land security. Thus, the province government refused to put such size land into property development approach. Meanwhile, in recent year, local authorities also recognized that the result of fixed asset investment on GDP growth no longer satisfied like it before.

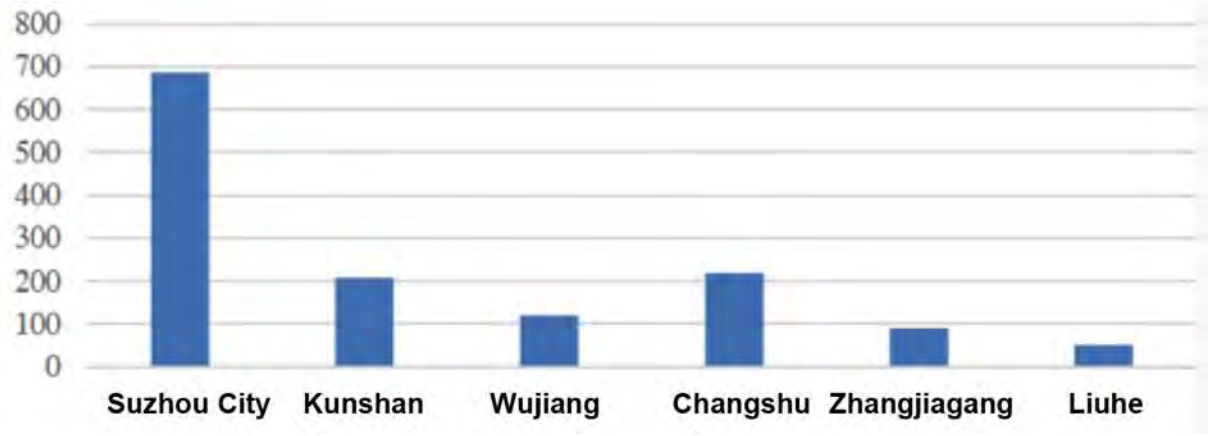
Therefore, depending on both two sides consideration, the local authorities begin to care about the truly industry for the resort rather than the land selling.

4 Tourism Industry Planning

4.1 Tourism economic background

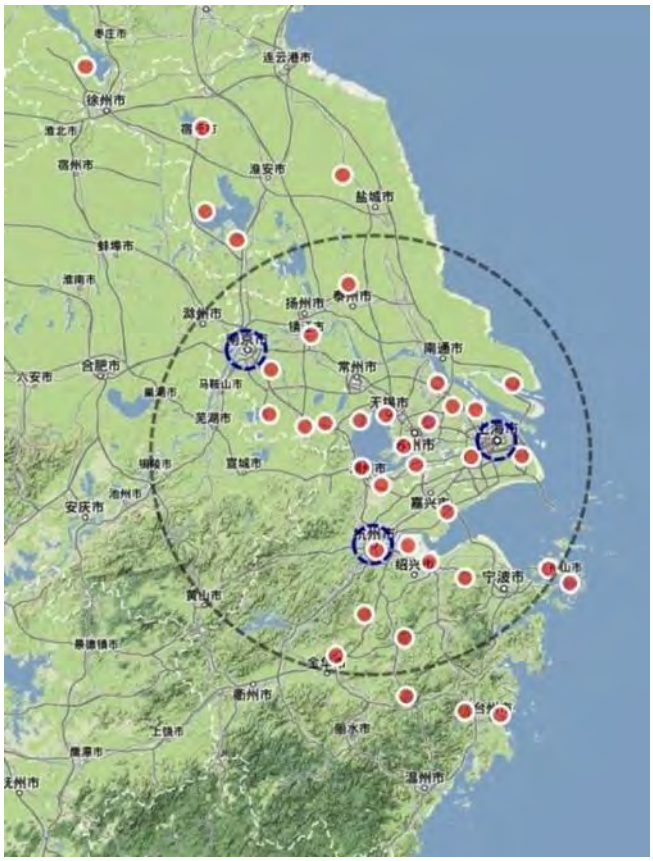
The resort will face strong competition while it entries in a huge tourism market, Yangzi river delta. Yangzi river delta, one of richest area in china, is biggest tourism market and biggest tourism destination. In 2011, the Jiangsu Province, Zhejiang Province and Shanghai city had 1.1 billion tourist receipts, and the tourism income reached 1400 billion Yuan. Suzhou, government at a higher level of Liuhe, obtained 150 billion Yuan in tourism. However, most of tourist used to interest on Suzhou city, and pay less attention on Liuhe town. In 2012, the

income of Liuhe tourism was just 1/10 of Suzhou city.



Tabel 4: Tourism Income in Suzhou (Source. Suzhou Statistical Bureau, 2014)

Meanwhile, as the latest provincial resort, the Yangzi river mouth resort will face competition of fifty resorts (include national and provincial) in Yangzi river delta area. These well-developed resorts have different of attraction point in natural or cultural aspects for tourism development. Furthermore, it already built steady tourism market and mature service system that challenge the development space of the YRM resort strongly. Therefore, the main task of the YRM resort planning will dig the tourism recourse which interesting enough for potential customers that can composite in the Yangzi delta tourism market.



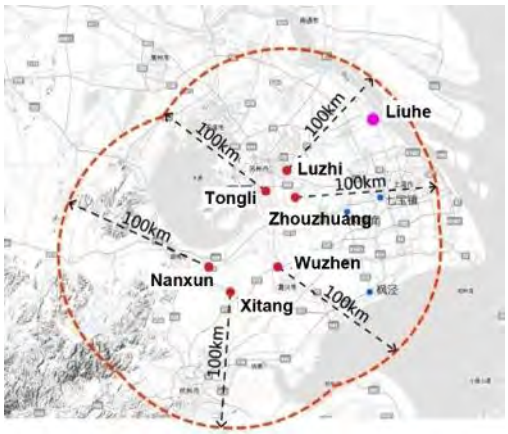
Pic 5: the Map of the resorts in Yangzi River Delta

4.2 Tourism Recourse

The main tourism recourses are based on the port, including the natural landscape, the history of port and town and the food material.

In Yangzi river mouth area, most of waterfront is used for industry and living function. The pic of waterfront using in Yangzi river mouth shows that there is a precious waterfront for ecological wetland at Liuhe town.

Meanwhile, Liuhe town is an ancient town with rich historical context. As the mother port for Zhenhe's travelling to the west, it leaves many legacies in Liuhe town, such as Tianhou temple (the National relic protection units) and ancient road fabric. However, comparing with the other ancient towns in Yangzi river delta, the scenic spots of Liuhe town were developed much later than them. In 2012, the top six ancient towns in Yangzi delta received more than 3 million tourist, the figure was no more than 300 thousand in Liuhe town. Therefore, Liuhe town combined the tourism development of ancient town with Zhenhe cultural theme for attracting more tourist and enriching the content of Liuhe's tourism.



Pic 6: Top Six Ancient Towns



Pic 6: Tianhou Temple

Food may be the most important tourism attraction. Because of special hydrology situation, there are three typical kind of food material that concentrated here which comes from the river, the lake and the sea. Therefore, the " River, Lake, Sea, Fresh Catering Festive", which lasts two month from June to August, is the biggest day in Liuhe and attracted 30 thousand per month.



Pic 7: Food Recourse in Liuhe Town

4.3 Tourism Planning

This planning divides the resort into three industry clusters with different themes, which are the forest park cluster, riverside leisure cluster, fishing port cluster and countryside park cluster.



Pic 8: Function Structure of the Resort

The forest park cluster bases on a rural area. The planning try to protect the farmland, water system and rural ecology, meanwhile inducts the rural spatial characteristic that gives tourist a space to have sports on rural field. In this area, a youth hotel and a country club are set here.



Pic 9: Forest Park Planning



Pic 10: Riverside Zone Planning

The riverside leisure cluster is the main development area. It connects most urban development land of this resort. Yangzi River and Liu River connect here, therefore, this cluster is not only the centre of resort tourism business, but also will be the core of town's public service. So beside hotel and restaurant, some public service facilities will introduce into this zone.

The fishing port cluster is the main zone, which shows the historical and cultural characteristic. Based on Liuhe fishing port and the trading market, it is planned as a special catering zone. Meanwhile, for showing the Zhenhe's voyage culture, this planning broadens the Liuhe River and set a yacht Club at the mouth area.



Pic 11: Fishing Port Zone Planning



Pic 12: Countryside Planning

The countryside part cluster extends the waterfront line for the resort, meanwhile, the resort is enhanced connection with Shanghai via this area. it offers an countryside image and wetland for Shanghai.

5 Conclusion

The Yangzi River Mouth Resort Planning was born in a transition period. The central government considers transferring the main tasks of urbanization from land development to quality of urban, therefore, the land policy will limit the intensity of land development and reduce the pace of land transition, which is from rural land-use to urban land-use. Meanwhile, the central government enhances the requirement for protecting rural ecology and urban Greenland. For local government, when they calms down from zeal of land market, they have to find an efficiency method to release from dependence on benefit of property development for local finance. Meanwhile, the local government is challenged by the declining profit of material industry. Therefore, under the both side demands, tourism development is a logic choice for Liuhe government.

The planning reduced the ratio of urban development land. Meanwhile, it claimed the function division between town center and the resort. Furthermore, it took care about the redevelopment for Liuhe port and offered new function for port area.

The evolvement of Suzhou's land-and-water fabric in three periods of its urbanization (1229-2013)

(Driving force behind the physical transformation)

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1. Introduction

Traditional urban fabric contributes notably to take on a city's history, and perhaps nothing else can do justice to its silent value to sustain cultural context and regional feature. In China, it has also been regarded as the highest principle of historical conservation plan to protect the old city as a whole, which was first officially declared by the State Council in 1982, and was soon incorporated into the law. Even so, however, this extensively acknowledged concept did not help to stop historical cities from being ruined step by step, especially in those "well-developed" regions. An invisible driving force literally consumed old urban texture not only in recent modernism, but also in the long process of urban development. It's not hard to find that the whole growth of human need is, indubitably, the core force, which keeps pushing the old to update. So, the preference for multi-storey buildings or broader road, is but fundamental requirements of mankind for a more convenient and faster urbanism.

Suzhou, one of the paradigm examples of historic conservation in China, firstly awarded the title of National Historical and Cultural City in 1982, is still losing its valuable urban texture both on land and on water, in reality, not only in the sunset of water carriage in modernism, but also in the golden age of ancient times. In 1229, there were nearly 90 kilometers of artificial waterways in this "orient Venice". In extreme contrast, however, only 34 kilometers were left today within the extinct city wall (Qu Weizu, 2007). Fortunately, given the growing proportion of tourist economy for place competitiveness today, the restoring programme of regional features becomes a major policy concern that both urban planners and local municipalities are keen to advocate.

To be sure, the existing studies of how those hundreds of lanes and intertwined water system transferred along the time are rich (Zhang Guangwei, Chen Yong, Yu Shenfang, Li Jian, Chen Fei), but the reasons why they reduce and how to recur the prosperity of the old town were rarely given. Located in the Jiangsu Province in the south of lower reaches of the Yangze River, Suzhou epitomizes an Water City with its unique "Chessboard" structure (Ruan Yisan,2005). And as one of the most developed cities in China, having the sixth highest GDP in China (EIU, 2013), financial supports were never problems. Thus, the purpose of this paper is to apply an evolutional study on Suzhou's land-and-water fabric along with a social perspective to inquire the dynamics behind. In short, this paper was trying to find something else to expanding common understanding of the unawareness of conservation away from an indignant criticism on political violence or strategy short sight toward a more historically and naturally developing view of the role that urbanization played on cultural context and spatial transformation.

Catering to the set target, this paper is divided into three parts. The first section describes the evolutional process of Suzhou's urban fabric on water, translating ancient maps onto a latest geography one, dividing the overall process into three, by addressing the feature of the total length of waterways. Subsequently, a social perspective is used to find non-physical dynamics behind, including demographic, economic, political and technical analyses by literature review. The final section provides a conclusion and offers further suggestions regarding the international literature on the urban fabric and urban regeneration, and empirically explores one way to create a new open space network along waterways with good connectivity to green lands, playing grounds or sight seeing tours to introduce vivid urban life back to this time-honored city.

2. Research Methodology

Drawing on the technology of historical map research and literature review for social study, the paper applies one fundamental measure focused on geographical coordinates. Firstly, three ancient maps are chosen according to their relatively completion and typicality of eras within ancient city wall. This technology named "re-mapping" or "re-drawing" to interpreter ancient maps onto a normative one was first applied by Dong Wei and Li Jian (2008) in the conservational plan of Hangzhou, China, setting up a practical technological system for spatial designing and management in maintaining historical context.

To be more detailed, the key problem of this technology is to deal with the distortion. As been well know, Chinese ancient maps were usually drawn to express "Topotaxy" rather than accuracy, those pieces of works are more arts than instruments. The resultant distortion becomes an insurmountable problem unless spatial information can be located accurately onto a normative map. However, thanks to the smooth vertical and horizontal form of Suzhou's urban fabric and numerous heritages, it's not hard to find the exact bridges or landscape buildings on the map within the city wall, helping to find the exact river through it or nearby. Another bub is to count the total length of rivers as precise as possible. Because of the doubt of ancient measuring tool, this paper prefers to keep statistics of existing studies and estimated statistics based on the "re-mapping" technology, aiming at providing more reliable results for readers to choose.

The second part of social research was not set before, avoiding priori judge. It was decided later after a careful look into the non-physical study according to the extracted characters of eras. Thus, the social perspective would be self- divided to find out whether it or not matches the physical transformation. However, as the modernization wears on, it is important to mention that things differ extremely not only on customs, concepts, but also the way we live. Like food, which played a key role of economy and politics in the past, is but one small part of today's transport and communication trade. These different kinds of social factors matter much to this economically developed city all along. So, in a word, social changes, including demographic, economic, technologic, or political factors, should all be considered.

3. From a Water Town to a Upland City: the Evolvement of Suzhou's Land-and-water Fabric in three Periods of its Transformation

3.1 Brief introduction of the physical transformation and map chosen

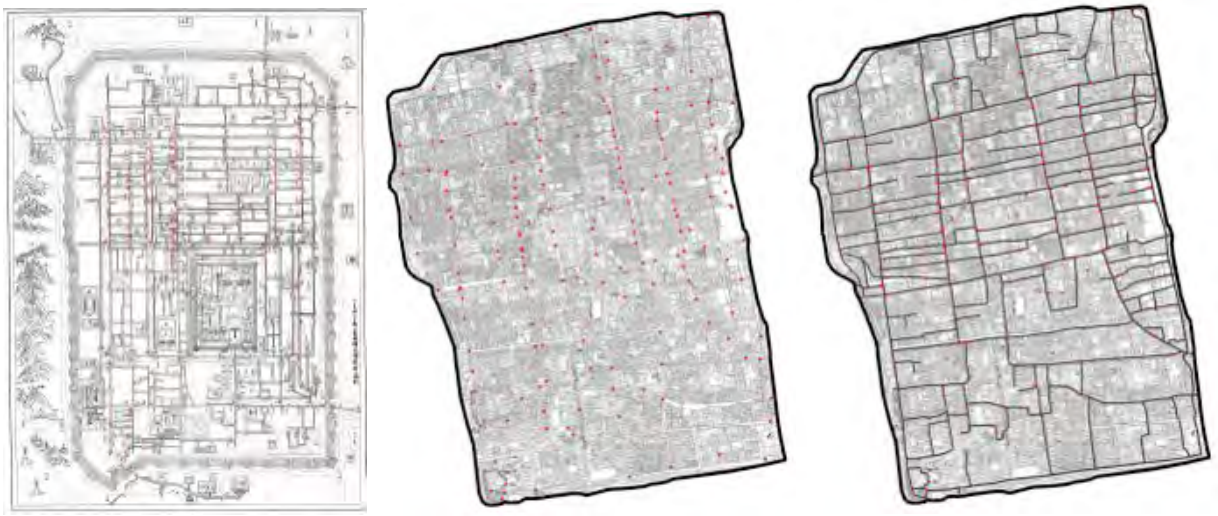
Suzhou's urban fabric transformed in three sharply demarcated phases according to the total length of rivers. In the long history of this city, the unique texture didn't appear in its early origin, which could be traced back to the New Stone Age. It was not until 514 B.C. that the texture was preliminarily formed under the leadership of Wu Zixu. As been well known, officer Wu complied the urban construction with natural physical physiognomy of Taihu Plain, where water densely covered the earth. Through the uplifted prosperity in Sui and Tang Dynasty, the urban construction of Suzhou peaked in Song Dynasty, i.e., the finishing time of the "Pingjiang Tu" in 1229, and sustained this booming to Ming Dynasty. Unfortunately, during the second period from the war of regime change of Qing Dynasty in 1644, to the end of the 19th century, more than half of the entire "Chessboard" system disappeared. What's more, in spite of the vehement requests on conservation and development, the city itself re-constructed greatly after 1949. To be more exact, not only the mighty municipal authority, but also the local citizens asked for change. As a result, it is not until the earliest Conservation Plan of the city in 1982, that Suzhou started protecting its old urban texture with only about 34 kilometers of waterways in its third period of physical transformation.

3.2 Re-mapping typical ancient maps in each periods

(1) 514B.C.-1644A.D.

The first chosen map was a rubbing copy from the monument called "Pingjiang TU", which was engraved in 1229 of Song Dynasty for the first time with a horizontal scale by 1:3000 and a vertical scale by 1:2500. The existing monument was restored in Qing Dynasty, picturing the city's heyday of its complete land-and-water fabric with great details of the names of bridges and landmarks. During this period, there were more than 340 bridges and over 80 kilometers of rivers in total (Statistic Bureau of Suzhou, 2004). After sorting out this map, there were 292 ancient bridges within the city wall (Figure 1-1), of which 168 one can be located onto the latest map (Figure 1-2). Then, accompanied with the help of landmark buildings, the urban fabric of lanes and rivers can be translated (Figure 1-3).

However, according to < Water Conservancy Book of Wuzhong>（Zhang Guowei, 1639）, from 1567-1620, the water administration underwent a tough period of poor management. For instance, plants grew excessively on the riversides without regular cleaning, plenty rubble and domestic rubbish were dumped into the narrow waterways by locals for convenience, and the majority of residents whose house was close to the river expanded their living room onto or even across the river. As a result, the entire "chessboard" structure was not as prosperous as it seemed to be. Just like one Chinese ancient verb, "Everything starts to fall just when it has reached zenith".



1-1 *1-2* *1-3*

Figure 1: The Re-mapping Process and Results of "Pingjiang TU"(1229)

(2) 1644A.D.-1800A.D.

The second chosen map was "Gusucheng Tu", made in 1743-1748 (Zhang Yinglin, 2004) for the reason of the relative stableness of urban fabric after the fall of Ming. In this map, we could find 238 bridges on Gushcheng Tu(Figure 2-1), with 134 bridges which can be translated onto the new map (Figure 2-2), along with 68.4 kilometers of waterways (Figure 2-3). During this period, as mentioned above, those dry riverbed and obstructed waterways were finally covered by new houses, followed by more blocked ones caused by the war, which led immediately to the loss of almost one quarter of the entire old fabric described in "Pingjiang Tu". What's worse, the overall urban fabric kept fading away until the end of 19th century. According to the calculation comparing the map made in 1914, to the "Gusucheng Tu" made in 1743, the total length of rivers lost another 38 kilometers. Refer to other researchers' results, like Dong Wei, Zhang Guangwei, they all agreed to the fact that this period saw a continuous disappearing of rivers and lanes.



2-1 2-2 2-3

Figure 2: The Re-mapping Process and Results of "Gusucheng Tu"(1743-1748)

(3) 1800A.D.-2013A.D.

The third period was quite a confused one. Although there was only one re-mapping map for this paper, but in according with the existing research results, the total length of rivers and lanes fluctuated greatly during the years from 1912-1949, namely the governing time of the Republic of China. One main river "Jingfan Bang" was totally ruined, but thanks to a good infrastructure management, the government dredged another 10 kilometers of waterways. However, in the new era after 1949, Suzhou kept losing its old urban texture until it was appointed the National Historical and Cultural City in 1982, which brought the old urban fabric back under protection again.

In this third chosen map made in 1941, 134 bridges can be found, as well as the landmark "Beisi Tower". Fortunately, the old town kept almost exactly the way it was in 1982 under the sever protecting acts, in spite of some newly dredged rivers following closely to the study of conservation plan, aiming at restoring some part of the ancient form of the urban fabric.



3-1 3-2 3-3

Figure 3: The Re-mapping Process and Results of "Wuxianchengxiang TU"(1941)

3.3 Summary

The overwhelming history of the transformation of Suzhou's land-and-water fabric peaked around 1500 A.D. on a good basis of its solid foundation of former urban construction. But it kept decaying in the 18th and 19th centuries, restored and ruined at the same time under the management of the government of the Republic of China, and finally got public attention in 1982 under the leadership of communist party with only one third of its total length of rivers remained. Thus, from all these phenomena with strong hints, it was not simply the unawareness of conservation in modern society, which was always blamed to be the major cause. In fact, the disappearance of the traditional urban fabric on water had started in the early 1600s. So, this paper surmises it is the historically developing process in all aspects that should be responsible for the continuous decline of historical urban texture.



Figure 4: the evolvement of Suzhou's land-and-water fabric

4. From an integrated transportation system to a distorted leftover: the Dynamics of physical transformation on social perspective

4.1 Demographic aspect of the population trend

In the long history of the feudal society in China, the northern and western cities on the central plain used to be population centers before Tang Dynasty (Zhang Jiaju, 1957). However, through the Tang and Song Dynasty, the environment of inland part became too severe to plant crops, which was extremely vital for living in ancient times, in particular, for farm-based Chinese. As a result, the atrocious weather and infertile soil gradually drove people to migrate to some more habitable places. Among these cities with suitable soil, Suzhou gained its popularity relying on its well-established circumstance. Around A.D.820 recorded in the local chronicles named <Yuanhe Junxian Zhi> of Tang Dynasty, there were over 100,000 people living in Suzhou, which laid a good foundation for its later prosperity. This absorbing trend kept all the way to late Song Dynasty, making Suzhou the largest city with a population at 2.3 million in total, ranking first national wide. What's more, around 1800 of Qing Dynasty, the total population in the city of Suzhou was 2.5 million, that is even more than recency, while the real down town area is nearly the same as today's downtown area.

Unfortunately, the followed period from the late Qing Dynasty to the Republic of China (1851-1949) saw a linear decrease of local residents. Based on or concerned with events in history as recorded, only 400,000 people survived in the flames of war during the Taiping Rebellion from 1851-1864 in the downtown area. And the population stayed at its lowest level at about 380,000 (Li Genyuan, 1938) until 1938, when almost all the citizens escaped from the bloody massacre in 1938 (Li Genyuan, 1938). Subsequent to that, local people came back bit-by-bit and the city basically returned to its former condition.

By the end of 1980s, this situation changed as Suzhou once again became a living paradise. According to the statistic bureau, there were 1.97 million people lived in the downtown area in 1990. As the twentieth century wore on, new comers preferred living in new constructed areas around the old town for a better living condition or a shorter work distance etc., while the downtown area was almost full and only served old houses or expensive new ones. Still, the core city with plenty waterways and historical buildings under sever conservation regulation maintained its total population level from then on.

Table 1: the Evolution of Suzhou's Population Density within Downtown area

Time (B.C.)	**Population** (10,000)	**Data source**	**Registrar**	**The area of downtown area (km^2)**	**Population density (1000 persons/km^2)**
820	10	<Yuanhe Junxian Zhi>, Vol.25,p200	Li Jipu	14.2	7.1
1275	33	<Gusu Zhi>, Vol.14	Wang Ao	40 ±	8.3
1600	50	<Demographic History of China>, Vol.4	Cao Shuji	40 ±	12.5
1700	70	<Quantitative Study of Jiangnan District during Ming and Qing Dynasty>	Liu Shiji	60 ±	11.7
1800	100	<Urban Study of Jiangnan District during Ming and Qing Dynasty>, P.62	Wang Weiping	80 ±	12.5
1841	103	<Industrial Growth and Urban Development>, Vol.2. p.63	Li Bochong	80 ±	12.9
1926	26	<Urbanization Study of Suzhou:1927-1937>, P.16	Fang Xuhong	100 ±	0.3
1938	38	<Xian Nan Yin> (famous poem)	Li Genyuan	168 (downtown area)	0.2
1990	197	Statistical Yearbook of Suzhou, 1991	Statistic Bureau of Suzhou	168	11.7
2000	76	Idem, 2001	Idem	86(downtown area)	8.8
2005	82	Idem, 2006	Idem	86	9.5
2010	95	Idem, 2011	Idem	86	11.0
2012	76	Idem, 2013	Idem	86	8.8

note: The total area of the downtown area includes those areas directly surrounding the city wall especially after 1200s.



Figure 5: Comparative pattern between the evolution of river length and population density
（The statistics of river length was quoted from Zhang Guangwei, 2012）

Taking a panoramic view of demographic evolution in chart one, we can find that the periods from 1600 to 1800 and 1950-2000 saw the greatest privation of the loss of rivers. Meanwhile, the population density stayed at the highest level during 1600 to 1800. When this situation happened again in modern times around 1980s, Suzhou quickly gained a flood of people from 1950 to 2000. Thus, this paper presumably concluded that the great need of population for more living space was one key factor that led to the loss of Suzhou's land-and-water fabric. And obviously, waterways or narrow lanes were not important enough to defend themselves from replacement.

4.2 Economic aspect of the leading industry

The industrialization process of Suzhou had several clear paths to follow. In chronological order, the first one was basic agriculture in the city's early booming. As mentioned above, during Tang and Song Dynasty, the economic center of gravity in China moved toward east and south (Zheng Xuemeng, 2003), making Suzhou the economic core national wide mainly depending on agriculture in Song Dynasty. Refer to official records by Fan Zhongyan (mayor of Suzhou, 1034-1035), 34,000 Qing (1Qing=6.67hectare) of land were under reclamation. However, according to Suzhe (1039-1112), another government official, the real number of farmland, including concealed and unreported ones for tax evasion, was 113,000 Qing (1qing=6.67hectare), which was accepted extensively by historians. As a result of economic pursuit, farmers expanded their lands by stuffing rivers according to a famous doggerel "与水争尺寸"(fight against water for one inch) by Sushi (1080s). Still, the key role of waterways played on grain transportation evenly matches the thirsty of farmland at that time. Thus Suzhou managed to maintain its crisscross rivers in this farm-based country for long, <舆地纪胜>(vol.5, 1224), and got its reputation as "the orient Venice" by Marko Polo in Yuan Dynasty. Because of the prosperity of agriculture and water transportation, Suzhou's urban fabric developed well, and rivers were under good management to guarantee the fluency of grain transportation until 1290s, when agriculture was no longer the leading industry in Suzhou.

Afterwards, the followed Ming and Qing Dynasty saw the booming of industry and commerce in Suzhou, which was usually regarded as the Capitalism rudiments of China by sociologists. Predominantly, silk manufacture and cotton fabric were the leading industries of Suzhou in the early years of industrialization. At first, silk production was mainly house-hold by citizens in the north part of the old town according to <Jiajing Wuyi Zhi>(1989). It is easy to connect this booming of silk machines to the final loss of rivers in northwest of Suzhou as

mentioned before. This rising industry soon took the place of agriculture, as well as the frequent usage of rivers for irrigation or transportation of grains. Recorded in the book named <吴县志>(1994), during 1750s, there were 57 Sizhangfang, one kind of silk factories, within the city wall, and the largest one even had 3 hundred loom machines. Subsequent to that, the total number of silk machines reached 12,000, along with 100,000 workers. Thus, with the prosperity of economy and its livable environment, Suzhou gained its popularity over the nation as a productive area of no more food but silk products with the emergence of a hectic business and trade center. From then on, it transformed from a transport point to an special industrial base city in feudal society. In the wake of industrialization and its relevant force of labors and machines on land from 1300s to 1800s, rivers became more and more useless.

In modern times, Suzhou's economic development came to a standstill from 1800s to 1949 because of political and social unrest. But later, Suzhou seized its opportunity to push itself among the leading industrial cities by small local enterprises of light manufacturing in 1980s. As the new century wore on, Suzhou built up the famous "Suzhou Industrial Park" in 1994 on the east of its old town, and "Suzhou New District" in the west. With the contribution of foreign capital investment and policy favor in these two places, the economy of Suzhou peaked in Jiangsu Province with 154 billion yuan in 2000 and 1302 billion in 2013. Depending on Suzhou's advantage of close location to Chinese economic center, Shanghai, and its city orientation of industry and manufacture, Suzhou became the richest city at the same administrative level in China, along with its old reputation as one of the two living paradises, which keeps attracting people, looking for jobs and beautiful environment. Thus, the old town turned to be a tourist one in contrast with the industrial districts, and gain great concern on its historical conservation.

Table 2: Evolution of Suzhou's Leading Industry and Relative Urban Space

Time	City Status	Leading Industry	Relative Urban Space
514B.C.-820A.D.	General agricultural town	Rice and fish	Farmlands with irrigation canals
820A.D.-1300A.D.	Key agricultural city and Important traffic hub	Rice and fish, commerce and trade	More farmlands for growing agriculture and smooth waterways for transportation
1300A.D.-1800A.D.	Rising star as a key industrial city national wide	Cotton processing and printing, silk manufacture, wine-making, tailoring, rice milling, oil milling, etc.	More lands for machines, less need for waterways
1800A.D.-1949A.D.	Lag period of society and economy because of war and other rising cities	Decline of above industries	Relatively steady urban form
1949A.D.-1994A.D.	Rising star as a manufacture center national wide	Garments production in suburban towns and silk Industry in downtown area	No more farmlands or irrigation rivers, huge demand for lands to build factories
1994A.D.-2013A.D.	Key manufacturing center national wide and famous tourist destination	Electronic processing in new developing areas and tourist economics within the downtown	The old town was under severe conservation acts

4.3 Political aspect of water management

Unlike recent maintaining of waterways for tourist economy and historical conservation, ancient management of rivers focused more on their actual function. As recorded in <New Tang Book>(Vol.35, 1060) in the rise time of Suzhou around 8th century, the Tang government attached great importance to canalization to ensure the safety and stability of capital power, considering the poor property of capital and surrounding cities in the north. One famous saying in historical book is, "three official dredging works of canals in the south of the Yangtze River" from 738 A.D. to 813 A.D. Under the great efforts of government administration from 8th to 10th century, the integral pattern of Suzhou's urban fabric began to take shape. Besides, Suzhou gained another advantage from its well management of water system that is the improvement of its administrative levels, which meant more power to govern rich towns and villages. By the time of the following Dynasty Song, the unique integral

pattern full of artificial canals known as "land-and-water chessboard urban form" was finally shaped, supporting the water-based transportation. Meanwhile, this water system also served domestic water, fire demand source, and flood control canals.

However, this boom period of water transportation and water management did not last long. For instance, during Yuan Dynasty around 1279 A.D., local citizens break 36 main bridges to defend thieves and robbers. This action blocked several rivers, which were later occupied by rich and powerful persons to reclaimed farmlands (Qu Weizu, 2007). This situation went from bad to worse in Ming Dynasty referring to < Water Conservancy Book of Wuzhong>(Zhang Guowei, 1639). As recorded, the main structure of Suzhou's water fabric was kept well from 1522-1566 with "three horizontal and four vertical" of main rivers. But ancient Water Conservancy Bureau of Suzhou ceased to be binding during 1567-1620. Therefore, Zhang drew the famous map (<Map of canals within Suzhou>, 1639) to record the water fabric in desperation, hoping the next generation to revive the prosperity of this valuable canal system.



Figure 6: Political influence on the loss of one main river named Jingfanbang and its tributaries between Pingjiangtu(1229) and Gusuchengtu(1743), and between Gusuchengtu(1743) and map of 2013



Figure 7: The south part of the main river named Jingfanbang in 1970s (www.jssdfz.com) and 2014

In the last feudal society of China, large number of officers and labor force were sent to fix water system for several times. For example, 1737, the mayor of that time enacted severe ordinations to forbid printing and dyeing industry within the city wall because of health hazard, and 14438 m^3 of silt were moved from the 7 main rivers in 1746. Besides, plenty local gentlemen of Gentry Class spent money on river regulation. Yet, all these efforts did not keep the rivers from being polluted or occupied. Generally speaking, although the government and local gentlemen endeavored to save the main 7 rivers, the Qing Dynasty still saw a slow but irreversible decline of the total water fabric mainly from 1746 to 1874.

The government of the Republic of China did not do something but little regular cleaning of rivers, but do fill the main river called Jingfanbang to build a new road on it in 1937 (figure 5). It was the worst loss of whole water system. In the next era, unfortunately, it is not until 1982 that the local officers started to protect its downtown rivers as cultural heritage. They concentrated more on large canals outside, like rivers connecting Suzhou to its governing towns. So, it became but another bad time for water fabric, and we lost almost 30 km of rivers from 1949 to 2000 as mentioned before.

4.4 Technical aspect of traffic engineering

Thanks to government's attention of water carriage for political concern in Tang Dynasty (618-907A.D.), the prosperity of water transportation soon extended to the booming of shipbuilding industry national wide, which also contributed to the prosperity of water-based transportation system. As new century progressed, by the time of Song Dynasty, the volume

of water carriage from southeast to the capital by only Pian River were 6 million Shi (1Shi=59.2kg), which meant 12 thousand big boats or 20 thousand small boats to carry (Xusong, 1931). As recorded, the highest output of boats was about 3000 from 1127-1279A.D., and nearly 2700 boats later (Lvyuan, 1128). As been well known, Chinese shipbuilding industry peaked in Ming Dynasty (1368-1644A.D.), which contributed notably to "Zhenghe Travelling to the West for seven times". Now, we can imagine the hustle and bustle on the boats in the dense network of crisscross rivers in Suzhou.

In the followed dynasties, those busy waterways became less and less useful under the great power of industrialization started from late Ming Dynasty to Qing Dynasty (15th-19th C.). According to Li Bochong (2002), government dredged rivers one time per 34 years in Ming Dynasty. However, this number rose to twice in Qing Dynasty, which indicated the increasingly frequent blockage of rivers. During this period, locals spent more time in their family workshops on land instead of farmlands or commercial boats, which also meant the less usage of waterways. This situation of traffic continued of long standing until a new society broke the feudal one in the end of the 19th century. And underwent the long depression of economy from 1840 to 1949, Suzhou lost one important river as mentioned above. After the establishment of China, Suzhou became a manufacturing center again, which brought advanced vehicles into the old town. Under the modernization, residents enjoyed small vehicles called electric power vehicles replacing bikes of 1960s to 1980s. As reported by local TV station in 2012, almost each family owned 1 to 2 ones, which means 700 thousand in total. What's worse, there're also over 2 million cars, and 2971 buses in end of 2013 in the whole City of Suzhou.

5. Conclusion

Whilst it is hard to get accurate or scientific statistics from the long past, it is still possible to find out obvious relations between the transformation of urban fabric and social changing. In general, Suzhou lost its traditional urban fabric for several close related factors according to above-mentioned aspects in detail. Therefore we could tell the hypothetical answer by looking into this table, correlational, the huge reform in demographic density, economic developing, political decision and traffic engineer perfectly match the transformation of urban fabric.

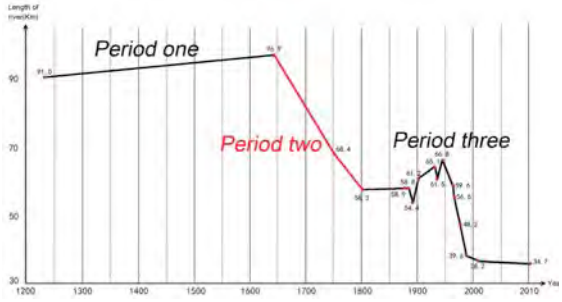


Figure 8: Period Division of water fabric

Table 3: Social Factors Behind the Physical Transformation and Correlational Research

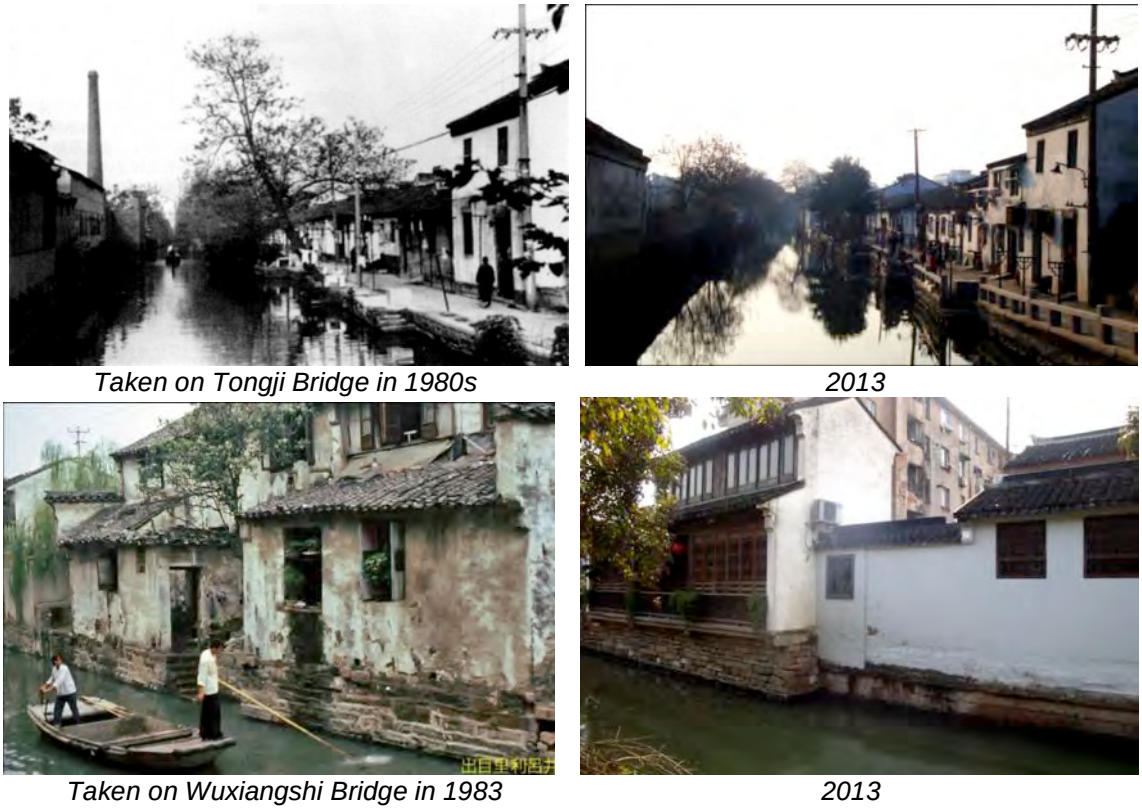
Period (A.D.)	Time (A.D.)	Length of Rivers (km)	Demographic Factors	Economic Factors	Political Factors	Technical Factors
Period One 1229-1644	1229	91.0	Steady growth to a high density	Traditional farming and commerce, budding industry	Feudal society relatively peaceful	Freight and passenger transport mainly by boat
	1500	92.3				
	1639	93.9			War	
Period Two 1644-1800	1743-1748	68.4	Peak of high density	Booming of industry	Feudal society Being relatively peaceful	Almost only passenger transport by boat
	1797	57.3				
Period Three 1800-2013	1896	61.3	Sudden drop	Lag period	Social unrest and war	
	1908	62.0				
	1914	62.3		Decline of statue	War and Weak government	Less and less transport by boat
	1941	60.8				
	1958	53.8	Sudden rise		Peaceful era under powerful government	
	1972	43.4				
	1985	39.6		Fast development		Booming of cars
	2013	34.7				

Data Source: length of rivers of other time were quoted from Zhang Guangwei, 2012

Reviewing the past, population density, economic development and traffic changing were much slower to take effects on urban form, while political events blocked rivers immediately. However, if we calculate carefully and budget strictly, population density and industrialization were way more influential than sudden events as long as we look into the transformation process. Yet whilst political decisions matters much in the total length of rivers, but this also happened several times in the long feudal society. Why only Qing Dynasty "successfully" ruined so many waterways? If we take the social changing as common industrialization process, and think of the functional value of those waterways, the answer will be clear. The destiny of artificial waterways was determined by their ability to serve people. In other words, no matter they were used for irrigation and transportation in the past, or taken as unique cultural heritages. Without a practical usage to serve the city like tourist economy or attraction improvement, these waterways would keep missing.

In effect, as the urban activity potentially determines the spatial appearance as its layout, it is also a viable way to provide solutions to revive the old town. So, this paper strongly suggests a new water-based travel system, in which boats are back on water and the waterways are dredged again to connect important sites, along with open spaces like parks and public squares. It is difficult to walk ahead, but Luckily, after years of compensation and struggle on the balance between conservation and practicability, Chinese urbanists reach a consensus about exploiting new space for urban development, while protecting the valuable downtown as a whole (Wu Liangyong,1982), which laid a good foundation for further conservation (Figure 9).

Quoting the saying of Liang Sicheng for ending(1950), "As a planned whole of a time-honored city, that grand and stately layout are not from any individual building, but from the rich historical significance and artistic expression within its reasonable and orderly street system with handling space and distributing focus of urban fabric that managed to create the excellence of urban images." Suzhou, so exhaustively studied and valued, I believe that it was and will always be one place that could evoke memories of locals, and create new on strangers.



Taken on Tongji Bridge in 1980s *2013*

Taken on Wuxiangshi Bridge in 1983 *2013*

Figure 9: Comparison Between old pictures and recent ones

Endnotes：
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Tourist Cluster Placement as a Tool of Urban Areas Development on the Basis of Local Authentic Features and Resources Usage

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1. Introduction

Tourism is an important factor affecting the development of many sectors of the economy of the city, the preservation and use of its cultural, historical and natural potential.
Event Management as part of the tourism cluster is one of the most effective tools to promote the territory under the existing image of "an isolated area."
Kronstadt is the object of our research.
Kronstadt is a municipal town in Kronshtadtsky District of the federal city of St. Petersburg, Russia, located on Kotlin Island, 30 kilometers (19 mi) west of St. Petersburg proper near the head of the Gulf of Finland (Figure 1). Traditionally, the seat of the Russian admiralty and the base of the Russian Baltic Fleet were located in Kronstadt guarding the approaches to Saint Petersburg. The historic centre of the city and its fortifications are part of the World Heritage Site Saint Petersburg and Related Groups of Monuments.

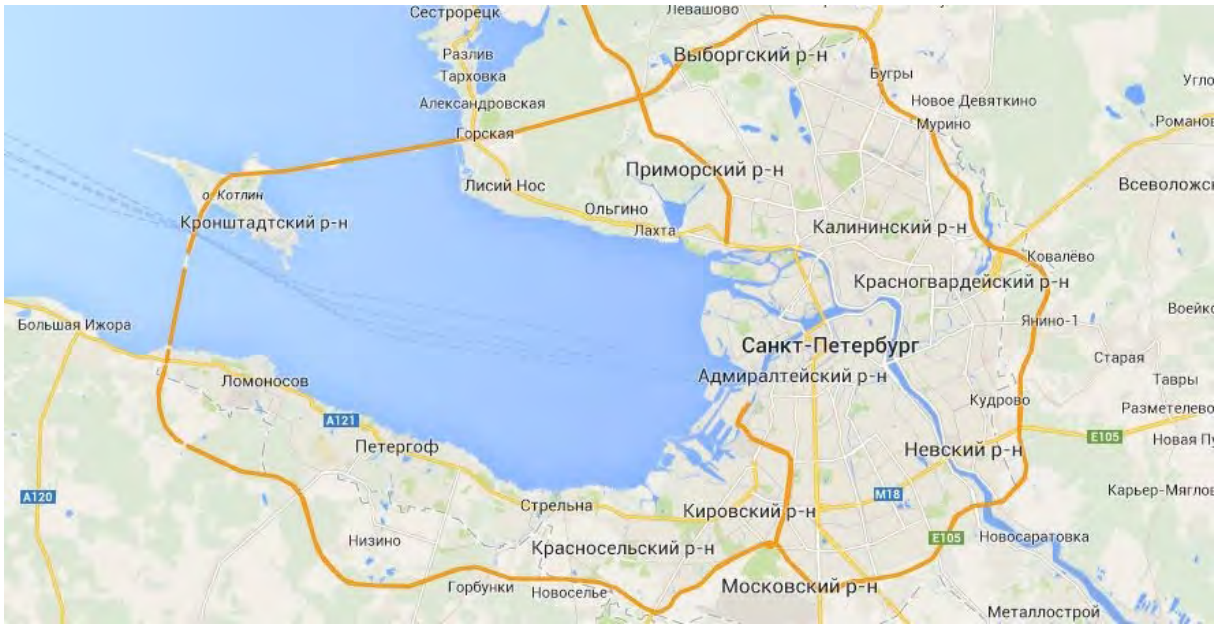


Figure 1: Geographical position of Kronstadt.

For a long time it was a closed administrative-territorial unit. But now it's an average district of Saint-Petersburg and need to be developed.
It has several problems:

- problem of the balanced social and economic development;
- the narrow specialization caused by the status of the city;
- existence of not used territories and objects;
- lack of workplaces for young people;
- youth outflow;
- need of an urban environment modernization;
- preservation of cultural and historical heritage and recreational resources.

Purposes and problems of work:

- involvement of Kronstadt able-bodied population in economic activity;
- increase in taxable base;
- stabilization of a demographic situation by youth fixing in the city;
- modernization of existing resources of the territory of the city;
- development of multidirectional competitive scenarios for leisure in Kronstadt;
- formation of positive image of the territory and effective use;
- involvement of tourists for regular pastime;
- creation of the territory brand – "the hospitable city".

2. Social and economic justification of the project

The project focuses on the Kronstadt working population involvement in economic activities, increase the tax base of the city, the demographic situation the stabilization by securing the youth in the city.

Consider the demographic structure of Kronstadt (see Figure 2). According to the social passport population at the end of 2012 amounted to 43.6 thousand people.

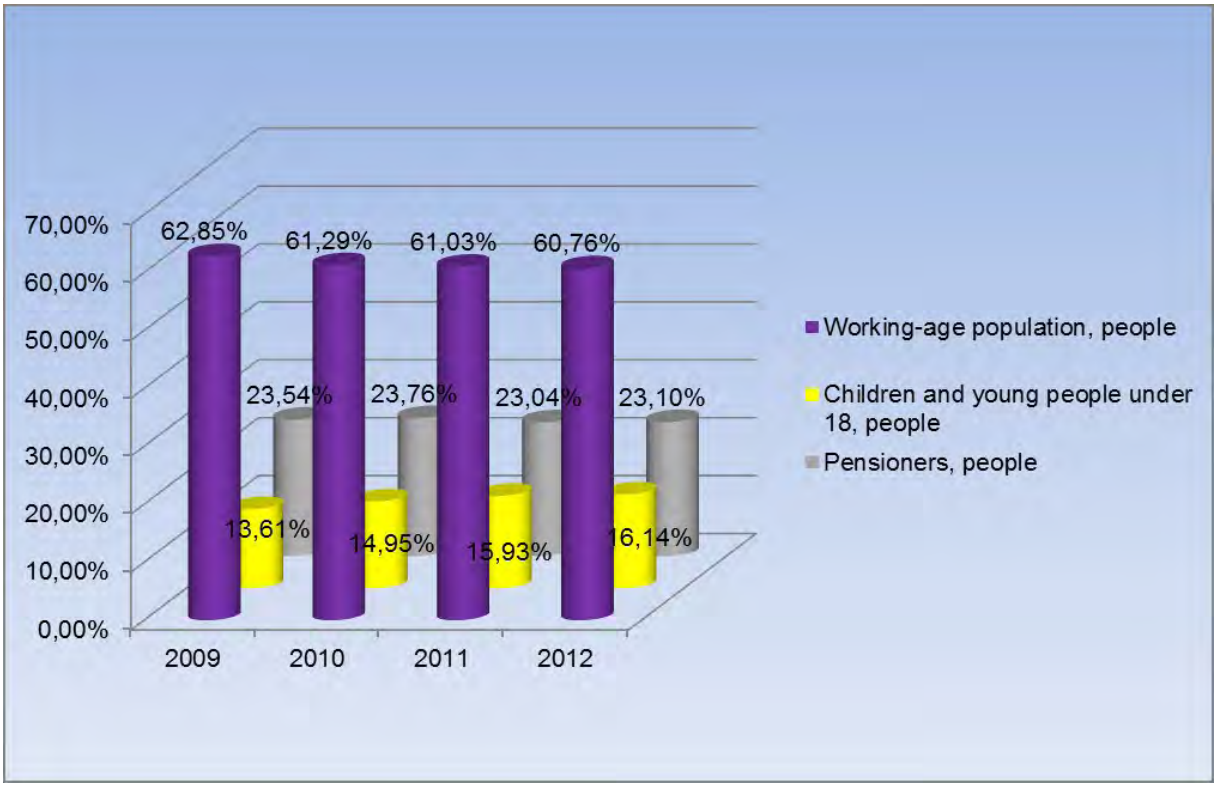


Figure 2: Kronstadt population structure 1

In the period from 2009 to 2012, the trend toward changing age structure of the population - a declining population of working age and the growing number of pensioners and young people. The growth in number of young people is only temporary - it is associated with the entry into childbearing age, the last Soviet generation of boomers (end of 1980). Soon the reproductive phase enters minorities generation beginning of the 1990s, leading to confidently predicted reduction in the number of new-borns and will entail a number of implications for the social sphere.

Reduction of number of youth will lead to an aggravation of the population demographic aging of the area which is showing already now. Reduction in the relative proportion of

[1] Social Passport Kronstadt district of St. Petersburg in 2012

residents of working age will lead to a significant increase in social burden on the budget at the expense of reducing the tax base of workers, and by increasing the number of pensioners. Relatively large proportion of the young and able-bodied population helped to mitigate the increase in social burden on the budget of an aging population, but only slightly. Violation of such a scheme on current trends is unlikely, since the population growth in Kronstadt is extremely weak. There is also an exodus to other parts of St. Petersburg for the purpose of employment.

Thus, it is necessary to consolidate the youth in Kronstadt, providing attractive jobs.

On the one hand, it would weaken the demographic burden on the working population, and on the other - will increase the tax base of workers, thus raising the revenues of the city.

Structure of the population represented in Figure 3, shows that currently the greatest number of employees in manufacturing, health care and education. However, only 21% of the population of working-age group are employed. There is a lack of jobs in the city.

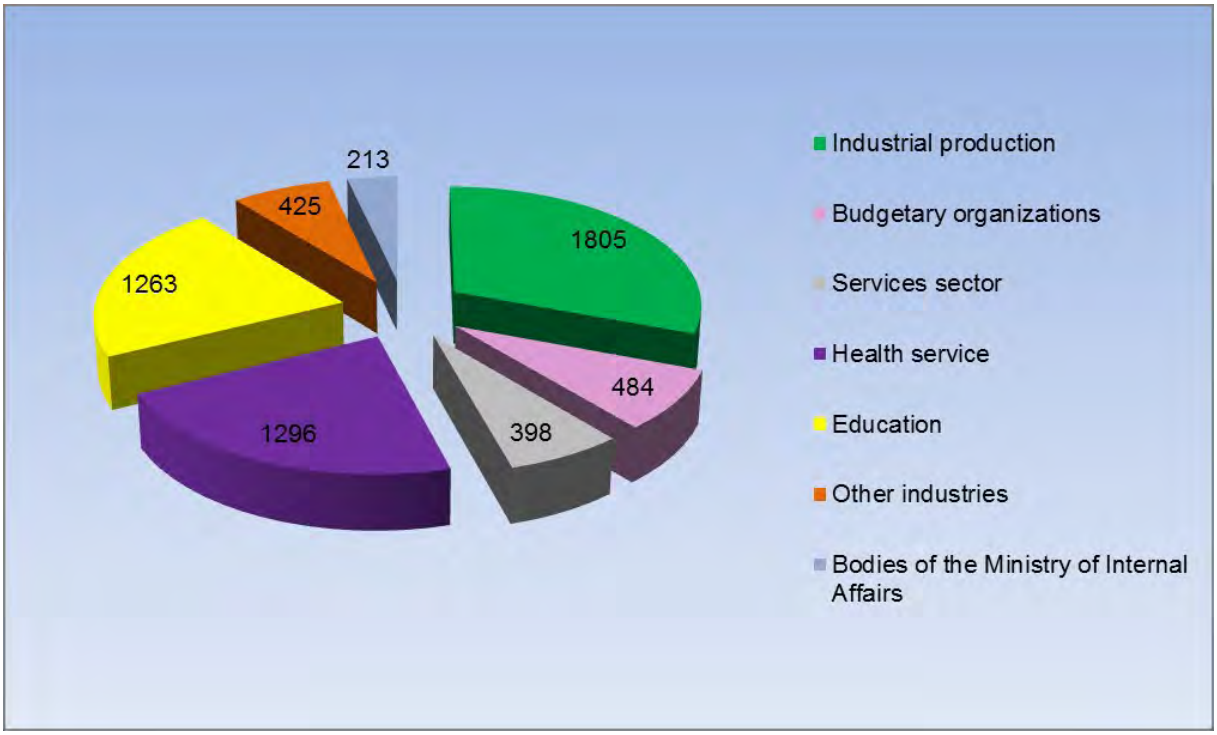


Figure 3: Kronstadt population structure of employment in 2012 [2]

Creation of a tourist cluster "The fishing village" will allow to create new workplaces: at a construction stage (builders, engineers and so forth), at a stage of opening of a complex (the service personnel of various qualification, managing directors and so forth).

The recreational cluster will serve both the population of Kronstadt, and the population from other districts of St. Petersburg coming on 2-3-day rest all the year round, and in spring and summer time and for longer periods.

St. Petersburg residents will be able to get to the "Fisherman's Village" on private vehicles on the ring road - at the initial stage of the project. Further growth in demand, as well as the pace of development of the city will require the involvement of water transport in the economic life of the city. Resumption of undersized water transport plying on the route Saint Petersburg will increase the flow of tourists.

[2] Social Passport Kronstadt district of St. Petersburg in 2012

For locals it is possible to reach "The fishing village" from any point of Kronstadt. In figure 4 the scheme of transport communication of the city districts is submitted.



Figure 4: Scheme of communications of the centre and periphery of Kotlin Island

3. Justification of the site location

As a site for the project to establish recreational cluster "Fishing Village" selected portion located to the east of the Ring Road, close to the highway Tsitadelskoe (Figure 5).

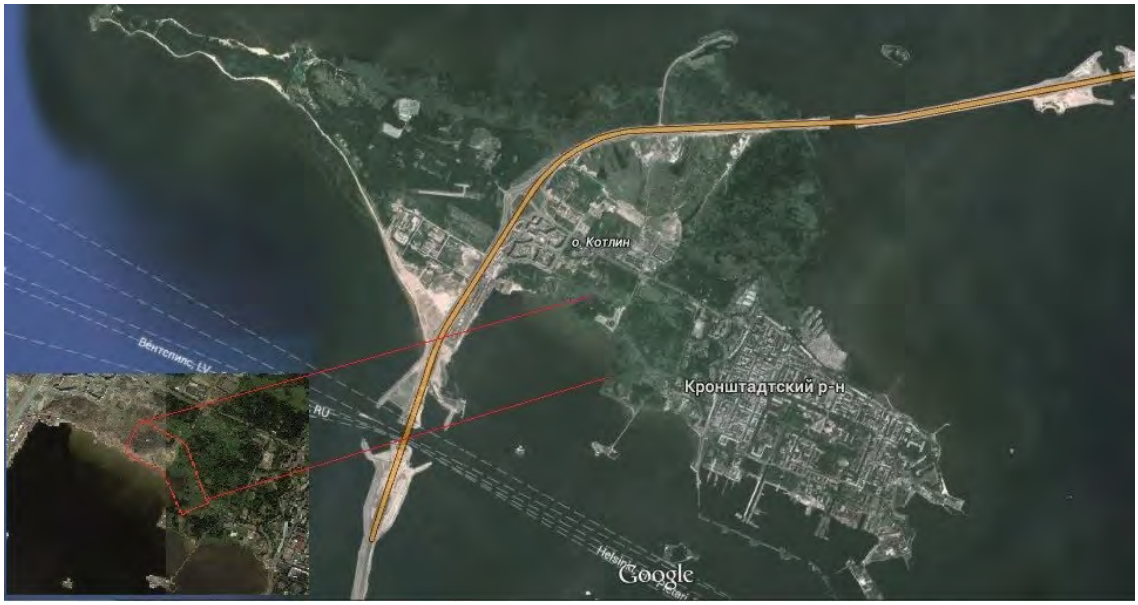


Figure 5: Site location

Currently, this area is partially occupied by military installations transmitted city partially territory is used for recreational purposes. At the same time, most of the chosen site is free for development (Figure 6).

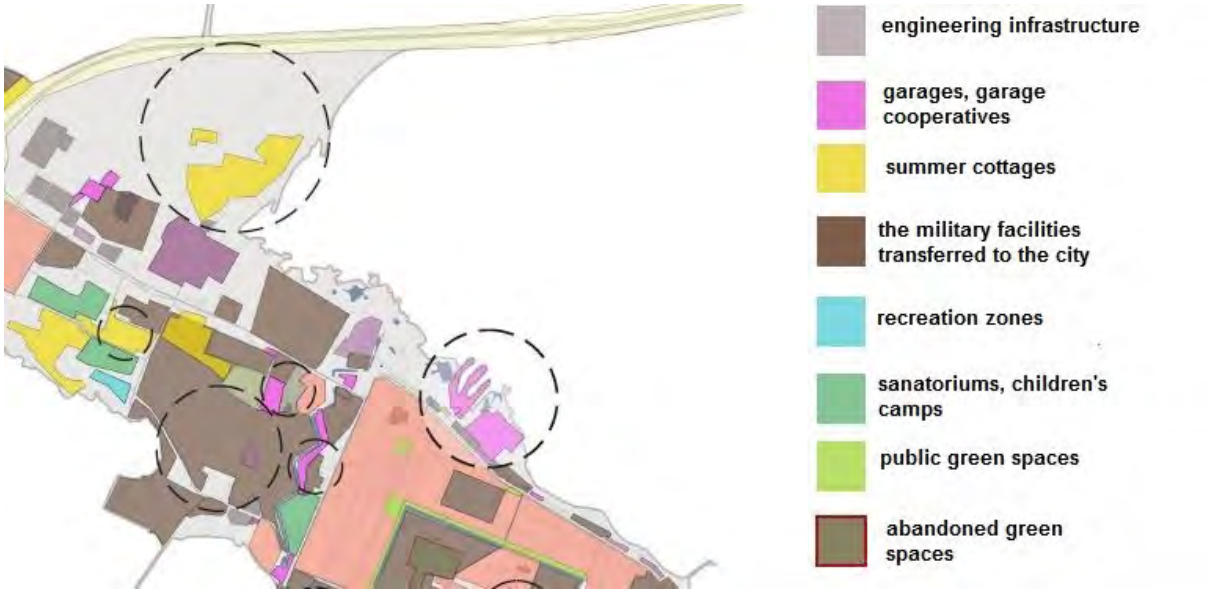


Figure 6: Current use of the territory

The selected area has a natural shoreline, which is partially swamped (see Figure 7). This, in turn, complicates the use of site: it will require additional measures to shore protection and site preparation, and, accordingly, large capital investments in the development of the project.

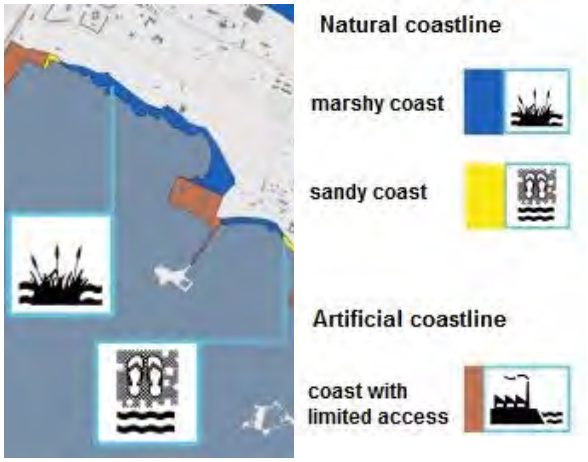


Figure 7: Coastline scheme

In the approved master plan of St. Petersburg, this area is designed to accommodate two functional areas: P3 - area of recreation, sport, leisure and entertainment, tourism and spa treatments, hotels and boarding houses of different types, the holiday fund, with the inclusion of engineering infrastructure, associated with this service area, and territory PP - planned for development zones for recreational purposes with the inclusion of engineering infrastructure associated with the service of this zone, after 2025 (see Figure 8).



Figure 8: Fragment of the map boundaries of functional areas with display parameters of the planned development of the zones and boundaries of St. Petersburg[3]

The recreational cluster project does not contradict the current functional zoning.

4. Kronstadt identity:

According to the results of the Kronstadt social research, Kronshtadt is the city strongly connected with its history as a town-protector with the sea character.

- The most unique value of Kronstadt is a marine outpost which was built to protect the new capital – Saint-Petersburg. After its foundation hydraulic, fortifications, 17 artificial islands with fortifications and batteries on the northern and southern shores of the Gulf were built immediately.
- Kronstadt was an important placement of sailing, shipbuilding and Russian science. The first Russian steamship made its voyage in Kronstadt, also the world's first icebreaker was built on this island.
- Outstanding scientists from architects to mariners worked on this territory

One of the main resources of the sea is fish.

The variety of fish species consist of freshwater fish; among them such well-known species of fish as perch, roach, pike, ruff, dace and many others.

Typical species of fish inhabit Eastern part of Gulf of Finland, they are: cod, eelpout, flounder, herring, Baltic sprat, sprat and some other marine fish.

Abundance of shallow water areas, good opportunities for warm-up and aeration of soil diversity, abundance of zooplankton and zoobenthos create favorable conditions for spawning of many commercial species.

[3] http://www.kgainfo.spb.ru/genplan/pril.html

In the eastern part of the Gulf allocated 2 faunal complex - marine and freshwater, the core of which is represented by the following families of fish: herring, salmon, smelt, pikes, carp, cod, perch, flounder, stickleback.

Fish Resources of the Gulf of Finland

The selected area is optimal from an environmental point of view: not affected spawning areas, which are located along the north coast of the Kotlin island.

5. Project design passport

Action Plan:

Implementation of the project is scheduled for 3 periods:

1. 2015-2020 - Start and growth

2. 2021-2030 - The maximum development

3. 2031-2040 - The transition to a new level - the international development

Let us consider the stages of the project.

Step 1: 2015-2020

At this stage the planned activities for site preparation for development, deployment infrastructure (houses, parking, mooring, various sites), with a recreation place for fishing.

Services:

- stay in a cozy corner of the sea with the possibility of fishing in the shore or from a boat;
- comfortable cabins for family vacations;
- an excellent restaurant where you can enjoy the best fish dishes from the chef himself or try to surprise their loved ones culinary skills;
- possibility of remote control neglect ships / boats compete in it with friends;
- try irreplaceable Russian bath.

Target group:

Families with children (from Kronstadt and other districts of St. Petersburg).

Necessary Resources:

- Financial (attracting investor);
- labor (builders, engineers, maintenance staff, managers);
- PR: attracting proven in the market of St. Petersburg restaurant projects (Ginza Project) for the promotion of the restaurant in the "fishing village."

Effects for the city:

- employment of the local youth;
- increasing of the tax base;
- the emergence of opportunities for family entertainment.

Risks:

- Social: 11% of residents voted against Kronstadt development of tourism in the city, along with the 61% "for" - perhaps popular discontent.
- Economic: lack of investors willing to do the project.
- Environmental: changes in the developing ecosystem coast of the selected area in the aftermath of the events on bank and site preparation for construction.
- Political: a change of priorities for the development of the city.

Step 2: 2021-2030

"Fishing village" becomes a popular brand. Creates a fish market near the recreation center for the sale of a variety of fish, seafood and fish products. The range of present and fresh and frozen, and the different ways of thermally processed fish and seafood.

The market is becoming the hallmark of the city.

At this stage actively developing dual direction - event-tourism: the organization of competitions in fishing, competitions in preparing dishes from fish, holding annual festivals (Neptune day, etc.).

Target audience: tourists (from St. Petersburg and regions), wishing to try fish dishes (no analogues in the St. Petersburg).

Necessary Resources:
- Financial for further infrastructure development.
- Administrative: obtaining permission to place a stationary object of trade, etc.

Effects for the city:
- Promotion of "Fisherman's Village" will be the impetus for the development of boating (passenger transportation St. Petersburg - Kronstadt).
- Development of small business;
- The emergence of small enterprises for processing of fish;
- Increase budget revenues;
- New jobs.

Risks:
- Environmental: the general deterioration of the ecological situation in the city because of industrial development in the surrounding areas of St. Petersburg.
- Political: a change of priorities for the development of the city.

One of the most important direction which starts on second stage is beginning of research events dedicated to the monitoring of the conditions of the island environment. The pollution of the Baltic sea threats more and more, that is why on the second stage prevention and treatment activities on the regular base going to be on the territory during realization of the project. The main idea that it is necessary to have an opportunity to know about the environment condition and control and improve it.

Step 3: 2031-2040

Further development of the areas of the "family vacation" and event-tourism. Accommodation at the "fishing village" sailing schools.

Development of maritime transport infrastructure - communication with the countries of the Baltic region - the nearest neighbors.

Target group: tourists Baltic region.

Necessary Resources:
- Financial for further infrastructure development.
- Administrative: obtaining permission to place a stationary object of trade, etc.

Effects for the city:
- Development of water transport - international direction.
- Increase budget revenues;
- New jobs.

Risks:
- Political: a change of priorities for the development of the city.
- Administrative: legislative framework in the field of water objects.

Thus we can see complex business project which consider all local peculiarities , have instruments for improving present situation by its sustainable principles, mechanism to involve locals and guests to the interesting activity which include beautiful atmosphere, nice alternatives to spend free time, different sorts of leisure. Such kind of project can be a good example of cohesively work of government, business structures and citizens.

A New Inland Waterway for the 21st Century

Reawakening a 200 Year-old Vision

Chris GOSSOP MRTPI , United Kingdom

Summary

In 1811 a group of businessmen based in Bedford in the English Midlands advanced the idea of connecting their then small town to the Grand Junction Canal, a highly profitable transport artery linking London to Birmingham and other manufacturing centres associated with the Industrial Revolution. However, the initiative faltered and by the middle of that century, much of the national canal network began a slow decline, supplanted by the new railways.

However, a revival began in the 1960s and Britain's inland waterways assumed a new role in terms of leisure boating and other recreation. That decade also saw the birth of Milton Keynes with The Grand Junction (now Grand Union) Canal becoming an integral feature of this planned new city. These factors, and the prospect of opening up a large circuit combining lengths of canal and river for leisure cruising, provided the spur for a fresh look at the case for a link to Bedford.

Two centuries after the initial vision, the planning of that waterway is now well advanced and the 26km route is safeguarded in planning terms. The task is now moving to that of defining the details, funding and implementation.

These are straitened times in a country that has undergone big cuts in public expenditure, and many challenges lie ahead, both technical and economic. After charting the origins, progress and main characteristics of the project, the paper reviews the realism of what is planned. It explores the supposed economic benefits and other merits of the waterway and the intended section by section approach to building it. This is an exciting project that has captured the public's imagination but can it 'stack up' and what wider lessons can be drawn?



Figure 1 New development on the Grand Union Canal (photo by the author)

Origins

England's Grand Junction Canal, developed in the 1790s, was the core part of an expanding network of canals that linked London with Birmingham and other manufacturing centres associated with the Industrial Revolution. Built to a standard superior to that of many of the earlier canals, and with its numerous branches to important towns, it rapidly became busy and profitable. At this time Bedford was a small town with a population of less than 4000, a place that was seeking to modernise but losing out in trading terms to places that were connected to the Grand Junction Canal.

So, in 1811 a group of eight businessmen petitioned the Mayor of Bedford with the request that he call 'a meeting of the inhabitants of the Town of Bedford to consider the Advantages likely to be derived to the Town by a NAVIGABLE CANAL from the most eligible point of the Grand Junction Canal to Bedford'. The proposal won local support as well as that of the Grand Junction Canal Company and a famous canal engineer, John Rennie, was engaged to survey the route.

Two optional lines providing the link to the Grand Junction were drawn up; both would then follow the same route between Brogborough and Bedford. Costs were estimated to be between £140,000 and £180,000, with an additional £20,000 for the reservoir required by one of the two options. However, the obstacle of a NIMBY landowner, some apparently spurious costings advanced on behalf of the opposition which suggested a significantly greater construction cost, and a general waning of enthusiasm among the former supporters led to this proposal being dropped (Gunning, 2012; Markham, 1986).

The advent of the railways from the 1830s onwards was to have a devastating effect upon the economics of the, by then, extensive canal system and, as the railways extended their coverage, this earlier network fell into decline. Indeed, one of the new railways largely followed John Rennie's line for the link canal; this is the Bedford to Bletchley railway built in 1846.

Overall, the canals simply could not compete with the new form of transport and they went into a long period of decay leading in many cases to abandonment. Their heyday was a six decade period which began in the 1770s; then they were the new form of transport which made Britain's Industrial Revolution possible. Indeed, by the close of that period, the network measured almost 4000 miles (6,400km) (Hearns and Macleod, 2009).

Revival

A new era of revival began in the 1960s by which time the length of navigable waterways had halved. They were reawakened by, initially, a handful of canal enthusiasts who appreciated their history, their beauty once softened by nature and their potential for recreation. So they assumed a new and growing role in terms of leisure boating and other pastimes (Canal and River Trust website, 2014).

Moreover, the canals have often become the centrepiece of and catalysts for urban regeneration schemes. In the centre of Birmingham, for example, the canals previously associated with rapid industrialisation over two centuries ago are now lined with restaurants and other leisure uses, and canal towpaths, bridges and other historic structures have been

restored. Together with the increased boating activities these changes have transformed once forbidding areas.

And at Brindley Place, which adjoins Birmingham's canal system, a vibrant mixed use area has been created which brings together stylish new and restored premises for business, as well as retail, cultural and residential buildings. In the master planning of Brindley Place, great attention was paid to civic design both for the buildings and the attractive public spaces that separate them. And the associated canals and towpaths (footpath routes) leading to and from Brindley Place have had a key influence on that design and on how Brindley Place relates to neighbouring developments and communities (Latham & Swenarton, 1999).

So the canals are no longer forgotten arteries. Often deeply loved by the communities through which they pass, local people have taken it upon themselves to restore and look after particular stretches of the canal network. To take one example, the Kennet and Avon Canal runs for a total of 87½ miles (141km) east-west across southern England. Also designed by John Rennie, it had fallen out of use and become derelict over most of its length, with the last full trip taking place in 1952.

Over a period of almost 40 years dedicated volunteers working with the government agency the British Waterways Board (BWB) and other bodies have progressively restored the waterway and it was reopened to boat traffic by the Queen 1990. This was a truly prodigious effort which shows what can be achieved by people and organisations working together (Kennet and Avon Canal Trust website, 2014).

Reawakening – Bedford to Milton Keynes

To dig an entirely new canal would present an even more challenging prospect but that is exactly the idea that Bedford resident Brian Young had in 1994 when he reawakened the vision of linking his town with the former Grand Junction Canal (now the Grand Union Canal). But other than the change of name, the difference between the 1800s and today is that the section of the Grand Union Canal that it would join is now part of a linear park serving the new city of Milton Keynes designated in 1967.

Brian Young founded the Bedford and Milton Keynes Trust as an informal group of volunteers (Gunning, 2012). During its 15 year life as a body on its own, albeit sympathetically supported by the local authorities and other bodies, the Trust achieved many things even though there are as yet relatively few signs of things happening on the ground. This is not surprising given the complexities and challenges that the project faces.

The primary challenge has been that of identifying a suitable route – to work out the optimum 'line and level' for a new waterway. Here the basic questions are the same as those faced by the original engineers 200 years ago; they include: what is the most direct route using the minimum number of locks (to cope with changes of level); where will the water come from to maintain the supply (and will reservoirs be needed) and can we site the waterway so as to make the 'cut and fill' volumes balance? That cut and fill question is important today because of the costs but it was even more important at the time of the original proposal when all the dug material had to be moved by hand (Seward and Williams, 2009).

But the present day planners and engineers face a very different situation to that of the early 19th century when this was a very rural area and Britain had less than one third of the

population it has now. By contrast, the present landscape is extensively urbanised and there is major transport infrastructure, notably the M1 motorway and the grid roads of Milton Keynes that a canal would have to pass under or over. While there are engineering solutions to all of these matters, the real obstacle is that of cost. And we are in a period of severely straitened times so far as public expenditure is concerned.

Moving forward

Nevertheless, important foundation work has been done. The waterway would pass through the area of three local authorities, Milton Keynes Council, Central Bedfordshire Council and Bedford Borough Council. The project has been integrated into all the key spatial plans covering these areas and planning permission has been obtained for a quarter of the total route. Thus the principle of the canal is firmly accepted by the relevant authorities (Bedford and Milton Keynes Waterway Consortium, 2013).

Also there has been some work done on the ground to accommodate the canal. The main example of this is the waterway and towpath underpass incorporated into the construction of the new dual carriageway A421 between Bedford and Junction 13 of the M1 motorway. In the current economic circumstances, the challenge is to take advantage wherever possible of opportunities provided by development along the waterway route.

Figure 2 shows the current version of the full 26K route.



Figure 2- Bedford and Milton Keynes Waterway, Route at January 2011 (source Bedford and Milton Keynes Waterway Trust)

Economic Justification

An economic impact assessment was commissioned by the Trust and the results published in September 2009. This recognised that the revived waterways now have a hugely different role to that of their heyday when their task was to carry freight (including coal and other bulky goods). By contrast to the situation on the European continent where many waterways have been widened to boost freight transport, typically the re-use of their British counterparts has centred upon their amenity value and their potential for leisure and tourism.

Among their economic and social benefits, the assessment lists their recreational role for leisure boating and other activities, their value as natural corridors providing amenity and ecological benefits and their role in regeneration and as a focus for development. Moreover, the waterways contribute to the tourism and visitor economy and they have 'place shaping' potential – in other words the potential to foster distinctive and attractive developments.

The assessment seeks also to quantify the potential economic benefits both from the increased boating activities and from visitor activities generally. Regarding the former, it considers that the B&MK waterway would have the scope to accommodate at least one. and potentially two, 150 berth marinas creating an annual spend of some £650,000. Beyond boating, the waterways have become very popular as walking routes and as places where people can relax and enjoy nature; also their towpaths are much used for fishing (Hearns, D & Macleod, W, 2009).

A Variety of Benefits

The economic impact assessment pointed to significant economic benefits with £18-25m Gross Value Added (GVA) being contributed to the local and regional economy once the waterway were operational. Beyond that, further GVA would be added through increased employment in construction, tourism and the visitor economy. There could also be 'property value uplift', possibly 18-20% for waterside property and 8-10% for the hinterland up to 1km away.

Beyond that, there would be the potential to design the waterway to assist in flood management and to provide sustainable drainage, to extend the horse riding and cycling network (the last of these through the designation of part of the towpath as Sustrans NCN51, i.e. as an element of the UK's national cycle route).

There could be further substantial benefit were the project to encompass an innovative engineering structure such as a boatlift. At one point along the route, at Brogborough Hill just to the east of the M1 motorway there is a particular design challenge requiring a descent of some 30m. This calls for an imaginative engineering solution and a structure with the potential to become an 'iconic tourist attraction' (Bedford & Milton Keynes Waterway Consortium, 2011)

Finally, the completion of the link between Bedford and Milton Keynes would create a waterway circuit and network that would connect the Fenlands to the east and, indeed, the North Sea to England's South East region. This would provide new opportunities for leisure

boating and tourism, boosting the local and regional economy. It is also possible that the extended route could carry some limited freight traffic (Figure 5)

Delivering the Waterway – the Consortium

During its 15 years as the driving force behind the canal project, the Bedford and Milton Keynes Waterway Trust achieved a massive amount. Through its dedicated volunteers, sheer hard work and leadership, the Trust had developed the initial vision for the canal to a stage where it could become a practical proposition – in particular, the basic route is established and the potential benefits are now much clearer.

However, it came to be recognised that different organisational structures were required. In a statement made by former B&MK Trust chair Jane Wolfson, she noted that the project had 'made tremendous strides' but it had 'grown and matured beyond the capabilities of a single charitable trust' and that 'the time is right for our partners to share the lead in delivering the Waterway'.

So in May 2010, overall responsibility passed to the new Bedford and Milton Keynes Waterway Consortium. As shown in figure 3, its eight members comprise: the three local authorities; two 'navigation bodies' - the Environment Agency and the Canal and River Trust (the Trust replacing BWB); two bodies that would take care of the green and blue spaces - Milton Keynes Parks Trust (MKPT) and the Marston Vale Trust; and the Bedford and Milton Keynes Waterway Trust. Within this grouping, the founder body, the Waterway Trust, continues in its role of 'keeper of the vision' and organiser of community involvement – today the Trust has some 500 individual members (Bedford and Milton Keynes Waterway Trust, 2010).



Figure 3 – Membership of the Bedford and Milton Keynes Waterway Consortium

Discussion - Can the Waterway be Realised?

The fact remains that, twenty years on from the initial vision, and four years on from the formation of the Consortium, there is little outward evidence of the project on the ground. While the route seems to be secure, subject to the willingness of the local authorities to maintain their commitments in land use and other terms, could the obstacles that remain lead to a waning of interest with the waterway relegated to a very distant dream? In other words, a re-run of the original project albeit on a more stretched out timescale? So what are the real difficulties and how can the vision be kept alive and delivered?

Funding is the Problem As has been concluded already, the main outstanding issue is that of paying for the project at a time when public resources are particularly stretched. Here local authorities have been badly affected with services cut back and major redundancies in some areas.

And there is too a big question mark over the possibilities for private developers to contribute to the cost. For some time now, communities have benefited from planning gain through Section 106 funding whereby, for example, local schools have been expanded and parks and open space provided. Such works, or the payment of money towards them, have often been a requirement of a grant of planning permission. Another use of the mechanism has been for the provision of 'affordable housing', most usually as part of the planned residential development.

But in today's financial climate, developers are claiming that the Section 106 burden is too high and across the country they have been negotiating reductions in the amount of affordable housing that should be built, for example. In this context it is 'a tough ask' to expect developers along the waterway route to fund the construction of sections of the canal even though they would be required to set aside the necessary land.

Think Total – Build Piecemeal Nevertheless, it is at the level of what can be done in partnership with individual private developers, or in some cases on Council, MKPT, or other publicly owned land, that this waterway is most likely to proceed. So the project, including necessary improvements to the River Great Ouse in Kempston, Bedford has been subdivided into 26 packages labelled A-Z and the approach is to construct the waterway in small sections as opportunities arise (Bedford and Milton Keynes Waterway Consortium, November 2013). It is acknowledged by the Trust that the total project may take 10-20 more years to complete (Bedford and Milton Keynes Trust website, 2014).

The obvious point is that these small sections would need to be fully compatible with the overall route, meaning that the line and levels of the particular length of the waterway within which the section would be built would have to have been established and fully agreed. But, beyond that, how ready will builders be to actually provide the section within their development? Notwithstanding the conclusions of the economic impact assessment regarding 'uplift' from the waterway, it may be difficult to convince a typical developer that an initially isolated section of canal, even if filled with water, would be able to cover its costs (as a result of possible higher sales values).

As has happened already with this project, developers may prefer to transfer the land for their particular section to the local authority. While such action at least secures the land for the waterway, alternative – scarce - funding still has to be found to build it. And where the

land starts off in public ownership, whether that means ownership by the Council, by MKPT or some other body, that obstacle is the same.

Where the land is in public ownership and there are development prospects, the way forward will be to draw up a development framework or brief that provides for the waterway to be built as well as meeting overall planning requirements, and to find a private sector partner able and willing to deliver that framework. That process has commenced for some of the A-Z sections. Thus for the first two at the Milton Keynes end, the developments would be marina led (for section B nearest to the canal) and residential led (for the adjacent C1section) (Mabbutt, G, April 2014).

Considerable uncertainties remain over viability. That applies even for those areas with potential for residential or commercial development and there are other areas with no such potential. So even applying the chosen piecemeal approach, the initial implementation is likely to start slowly.

In addition to pursuing this opportunistic section by section approach, the promoters have also been thinking about the overall character and function of the waterway and the image that it should present. These matters are discussed further below.

Vision – beyond a canal The promoters view the waterway as a multi-purpose green corridor, in effect a sequence of waterway parks that would provide for local recreation as well as a continuous footpath and cycleway route and a canal for leisure boating. Thus, the Consortium's Terms of Reference refer to the Bedford Waterway Park, the Marston Vale Waterway Park and the Milton Keynes Waterway Park.

This multi-purpose use for the waterway accords with the recommendations of the economic impact assessment. And by combining the green and the blue, together with appropriate wildlife management, this parkland structure would provide rich opportunities for wildlife. As is happening already within the built up part of Milton Keynes, a new landscape feature would be created with scope to provide a wide diversity of habitats. Moreover, this would become a significant wildlife corridor enabling the movement and migration of fauna, for example bats and other mammals, and certain bird and butterfly species.

As has been mentioned earlier, the A-Z sections provide for some improvements to navigation in the River Great Ouse. These works would be in the context of the wider strategy for improving the river and the riverside environment which is being developed under the Bedford Waterspace Study (Vann.P, 2013).

Vision – place making At the same time there is the potential for the waterway to become an integral part of the master planning of individual developments along the route. Brindley Place in Birmingham (as referred to earlier) is a good example of a scheme where the associated waterway network helps create a particular sense of place but there many others. In the case of the Bedford to Milton Keynes project there are several possible sites where the waterway could become the central feature around which development could be structured.

In 2008 this almost happened. That year, the previous government shortlisted the Marston Vale eco town as one of a number of small new communities. Midway between Milton Keynes and Bedford, this would have been located astride both the present railway link and

the line of the proposed waterway (Bedford and Milton Keynes Waterway Trust, June 2008). However, the project ran into opposition and it was not proceeded with.

Illustrative Plans prepared for Bedford Borough Council for the Marston Vale Innovation Park show the waterway winding its way through the middle of this proposed office/commercial development and a waterside park along one stretch of the canal. With the land in Council ownership, this section could be the first part of the Waterway to be built. However, at the time of writing there were uncertainties over the funding of the Innovation Park, bringing the possibility that the land might need to be disposed of to a private developer (Bedford and Milton Keynes Waterway Trust, July 2014).

Inevitably, there are going to be limits to the extent to which the waterway can combine with development to create a real sense of place. There may be good technical reasons why such a corridor has to skirt a development area rather than pass through it. But even so the two should be visually and functionally linked rather than being segregated from one another. All too often existing development backs on to the local canal, preventing public access to the towpath and placing a monotonous solid fence along the common boundary. With the proposed new waterway we have the opportunity to avoid such mistakes.

Vision – an iconic structure? The challenge presented by Brogborough Hill provides an excellent opportunity to depart from the traditional flight of canal locks and develop new solutions to a sharp change of levels. In Scotland, the Falkirk Wheel has been developed as a revolutionary new approach to the boat lift principle. With its carefully balanced rotating arms this system uses miniscule amounts of energy to transfer boats in enclosed caissons between the levels. Because of its scale, its beauty as a dynamic engineering structure and the potential for tourists and other visitors to travel in it, the Wheel has come to be recognised as a truly iconic structure which has attracted large numbers of tourists and other visitors (figure 3).

Something on these general lines could well be applicable to Brogborough which is also well sited for access from the M1. Based on a similarly striking design and the technology pioneered by the Wheel, Brogborough could itself become the location for what could also become an iconic tourist structure. However, there is a question mark over its phasing; this site is remote from either end of the waterway and the likelihood is that it would be provided quite late in any development programme.



Figure 4 The Falkirk Wheel, Scotland

Conclusions

This is in several ways a remarkable project that has already been sustained for twenty years in the face of many complexities and frustrations. On the present basis, many more years are likely to elapse before the waterway could be fully open and the supposed economic benefits realised. Moreover, given present economic conditions, and the test of viability for each individual development and section, there can be no absolute guarantee that it will be built.

However, the project is led by a determined team who have been pursuing progress on several parallel fronts. This increases the chances of an early breakthrough leading to the first section of canal being dug. That would be a tremendous boost to the project and to team morale. In the meantime, morale has been sustained by good leadership, through the commissioning of the Trust's community boat *John Bunyan* now in service for cruises along The Great Ouse and providing publicity for the waterway cause and by the plan to use volunteers to dig a section of the waterway, probably within the Marston Vale area. The last of these would involve a partnership with the Waterway Recovery Group who have great experience of working around the country on this type of work.

Once a few sections of the waterway are in place, new possibilities are likely to emerge. Momentum will have been gained to join these up and to seek external funding for those linkages. This might be the stage at which the Consortium hands over responsibility for the final detailed delivery to the Single Purpose Vehicle envisaged in their Terms of Reference. There have been numerous delays and frustrations along the way but the signs are that the 200 year old vision will finally be realised.



Figure 5 The canal and river circuit that would be formed by building the Bedford and Milton Keynes Waterway

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Accelerator of the Entrepreneurship - Suburbs in the coastal metropolis of GOM

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1. Introduction

Polish model of suburban structure is made of variety types of enterprises in different scales, and a range of housing. However this mass of unordered structure with its urban development problems, often leads to the establishment of business and also the development of local entrepreneurship. This article investigates SME sector located in the suburban area of costal metropolis GOM to prove the thesis that the positive effect of Polish suburbanization process is the high level of entrepreneurship located there. Additionally, authors formulate the thesis that the communities adjacent to the central cities have higher economic activity than ones in the periphery. In their research basing on statistical data authors analyse economic activity in 44 communities in GOM in 2013.

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2. Briefly about the suburbanization process

2.1 The origins of Polish suburbanization

Suburbanization, as a special kind of urbanization is associated with urban development. The historical origins and rapid growth of the suburbanization in many countries like Great Britain or US is associated with the development of urban area in the first half of the XX century. In Poland the process of suburbanization results from political and economic after 1989. There are at least three forces which could be recognized as determinants of this process in Poland:

- hibernation of land ownership in the socialist times,
- enrolment in the socialist times of the rural areas to the city limits as it was growing,
- introduction of free market economy.

The first stimulant of the development could be seen as social opportunity change. Before 1989 the Polish communist government supported the idea to ensure all citizens equal access to housing in building blocks. The concept of having any ownership by the average Pole, and having single-family home surrounded by greenery was incorrect ideologically. It resulted in that only a few “meritorious” could afforded it. Furthermore, the development of a typical suburban zone meaning sprawl of the city beyond its administrative boundaries were necessarily rendered impossible. As the city was growing by the investment, these areas have been systematically enrolled in other areas of the city limits. Thus, there have been still no 'transitional’ zone between the city and village.
In 1989 when Poland regained freedom, finally thus the self-determination of society of having single-family home was finally possible to implement. Thus, it seems very obvious that suburbanisation process boomed. The process has been manifesting the individual social needs of owing a housing on the outskirts of cities and in their environment.
The last force of Polish development on the outskirts of the cities was the transformation of Polish economic system from planned economy to the rules of the free market. The revival of the real value of land rents caused that a number of projects have begun to be implemented on the periphery of urban centres, where real estate prices had been significantly lower than in the centres of cities. In

addition, a number of projects could not be realized in the city centres because of formal reasons like legislations.

Suburbanization processes ongoing in various countries in Europe and the world are not homogeneous. This is due to the fact that the suburban areas in different countries are shaped by different social, economic and spatial factors. Despite, analysis of the literature describing the process of urbanization in Poland, shows that authors characterize it often citing European or American examples [Kamieniecki 2002, Radziejowski 2006], skipping Polish economic and social conditions. Furthermore, analysing the causes of suburbanization, presenting Polish-specific phenomena such determinants are described:

- lack of tradition of "efficient" use of land;
- lack of tradition, local practices and standards for use of space;
- weakness of spatial planning, mainly in the local scale, manifesting itself in freedom in preparing spatial development plans and their easy alterations "[Fogel, 2012].



Figure 1: Polish suburbs

However, apart from appearing in the suburban areas residential functions, exists in Polish landscape the second form of suburbanization. It appears as commercial or industrial and more often local entrepreneurship urban tissue, sometimes technology parks surrounded by residential buildings. In Poland suburbanisation process mainly concentrated in major cities and the suburban areas: Warsaw, Tri-band, Poznan, Wroclaw and Krakow. However, high dynamics of this phenomena also occurred in the Eastern Polish cities such as: Lublin, Bialystok, and Rzeszow or Olsztyn (Figure 2).

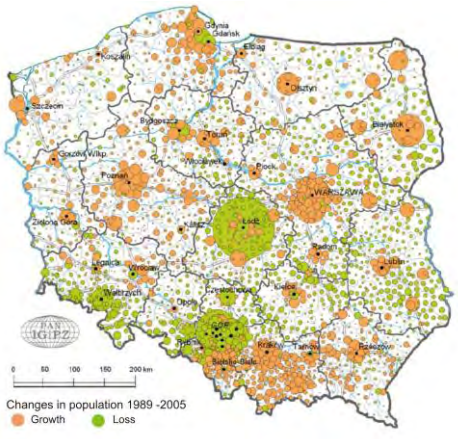


Figure 2: Changes in population 1989 -2005
Source:Lisowski 2009, 234

2.2 The characteristics of Gdansk Metropolitan Suburbanisation process

Gdansk Metropolis is subject to a similar extent of suburbanisation process as other metropolitan regions areas. The Tri-city bypass is the most powerful stimulant of the development process. This is currently the main transport system network in the area. Arranged around the bypass, we can observe a growing suburbs. These areas are different communities (Figure 3).

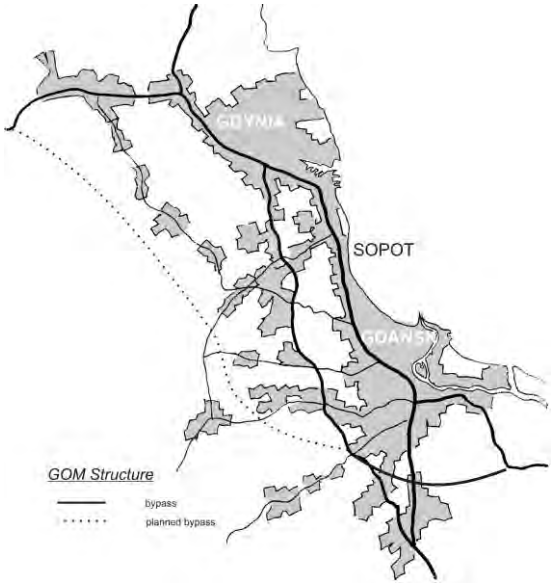


Figure 3: Structure of GOM

Basic functions located in this area are a number of residential buildings with very diverse structure but as well various economic activities, of which the foreground stand out the character trade, namely: hypermarkets, warehouses, gas stations, etc. The systematic improvement of the quality of roads access to 'bypass' will deepen this process. Moreover, the process of building a new Metropolitan bypass has been emerged. Those decision would definitely strengthen and accelerate the process of suburbanization in the region. The dynamics of the process can be observed in the analysis of migration statistics (Figure 4). It illustrates the relationship between migration and the processes of residential suburbanization.

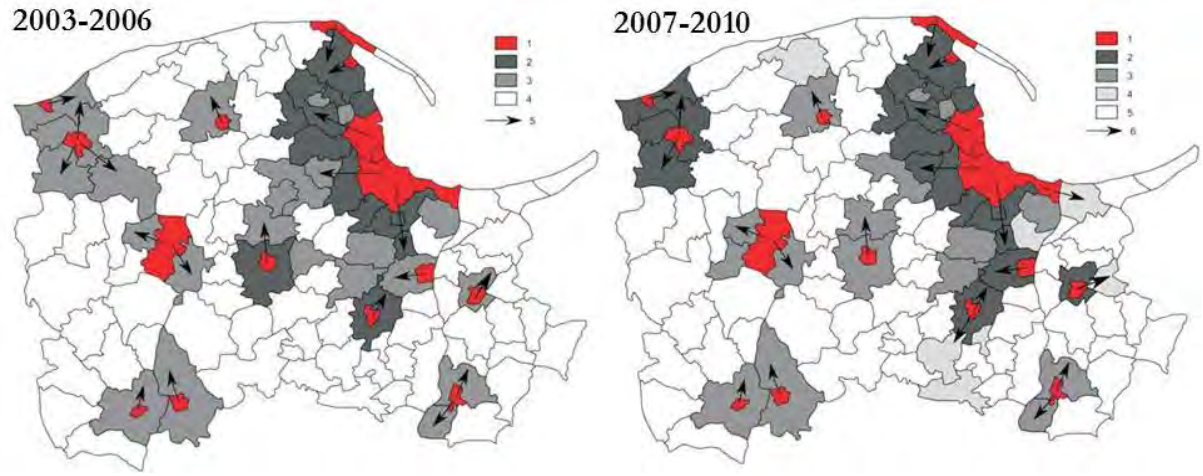


Figure 4: The relationship of migration and processes of residential suburbanization
Source: Czynniki i ograniczenia rozwoju miast województwa pomorskiego, 2012

Although the urban center (Gdańsk, Gdynia, Sopot) is the area of the highest concentration of population in the labour market, it does not provide an affordable and attractive offer of investment areas and new housing stock. These cities, including Gdańsk, exhibit diverse growth of population and housing, but as a whole Tri-City loses population. The population of Gdansk amounts:

- 2012 – about 460,5 thousand,
- 2002 – about 461,6 thousand,
- 1990 – about 465,1 thousand.

Decline in population does not inhibit the development of new housing on large areas (Gdańsk South). Gdańsk reduces the number of people, often losing the wealthiest and most active group of people who search of a higher standard of resident, so that move to suburban communities. On the contrary, the functional urban area shows both the demographic and investment dynamics. The highest migration rate in the period 2007 - 2010 amounted following communities:

- Pruszcz Gdanski 38,4 promile;
- Kosakowo 29,8 promile;
- Żukowo 25,7 promile;
- Kolbudy 24,0 promile;
- Szemud 22,0 promile.

In the context of investment activity, we can analyse the number of new completed buildings. The highest indicator calculated as new buildings per 1000 existing ones in years 2008 – 2010 were recorded in the following communities:

- Pruszcz Gdanski 63,5;
- Choczewo 58,0;
- Kolbudy 53,0;
- Wejherowo 48,1;
- Kosakowo 46,5 [Dzialek, 2012].

Taking into account the migration rate and new building indicator , we can select the communities of GOM with the highest rate of suburbanization in period 2007 – 2010: Puck, Kosakowo, Wejherowo, Luzino, Szemud, Przodkowo, Żukowo, Kolbudy, Pruszcz Gdanski, Pszczolki, Tczew, Starogard Gdanski [Dzialek, 2012].

Observing the development process of suburbanization in the GOM it may seem that it entered the world trends - dynamic processes of urbanization mostly "spontaneous" or even "chaotic", not full-fledged shaping the spatial structure . This is due to:

- transport accessibility and the price of land;
- the supply of building land in response to the demand - the owners are trying to sell all the land area that can find potential buyers.

On the contrary authors suggest that this process also positively influences on the suburban areas. It seems that the specificity of Polish suburban areas is also high economic activity in SME sector, boosted in the last 20 years.

3. SME sector in Poland

Entrepreneurial spirit is characterized by innovation and risk-taking, and is an essential part of a nation's ability to succeed in an ever changing and increasingly competitive global marketplace. People establishing business activities have various motives – from economic and social to the will of accomplishment. However, it is unknown what configuration of motives has the greatest influence on the success of an undertaking. Entrepreneurial attitudes of the Polish society are ambiguous. On the one hand, in comparison to other European countries we come off quite positively in terms of a willingness to start up an enterprise in the nearest years, we also assess very well our knowledge on running an enterprise. The analysis of the results by some indicators shows that entrepreneurship defined as the share of adults who have started a business or are taking steps to start one, reaches the level of 25% - as compared to the EU average of 23%. The largest difference as compared to the EU average occurs in relation to the following indicators: "feasibility of becoming self-employed", defined as the percentage of adults who think it is feasible to become self-employed (Poland - 49%, EU - 30%), "preference for self-employment " measured as the percentage of adults who would prefer to be self-employed (Poland - 47%, EU - 37%) and “entrepreneurial intention", i.e. the percentage of

adults who intend to start a business within the next 3 years (Poland - 22%, EU - 13%)[Report, 2012][1]. On the other hand, our society lacks the ability to notice business opportunities. What is more, a percentage of people who are able to perceive them, has decreased over the years 2011-2012 by about 13 p.p. Comparing to other European countries, the Polish society is characterised by a very high level of fear of failure [Zbierowski et al., 2013]. Fear of failure is an important factor that limits the level of entrepreneurship at the national level. Despite an identified opportunity and the will to use it, and despite of positively perceived capabilities, some entrepreneurs give up the establishment of a business. In Poland, the fear of failure is much higher than in the comparable countries and it might be an essential factor that hinders the entrepreneurship. Over 58,7% of Poles think that fear of failure can prevent them from starting up a business. The number of businesses established due to will to seize an opportunity is only slightly higher than the number of enterprises started up out of necessity. It might be evidence of a low development potential of Polish enterprises. A more disadvantageous ratio of the opportunity-driven entrepreneurship to the necessity-driven entrepreneurship can be found only in Bosnia and Herzegovina, Iran and Pakistan [Zbierowski, et al., 2012]. Unfortunately, value of the indicator of people perceiving business opportunities for Poland is low [2]. Slightly more than one-fifth (20,4%) of people perceive business opportunities. The above demonstrates a high level of uncertainty about the pursuing a business. To sum up strengths and weaknesses of entrepreneurship in Poland, we present them in the Table 1.

Strengths	Weaknesses
High entrepreneurial intentions	Low capability of noticing business opportunities
High assessment of business knowledge	High fear of failure
Desirable career choice	Low social status of entrepreneurs
	Relatively low number of established enterprises
	Low percentage of ambitious enterprises
	High percentage of discontinuation of business
	Very high percentage of enterprises started up out of necessity

Table 1. Balance of entrepreneurship in Poland in 2012
Source: based on Global Entrepreneurship Monitor 2012 data.

At present about 1.8 million businesses are currently operating in Poland. As compared to 2010, this figure has increased by 3.4%. The vast majority of them are small and medium-sized enterprises (SME) (99,8%):

- Microenterprises 95,9% Poland (92,5% EU),
- Small businesses 3,1% Poland (6,2% EU),
- Medium-sized enterprises 0,9% Poland (1,0%EU).

As compared to the EU average, the SME sector in Poland is increasingly dominated by microenterprises. In 2010, Poland was among the EU countries with the highest number of new enterprises. In comparison with the other EU countries, the industry structure of enterprises in Poland is slightly different. Nearly three-quarters of Polish SMEs operate in trade (35.5%, as compared to 28.6% in the EU) and services (36.3%, against 45.9% in the EU), one in seven in construction (15.8%, against 15.2% in the EU) and one in ten in industry (12.5%, against 10.4% in the EU). As compared to the average for EU countries, Poland is therefore characterized by a much larger number of enterprises operating in trade and a smaller number of those operating in the service sector. However, the industry structure of Polish enterprises is gradually changing (the number of service enterprises

[1] The value of this indicator is higher only in Romania.
[2] It is measured by the percentage of persons who claim that there are good conditions for business start-up in their neighbourhood within the next six months. That rate also falls as the economic development decreases – the average for factor-driven economies amounts to 53.6%, in the case of efficiency-driven economies it is 40.3%, and in the case of innovation-driven economies it is 34.9%.

has been increasing, and consequently the Polish structure resembles the EU structure). In Poland, in contrast to the global trend, small businesses have a very low share in the industries belonging to high-tech industries. In most developed countries, small firms dominate the industry of IT, automation, specialized chemistry. In Poland, however, these companies dominate in the repair, manufacture and construction.

The majority (92.1%) of all businesses in the SME sector are natural persons conducting an economic activity. Legal persons and entities without legal personality represent 7.9% of small and medium-sized enterprises. According to data from the Central Statistical Office, Polish micro and small companies provide the majority of jobs (52%, 4.7 million people) in the enterprise sector. One in five persons employed works in medium-sized companies (18.2%, 1.6 million people), and one in three in large enterprises (30%, 2.7 million people). In terms of structure of the enterprise sector's contribution to GDP, SMEs generate every other zloty (47.3%), whereas the smallest companies account for nearly every third zloty (29.4%) generated.

The Eurostat figures indicate that the sector of micro and small enterprises in Poland is clearly smaller than in the EU, as measured by the contribution of this sector to the generation of gross added value by enterprises. According to the available data, microenterprises in Poland account for 15.9% of gross value added of businesses, while in the EU-27 their share amounts to 21.2% (5.3 percentage points difference). A similar difference is observed in the case of small enterprises (5 percentage points - 13.2% and 18.2% respectively). Medium-sized and large companies evidently contribute to a greater extent to the generation of gross value added in Poland as compared to the EU-27 [Report, 2013]. The SME sector has a full range of functions, not only economic, but also an important social ones. The primary social function performed by the SME sector in Poland is the formation of an economically independent middle class. It is commonly believed that the prosperity of the state and the smooth functioning of the market mechanism depend on the degree of development of the middle class in the society. Additionally, efficient business processes are created because of the propensity of SMEs to the use of local resources and the ease with which these resources are able to use, increasing affluence in the region, changing lifestyles owners and employees based on the free market choices, economic freedom and effective enterprise. The social function of Polish SME is also reducing social costs and to alleviate social tensions associated with economic transformation.

4. Economic activity in suburban periphery communities in GOM

According to our preliminary results of business statistics and spatial analysis made by authors in 2012 and 2013 within GOM [Martyniuk-Peczek, Martyniuk, 2012, 2013], we can formulate the thesis: The communities adjacent to the central cities (Gdansk, Sopot, Gdynia) have higher economic activity than ones in the periphery.
In order to describe the economic activity in the studied areas, authors calculate the number of SME per 10 000 working – age population in:

- 5 districts (gdanski, kartuski, wejherowski, pucki, nowodworski) adjacent to central cities;
- 44 communities within these districts.

For the study purpose we divide the communities in two groups:

- Group A – adjacent to central cities (13) (green in Table 2);
- Group B – periphery (31).

The analysis takes into account companies by size classes:

- Microenterprises (0 -9 employees);
- Small enterprises (10 – 49 employees);
- Medium – sized enterprises (50 – 249 employees).

As compared to the national average, the SME sector in analyzed area is dominated by microenterprises 96%, small companies represents only 3% of SME, medium – sized companies 1%. Average number of enterprises per 10 000 working age inhabitants in analyzed communities amounts as follow:

- Microenterprises 3045,1;
- Small enterprises 87,85;
- Medium – sized enterprises 0,95.

The highest economic activity is registered in Krynica Morska 5 384,7 companies per 10 000 working age inhabitants, the lowest in Nowy Dwór Gdanski (rural areas) 883,1 companies per 10 000 working age inhabitants. Median in the population amounts to:

- SME in total 1604,35;

- Microenterprises 1531,9;
- Small enterprises 48,85;
- Medium – sized enterprises 7,5 .

Dividing the population into the groups above and below median, we observe that nearly all communities from group A have the number of SME per 10 000 working age inhabitants higher than median (Table 2).

Community	Micro (0-9)	Small (10-49)	Medium (50-249)	Total
Krynica Morska	5235,4	149,3	0	5384,7
Jastarnia	4543,2	44,5	4	4591,7
Wladyslawowo	3401,3	41,2	11	3453,5
Hel	2547,9	50	8,3	2606,2
Pruszcz Gdanski city	2163,2	79,7	18	2260,9
Kosakowo	2113,8	38,7	6,5	2159
Pruszcz Gdanski	2007,4	74,3	9,8	2091,5
Sztutowo	2047,5	38,2	4,2	2089,9
Żukowo - city	1959,4	93,1	31	2083,5
Kolbudy	2000,4	70,6	11,1	2082,1
Kartuzy - city	1896,5	85,3	27,3	2009,1
Puck	1889,3	89,1	21,6	2000
Żukowo – rural area	1769,8	71,3	11	1852,1
Rumia	1795,7	41	11,1	1847,8
Stegna	1765,2	42,1	6,2	1813,5
Wejherowo	1731,4	58,4	15,6	1805,4
Żukowo	1721,5	65,7	15	1802,2
Reda	1616,5	49,8	4,5	1670,8
Szemud	1604,9	50,8	11	1666,7
Kartuzy	1591,6	60,4	14,1	1666,1
Wejherowo	1573	39,5	12,3	1624,8
Nowy Dwór Gdański - city	1522,2	73,7	19,9	1615,8

Table 2 SME sector in TMA communities (above median)
Source: own study based on BDL data base 20/07/2014

The exception is only the community Cedry Wielkie. It means that in 12 out of 13 communities adjacent to central cities the number of SME is higher than in periphery communities. The average in group A amounts 1860,25. It is lower than average in whole population. However, if we eliminate 4 seaside communities (Krynica Morska, Jastarnia, Władysławowo, Hel[3]), the average in the population decreases from 3133,9 SME to 1572 SME. As expected, communities close to the central cities have higher economic activity then in the periphery. Preasumably, one of the reason can be migration of young creative middle class from the central cities to the suburban areas because of the standard of living and prices on the real estate market.

5. Conclusions

In Poland suburbanization is not a synonym for sustainable development, it is quite the opposite. The following step is the rapid expansion of agricultural lands, leaving a degraded urban areas. It was

[3] In these seaside communities exists a lot of rental room services which substantially create the specific SME sector in them.

started after 1989.The response to these spatial changes in the economic sphere was the dynamic development of the micro, small and medium-sized enterprises. Authors attampted to identify the relationship between both processes. By observations and staistical studies indicated that suburban zones around GOM are areas of intense economic activity of SME, higher than in pheriperies and central cities. So that, authors called suburban areas as an entrepreneurship nests. It can be questionned, if it is typical just for GOM or for all Polish suburban areas distinguishing them from their counterparts in the United States or Western Europe.

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Return the riverfront to the enjoyment of the people

The case of Lisbon

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Synopsis

The new Lisbon's vision is defined in three major's objectives: more people, more jobs and better city.

The historical relationship between the city and the Tagus estuary requires particular attention to the regeneration of the riverfront in the framework of urban planning, to have a better and more attractive city.

Framework

Lisbon, until the 19th Century, was developed in the central hills and along the riverfront.

Despite Lisbon was known during centuries as port city, with a big importance during the 16th Century in the first steep of the globalization (with the Portuguese Discoveries), the harbor activities were mixed with other city functions.

The relationship between city, port and estuary was quite balanced along centuries. But, during the final quarter of the 19th Century, was constructed a new commercial harbor, creating new embankments, which have created new barriers between City and Tagus River, broking the ancestral relationship of those two elements.

With the new commercial port, new industrial areas were developed along the riverfront, emphasizing the gap between city and river.

During the 20th Century, the industrialization process of metropolitan area increased, and Lisbon's harbor resulted multipolar with wharves in both banks and locations of the river.

This process creating an industrial decline inner city: first in the central and occidental part, and after, in the last quarter of the 20th Century, in the oriental part.

A new governance framework was created in 2009 in Lisbon´s riverfront, with the jurisdiction transfer between Central State and City Council of former harbor areas.

This industrial decline, allied with harbor areas contraction create a new opportunity to think in an integrated way the Lisbon's riverfront future, to rediscover the relationship between city and river.

The vision

The new Lisbon's vision is defined in three major's objectives: more people, more jobs and better city.

The objectives are anchored in a diagnosis of depopulation, operated in the last forty years in the metropolitan city center, and a profound transformation of the functional relations in the metropolitan area, with a deindustrialization process accompanied by the increasing of the tertiary in the economy that extended to the urban periphery.

This three major objectives were translated in the new Lisbon's Master Plan in seven goals: attract more inhabitants; attract more companies and jobs; stimulate the urban rehabilitation; improving the public spaces; return the riverfront to the enjoyment of the people; promoting sustainable mobility; increase environmental efficiency.

To regenerate the riverfront, the Master Plan proposes: conversion of the riverfront with predominantly recreational urban use, leisure and watersports; harnessing new interventions to create more public space; reduce the importance of riverside promenade as main road axis; increasing cases of transposition of the railway and roads to promote the access to the riverfront for pedestrians.

The riverfront conversion is also an opportunity to create new open spaces and public facilities, that aren't possible in the nearby historic city.

To consolidate these goals, the city, in partnership with diverse stakeholders, has been working on a set of plans and projects that converge to Lisbon's riverfront integrated regeneration.

The Plans and Projects

To speak about the plans and projects we are developing in the riverfront, I propose a travel from the occidental to the oriental part.

In Pedrouços, in the end of the occidental part of the city, we are converting the old fishing dock and market in a new dock dedicated to oceanic regattas, like Volvo Ocean Race.

Connected with the Pedrouços Dock was built the new Champalimaud Foundation, inaugurated in October of 2010, with a project of Charles Correa, an Indian Architect.

The extraordinary architectural project is more than a building project: it generates new public spaces and the building program constitutes a regeneration anchor of the riverfront.

The Champalimaud Foundation is a Portuguese organization dedicated to an advanced biomedical research and clinical care of excellence.

Near the Presidential Palace of Belém was built the new Carriage Museum, projected by the Brazilian Architect Paulo Mendes da Rocha.

The building was implanted in old military industries facilities; it creates a new oriental façade of the Belém monumental area, and a new link with the riverine promenade.

This fantastic building will house the largest carriages collection of the world, and the most visited museum of Portugal.

In opposite south, near the river line, we have the Electricity Museum, in an oldest coal power plant, managed by EDP (our National Electrical Company), which intends to build a new Arts Center in the same complex.

The new Arts Center, designed by Armanda Jane Levete, a British Architect, is a very impressive project: the building's roof create a new public space, with a viewpoint over the Tagus and a new linking between city and river, across the railway line.

In Alcântara, a former industrial area, linked with the most important wharves of the Lisbon´s Harbor, we make an Urbanization Plan, coordinated by the Portuguese Architect Manuel Fernandes de Sá.

We intend that the Urbanization Plan promotes the regeneration of Alcântara area, creating a new urban hub linked with the existing and planned public transports net.

Alcântara is an important transport hub, which has been connecting the urban transport service and the metropolitan transport service. This hub has a potential development with a new links between the ring railway line and the Cascais railway line and the future subway line extension.

Because an important part of the people who work or study in Lisbon lives in the Metropolitan Area, one of the new Master Plan's most important idea is developing the new urban hubs linked with the transport hubs, to promote a sustainable daily commuting.

On the other hand, the plan intent to create a new green corridor between the Lisbon´s biggest urban park, Monsanto, and the Tagus estuary.

The green corridor will be created in our most important valley (Alcântara Valley), which drains the city´s largest drainage basin.

The Alcântara's drainage basin have frequent floods problems, caused by the combination of soil sealing in upstream areas and more frequent extreme climatic events.

This green corridor is an opportunity to respond the needs of climate adaptation and create new good public spaces, to improve the quality of life for all who live, work or visit this area.

In Alcântara, at Lx Factory, appeared a new regeneration concept by the old industrial buildings reuse. This experience is very important to thinking the urban regeneration approach in crises times.

The Lx Factory is an actual vibrant cultural hub in the Lisbon's occidental part. With an old industrial facilities reuse, there are new creative activities, restaurants, book shops and other alternative shopping places.

Approaching historic center, in a former industrial area, conquered to the river in the 19th Century, the Boavista Landfill has been a mix between a regenerated industrial facilities in a university or professional schools and empty spaces.

The Boavista Landfill Detail Plan, coordinated by the Lisbon's Architect Carrilho da Graça, pretend redesign the place reinventing the traditional site occupation, through narrow streets perpendicular to the river, that flare into small squares, into Mediterranean style.

The main idea is creating in Boavista Landfill an integrate urban regeneration, using, as main ingredients, the link with the transports hub to create an urban hub, witch the new EDP headquarter, an Manuel Aires Mateus project, is an anchor.

The new Boavista Landfill will be connected with the riverfront, across the railway line, with a pedestrian overpass.

In the opposite railway side, at the riverfront, the Santos Wharf is in conversion process, with a partnership between the Municipality and the Harbor Authority.

The main ideas are: creating new public spaces open to the Tagus and linking with the historic city, conversion to new uses, as nautical recreational activities and other recreational uses, and connect this area with the city's riverine bike lane.

To maintain the traditional character of the streets in the surround hilly historic city, and its secular visual relationship with the river, the new buildings align in Santos Wharf must respect the visual perspectives of perpendiculars streets to the river in the opposite interior land area.

Between the Boavista Landfill and railway line, by the coordination of Grade Ribeiro and João Almeida, we are developing the project to renew the 24 de Julho Avenue, to reduce the road lanes into a new boulevard which invite pedestrians to enjoy the urban space.

This future new boulevard is connected, in the oriental part, with an important group of urban spaces that we are intervening: Cais do Sodré and Corpo Santo, with a Bruno Soares project; Ribeira das Naus, with a João Nunes project; Praça do Comércio, with a Bruno Soares project, and Praça das Cebolas, with a Carrilho da Graça project.

This group of urban spaces projects is improving the relationship between the historic center and the river, and create new spaces witch is possible people enjoy the riverfront.

Our historic center was rebuilt after the earthquake occurred in 1755, with an illuminist plan. All the rebuilt process was quite modern: we developed new structures to resist a new earthquake and, for the first time at the 18th century, we developed prefabricated construction in an industrial way.

In 2011 the Municipality approved the Baixa Pombalina Detail Plan to promote the integrated urban regeneration of this particular historic district.

The Detail Plan is a contemporary reinterpretation of the 18th Century plan, gives the particular rules to the rehabilitation of each building, according with the National Institute of Heritage practices, and also concern with the buildings seismic resilience, in urban renewal process.

The plan pretend the public space improvement, the private cars traffic decrease and promote public facilities, to improve the quality of life, to attract more inhabitants into the city center. These particular goals are also important to assert Lisbon as a tourist destination.

As anchors of urban regeneration, there are some important projects:

- the MUDE (Fashion and Design Museum), inaugurated in 2009, which reuse a former bank headquarter;
- The Lisbon Story Center, an interactive equipment that tells us, from past to present, the major city events, located in the renewed main square, Praça do Comércio;
- The Currency Museum, located in the recently renewed Bank of Portugal headquarter, projected by the Portuguese Architect Gonçalo Byrne;
- The new lifts between down town and Castle, which create new facilities - parking places, supermarket and a panoramic terrace and restaurant in the top.

The new lifts are integrated in a general strategy to improve the pedestrian accessibility into the city's central hills. This idea is very important to link the hilly areas with the down town and public transports facilities, as the subway. It is also important to promote social cohesion, when we think that in the central hilly areas living oldest people, in most cases isolated.

Continuing our travel to the oriental part of the city, connected with Praça das Cebolas, in the Jardim do Tabaco wharf, is projected the new Lisbon's Cruises Terminal, whose authorship belongs to the Architect Carrilho da Graça.

The new Cruise Terminal isn't just a new building, is an urban intervention, witch create a new public space: a new garden near the historic center and the medieval neighborhood of Alfama.

With this project the city historic center will have two new riverside gardens: Ribeira das Naus, in the occidental part, and Jardim do Tabaco, in the oriental part.

Jumping to the extreme oriental part of the city, we arrive at Parque das Nações, the area transformed to host the Lisbon World Exposition, in 1998.

The Expo 98 was a very important urban large scale regeneration experience of old brownfields in the city's oriental part, with 340 ha of intervention area.

Now, the actual Parque das Nações is a modern and high standard neighborhood, one of the touristic hubs, grace of the new pleasant public spaces, cultural, and ludic facilities.

Its central area won a new economic hub, where is located many important new technologies company headquarters, well linked with main railway line and highways of the country, public transports and nearby Lisbon airport.

The Expo 98 urban reconversion experience was also a very important to offer great open and public spaces to the enjoyment of the people in the riverfront.

There was also here the climate change adaptation strategy began to be implemented, changing up the elevations of the terrain.

The actual challenge is linking this neighborhood with conversion process of the nearby old industrial areas.

At the railway opposite side, in the surrounding area to the East Station (a Santiago Calatrava magnificent project), the Municipality began developing an Urbanization Plan, coordinated by the Catalan Architect Joan Busquets.

In this site, the future plan proposes the urban regeneration of this old industrial area in continuity with the Parque das Nações business district.

Connected with the south of Parque das Nações, there are brownfield areas to renew, which are approved an urban project and a detail plan: Braço de Prata, coordinated by the Italian Architect Renzo Piano, and Matinha, coordinated by the Portuguese Architect Manuel Salgado.

These two interventions propose extend the Parque das Nações area into city center direction, regenerating old industrial sectors.

On the other hand, they are strategic to promote the improvement of riverine public spaces, and formalize the ecological structure, linking the terrestrial wet system in the riverfront with the interior valleys.

Future challenges

The possible transfer to the Setúbal Harbor the harbor cargo terminal located between Santa Apolónia and Poço do Bispo, and a possible functions transfer in the actual Santa Apolónia Rail Yard, can open a new territory to think the link between city and river in the Lisbon's oriental sector.

This considerable territory can be strategic to the urban regeneration in city's oriental area. There can be an opportunity to redesign the riverfront landscape, creating new open and green spaces connected with the interior valleys, as contribution to improve the surrounding urban spaces quality, and decisive for the climate change adaptation strategy.

Conclusions

All together plans and projects run responses to distinct problems and programs: improvement of public spaces as important anchors for historic central district rehabilitation; the conversion of old industrial areas and old harbor areas to new urban uses, as important opportunities to rebuilt a new continuity between the city and the river, or a continuity between new regenerated areas and the historic central district; the need to redesign the landscape, seeking continuity of the ecological system, mainly in the wet system (linking the riverfront and the valleys), as a contribution to climate change adaptation.

The different plans and projects, in their different scales and urban contexts, all together converge to consolidate of the city's vision contained in the new Master Plan.

Green & Blue: Documenting the Contribution of Waterfront Eco-Districts to Stockholm's Green Profile[i]

Mitchell REARDON & Ryan WEBER; Nordregio; Canada/Sweden

Commonly referred to as a "the Venice of the North" Stockholm is made up of fourteen islands. As a result, water heavily defines the city's built environment. The relationship between water, the city and its residents has existed since permanent settlement in this strategically important location. From its initial usefulness for trade and mobility, water became an essential element in the city's industrialization, which also led to significant water pollution. Stockholm has a long history of working to safeguard its environment and notably, its water. These efforts towards greater environmental sustainability were rewarded when the city was recognized as the first European Green Capital in 2010. A major aspect of Stockholm's contemporary green success has been the development and promotion of flagship eco-district projects. Beyond the significant environmental benefits, these waterfront eco-districts have become well-known around the world as good practices in urban sustainability. Building on Sweden's strong reputation as an environmental leader, this trend has helped to establish Stockholm as a leader in the cleantech sector. This paper explores the connection between Stockholm's renowned eco-districts and the growth of its cleantech sector. In doing so, the evolution in the city's urban development approach to these projects, along with a much broader political and socioeconomic shift as well as the potential for transferability are explored.

Introduction

When development in Stockholm's Hammarby Sjöstad was undertaken in the 1990s, it not only represented the biggest urban development project undertaken in more than 20 years, it also represented a new avenue through which the City of Stockholm could promote sustainable development. Less than a decade after Hammarby Sjöstad was defined as an eco-district, planning for Stockholm Royal Seaport, another eco-district of similar scale, and which had the intention of learning from its forerunner, was initiated. In the years since they were established, the city has leveraged these projects as a means to support their own sustainability goals, develop their knowledge and institutional frameworks for planning for urban sustainability and to support the development of the clean tech sector more generally.

Stockholm refers to itself as "The City on the Water" in its comprehensive plan, and both eco-districts, as waterfront urban neighbourhoods, are well integrated into the City's broader planning strategy related to its green and blue spaces. This includes a focus on increasing recreational access to the shoreline, improving the role of waterfront areas as multimodal transportation hubs, enhancing the City's port facilities and improving local water quality (City of Stockholm, 2010).. Further, since 2003 (City of Stockholm, 2003) economic growth has become increasingly prominent in the City's environmental program, first through efforts to promote "attractiveness" and more definitively in the 2008 program, where it was stated that sustainable development does not stand in contrast to economic growth (City of Stockholm, 2008), an indication of these City's efforts to promote green growth. These efforts are clearly evident in the Hammarby Sjöstad (HS) and Stockholm Royal Seaport (SRS) projects.

Stockholm's efforts towards the environment, urban sustainability and green growth are well established in the international planning and policy world. The City was recognized as the first European Green Capital in 2010, and was profiled in one of the OECD Green Cities Programme's four metropolitan-level case studies on green growth in cities. However, one thing missing in the OECD report, as well as in the current discussions surrounding both HS and SRS (as well as eco-districts more generally) is a closer analysis on the extent to which these projects have helped scale up Stockholm's green profile, particularly in terms of supporting the development of its cleantech sector. Such an analysis is needed given that profiling of Swedish technologies has been a main objective of both eco-districts.

From an international perspective, while not without its issues, the coupling of eco-districts and green growth presents incentives for different actors to pursue such an approach, along with the environmental, social and economic incentives. Our aim is therefore to analyze the success of Stockholm's waterfront eco-districts as "planning projects", and their role in bolstering Stockholm's clean tech sector. In doing so, we describe the importance of the eco-districts for initiating urban sustainability efforts in Stockholm and provide key transferability messages. We also suggest that this type of analysis can be used to further motivate the use of eco-districts as widely integrated approaches to urban and business development.

We begin with a conceptual discussion of eco-district before elaborating on mixed method approach. Next, a discussion on urban sustainability in Stockholm provides a view to how the issue has developed through time. This includes a profiling of both HS and SRS as eco-districts in Stockholm, which has a focus on the features of the developments and the planning and governance processes involved in realizing them. This is followed by an analysis of the connection between the eco-districts and the cleantech sector, using both existing statistical information as well as a number of interviews with key stakeholders. Transferability messages are then highlighted, prior to the concluding remarks.

Methods

Based primarily on research carried out during the INTERREG IVC REGREEN[ii] project, this paper also draws on material gathered during the FP7 SUME[iii] and ESPON TANGO[iv] projects, augmented by smaller studies carried out by the authors. Case studies and reports prepared for these projects have focused on Stockholm's eco-districts from a diversity of perspectives including their influence on the region's green growth, governance to promote resource efficiency, role in the region's urban development and their metabolic impact.

Qualitative material for the article comes mainly via a literature review, interviews, firsthand observation and a situated research perspective. The literature review focused on key contemporary articles and books examining Stockholm's eco-districts, while adopting a broader geographic scope in regards to the connection between eco-districts and waterfronts. For interviews, in speaking with a range of urban development actors in Stockholm, we hoped to gain a deeper understanding of the underexplored connections between eco-district development and green growth in Stockholm. Inspired by Forester (1989, 2000) and Sandercock (2000); discussions with the actors served to provide an understanding of the planning situation that was not present in theoretical debates or official plans. In total 26 semi-structured interviews were carried out between 2009 and 2014, with urban planners from the City of Stockholm and Stockholm Region; grassroots organizations; private planners, architects and developers; representatives from HS and SRS; researchers; housing organizations and clean tech companies, including several specifically for this paper.

Building on a tradition elucidated by Jacobs (1961), that there is no substitution for firsthand experience, firsthand observation and a situated research perspective augmented the authors' understandings of how the eco-districts contribute to green growth and improved their about the physical location. A situated research perspective was achieved through many tours of the districts that the authors have hosted for visitors from around the world. The perspective has been greatly augmented by the fact that one of the authors has lived in HS since 2012. As Flyvberg (2004) argues, it is only when the researcher is situated within a context that the most significant levels of understanding can be achieved.

To quantitatively study the contribution of HS and SRS to cleantech development we investigate the potential linkage in two steps, taking each as far as possible. In Step 1, we examine the available published statistics related to development of the cleantech sector; gaining knowledge on what type of information is (and isn't) available through organisations such as the OECD, the EU's Eco-Innovation Observatory, Eurostat, Statistics Sweden and Vinnova[v]. In attempting to better represent the contribution, Step 2 identifies a representative sampling of "clean tech" firms based in Stockholm and evaluates their development. Here, we turned to the EnviroSweden portal, which includes 591 companies that have the common objective of "showing Swedish environmental technology to the world" (EnviroSweden, 2014). From this list we identified 51 companies that a) indicate that their head office is in the Stockholm Region, and b) that participate in activities potentially attributed to eco-district development (including any variety of product and service activities relating to waste, water, air quality, energy buildings and transport, and excluding activities related to primary production). While this certainly does not represent the full coverage of clean tech firms in Stockholm, it illustrates a new approach to interpreting the coverage of the sector and measuring sector trends in Stockholm. We then obtained the organisation number of these companies SCB was able to provide us with the annual turnover for 44 of the 51 companies. With the quantitative analysis taken as far as possible within the current scope of our research we then returned to interviews to support our thesis.

Terminology

Like green growth, and environmental technology, "eco-district" can have different meanings depending on the context in which the term is exercised. We suggest that eco-district refers to a scale of development that goes beyond the building scale or block, allowing for the integration of ecological planning among multiple aspects of the built environment. Most often this includes buildings, mobility systems and waste and water management. Within these aspects issues of planning, architecture and design are also integrated. In the context of this article the OECD's (2013) emphasis on eco-districts and innovation is helpful as well: "The eco-district therefore appears to afford a rough template for mixing an array of eco-innovations into a modular system that can, in turn, be flexible scaled up to the smart-city region"; and " [eco-districts] offer a format for testing the technical and financial viability of various applications as well as their acceptability for residents".

Development of Environmental Sustainability in Stockholm

The relationship between water, the city and its residents has existed ever since Stockholm's permanent settlement, strategically located between the Baltic Sea and Lake Malären, in roughly 1250 AD. Of particular interest for this paper; for more than a century the logic for pursuing environmental sustainability in Stockholm has reflected the broader perceived value of the city's green and blue spaces. Metzger and Rader-Olsson (2013) offer a thorough analysis of the evolution of Stockholm's sustainability, including the identification of three distinct eras of environmental sustainability: promoting human welfare & prosperity; environmental protection; and sustainable city branding and marketing. These eras provide a strong indication of the city and country's shifting socioeconomic priorities over time and offer a clear idea of a broader societal shift and the effect it has had on sustainability efforts.

Stockholm's Three Eras of Environmental Sustainability

From its initial usefulness for trade and mobility, water became an essential element in the city's industrialization, which was an essential driver of Stockholm's population and economic growth well into the 20th century, but also led to significant water pollution. In response to

environmental degradation, particularly of recreational spaces, coupled with a growing workers movement (Inghe-Hagström, 1997); the first era of sustainability in Stockholm, *promoting human welfare & prosperity* developed in the years around 1900.

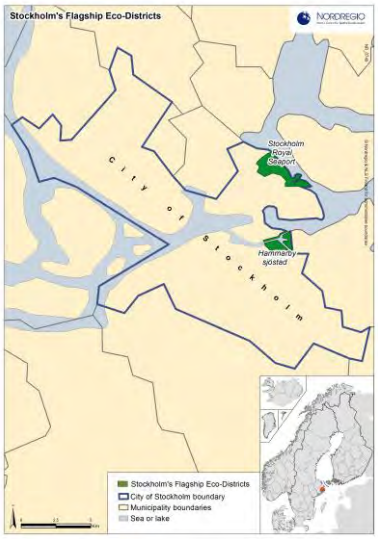
Extending into the late 1960's or early 1970's, the general policy emphasis of this era can be characterized by egalitarian public welfare and collectivist solutions (Metzger & Rader-Olsson, 2013). Beyond housing policy tailored to the Swedish and Stockholm socioeconomic context of the time, this included the protection of quality green space and the integration of land use planning and infrastructure, particularly public transport. While these efforts were undertaken to pragmatically improve quality of life for residents, early efforts at transport-oriented development (TOD) contributed to the city-regions environmental sustainability (Metzger & Rader-Olsson, 2013). These TOD developments, including Vällingby (internationally recognized in the 1950s and discussed below), offer a time-tested example of Vancouver urbanist Brent Toderian's assertion that "The best transportation plan is a great land use plan." (Toderian, 2013). As Metzger and Rader-Olsson (2013) note "even if this was not their expressed aim, many of these interventions and investments also turned out to have unanticipated positive environmental effects." Stockholm continues to benefit from the decisions of this era, including the over-development of the subway system and the protection of its green wedges (Marcus, Balfors & Haas, 2013; Hårsman & Wijkmark, 2013).

Growing awareness, the well-recognized value of green space and the important role of nature in the country's narrative served to usher in Stockholm's second era of sustainability; environmental protection. In 1972, Sweden initiated and hosted the United Nations Conference on the Human Environment (commonly referred to as the Stockholm Conference). Viewed widely as the beginning of contemporary public and political awareness of environmental challenges globally, it established Sweden and its capital, as international environmental leaders (Baylis & Smith, 2005). Following the Stockholm Conference, the Swedish government maintained its international leadership through ambitious legislation for environmental protection while strong NGOs that ensured environmental issues remained on the City's political agenda (Metzger & Rader-Olsson). This, coupled with an international reputation for innovative district development, ensured Stockholm was well positioned for the current, era of sustainability; sustainable city branding and marketing.

Policy development towards city branding and marketing is succinctly described by Metzger and Rader-Olsson (2013). "This set of policies, emerging locally in Stockholm roughly from the mid-1990s and onwards, positions Stockholm as an international best-practice example of urban sustainable development to promote not only the city itself but also a wide range of Swedish urban clean-technology products and services, particularly using the eco-district of HS as a live showcase for these technologies and processes." It is this use of eco-districts, which includes SRS, which will centrally be explored in this paper.

The current approach to sustainability, despite considerable and tangible contributions to urban sustainability, has come with a considerable degree of scepticism. In focusing on the marketability of the City's eco-districts and the technology they produce, there are concerns that there may be a greater focus on the City's sustainability image than actual outcomes (Bradley, Hult & Cars, 2013; Reardon & Schmitt, 2013). For example, SRS demonstrates that political will still exists for developing eco-profile urban districts that promote Stockholm's green profile internationally. However, research by Reardon and Schmitt (2013) show that economic considerations have tended to limit the extent to which urban sustainability is applied other projects without an eco-profile. Implicitly, the emphasis on branding and

marketing, based in part on the continued development of cleantech, has also reduced the need for personal accountability for environmental sustainability. This steadfast focus on technological solutions for environmental sustainability has permitted Stockholm to avoid "uncomfortable discussions regarding established ideals of personal consumption, freedom and individual lifestyle choices" (Metzger & Rader-Olsson, 2013). Rather than permanently solving these challenges, such an approach is likely delaying the discussion. Thus, while this current era of sustainability has resulted in increased environmental sustainability and helped to ensure ambitious projects like HS and SRS have been achieved, it may also limit the potential for broader societal innovation that is also much needed.



Map 1 The City of Stockholm & Its Flagship Eco-Districts Map design: Linus Rispling, Nordregio

Stockholm Eco-Districts: Settings & Locations

Given that one of the most distinctive features of the City is its interplay with nature, including the vast green spaces, islands and water, it is hardly surprising that HS's and SRS's respective boundaries are defined by geographic features (Inghe-Hagström, 1997). This combination of nature and urbanity has also ensured that the eco-districts (as well as the City's planning strategy more generally) are being developed to harness Stockholm's traditional strengths. Further, the focus on environmental sustainability in HS and SRS is enhanced by their proximity to natural environments, which are in turn used as important symbols of the significance, vitality and need for protection of the natural environment. This approach is further evident in plans that ensure access to quality green spaces, both within and around the districts (Norra Djurgårdsstaden, 2009).

Stockholm Eco-Districts: Development Trajectories

The various uses for HS through time reflect broader development patterns in Stockholm and the three eras of sustainability described above. During the 19th and early 20th century the area provided an escape from the city for workers and their families living in Södermalm (Inghe-Hagström, 1997). It was a site of natural beauty, relatively untouched by development and a location for outdoor recreation and picnics (Inghe-Hagström, 1997). In 1917, the City purchased the land and opened it to industrial development, which was facilitated by the recently completed canal that linked Hammarby Sjö with the Baltic Sea (Vestbro, 2005). While several large companies established themselves in the area early on such companies were exceptions and the area soon came to be characterized by a series of informal factories and as a haven for underworld activity (Vestbro, 2005). Development in the area was stagnant for decades which eventually led to it being seen as a "shantytown". By the 1970's it was heavily polluted due to the vast quantities of oil and hazardous waste that accrued from local industry (Vestbro, 2005).

When planning was initiated in the early 1990s, HS was the most extensive housing project that had been undertaken in Stockholm since the Million Homes Program of the 1960's and 1970's (Johansson, 2005). When completed in 2017 it will include roughly 11 000 apartments for over 20 000 people and 10 000 employment locations (GlashusEtt, 2007).

Efforts to create a leading edge eco-profile district took a range of forms. In cleaning up the area and renewing the natural environment, the project resulted in the removal of 130 tons of oil and grease and 180 tons of heavy metals from the area (Interview). The project also

developed the Hammarby Model, which created eco-loops to maximize the resource efficiency of water, energy and waste in the district, while also facilitating underdeveloped connections between distinct technologies (GlashusEtt, 2007). From an energy standpoint, building energy standards were twice as efficient as typical buildings in Sweden in the mid-1990s (200kWh/m^2a); heat is supplied by waste incineration or renewable energy sources; energy is extracted from 99% of all domestic waste from which extraction is possible; and electricity must come from suppliers that have the Swedish sustainability label (bra miljöval) (GlashusEtt, 2007). While ambitious water consumption targets 50% below average were endeavoured, a reduction of 40% has been achieved (Högström, Wangel & Henriksson, 2013). Further, 95% of the phosphorous in the waste water is captured and used for fertilizer, while drainage water is connected to a stormwater network, rather than the waste water network (GlashusEtt, 2007). An additional 80% of food waste is used as compost or fertilizer (Interview), while an innovative waste system (see discussion below) has ensured that 60% less waste is transported by heavy vehicle in the district (GlashusEtt, 2007). Rather than the standard "minimum parking places per dwelling" HS also established a maximum of 0.8 parking places per dwelling (0.35 street parking and 0.45 garage parking) (GlashusEtt, 2007). The tram system is well-integrated into the city's public transit system and was operational when the first residents moved into the district (GlashusEtt, 2007). Finally, Högström, Wangel and Henriksson (2013) found that there is 40% less environmental stress, 50% less eutrophication and 45% less ground level ozone in HS compared to city-wide.

The unique nature of the development process, originally catalysed around a "greenest Olympics" bid for 2004, provided opportunities for the City to have a great influence over the development of the project – to take advantage of potentially problematic situations and transform the project for the better (Svane, 2002). The integrated planning model succeeded in mitigating any meta-conflicts that may have arisen by creating a direct dialogue between actors (Hall, 1980). Further, by uniting actors who rarely meet in person, the issue of having internal solidification that can create division between bureaucratic units and is often a characteristic of large organizational structures was mitigated (Hall, 1980). While Stockholm was unsuccessful in its Olympic bid, this communicative approach contributed to the plan's resilience, enabling the development to overcome what could have been a major challenge with its profile intact. It also encouraged greater cooperation among development actors from a range of sectors, fostering new innovation through interdisciplinary exchanges and applications of technology and ideas. This concept was enshrined as the "Hammarby Model" and has been further developed as the SymbioCity platform and in the development of SRS.

Initiated in 2001 and under construction since 2010, SRS is being developed based on the experiences gained from HS. It has good proximity to the city centre with an established metro line, it borders the greenery of Nationalstadsparken (the Royal National Urban Park) and is located along the waterfront of a strait running between the future Norra Djurgårdsstaden and the island of Lidingö. With a completion date of 2025 the mixed-use district will help mitigate housing shortages in the inner city, provide opportunities for business development, promote technological innovation and continue in its role as a port of entry and departure for cruise ships travelling across the Baltic Sea. Finally, there is a strong focus on linking the new development to the existing neighbourhoods that it borders. Once completed, SRS will offer 10 000 new apartments, 30 000 office spaces and 600 000 square metres of commercial space in an area of 236 hectares, thereby having a considerable impact on growth in the inner city (Norra Djurgårdsstaden, 2009).

Building on the achievements of HS, some of which, including highly efficient energy standard of 55kWh/m^2 per year for new residential buildings, have been accepted city-wide, environmental sustainability in SRS focuses on energy use, transportation, eco-cycle systems, lifestyle and climate change resilience (City of Stockholm, 2013). In concrete terms, SRS aims to be fossil fuel free and climate-plus by 2030, have CO^2 emissions that do not exceed 1.5 tons per person annually and have 30% of the district's energy produced locally through renewable sources (City of Stockholm, 2013). The district will also include passive and plus energy houses, a biofuel CHP system individual energy monitoring while also meeting the city-wide, but still ambitious, energy standard for residential buildings (City of Stockholm, 2013). From an R&D perspective, SRS will include a large scale smart grid system, sustainable ICT development and an advanced evaluation model research program to measure the impacts and improvements of the district (City of Stockholm, 2013). From an planning perspective, SRS has followed up on HS, ensuring that the tram system was operational when the first residents moved into the area. The area also has more stringent parking maximums of 0.5 parking places per dwelling, as well as bicycle parking minimums (Galera Lindblom, 2011). Finally, the eco-district prioritizes mobility options as follows: walking and biking, public transport, car pools, private cars (City of Stockholm, 2013).

The aim to attract firms working with the innovation of environmental technology is seen as a key aspect in ensuring the economic viability of the area while also promoting SRS's reputation as a leading district in environmental sustainability. This has been realized through the creation of, the Hammarby Model and SymbioCity inspired, *Stockholm Royal Seaport Innovation Arena*, a key forum for the innovation of clean technology in Stockholm and an important tool in encouraging cross-sectoral cooperation. The *Innovation Arena* is a clear example of how decision-makers in Stockholm are building on the city's eco-district experience, and even more than in HS, a direct indication of how Stockholm eco-districts are intended to support and contribute to green growth in the city and region. Beyond firms working with environmental technology, the area is also being promoted as a new financial hub for Stockholm and is slated to be the home for a number of financial offices, including the Nasdaq OMX (Norra Djurgårdsstaden, 2009).

Stockholm's Other Notable Developments

The Högdalen 2020 project intends to transform an industrial area into a leading cleantech cluster, complete with demonstration sites and venues for cooperation between firms. The project appears to be the most definitive effort to connect green growth with the built form (Stockholm Business Region Development, 2013). The development is in its very early stages and is thus very difficult to evaluate in this regard. An important caveat here is that although there is a strong connection between the built form and green growth in this project; the transformation of an industrial area into a clean tech cluster does little to contribute to the vitality of Stockholm's built form in the way HS or SRS do.

Connecting the Dots: The Role of Eco-Districts in Stockholm's Green Profile

Analysing the Rise of Cleantech in Sweden & Stockholm

As a point of departure, the OECD case study (2013) notes how the Stockholm County and the City of Stockholm have built up an effective network governance to promote green growth. They note that the growing sector of "green technologies" accounted for 3.4% of Stockholm County's Gross Regional Product in 2008, with the main sectors being waste and wastewater management, renewable energy sources and environmental consultancy, all of

which showed strong growth between 2003 and 2009. However this analysis, based on the broad EU definition of "Environmental Goods and Services" requires further development.

Vinnova's report, "Companies in Environmental Technology 2007-2011, provides additional insight into evaluating Stockholm's cleantech sector. First, their definition of "environmental technology" is narrower than the definition of the environmental sector, mainly because it excludes primary production, and is therefore an accurate account of what we refer to as the "cleantech" industry for Stockholm. Their analysis identified 1 571 firms (compared to 5 500 using the environmental sector definition), of which 433 (27 %) have offices in the Stockholm County, totaling 0.9% of the workforce. This indicates that the geographical distribution of the sector is broadly correlated to population density with the greatest level of workplaces therefore located in the Stockholm region. Specific examples of Stockholm's performance are noted in relation to waste water solutions, energy efficiency in buildings and the large number of consultancies exporting cleantech solutions globally. A note is also made about the test beds of the SRS project where smart grid and smart building technology is being developed. (Strandberg et al., 2013)

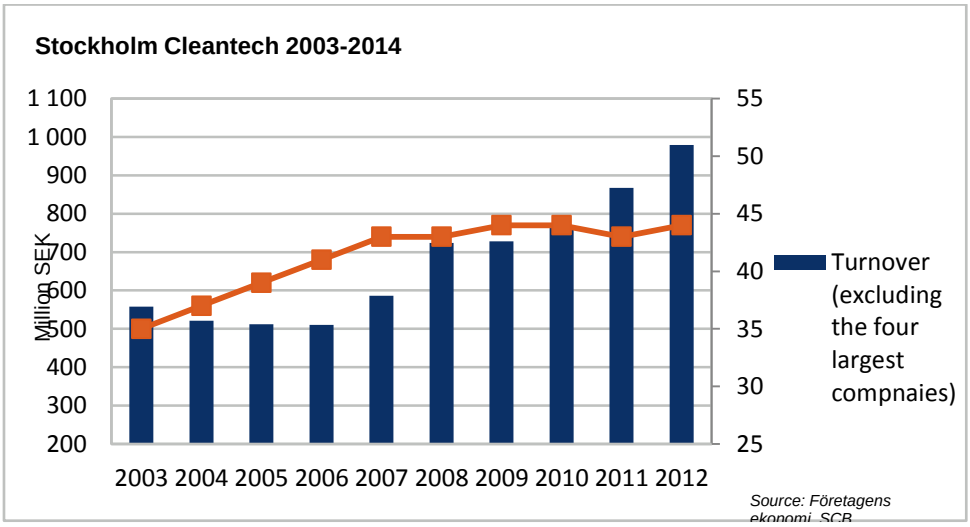


Figure 1: Annual turnover & number of companies based on the selection of Stockholm cleantech firms

Taking a closer look at the cleantech trends in Stockholm, Figure 3 shows the nine year performance trend of 44 Stockholm-based cleantech companies based on our own selection of cleantech firms. The findings are notable in regards to the general trend and the possible correlation to eco-district development. Generally, it shows that during the period 2003-2007, gross turnover of these firms was stagnant, even slightly decreasing. But at the same time as the number of companies was steadily increasing. This gives the impression that this was a period where companies were being established and doing first implementations, but were not necessarily highly profitable. In contrast, 2007-2012 reveals a situation where the companies in this sampling were mostly already established and but where their productivity (in this case turnover) was steadily increasing. This matches well with the discussion on eras of sustainability where it is noted how the current focus is "economizing" the sustainability efforts in Stockholm. Further, while the increase of turnover slows slightly in the period 2008-2009, the indication is that the sector managed to continue a growth trajectory throughout the financial crisis. As a result, the turnover of these companies increased by 90.4% between 2006 and 2012.

The connection between the results in Figure 3 and the development of eco-districts in Stockholm opens up an interesting discussion that can be supported by qualitative and company specific evidence. Most notably, the turn towards increased turnover in 2008 coincides well with the timing of development in HS (all main infrastructures in place and the district established as a functioning neighbourhood). But it coincides especially well with the most intense period of national and international study visits, especially by delegations from other cities looking to be inspired for their own eco-district projects. The number of visits steadily increased between from 2002 reaching a peak of roughly 13,000 visitors in 2010 (Freudenthal, 2014).

Nevertheless, to extend the qualitative investigation on the contribution of Stockholm's eco-districts to the cleantech, sector we focus on two additional aspects, both of which reflect the broader importance of eco-districts in Stockholm's overall sustainability profile: the institutionalization of knowledge and governance developed via HS and a company specific profile documenting the direct connection between HS and cleantech business development.

The institutionalization of knowledge and governance developed via HS

Hammarby Sjöstad has been an experimental project in many regards. This includes the experiences of key actors involved in designing, planning and developing HS who were able to articulate, formalize and apply the diverse, facets of knowledge and experiences they were gaining by being involved in HS. For instance, Ulf Ranhagen, was a key part of Sweco's team working with planning, architecture and design and engineering projects in HS and used these experiences as a starting point for the SymbioCity Approach (formerly the Sustainable City Concept), which has become a key Swedish network for cleantech companies working with urban development. Ranhagen notes that Sweco has applied lessons from HS, the development of SymbioCity, and other eco-districts in Sweden to about 25 planning projects in China and other parts of the world (personal communication, 2014).

SymbioCity is first and foremost about prioritising Swedish cleantech businesses working with sustainable urban development; acting as a chamber of commerce for the 88 businesses that are members (In the discussion below, the impact of SymbioCity is independently recognised by ENVAC as one of the key milestones of for the growth of their company (see discussion below). At the same time, its main conceptual role (reflecting the change in name from Sustainable City to SymbioCity) is to promote the benefits of a holistic approach to urban planning. The aim is to discover and unlock synergies between the building blocks the urban system (Energy, Traffic and Transport, Information and Communication, Architecture Water Supply and Sanitation and Waste Management) at all urban scales, from the neighbourhood to the metropolitan region.

In addition to the formation of business networks and impacts for companies such as Sweco, it is also crucial to point out how the urban planning, design and governance lessons coming out of HS have been institutionalised by the City. Most directly, this included even stricter environmental measures in SRS as well as the ability for the City adopt a policy limiting energy consumption in all new buildings to 55 kWh/m^2 per year.

Eco-Districts & Business Development: The ENVAC Case

To further explore the outcomes of connecting clean tech and eco-districts, ENVAC AB (inventors of the vacuum waste system and makers of Envac Automated Waste Collection System) provides a good practice example. After a first installation in a Swedish hospital in 1961 ENVAC was still mainly serving the Swedish market when it received the contract for installing their technology in HS. According to Jonas Törnblom, ENVAC's Director of

Marketing and Communications, the company's future growth potential in the environmental sector, or the impacts of being involved in the HS project, was not well understood or envisioned by the company: "when we received the contract around 2000 it was more just about doing business, applying our technology and being successful as a company."

ENVAC first began seeing the growth impacts due to their involvement in HS in 2003-2004, as described as a series "milestones" by Törnblom:

"The first important milestone was in 2003-2004 when the Swedish Government started Symbio-city (then called Sustainable Cities) as a marketing programme to promote environmental companies."

"The second milestone was the change in government and city administration in 2006, leading to an increased focus on the advancement and marketing of urban sustainability."

"Both of these factors really helped to market our technologies nationally and internationally. We got the Wembley contract directly out of HS in 2007 and then Tianjing EcoCity in 2009, but there have more contracts that were affected by visits to Hammarby."

"The third milestone was when Stockholm was awarded the as the first European Green Capital in 2010."

By 2008 they had revenue of SEK 1330 million, in 30 offices that employed roughly 600 people (SymbioCity, 2014). While updated company figures are not available, the ENVAC website notes that by 2012 their global reach had expanded to 40 offices around the world, including Australia. Directly tying the success of ENVAC to HS Törnblom adds, "The importance of HS for ENVAC cannot be overestimated…Not only have we been able to attract a lot of potential customers to (visit) Stockholm, but we have also had many unsolicited requests that come from everywhere in the world…We can attribute a number of specific orders that we have because of our presence in HS, but the most important thing for ENVAC with HS was not just to be seen as a waste management company but to be embedded in the larger context and "rub off" on the sustainable city context." He also adds that their involvement has led to refinements of their technology portfolio. ENVAC now supports the Innovation Arena in SRS with a five year commitment of SEK 2.5 million, something Törnblom notes as an opportunity not to be missed out on and a token of ENVAC's gratitude for their positive experience in liaising with the City in HS.

Transferability

With a focus on city-makers in other cities, this section explores the extent to which some of Stockholm's efforts to promote cleantech through eco-districts can be applied by urban decision-makers around the world. In doing so, recognition of Stockholm's unique features and distinct advantages the city has will be outlined before discussing prospects for cleantech growth through eco-district development. Here, the focus will be on the potentials for eco-districts created by waterfront development; opportunities to promote cleantech innovation by fostering connections between existing firms and sectors, and the many good practice examples that offer guidance about how to grow the sector in combination with eco-district development.

Stockholm's Unique Features and Advantages

While cities share many common points, they also enjoy distinct characteristics that differentiate them from one another. Stockholm has benefited from several unique characteristics, centrally including its natural and geographic setting, good governance and a

longstanding profile as environmental leaders, in the promotion of its environmental sustainability, green growth and cleantech development.

Benefiting from its location at the strategically valuable point where the Baltic Sea meets Lake Mälaren, Stockholm's urban development through history has been supported by the important mobility connections it offers, and relatedly, its designation as Sweden's capital centuries ago. Beyond these strategic advantages, its geography and natural setting, including the 14 islands and vast bodies of water around them, have meant that green and blue spaces have always had a prominent position among residents. Recognition of the value of these spaces, for different reasons through time – as illustrated through the discussion about the different eras of sustainability – has influenced the manner in which urban development in Stockholm is considered. Centrally, and quite distinct when considered in a global context, this has meant that economic growth at the expense of environmental degradation has been difficult to justify and politically untenable.

Both stemming from and reinforced by this rationale, there has been a high degree of political consensus about the value of the environment and need to protect it. Although policy differences among parties from across the spectrum are evident, widespread environmental support has been explicit since the 1960s (Gunnarsson-Östling, Edvardsson Björberg & Finnveden, 2013). The high degree of political consensus in Stockholm extended beyond environmental issues and is well illustrated by the fact that until the 1980s, the parties shared leadership and governing roles in the city (Hårsman & Wijkmark, 2013). The cooperative approach may have limited political cynicism, and coupled with the low levels of corruption in Swedish politics (Transparency International, 2013), may contribute to Sweden's relatively high trust in government (The Economist, 2013). In turn, this trust could facilitate policy deployment, including on environmental sustainability and green growth, and foster a cooperative atmosphere between public, private and academic actors.

Finally, Swedish and Scandinavian efforts to establish sustainability models have been acclaimed internationally (Kreuger & Gibbs 2007). Sweden's strong international reputation as environmental leaders, which at the very least, has not been hindered by a clear and long-standing commitment to environmental sustainability at the city level, also offers a unique advantage to firms working in Swedish cities, including the national capital. This is illustrated by the fact that urban development and architecture firms with offices are frequently invited to take part in aspects of eco-district development around the world, something elaborated on in the previous section of this article. Further, Hult (2013) has detailed how branding as "sustainable and Scandinavian" serves as a motivation for these Swedish firms. While not all cities share these advantages, the vast majority do have characteristics, recognized or untapped, that offer a competitive advantage. Beyond distinctions, other cities can also draw from Stockholm's efforts to promote cleantech, which have been outlined throughout this paper. Several key aspects for transferability are identified and discussed below.

Connecting Eco-Districts and Green Growth

As illustrated through the SymbioCity and Envac cases, HS and now SRS have played an important role in Stockholm's green growth, something that has been recognized by a number of actors – public, private and academic – and has been institutionalized through the SRS innovation arena. While Stockholm has clearly been effective in combining eco-district development with urban green growth, this approach need not be exclusive to the city. As urban environmental sustainability solutions become more pervasive and accessible, more cities will have opportunities to apply the eco-district concept in ways that suit their local

contexts. Waterfront locations offer certain advantages, but other potential eco-district settings including former military bases, industrial complexes and even shopping malls present distinct opportunities that may relate more closely to the urban and green profiles other cities are promoting. In addition to identifying a setting that corresponds and reinforces the broader narratives of respective cities, eco-district development presents a clear opportunity to harness local economic and knowledge potentials. In doing so, decision-makers should survey existing green growth strengths in the local economy, engage these sectors, firms and organizations, and identify specific aspects of eco-district development that can also contribute to the urban and regional economy. As demonstrated in HS and SRS, there are many good practices on eco-district development, and the potentials to link urban development and green growth, around the world. These can provide inspiration and guidance for cities looking to establish similar project; however these cities would also do well to identify and promote opportunities for domestic firms to take part in such developments, rather than focusing primarily on the expertise of global firms with limited stakes in the city. Decision-makers who maintain this local focus will find this paper particularly useful in identifying solutions that are transferrable to their respective cities.

Waterfront Property: An Eco-District Driver

While the Stockholm's stunning and distinct relationship with water and green space plays a central role in establishing the eco-districts profiles, the waterfront locations also serve an important economic function in realizing these world-renowned developments. With high environmental standards, and significant environmental clean-up in both HS and SRS, these ambitious projects require considerable investment, particularly early in the development process. In many economic and development contexts, this can lead to situations where important investors, including city administrations, developers and property speculators may be hesitant or unwilling to make the long term investment, and inherent risk, that such projects require. This has been a key contemporary challenge for urban development in Stockholm, where a number of factors, including slow development processes, an overreliance on large companies and limited consistency between projects have contributed to a serious housing shortage (Reardon and Schmitt, 2013).

For Stockholm's eco-districts, the selection of attractive locales, with extended waterfronts and access to high quality natural green spaces, have helped assuage the fears outlined above, ensuring that high environmental standards have been combined with viable market rationales. This was particularly important in HS, where in the early 1990s; there was considerable uncertainty about people's willingness to choose dwellings in urban, rather than suburban, settings. In that situation, an attractive waterfront setting, and the seaside views it offered, helped the City and other public actors to get private actors, including developers and engineering firms, on board, with construction companies eventually covering 80% of HS costs (SymbioCity, 2014b). By the time construction in SRS was initiated, a renewed interest in urban living, coupled with strong population growth, was clear in Stockholm, and eco-district's rich environment and proximity to the city, along with the success evident in HS, facilitated support for the project. However, there is little argument that a location along the seaside was seen as an asset by the actors involved. This position is further supported by the fact that Stockholm's two flagship eco-districts are located along waterfronts. In Stockholm, it is evident that waterfront development is seen as an asset in advancing an environmental, branding and green growth strategy. It is highly likely that a waterfront locale would also be an asset for other cities and regions seeking to develop eco-districts. Given that the vast majority of cities in Europe and around the world have developed near a body of

water, and that many of these locations are or were at one time used for industrial purposes, this is an important aspect of the transferability of eco-districts, which subsequently presents new opportunities for urban green growth.

Identifying and Promoting Connections between Firms and Sectors

Through the Hammarby Model, the SymbioCity concept, and SRS Innovation Arena, the benefits achieved by promoting integration among a diversity of actors, interdisciplinary cooperation and the innovative application of existing technologies in new ways are evident in Stockholm. Of equal importance, these approaches have the potential for application in cities across around the world. The value of these concepts and projects and in encouraging the integration of actors with different backgrounds and motivations is due in large part to the potentials for the cross-fertilisation of ideas and new perspectives on ways to apply or modify existing technology. Within this context, the OECD (2013) underlined the opportunity for newly developed eco-districts to serve as test-beds for developing new technologies and the use of existing technologies in new ways. Given that conceptualisation, development and deployment can take place in parallel with the development of an eco-district – from early planning stages to inhabited districts – eco-districts have the potential to serve as "living-labs" in the fullest sense of the term (OECD, 2013). While a strong tradition of consensus and faith in government have facilitated an integrative approach in Stockholm; similar opportunities of varying intensity exist in many other cities who have achieved the size, scale and population to realize their own eco-districts.

Discussion

This paper has contributed to a better understanding of how eco-districts can contribute to urban green growth. The Stockholm case has illustrated how, in the right setting, eco-districts can be viewed as an effective tool to foster growth in the cleantech sector. However, if growth of the cleantech sector is included as an aim of the project, the success of the project in achieving this aims needs to be assessed. Such efforts will not only guide planning efforts, but can also be used by planners to leverage public and private investment in future projects. Envac's view "not miss out" on the Innovation Arena in SRS is only one such example.

However, our research showed that making such direct assessments can be challenging in a number of regards. Access to data is a notable constraint, as are challenges associated with the definition of the sector, accurately identifying specific firms, and defining what share of these companies are actually attributed to the cleantech sector, let alone specific eco-districts. Nevertheless, our approach to identifying clean tech firms via the CleanTech Stockholm and EnviroSweden networks shed light on what appears to be an exciting area for future research. In particular, our experience indicates that with additional time and resources, a more detailed account of firms specifically involved in eco-district projects would provide more robust results. Along with additional information such as foreign export and employment alongside company turnover, a refined analysis could act as a transferable approach for monitoring an important dimension of eco-districts. Finally, this paper has documented how green growth in Stockholm, specifically in the cleantech sector, has developed together with the city's eco-districts. A comparison with other cities with well-established eco-districts would further test the assertion that was advanced in this paper. A study of this sort would also be of considerable benefit to decision-makers in cities considering support for local cleantech firms through the development of their own, city-specific, eco-districts.

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[ii] REGREEN is an INTERREG IVC project to promote good practices and knowledge exchanges in green public procurement. It runs from January 2012 until December 2014. For more information please see http://www.re-green.eu/en.

[iii] SUME (Sustainable Urban Metabolism for Europe) was a Framework Program 7 project that explored the potentials for European cities to increase their resource efficiency. It ran from November 2008 until October 2011. For more information please see http://www.sume.at/.

[iv] TANGO (Territorial Approaches to New Governance) was an ESPON project that explored the potentials for territorial governance in different settings and scales across Europe. It ran from September 2011 until February 2014. For more information please see http://www.nordregio.se/en/Nordregio-Research/Territorial-Approaches-to-New-Governance-ESPON-TANGO/.

[v] Swedish Governmental Agency for Innovation Systems

Assessing the socio-economic benefits from green and blue space rehabilitation: a case study for the Confluence area in Lyon

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Shortened abstract

This paper aims to demonstrate the added socio-economic value of green/blue spaces in urban areas. The Sustainable Urban Landscape Development (SULD) hedonic pricing simulation model is applied to the case-study of Confluence in Lyon, France. Scenario simulations are performed for the establishment of urban parks, along with the requalification of riverfronts and development of road infrastructure. Results show that the first two interventions (parks and parks plus requalification) attract high-income households and, hence, lead to increases in real estate values up to +28%. The latter intervention (parks plus new road infrastructure) also attracts low-income households, which leads to a smaller increase in real estate values. SULD aids in improving urban planning strategies, in terms of drafting plans, public discussion and monitoring.

1. Introduction

As urban areas grew, developed and evolved over the past century, green and blue (g/b) spaces have always been under scrutiny, pressure or risk, being sometimes regarded as potentially profitable residential, industrial or waste-disposal sites. Even where this has not occurred, urban g/b spaces have often been secondary on urban growth agendas, as their maintenance and/or rehabilitation has not been deemed urgent in the short term and, hence, they have usually not been integrated in spatial development and management policies. This has resulted in insufficient public and political support as well as in a lack of awareness from stakeholders on the added value effective g/b space management can bring to spatial development.

However g/b spaces effectively make an important contribution to urban society and sustainability (see TEEB, 2011). It is not a question of 'just' providing important ecosystem services and leisure areas (Chiesura, 2004, Costanza et al., 1997), it has also been shown that g/b spaces can stimulate higher real estate prices, as well as prevent problems and financial losses in the medium-long term through, for example, flood risk mitigation (Baptista, 2013, Zhang et al., 2012). Studies from the economic/land-use literature have systematically been exploring how, and to what extent, urban environment amenities impact on the distribution of residential land-use, on property values, and on the social-mix. This has been determined in various ways, such as using contingent valuation methods – a survey-based

economic technique that asks dwellers in a hypothetical market how much they are willing to pay for a specific public good (Chiesura, 2004, Salazar and Menendez, 2007). The most popular approach has been the application of hedonic pricing models – a regression method that estimates the economic value of properties as a function of the proximity to environmental and urban amenities. Such models have had a wide spatial application, from the US (Crompton, 2005, Irwin et al., 2014, Netusil, 2013), to the UK (Gibbons et al., 2014), Denmark (Panduro and Veie, 2013), Austria (Amrusch and Feilmayr, 2009), China (Jiao and Liu, 2010), Japan (Hoshino and Kuriyama, 2010) or the Check Republic (Melichar and Kaprova, 2013). Yet the major criticism to hedonic pricing models is that they require previously observed data and, in the words of Crompton (2005), "*a threshold number of property sales to have occurred around a park to generate the market data needed to undertake the analyses*". In many cases, this data may be insufficient, missing or hard to come by. Only very few studies have applied hedonic pricing simulation models to determine the added value of g/b space (Wu and Plantinga, 2003, Roebeling et al., 2007b). The difference is that, although based on empirical relationships, simulation models are able to estimate added values of amenities that do not yet exist (and for which no surrounding property sales data exist) and, therefore, constitute a powerful tool when addressing future planning and rehabilitation of urban spaces.

This paper's main goal is to assess and compare the socio-economic impacts of potential g/b space development scenarios in the Confluence area in Lyon, France. To this end, we use the Sustainable Urban Landscape Development (SULD) scenario simulation decision support tool (Roebeling et al., 2007b). First, the SULD is contextualized in the economic land-use modeling literature, as to highlight how it differs from the most commonly used models. Then the Confluence case-study and the proposed developed scenarios (namely the establishment of urban parks, the requalification of riverfronts, and the development of road infrastructure) are presented. Lastly the SULD is applied, results are discussed and conclusions are drawn concerning the projected differences in land-use distribution, population density, household distribution patterns, and real estate values.

2. The economic land-use modeling background and the decision support tool

Land-use change patterns have been attributed to a wide range of variables (economic, demographical, morphological), and consequently have been the object of a wide range of models used for explanatory, forecasting and simulation purposes. For the same reason, and because they are developed by scholars with different backgrounds and purposes, these models have failed to be classified under clear and consensual headings. Overlap in characteristics of different models and the convergence of models to a more integrated approach (see also Ward et al., 2003) has led to a plural typology within the literature. Reviews over the last ten years have usually distinguished between non-economic and economic models of land-use change (Brady and Irwin, 2011, Eppink et al., 2004, Irwin and Geoghegan, 2001, Roebeling et al., 2007a).

2.1. Non-economic models

Non-economic models of land-use change have appeared mainly in environmental science and geographical literature. They are characterized by large scale exogenous forces and are spatially explicit, so they have proven more popular in describing land-use patterns at a macro-scale (Eppink et al., 2004, Parker et al., 2003, Roebeling et al., 2007a). These include (i) models of growth or land-use change which use heuristic decision rules based on historical land-use patterns (Andersson et al., 2002, Baker, 1989, Deal and Schunk, 2004, Eppink et al., 2004); (ii) spatially explicit discrete cell-based models known as 'cellular automata' (Deal and Schunk, 2004, Eppink et al., 2004, Irwin and Geoghegan, 2001, Parker et al., 2003, Wang, 2012); (iii) hybrid models where both the estimation and the simulation

capacity of the previous models can be joined (Syphard et al., 2005, White and Engelen, 2000); and finally (iv) multi-agent systems, which focus primarily on human actions and interactions, aggregated up over scales and time to form land-use patterns (Brown et al., 2004, Heckbert and Smajgl, 2005, Ligtenberg et al., 2004, Parker and Meretsky, 2004, White and Engelen, 2000, Benenson et al., 2005). The literature has criticized these models because a) they lack a conceptual economic structure, b) they cannot differentiate between the impact of endogenous interactions and spatially correlated exogenous forces/landscape features, c) they provide just one possible pattern-interaction solution, d) they seldom consider that external features may change over time, but not over space, and e) they don't explain individual behavior (Irwin and Bockstael, 2002, Irwin and Geoghegan, 2001, Roebeling et al., 2007a). Even multi-agent systems which account for this behavior are very sensitive to the definition of original parameters and exhibit path-dependency (Parker et al., 2003).

2.2. Economic models

Economic models of land-use change, also called optimization models as they aim to optimize decision variables in order to maximize an objective function representing utility or profit (Eppink et al., 2004), are generally characterized by small scale processes, and thus allow the understanding of an individual's response to incentive changes. According to Irwin and Geoghegan (2001) they can be either spatially or non-spatially explicit.

Non-spatially explicit models generally stem from the traditional Alonso-Muth- Mills economic model or bid-rent model (Mills, 1981, Mills and Hamilton, 1994, O'Sullivan, 2000). Here, the landscape is assumed to be a featureless plane, where any two residential locations are considered to be identical in their preferences, income and derived utility, and the only aspect that differentiates them is the distance to a given center (CBD), where they are assumed to commute on a daily basis (Wu, 2006). Therefore, the model considers that households only trade-off accessibility to the center against residential space. Other non-spatially explicit models include agent-interactions (that lead to individual location decisions that affect other individual's decisions – Irwin and Bockstael, 2002) and regional economic models (that describe population and other economic flows across regions). These, according to Irwin and Geoghegan (2001), are more robust in explaining the emergence of agglomerations and urban spatial structure. Nonetheless, these models have been criticized for their lack of spatial explicitness, namely the fact that they fail to explain the impact of heterogeneous landscape features on the resulting land-use pattern (Mills and Hamilton, 1994, O'Sullivan, 2000, Roebeling et al., 2012).

More recent spatially explicit models have incorporated this spatial heterogeneity (see Irwin's reviews – Brady and Irwin, 2011, Irwin, 2010, Irwin and Geoghegan, 2001). Some consist of updates of cellular automata (Caruso et al., 2007, López and Sánchez, 2012, Wang, 2012) or multi-agent systems models (Magliocca et al., 2012, Magliocca et al., 2011), with an added economic component. Yet most of the previous mentioned critics may prevail and hence hedonic pricing models have appeared has an alternative that not only determines property values as distance to urban center(s), but also includes more specific locational features in the landscape. Hedonic pricing models (reviewed in Malpezzi, 2002, Sirmans et al., 2005, Waltert and Schlapfer, 2010) therefore estimate what individuals are willing to pay for different attributes of a house and its surroundings, and consequently the landscape configuration. In the literature a differentiation can be made between hedonic pricing regression and hedonic pricing simulation models.

Hedonic pricing regression models have mostly dealt with the subject of green spaces, including woodlands or forests (Garrod and Willis, 1992, Ham et al., 2012, Tyrvainen and Miettinen, 2000), agricultural land (Bastian et al., 2002) and different types of urban green spaces or parks (Bark et al., 2011, Cho et al., 2008, Hoshino and Kuriyama, 2010, Kong et al., 2007, Melichar and Kaprova, 2013, Panduro and Veie, 2013, Salazar and Menendez, 2007). Other studies assess the influence of micro-scale elements, such as trees (Mansfield

et al., 2005, Pandit et al., 2013) grass (Saphores and Li, 2012), plant species (Amrusch and Feilmayr, 2009) and domestic gardens (Gibbons et al., 2014). Conclusions have mostly been threefold: proximity to green elements is (almost) always an asset, the derived benefits differ according to the type of green space, and households with different utility functions value differently environmental characteristics.
On the other hand, hedonic pricing simulation models have been extensively applied in development and planning processes to investigate, for example, the efficiency and distributional impacts of alternative policy measures designed to assess smart growth, land conversion (Bento et al., 2006, Irwin and Bockstael, 2004) and effects on property values (Cotteleer and Peerlings, 2011). Authors have also examined urban sprawl (Irwin and Bockstael, 2002, Irwin and Bockstael, 2004, Wu, 2003, Wu and Plantinga, 2003) optimal city size and urban concentration (Brueckner et al., 1999, Henderson, 2003), and geographic/amenity features and land development patterns (Wu, 2003, 2006, Wu and Plantinga, 2003). Finally, Wu and Irwin (2003) and Roebeling (et al., 2007b) developed a dynamic spatially explicit model that explores the interaction between land-use pattern and water quality.

2.3. The Sustainable Urban Landscape Development (SULD) decision support tool

Although these models have made considerable contributions as they have incorporated the spatial explicitness of the landscape, authors still stress a number of shortcomings of the approaches developed to date (Eppink et al., 2004, Parker et al., 2003, Roebeling et al., 2007a). Equation based models require market equilibrium conditions, consider a relatively small influencing area (large-scale exogenous forces are generally ignored) and require simplifying assumptions in order to achieve analytical tractability. Increases in landscape heterogeneity, number of agents or spatial interactions, and data detail regarding socio-economic factors diminish the chances of arriving at an analytical solution. For that reason models have omitted variables and been case- or variable-specific, something which obviously undermines their ability to accurately identify economic trends (Kuminoff et al., 2010). Furthermore, with few exceptions, the added value of g/b spaces is determined based on existing data and the ability to make future projections is undermined. In this sense, simulation models offer a noteworthy alternative, but most of these studies are based on abstract problems (Irwin and Geoghegan, 2001, Wu, 2006) and real world applications are scarce. The effect of size and composition of population growth on environmental (Dendrinos, 2000, Wu and Irwin, 2003) and/or urban amenities (Brueckner et al., 1999, Wu and Plantinga, 2003) is also usually not considered, or is considered exogenously.
The Sustainable Urban Landscape Development (SULD) decision support tool (Roebeling et al., 2007b), is a GIS-based optimization model that has been developed so as to enable more informed and equitable decision making regarding sustainable urban development and g/b space management. It builds on hedonic pricing theory that determines property values as a function of proximity to environmental and urban amenities, but it is not a static calculator, and can be used both to address real world problems (i.e. new planned developments) and to make simulated projections independent of real estate and land-use data. Furthermore population growth is exogenously determined, implying shifts in the demand curve to reach a state of equilibrium.
In essence the model determines the value of housing given its location relative to urban centers and environmental amenities – i.e. the equilibrium price for which demand for and supply of housing are equal (Roebeling et al., 2007b, Roebeling et al., 2007a). Households (the demand – Eq. 1) are characterized by their preferences for a certain set of goods and services: residential space S, other goods and services Z, and environmental amenities e. The utility obtained by households in each location is a function of their preferences, distance to environmental amenities and income. Households maximize their utility U at location i subject to the budget constraint y, which is spent on housing S, other goods and services Z, and transportation between the residential area and the urban center ($p_X x$):

$$\underset{S_i,Z_i}{Max} U_i(S_i, Z_i) = S_i^{\mu} Z_i^{(1-\mu)} e_i^{\varepsilon}$$

subject to $y = p_i^h S_i + Z_i + p_x x_i$

U_i = household utility

S_i = residential space

Z_i = other goods and services

e_i = environmental amenity value (1)

y = household income

p_i^h = rental price housing

p_x = commuting costs

x_i = distance to urban centre

The environmental amenity value e_i that the household experiences at location i is decreasing with distance from the amenity source, and is determined by:

$$e_i = 1 + a \cdot \exp^{-\eta z_i} \quad (2)$$

where a is the environmental amenity, η is the amenity distribution factor, and where z_i is the distance from location i to the environmental amenity a. The household's bid-rent price at a given location can now be derived (see Roebeling et al., 2007a), i.e., the household's maximum willingness to pay for housing, given their utility obtained.

Developers (the supply – Eq. 3) optimize their profit by trading off returns from housing development density net of associated development costs, subject to households' willingness to pay for housing. They aim to maximize their profit π at location i, which is given by the revenue of construction ($p^h D$) net of incurred development costs ($l + c_0 + D^{\eta}$):

$$\underset{D_i}{Max}\, \pi_i(D_i) = p_i^h D_i - (l_i + c_0 + D_i^{\eta})$$

with $D_i = n_i S_i$

π_i = developer's profit

D_i = development density

p_i^h = rental price housing

l_i = opportunity cost land (3)

$c_0 + D_i^{\eta}$ = construction costs

n_i = household density

S_i = residential space

The developers bid-price for land can then be derived (see Roebeling et al., 2007a), i.e. they will develop when residential land rents ($pi^h Di$) are larger than the opportunity cost of development ($l_i + c_0 + D_i^{\eta}$), where the latter is equal to the forgone land rents (l_i; e.g. revenues from agriculture) plus the value of the capital invested in converting the land ($c_0 + D_i^{\eta}$). Residential development takes place where demand equals supply. The land rent price at a given location can then be derived, and development patterns for population size are determined given the location of environmental and urban amenities (Roebeling et al., 2007a).

The SULD decision support tool builds on a numerical application (Roebeling et al., 2007a, Roebeling et al., 2014) of the above described classic urban economic model with environmental amenities, using GAMS 21.3 (Brooke et al., 1998). The study area is divided

into a grid of 185*185 cells, and the data is treated in raster format. Starting from a base-scenario with specific land-use characteristics and a set of distances to existing amenities, and relying on scientific and stakeholder input to assess valid future scenarios, the model calculates the equilibrium price for housing as a function of demand and supply. It determines the location of residential development, the residential development density, the population density, the housing quantity, the living space and the real estate value, taking into account households' willingness to pay as well as the opportunity cost of land, according to changes made in land-use, location of amenities or commuting costs. It should be noted that land use conversion can only take place between residential and user-defined non-residential land-uses – the remaining land-uses (e.g. forest, water) are fixed.

3. The Confluence case study and the application of the SULD

The city of Lyon is currently addressing an urban renewal challenge in an area located in the Perrache Peninsula – the "Lyon Confluence" project (Figure 1). As described in Roebeling et al (2012), on one hand this area has had problems related to water management and flood control, namely maintenance difficulties caused by silting pipes or inadequately sized infrastructures; pollution of the receiving bodies during storm events due to overflow devices; and improper conditions for river side residents caused by the presence of rats, odor pollution and the risk of flooding. On the other, this area has long been restricted to industry and transport facilities, and therefore had the risk of becoming yet another brownfield. Furthermore, the A7 Highway, has become a man-made barrier between the Confluence and the Rhone river, forcing the area for many years to turn its back on the water.
The "Lyon Confluence" project aims therefore to transform this area of approximately 2.5 km2 into a new downtown district, opened to the water, increasing its number of inhabitants from around 17.000 to 25.000 by 2030, creating 14.000 new jobs, and improving the natural environment as to provide new ecosystem services (leisure and cultural infrastructures). The latter by developing urban g/b spaces, and by integrating storm water management in the cityscape. Proposed solutions for the area include enhancing the receiving bodies' water quality, protecting the water resources, reducing flood risks by rehabilitating the sewer networks, and reducing investment and operation costs of technical solutions, by implementing the options that best fit sustainability criteria (Roebeling et al., 2012).



Figure 1 – The Lyon Confluence case-study area

In partnership with the Gran Lyon urban community (http://www.grandlyon.com/), the application of the SULD was expected to provide spatially explicit information on the (added) value of g/b space preservation/rehabilitation scenarios, in terms of household welfare,

property values and flood control in the peninsula, as well as on the preferred locations and types of urban development needed to house population. The study area comprises a square of 2.850*2.850 meters, designed to contain the Confluence but also to be sufficiently large to account for edge effects, which was then transformed into a raster image with a 15.4 meters cell size (185*185 cells).

Starting from the current situation (base-scenario), two scenarios were assessed: the establishment of two different urban parks (Scenarios 1 and 2 respectively), as this is a local planning priority. In each case the remaining brownfield area was deemed as open space, available for development (see Figure 2). Based on these two scenarios, the remaining scenarios were developed – namely the requalification of the riverfront (including the requalification of Highway A7; Scenarios 1a and 2a), and the development of a new road infrastructure (including new bridges over the Rhone; Scenarios 1b and 2b).

The numerical application of SULD is based on a population comprising three household types (low, medium and high income households), differentiated by number of households, levels of expendable income (y_1=18.050, y_2=43.862, y_3=69.312…) and shares of housing expenditures (μ_1=0.290; μ_2=0.285; μ_3=0.275) as well as levels of utility (u_1=3.300 for HHtype1, u_2=8.019 for HHtype2 and u_3=12.672 for HHtype3). All household types share the same appreciation for environmental amenities (ε=0.08; η =1.0), annual commuting costs (p_x=375 €/km), opportunity cost of land (l_i=1,000 €/yr) and development costs (c_0=0 and η =1.75). The model assumes that the number of inhabitants of each household type remains constant – what may change is their spatial distribution. The study area includes eight environmental amenities (seven parks and the water, with values of a=10, a=7.5 and a=5 for high, medium and low quality environmental amenities, respectively) and twelve urban centers (transit stations, public facilities, and education, entertainment, shopping and cultural centers). Distances to environmental amenities and urban centers are based on straight-line and road-network distances, respectively.

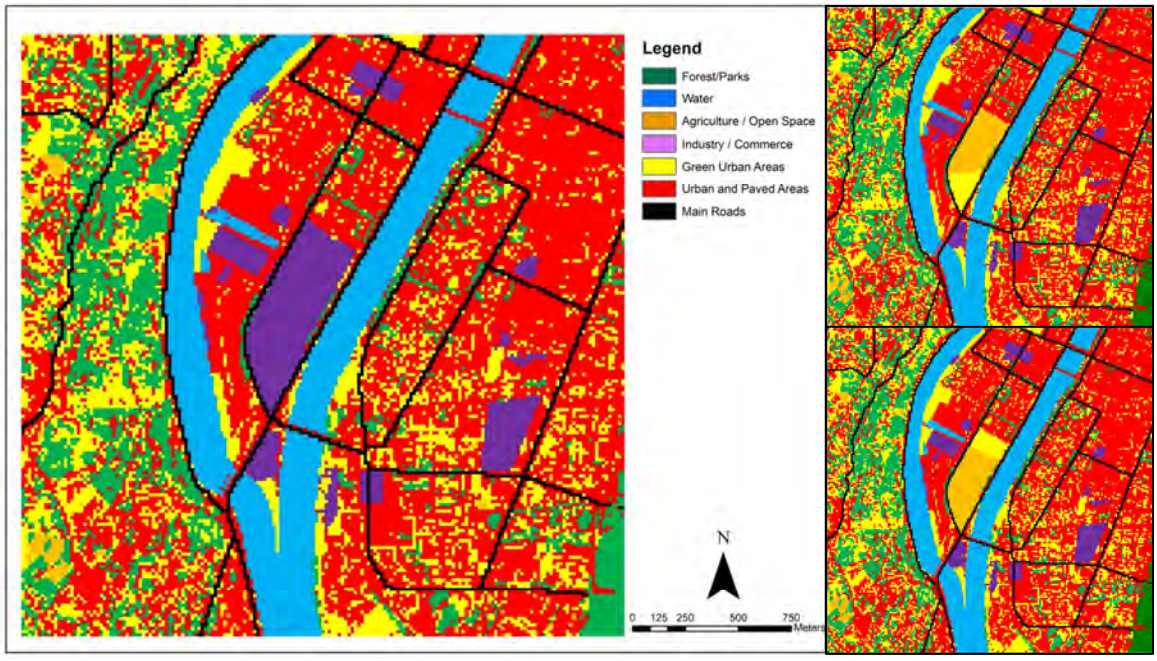


Figure 2 – Land-use map for the Base scenario (left) and Scenarios 1 (upper-right) and 2 (lower-right)

4. Results and discussion

4.1. Base-run and Scenarios 1 and 2

For the base scenario (i.e. existing conditions are maintained), we see mainly an urban area (339 ha), albeit a strong presence of green spaces is detected (155 ha of urban parks and

102 ha of forest). Only 12% of this green area is located in the Confluence intervention area, mainly on the East-side, while on the West-side the area is dominated by the industrial brownfield. The area is mainly low-rise (seldom over 3 stories high) with 60.000 inhabitants, of which around 50% correspond to low-income households (HHtypes1) and only 12.5% correspond to high-income households (HHtypes3, see Table 1). This discrepancy is even more acute in the Confluence area, where almost 70% of households correspond to HHtypes1, that live close to the brownfield, urban centers and the main roads. High income households live in more attractive areas, close to the waterfront and urban parks.

The total built area (housing quantity) is almost $1.6*10^6$ m2, where around 20% corresponds to HHtypes1, 60% to HHtypes2 and 20% to HHtypes3. The total floor space (development density) covers almost double this area ($2.9*10^6$ m2), while noting that low income households are located in more densely populated areas (over 3.8 households per grid cell). This situation is even more acute in the Confluence area, where almost 50% of the total floor space corresponds to HHtypes1. On the other hand, higher income areas have the lowest household densities. Available living space is on average 98 m2/hh in the study area, and about 84 m2/hh in the Confluence area, ranging between 59 m2/hh for HHtypes1 and 158 m2/hh for HHtypes3.

Lastly, real estate (rental) values are equal, on average, to 95 €/m2/yr, varying from 88 €/m2/yr for HHtypes1 to 118 €/m2/yr for HHtypes3. Larger values can be observed in attractive high income areas (close to the river and green spaces), whilst lower values can be observed in low income areas (close to main roads and urban centers as well as the railway station). The total real estate (rental) value for the study area is 288 million Euros per year, and 75 mEuro/yr for the Confluence area. It should be noted that the average values per household type are greater in this area – despite the brownfield it is an attractive zone containing a considerable number of urban and environmental amenities. It is this potential that the proposed interventions wish to maximize.

In each of the Scenarios 1 and 2 a new urban park is established in the Confluence brownfield area, and the remaining brownfield area becomes available for urban residential development (Figure 2). In Scenario 1 the park is situated in the South end of the brownfield, whereas in Scenario 2 it is located on the North end. Overall, Scenario 2 seems to present greater benefits, both to the study area and the Confluence. The location selected for the park in Scenario 1 is near relevant road infrastructure and environmental amenities. Therefore, actually, this location will produce greater economic and social benefits if it is used for housing, and the Park is located elsewhere (Scenario 2). Furthermore, in Scenario 1 the park's range of influence only stretches northward as it is limited by roads and rivers in other directions. On the contrary, in Scenario 2 the park can affect immediate urban areas both northwards and southwards.

Because of this, even though the park of Scenario 1 is a little larger than that of Scenario 2, the reduction of total urban area will be less in Scenario 1 (-3.5%) than in Scenario 2 (-3.9%). Similar tendencies can be observed for other variables; development density, housing quantity and living space. Both Scenarios result in a more condensed city (the open space area practically doubles, located at the edges of the study area) and people are willing to live in more densely populated areas and smaller houses in order to live closer to the environmental amenities. However there is a clear preference for Scenario 2. The population in the Confluence, for example, is estimated to increase by +21% in Scenario 2, against only +17% in Scenario 1, much closer to the proposed goal of 25.000 inhabitants by 2030.

Built area (housing quantity) and living space decrease by respectively -5.6% and -1.5% in Scenario 1, and decrease by -6.3% and -1.7% in Scenario 2. This decrease is much more accentuated for medium and higher income households, meaning that they are willing to move to the more attractive areas at the expense of the size of their homes. In Scenario 2 the decrease in these two variables is even more accentuated, and the values for HHtypes2 and 3 are almost the same. Both types are significantly attracted to this scenario; there is a 37% population increase for each type in the Confluence area.

Model Area		Base Scenario	Scenario 1		Scenario 2		Variable / Legend	Base Scenario	Scenario 1	Scenario 2
		BaseS	BaseS & Proj1	%	BaseS & Proj2	%		BaseS	BaseS & Proj1	BaseS & Proj2
Land-use:							Income Household type			
- Open space	ha	30	58	93.2%	60	100.8%				
- Urban	ha	339	327	-3.5%	326	-3.9%				
- HHtype1	ha	114	112	-2.1%	112	-2.2%				
- HHtype2	ha	173	166	-4.1%	165	-4.8%				
- HHtype3	ha	51	49	-4.7%	49	-4.8%				
- Total (all other uses constant)	ha	812	812	0.0%	812	0.0%				
Population:										
- Model area	#	60418	60418	0.0%	60418	0.0%				
- Confluence area	#	17493	20972	16.6%	21185	21.1%				
Housing quantity:							Household density (hh/gridcell)			
- HHtype1	1000m2	287.5	279.1	-2.9%	278.6	-3.1%				
- HHtype2	1000m2	969.5	911.1	-6.0%	901.7	-7.0%				
- HHtype3	1000m2	347.0	323.5	-6.8%	322.8	-7.0%				
- total	1000m2	1604.0	1513.7	-5.6%	1503.1	-6.3%				
Living space:										
- HHtype1	m2/hh	58.8	58.3	-0.9%	58.3	-0.9%				
- HHtype2	m2/hh	130.9	128.6	-1.7%	128.2	-2.0%				
- HHtype3	m2/hh	158.1	155.1	-1.9%	155.1	-1.9%				
- average	m2/hh	98.2	96.8	-1.5%	96.6	-1.7%				
- average for the Confluence	m2/hh	84.2	85.7	1.8%	86.2	2.4%				
Real estate value:							Real estate value (€/m2/yr)			
- HHtype1	€/m2/yr	87.5	88.3	0.9%	88.4	1.0%				
- HHtype2	€/m2/yr	94.0	95.8	1.9%	96.1	2.3%				
- HHtype3	€/m2/yr	118.3	120.9	2.2%	121.0	2.3%				
- average	€/m2/yr	95.5	97.00	1.6%	97.2	1.8%				
- total	m€/yr	287.6	288.2	0.2%	288.2	0.2%				
- total for the Confluence	m€/yr	74.9	92.3	23.2%	94.1	25.6%				

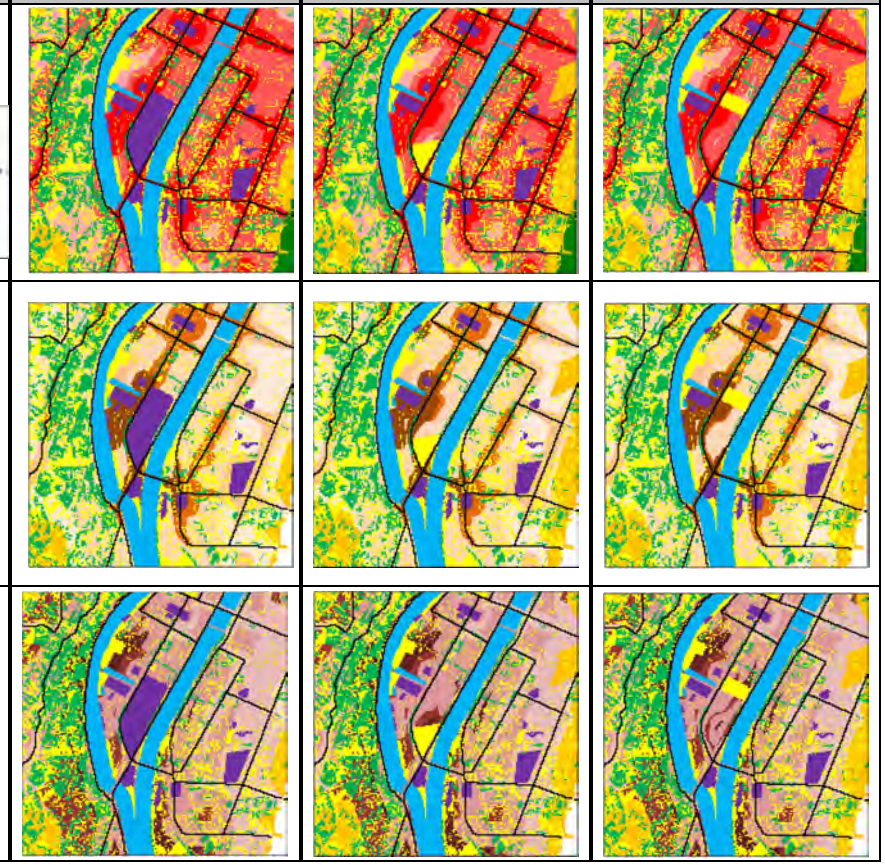


Table 1 – SULD results for the Base Scenario and Scenarios 1 and 2

Even so, HHtypes3 still prefer less densely populated areas and tend to locate on the West side of the parks, away from urban centers and closer to the water. It is also noteworthy how in Scenario 2, HHtypes2 and 3 occupy almost the entire South edge of the former brownfield. For such reason in this Scenario living space area increases in average +2.4% in the Confluence. As well, any of these interventions has a positive impact on total real-estate (rental) values: on average +0.2% for the study area and, respectively, +23% and +26% for Scenarios 1 and 2 in the Confluence area.

4.2. Scenarios 1a, 2a, 1b and 2b

Scenarios 1a and 2a add to the establishment of each of the parks the requalification of the Rhone riverfront, where the Highway A7 will be requalified to a local road thus allowing greater interaction of Confluence households with the water. This intervention will make the study area contract even more, in relation to the Base Scenario, in terms of urban residential area (-4.1% for Scenario 1a and -4.4% for Scenario 2a – See Table 2), indicating that the Confluence will become even more attractive. The open space area increases in the periphery, as households move to the Confluence. HHtypes2 present the largest contraction in urban land use for both Scenarios (-5.0% and -5.5% respectively), albeit with the same order of magnitude as HHtypes3. When only the parks were established, the added value had been mostly obtained by high income households; when the requalification of the riverfront is added to these parks, the added value is large enough to benefit medium-income households as well. Hence, they are willing to reduce their living space as to dwell in this attractive area. Consequently, there is a decrease in housing quantity of -7.3% for HHtypes2 and -7.2% for HHtypes3 in Scenario 1a; and of -7.9% for HHtypes2 and -7.6% for HHtypes3 in Scenario 2a. There is also a decrease in living space of -2.1% for HHtypes2 and -2.0% for HHtypes3 in Scenario 1a; and of -2.3% for HHtypes2 and -2.1%for HHtypes3 in Scenario 2a. These values are twice as large as those related to HHtypes1, that are less able to benefit from these added amenities. Note that these values are usually greater in Scenario 2a.

The contraction of the urban area is obviously translated by significant increases in the centrality and urbanity of the Confluence. The population increases by 21% for Scenario 1a and 22% for Scenario 2a (an increase of, respectively, 4 and 1 percent points in relation to Scenarios 1 and 2). While the increase in population and urban residential area for HHtypes1 and 2 remains about the same in relation to Scenarios 1 and 2 (around +13% and +35%, respectively), the increase for HHtypes3 has been from +35% in Scenarios 1 and 2 to over +50% in Scenarios 1a and 2a. This trend can also be observed for development density and housing quantity. That is, high income households and housing considerably increase in the Confluence when a park is established and the riverfront is requalified.

The major locational difference to Scenarios 1 and 2 is that high income households now also tend to locate on the riverside area North of the brownfield. This allows for an urban continuity of high income neighborhoods in Scenario 1a (as the park is at an extremity), while this is not possible in Scenario 2a. Yet in Scenario 2a high income households (HHtypes3) can locate on both sides of the park, maximizing its benefits, and the core area of HHtypes3 (at the South end of the Confluence) substantially increases, even in relation to Scenario 2. This obviously reflects itself in terms of real estate (rental) values. An overall increase of only 0.2% is again seen for the study area, but the increase for the Confluence area is around 26% for Scenario 1a and 28% for Scenario 2a – the largest increase of all accessed scenarios. Note that the largest increases in real estate (rental) values are obtained by the medium and high income households.

Lastly, Scenarios 1b and 2b add to the implementation of each park the development of a new road infrastructure, including two new bridges over the Rhone, linking the Confluence to the Eastern part of Lyon. The increase in accessibility between these two areas does not significantly affect its attraction potential. The overall gains from these two scenarios are lower than those obtained from Scenarios 1 and 2, and even lower than those obtained for Scenarios 1a and 2a.

Model Area		Scenario 1a	Scenario 2a	Scenario 1b	Scenario 2b
		% related to the Base Scenario			
Land-use:					
- Open space	ha	99.9%	106.2%	94.4%	101.8%
- Urban	ha	-4.1%	-4.4%	-3.6%	-4.0%
- HHtype1	ha	-2.3%	-2.5%	-2.7%	-2.6%
- HHtype2	ha	-5.0%	-5.5%	-4.1%	-4.8%
- HHtype3	ha	-5.0%	-5.2%	-4.2%	-4.6%
- Total (all other uses constant)	ha	0.0%	0.0%	0.0%	0.0%
Population:					
- Model area	#	0.0%	0.0%	0.0%	0.0%
- Confluence area	#	21.2%	22.2%	21.4%	22.3%
Housing quantity:					
- HHtype1	1000m2	-3.3%	-3.5%	-3.8%	-3.7%
- HHtype2	1000m2	-7.3%	-7.9%	-5.9%	-6.9%
- HHtype3	1000m2	-7.2%	-7.6%	-6.2%	-6.6%
- total	1000m2	-6.5%	-7.0%	-5.6%	-6.3%
Living space:					
- HHtype1	m2/hh	-1.0%	-1.0%	-1.1%	-1.1%
- HHtype2	m2/hh	-2.1%	-2.3%	-1.7%	-2.0%
- HHtype3	m2/hh	-2.0%	-2.1%	-1.7%	-1.8%
- average	m2/hh	-1.7%	-1.9%	-1.5%	-1.7%
- average for the Confluence	m2/hh	2.3%	2.7%	-0.0%	1.0%
Real estate value:					
- HHtype1	€/m2/yr	1.1%	1.1%	1.2%	1.2%
- HHtype2	€/m2/yr	2.3%	2.5%	1.9%	2.2%
- HHtype3	€/m2/yr	2.4%	2.5%	2.0%	2.2%
- average	€/m2/yr	1.9%	2.0%	1.7%	1.8%
- total	m€/yr	0.2%	0.2%	0.2%	0.2%
- total for the Confluence	m€/yr	26.3%	28.1%	22.0%	24.8%

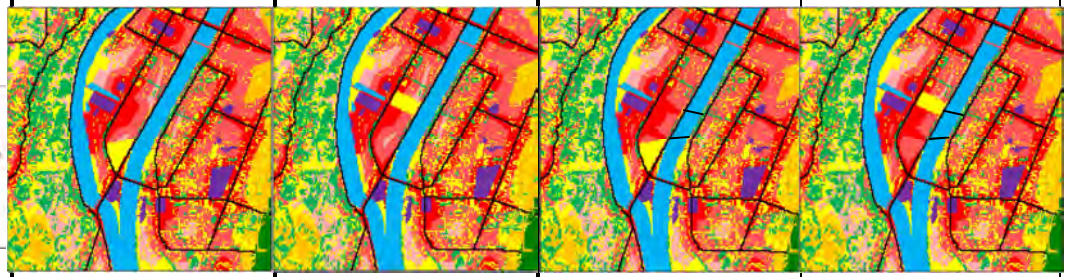
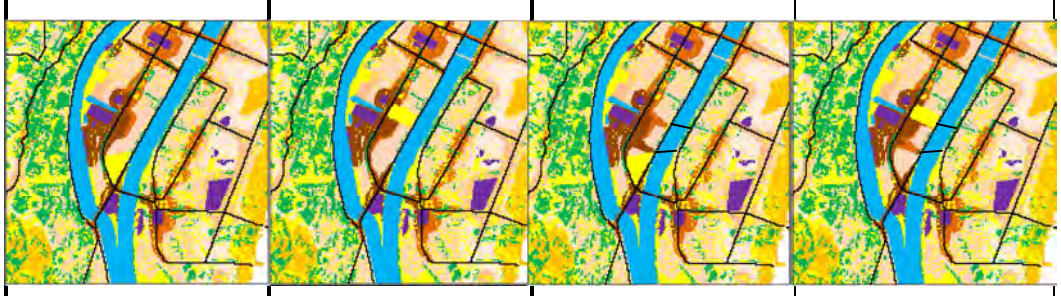
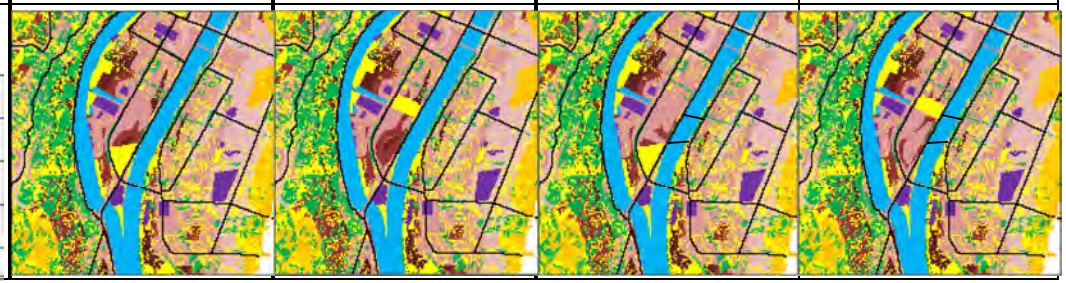
Variable / Legend	Scenario 1a	Scenario 2a	Scenario 1b	Scenario 2b
	BaseS & Proj1 - A7	BaseS & Proj2 - A7	BaseS & Proj1 & Bridges	BaseS & Proj2 & Bridges
Income Household type				
Household density (hh/gridcell)				
Real estate value (€/m2/yr)				

Table 2 – SULD results for Scenarios 1a, 2a, 1b and 2b

Low and medium income households now locate around the roads leading to the bridges, while noting that the areas become less attractive for high-income households. In Scenario 2b this situation is somewhat mitigated, as one of the bridges is in line with the Park.
The city contracts less than in Scenarios 1a and 2a. The urban residential area decreases with -3.6% in Scenario 1b and -4.0% in Scenario 2b – in particular for HHtypes1. Looking at the Confluence, it is observed a substantial decrease in HHtypes3 in favor of HHtypes1. This means that the Confluence area will become more attractive for low income households though less attractive for high income households. Similar tendencies can be observed for the other variables; development density, housing quantity and living space. For these variables, the average values, and the values for HHtypes2, are very close to those of Scenarios 1 and 2, implying that the inclusion of bridges may not be of significance. But for HHtypes1, the values increase when the Confluence area is considered. The areas close to the new major road infrastructures leading to the bridges cease to be attractive to medium and higher income families, and HHtypes1 have now the tendency to live closer together near these spaces. In Scenario 1b, HHtypes3 are not located near the new park at all, whereas in Scenario 2b they locate only in a small strip on the Northern side of it.
Overall, this leads to reductions in real estate (rental) values – in particular in the areas surrounding the access roads to the bridges. The concentration of medium and high income families in the South end of the former brownfield observed in Scenario 2a does not occur in Scenario 2b, precisely because the southern bridge is aligned with this area. In Scenario 1b this bridge is also too close to the established park, diminishing its potential attraction to large income families. Consequently, HHtypes1 are the only ones that, overall, present increases of real estate value in relation to Scenarios 1 and 2 (1.1% for Scenario1b and 1.2% for Scenario2b). Considering only the Confluence, HHtypes1 and HHtypes2 increase in value as compared to Scenarios1 and 2, but not as compared to Scenarios 1a and 2a. HHtypes3, on the other hand, reflect the smallest decrease in value as compared to the base scenario (-0.1% for Scenario 1b and -0.6% for Scenario 2b) as they neither seek new locations nor compete for land. The total real estate (rental) value increases with 22% for Scenario 1b and with 25% for Scenario 2b – the lowest increase of all accessed scenarios. A solution of bridges and new road infrastructure undermines the influence of the proposed urban parks and, hence, an alternative location for the bridges may be considered.

5. Concluding remarks

Using the Sustainable Urban Landscape Development (SULD) decision support tool, this study shows that the establishment of high quality urban parks, along with the requalification of the riverfront, can be extremely beneficial in changing the landscape and the identity of the Confluence. Three main insights have been obtained. First, the urban parks bring added value to residents in urban areas, attracting medium and high income households. Second, requalification of riverfronts brings additional benefits, attracting in particular high income households. Note that in both cases these benefits are proportional to the area of residential land-use immediately surrounding the g/b space. Finally, establishment of new road infrastructure may reduce the benefits of g/b spaces when constructed in their vicinity, as they attract low income households. Consequently, the value added of g/b space is dependent on the location, size and type of intervention relative to existing urban residential areas, urban centers and environmental amenities.
These results, their visualization and reflected insights showcase the potential of the SULD decision support tool to improve urban planning practice. The contributions may be twofold. Firstly, it may improve the drafting of urban plans when alternative planning strategies and land use options are being considered. By making available new information, the decision support tool may help to better identify and configure land-use development options taking into account the environmental and economic values offered by g/b spaces. It may also facilitate stronger synergies between land-use and water resources protection (Fidelis and Roebeling, 2014) and nature conservation.

Secondly, SULD facilitates the planning process and public discussion. By improving stakeholder awareness of the different dimensions of urban land-use and associated environmental-economic costs and benefits, it enriches the public discussion, adds transparency and improves public gains into urban planning decision-making processes. Particularly concerning participatory planning and the participatory process itself, the prospect of a high quality g/b space can exert considerable attraction and potentially enhance the level, intensity and quality of participation. For a successful participation process it is required that 'enough' people are involved (in terms of number and diversity of social groups) and that the focus is on the richness of the discussion.
Consequently, the SULD decision support tool is not an aim in itself but the starting point of a process that has already been applied in several cities, including Copenhagen, Eindhoven and Aveiro. It facilitates participatory planning and scenario development, creating confidence and familiarity with the model and its outputs, encouraging stakeholders to reflect about their reality and future possibilities, and effectively engaging them in the design of urban development plans where the value of water and green spaces may assume a forefront position.

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Revitalisation of the *Ribera de los Ingenios* in the historical core of Potosi, Bolivia

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1 Synopsis

This paper describes a proposed scheme for urban conservation and integral development in a historical city in Bolivia. The strategy combines heritage conservation, participation, cultural research and ecological revitalisation as a chance to reduce poverty and reorient domestic economy.

2 Purpose of paper

If we try to describe a typical planning background for the revitalisation of waterfront districts, we would usually refer to a waterfront area with industrial use somewhere at a coast or riverside, which became underused because of not fulfilling anymore infrastructure requirements for a modern and competitive harbour or hub for logistics, missing appropriate complementary access with railway or motorways, expansion area, etc. Very often is this aspect connected also to the compatibility or not with the standard shipping container in former logistic centres (Schubert 2012:44)

The case of Potosi is different. The city, located next to the river Huayna Mayu is not a harbour city and the river was never a waterway. But the function of the water was vital for its economy, not only as a freshwater provider, but as an energy source for Potosi's mineral treatment mills (Rios 2004:28-29). What is very similar to a typical historic waterfront district is that it is located very close to the city centre, it contains a large resource of historic heritage and it represents an opportunity to readjust the city's economy to modern times, without compromising its legacy. And that makes it particularly exciting.

The purpose of this paper is to show an example of waterfront revitalisation in a site of extremes, where physical witnesses of ancient wealth and speculation in perhaps one of the very first examples of a pure capitalist city in America meet today an authentic industrial legacy from the times of Bolivia's independence fights (Hafner 2010).

Besides environmental pollution, poverty and corruption, this encounter displays a real challenge for Bolivian planners and heritage specialists (Higheras 2012, Strosnider 2008, Rios 2010). They have started a long term process of heritage documentation and revitalisation, which searches for tools for control and participation, as well as research and innovation, which hopefully will be inspiration for other historical sites in Bolivia.

3 Historical Background of Potosi

Potosi is located in south west Bolivia in the high Andes Mountains. It spans between 4100 and 3700 m above the sea level. It was first registered in 1545 and contrary to popular belief, there are no documents of an official foundation (Abela et al 1990). In that year, local indigenous referred to the high silver contents of the soil in the summit of a conic shaped Mountain they called "Sumaj Orck'o".

Speculators would rapidly settle just at the bottom of the mountain, Spaniards coming from all colonial cities of New Spain and natives hoping to work for them. The city would develop rapidly and with little control (Rios 2004:36).

Several chronics describe how easy it was to recover silver from the Potosi Mountain. In the first exploitation decades, there was no need to excavate adits into the mountain. Melting furnaces called by locals "wayras" were set up directly on the hills. Natives were experts in

building and using the furnaces, and also had developed own techniques to extract the silver ore from the rock (Gioda et Serrano 2000, Rios 2010).

Around 1610 Potosi had more than 120 thousand inhabitants and was one of the largest cities in the world in population. Even during its new apogee at the end of the 19th century, Potosi would never revive the extravagant wealth of 1610 (Rios 1994:46).

Throughout its history, Potosi experienced several economic ups and downs, mainly connected to the decline of mineral contents in the rock, recovering when new techniques were introduced. From 1885 on, tin would replace silver as the main exploited commodity.

4 Architectural, Urban and Industrial Heritage

The different cultures that populated Potosi (Spaniards and natives from different ethnic groups in the Andes) shaped also the city with three particular typologies: (1) the Spanish district around a central market square, surrounded by (2) the Indigenous districts in the city boundaries and (3) the mineral treatment refineries called “ingenios” along the River Huayna Mayu and the “Ribera de Los Ingenios”, a river supplied with water from artificial lagoons built in the Cordillera highlands (Muñoz et al. 1996).

Usually the Indigenous districts would be separated in several neighbourhoods populated by a different ethnic group each. And in each neighbourhood a catholic temple dedicated to one of these groups was located. Around 30 churches were built, almost all from different religious orders. The Conquista was not limited to military and political power, but also expanded to a faith crusade.

The temples in Potosi display today clearly how important was the indigenous workforce for the development of New Spain. Particularly the baroque portals were richly decorated with local symbols, a detail which only in the Andean Viceroyalty of Peru was tolerated by the church and denominated “Barroco Mestizo” or Andean Baroque (Rios 2004).

To the architectural heritage belong also private palaces of rich miners and buildings which used to belong to political figures and their families. Also administrative buildings and the first banks in today’s Bolivian territory still exist. The most important civil building in Bolivia, the Potosi Mint, is today perhaps the best museum in the country. The building was financed by the Spanish Empire and was finished in 1773. After its independence, Bolivia minted its first coins here (Rios 2004:49).

The first processing refineries in the city and outside the mountain were only built 25 years after the discovery of the ore. The series of processing plants along the stream was called the “Ingenios de la Ribera del Señor de la Vera Cruz” (“Refineries of the Riverbank of our Lord of the True Cross”). They are today referred to as in its Spanish short name “Ribera de Los Ingenios” (Rios 2010).

Along with the expansion of the silver production, there was a higher need for water supply, not only for domestic use but also as energy source and for mineral washing. A series of dams and water canals were built in the high valleys of Kari Kari, a geological formation from which several streams flow into Potosi. In the next 50 years after 1570, a total of 24 lagoons were built, which provided the processing refineries a constant stream of 150-250 l/s (Rios 2010).

The use of vertical furnaces with conical cavity (similar to the ones developed in Britain for the production of iron and later steel) continued in the refinery plants. However, they would be soon replaced with amalgamation and decantation basins, after the introduction of mercury in the end of the 16th century (Cobb 1977:85).

With the arrival of steam engines and electricity towards the end of the 19th century, water was not needed as energy source anymore. But the rise in the production of tin would mean a rebirth of the city's economy, increase of population and eventually the restoration of the system of lagoons and canals. This would be the last resurgence of Potosi, even though a small one. The main tin producers were other mines like Llallagua and Uncia, a fact which probably also contributed to Potosi's industrial heritage not being completely sacrificed and replaced (Rios et al. 2004, Rios et al. 2010).

5 Revitalisation for a sustainable future. The Master Plan of the Ribera de los Ingenios

The evident need to recover the Ribera de los Ingenios emerged in the early 1980s, when extreme poverty had struck Potosi after the low tin, silver, lead and wolfram concentration in the mine made its exploitation unviable. In addition, the 1952 created Bolivian Mining Corporation, which nationalised all private mines in the country, was in the verge of bankruptcy because of the worldwide fall of the prices of tin and other key mineral commodities.

In 1987 UNESCO inscribed the historical centre of Potosi and the area of the Potosi Mountain in its list of world cultural heritage, which incidentally was the first inscription of a world heritage site in Bolivia (Muñoz et al. 1996).

5.1 *Design of a local strategy for integral rehabilitation*

In the early 1990s, after the first documentation works on heritage conservation had been completed, the agency "Plan de Rehabilitacion de Areas Historicas de Potosi" PRAHP started the development of a general strategy for the revitalisation of the historic city centre, which also included the industrial heritage along the Ribera de los Ingenios, the historic mines of the Potosi Mountain and the artificial lagoons and several cultural monuments in the region. This work was the result of different studies and long cooperation activities between many stakeholders. It required funding from several sources, mainly the Spanish Agency for International Development Cooperation and the Junta of Andalusia, a self government institution of the Autonomous Community of Andalusia in Spain (Rios 1994).

Eventually in 2004 a complete inventory of all refinery plants along the Ribera de los Ingenios was published, together with a rehabilitation strategy proposal and a set of training materials for architects, heritage conservers and planners. This set of inventory and strategy is intended to become a reference document for revitalisation works and an instrument for decision making (Rios 2010).

Even though it is rather a strategic guideline and not formal planning legislation, it is referred to as a master plan. This master plan combines many key elements in the search of an integral and sustainable approach for revitalisation. Among these elements are included education and training strategies, environmental legislation and relieve actions, traffic and transport redesign, healthcare strategies, formal urban planning and economic development strategies.

5.2 *Potosi's challenges today*

A detailed description of this rehabilitation strategy would go beyond the scope of this paper. However, a short description of today's challenges would help to understand its main targets.

Today are still being processed in Potosi Tin, Lead and Wolfram ores. Around 60% of the local population lives directly or indirectly from mining. Miners work mostly as autonomous

workers grouped in cooperatives. They still apply with very primitive mining techniques and die very young usually with pulmonary related diseases (Michard 2008:53).

Even though new markets have arisen, which are driving the prices of mineral commodities, poverty in Potosi is still very present. Half of its population live in poverty conditions and around 14% under extreme poverty conditions.

The historic city centre is very densely built and contains very few green and amenity space areas. Neither do forests surround Potosi. This is because of a long time of deforestation for charcoal and firewood use, but also because given the climate conditions in the Bolivian highlands vegetation growth happens at a very slow speed.

The century long treatment of minerals with basically no pollution relief measures has left a sequel of high soil and ground water contamination (Higueras 2012). The rivers around the city and the Ribera de los Ingenios is still being misused to dump industrial waste waters and domestic waste water and garbage, despite of existing legislation (Rios 2010).

The fact that mineral refinery plants are granted permits to operate anywhere in the city without environmental impact licenses demonstrate that no strict legislation is useful given the high levels of corruption in public administration.

The lack of basic school education, adequate infrastructure for education and infant work are a picture of the severe poverty in Potosi. Social segregation belongs to that picture as well.

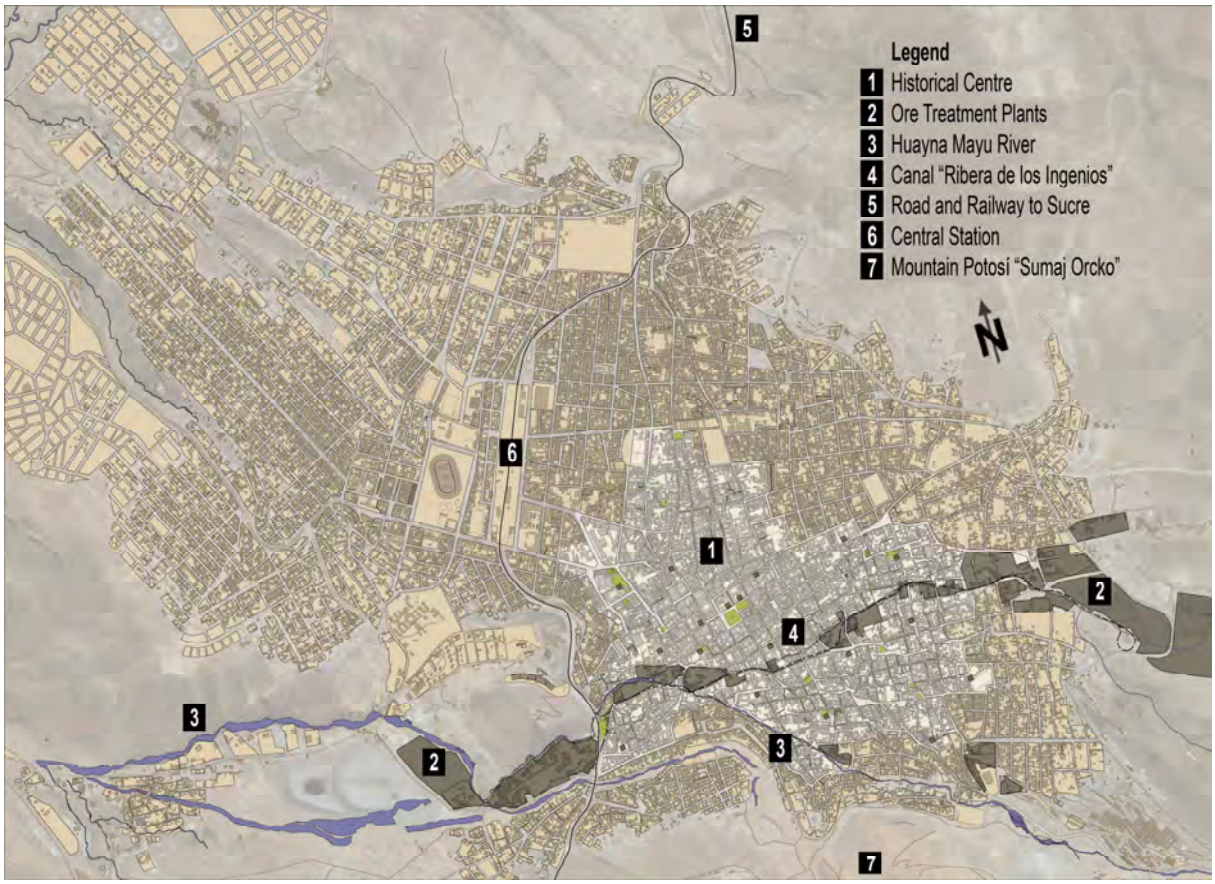


Fig. 1 Drawing displaying the current situation: historical centre, refineries along the Ribera de los Ingenios. Maps not to scale, all drawings by author.

5.3 *Applying the general strategies into a local concept for revitalisation*

The following points are examples of how the basic principles of the revitalisation strategy can be applied into practical solutions with an integral scope. They are not literally part of the strategic master plan, but suggestions developed by the author.

5.3.1 Social development strategies

An evident need is to provide cultural and citizen centres in the city as a participatory key. These sites shall promote social cohesion and involvement of citizens in the discussion on issues of common interest. The use and administration of public funds for community led projects is supported by law in Bolivia, and these centres could be used by dedicated institutions.

These centres can host seasonal cultural fairs, information centres for visitors and similar activities. The neighbourhoods of the ancient indigenous districts can be represented here, providing locals the opportunity to learn about the history of each area and also offering a space for cultural expression through local arts and music. Public libraries would encourage research and reading among the young population and also host local archives and documentation centres, as places of collective memory. They would connect locals through their common history and identity.

The centres can be integrated to the religious temples throughout the city, many of them are underused. This way, these historical buildings would obtain an additional function which can contribute to their preservation. It can be understood as a new interpretation of the role of religious temples in the indigenous districts.

5.3.2 Promoting authenticity and cultural expression

The rich folklore in the macro region Potosi – Sucre – Tarabuco is a well known regional feature, ideal for dissemination of the local culture, strengthening of identity through music, dance and the production of textiles, costumes and music instruments.

While seasonal festivities for students and local groups are very popular in the city and they take place all year round, one can observe that the quality and authenticity of instruments and fabrics has dropped substantially due to industrially, mass manufactured alternatives of lower cost. Traditional local producers cannot compete without adequate infrastructure and support, neither can they pass their skills to young generations if their products get lost.

This issue should get considered when revitalisation of vacant areas is addressed. Considerations will be described below under urban design implementation.

5.3.3 Environmental protection tasks

As explained before, the environmental issues that the long lasting mineral treatment plants have caused need to be addressed in the implementation. The main goal in the short and middle term is to start the relocation of refinery plants from the historical district to a more adequate industrial park, where they can continue their operation following mandatory measures. An industrial park would as well provide improved logistic and energy supply services.

The geographical location of Potosi, 4000m high and 19° South of the Equator predestines the city for the use of solar heat and photovoltaic energy. The sun radiation and temperatures at noon make it possible to collect and save heat energy for immediate use in the evenings. The development and manufacture of solar absorbers and related devices for

heating could be an opportunity for introducing these simple tools, create jobs and improve life quality not only for Potosi, but also for neighbour cities in the Bolivian highlands.

5.3.4 Recovering of heritage and creation of infrastructure for the city

The recovery of the historical water systems ("Ribera de Los Ingenios") and adaptation of historical industrial facilities as useful public infrastructure cannot work without a serious environmental recovery and renaturalization of all water streams affected by the mining activity. These areas, once recovered would become ideal green and amenity space, crossing the entire city. With proper landscape design, they can become a very attractive way for locals and visitors to rediscover the Riverbank of Potosi and look at their industrial heritage from a much more pleasant perspective.

The historic water reservoirs in the high valleys upstream are a good example of how water can enhance the landscape. This can be applied also along the "Ribera de los Ingenios" for gardening and landscaping. Industrial basins of the refineries can be connected to this system and used for collecting rain water, which can as well be used for watering the new green areas. The whole chain would become a green ribbon, enhancing the micro climate.

5.3.5 Infrastructure to support the tourism economy

Among the possible adaptations in former industrial plants, creating tourism related facilities shall be a core component. There are many examples which show how much private investment the creation of single cultural highlights can generate (Schubert 2012). The green ribbon would certainly been a chain of heritage highlights.

A fundamental backbone of this ribbon is an adequate public transportation system, not only within the city boundaries, but also to interconnect Potosi with other attractive sites in the region. The regional railway line, which is underused and currently in operation mainly for the transport of mining products and supplies, is a great opportunity and shall be reactivated with the implementation of this strategy.

5.4 ***A concrete urban design implementation***

The following proposal has a more personal touch by the author. The purpose is to apply the strategic concept into urban design options. It suggests the creation of four nodes of revitalisation in the Ribera de Los Ingenios. These nodes are centred in former refineries with a high heritage value, which are (from west to east: Velarde, Dolores, San Marcos and Ingenio Cooperativas). One of them, the Ingenio **San Marcos** has been already successfully implemented by the local agency for rehabilitation of historical sites PRAHP and functions as museum and restaurant (Rios 2010, Rios 2004). The other three will be described here, having each node a different function for implementation.

The spatial interconnection between all development nodes would be the green ribbon along the revitalised riverbank. In addition, a light urban "green tram" is suggested, which would circulate on adjacent roads and along the river as a smart transportation solution for locals and visitors.

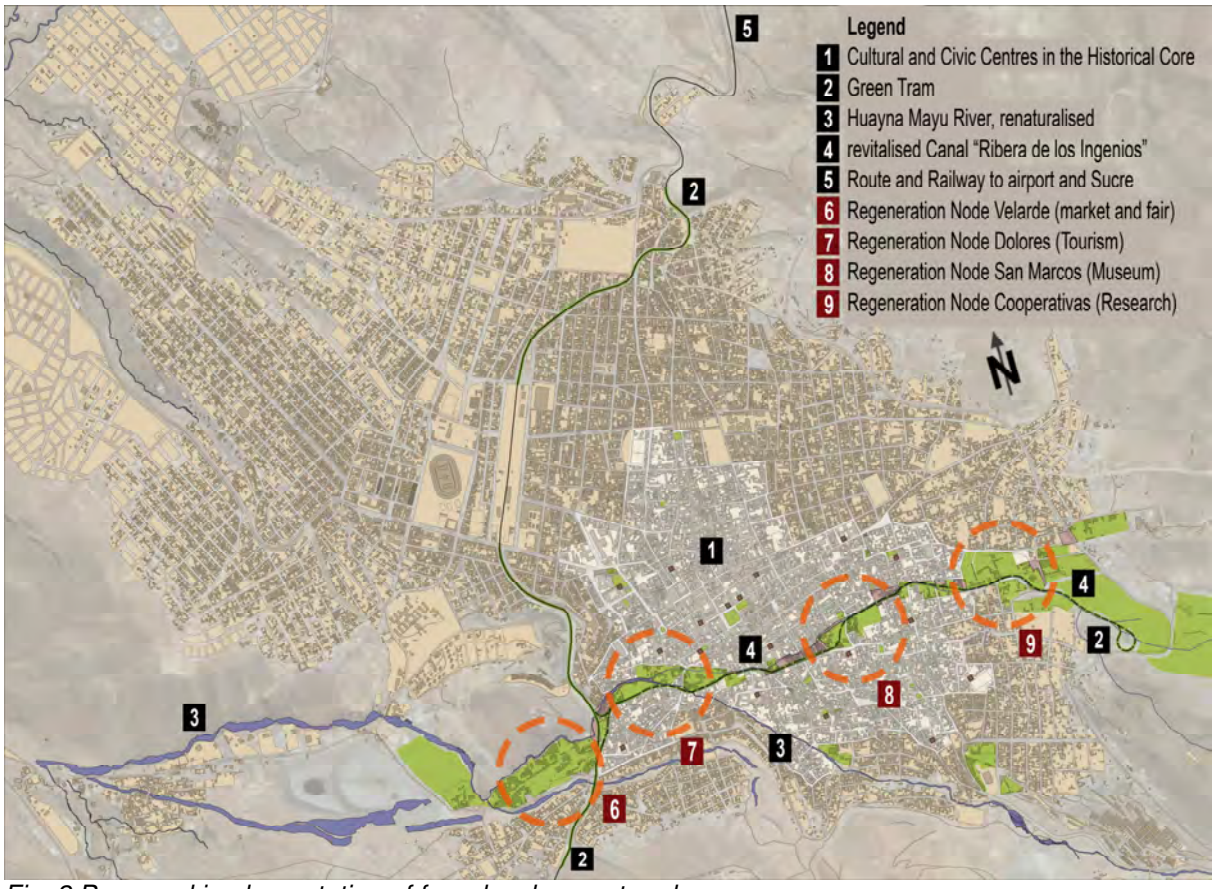


Fig. 2 Proposed implementation of four development nodes.

Velarde is the largest and perhaps the most valuable one, because it describes the historical development of the technologies for mineral refinery, visible in the existing building heritage. It is suggested to combine different functions, among them exhibition fair halls, an open air theatre, green areas and local market.

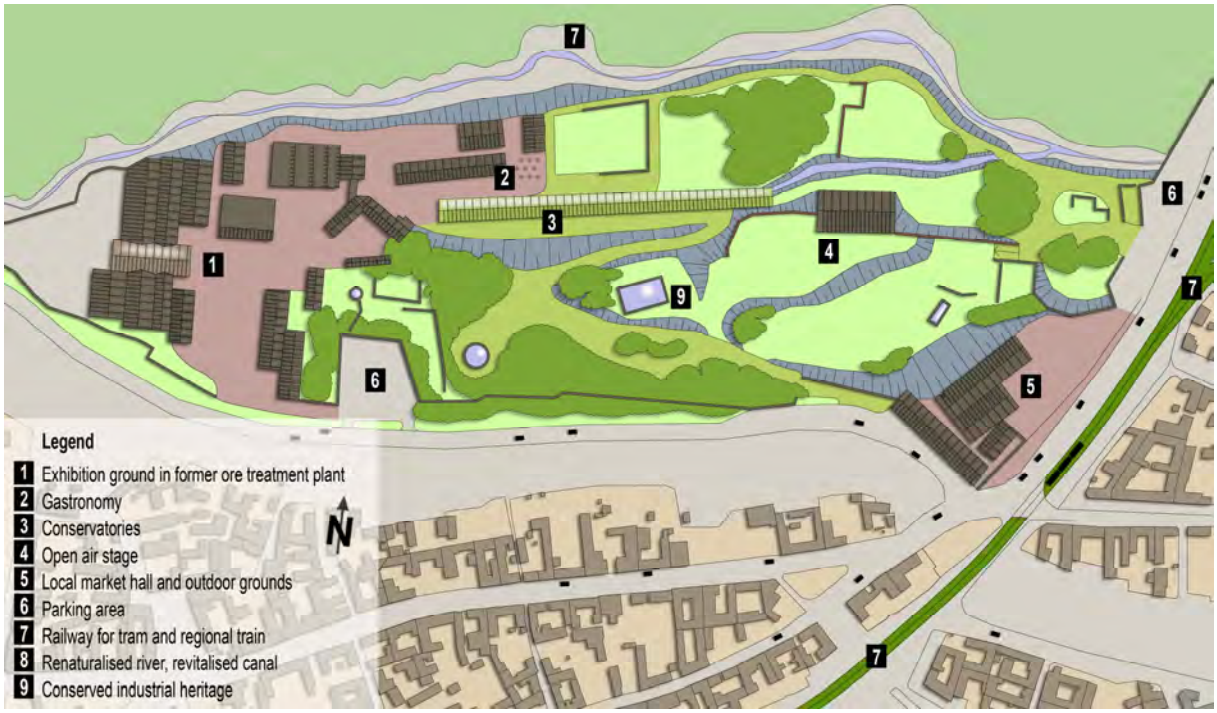


*Fig. 3 Development node **Velarde**, proposed for exhibition fair, open air theatre and local market*

The second node, **Dolores**, shall be dedicated to the tourism economy. It combines four former refineries, and proposes a small park, a youth hostel, a souvenir market and gastronomy along a series of pedestrian zones and children playgrounds.

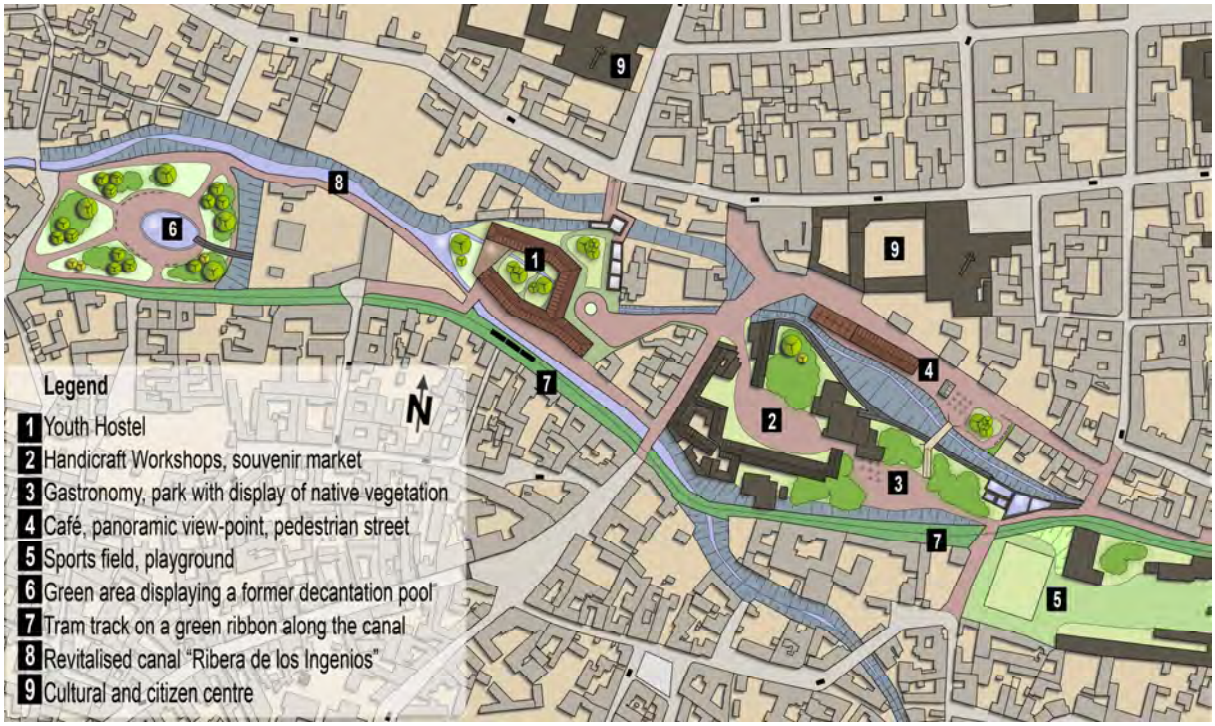


Fig. 4 Former refinery Dolores, converted to provide tourism related services.



Fig. 5 Pedestrian area, water feature, green tram, historic city centre

The development node **Ingenio Cooperativas** is dedicated to research and education. It shall become a subsidiary of the local Tomas Frias University and host institutes for the development of local technologies which shall consolidate the economic transformation of Potosi. History, anthropology, music, language and native arts can be documented and researched in this place as well.

Among the innovative disciplines to be implemented here are: research for generation and implementation of renewable energies in the highlands, bioremediation for the natural recovery of the mining pollution in soil and water systems in the region and the rest of the country, optimisation of agriculture at high altitude and other ones. This site could be a unique location for the research of these sciences.



Fig. 6 Proposed use of the areas in Ingenio Cooperativas as a research centre

6 Conclusions and Recommendations

Potosi will need a long time to implement this strategy, but if the city manages to realise this vision, the benefits will be not only for Potosi. The worldwide monopoly of Bolivian tin lasted for almost a century and left a series of similar outstanding historical mining and industrial centres distributed along the Bolivian Cordillera. The revitalisation of the Ribera de los Ingenios shall be an ideal inspiration.

Despite of the great heritage resources, the process is a real challenge and efforts so far have been by far insufficient. On 16th of June 2014, Unesco registered Potosi in the list of world heritage sites in danger. Perhaps this fact will provoke proper attention by local authorities and population. Without the collaboration of all, the city might see its treasures disappear. Because once they are lost, they cannot be replaced.

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Mysteries of Szczecin's Historic Islands

Anna Tertel

Abstract

This research present reason for the promotion of a historic architecture of ecosystems within city structures to develop water management, describe and qualify water, polders area and protect old hydrological structures from damage allow it to evolve in time for future settlements. This topic is as spatial and formal as political, economic and social issues with the potential to influence thinking and policy of the governors. The studies were performed with qualitative research, literature studies, observation of the study area, the preparation and analysis of historical and contemporary maps and comparative studies.

The aim is to raise awareness the issue of lack of water planning or planning cursory, poor protection of historic ports and urban water, bring attention to urban planning of the aquatic environment and the risk of the destruction of the unique monuments located in closed port areas, as well as to bring attention to the lack of inventory and registry entries monuments and the lack of documented cultural heritage maritime coastal cities. About 60% of Szczecin (PL) is covered by green-blue infrastructure of parks, forests, polders, waters and islands. The islands are located in Oder river delta between Dąbie Lake and West Oder River as unique in European scale natural habitat for plants and animals within the urban structure. The Gryfia is an island, where a shipyard for ships and u-boots functioned. Presently new developments are planned to be built and there is a risk of damage to unknown historical heritage (Figure 1).

Water areas of Szczecin are characterized by a unique natural and historical heritage, which needs constant protection, development, education and promotion among tourists, residents and students. The challenge is to preserve the maritime tradition of that area, respect culture and history of previous centuries. The historical structures should be renovated and preserved as qualitative aspects of landscape and technical heritage. The education about such achievements would increase people's aspirations, values and concerns to water, ecology and climate related topics in port cities everywhere.



Figure 1: View from Ostrow Grabowski on Eagle Isthmus and Naval Island (photo by author 2014)

1. Introduction

This research describes reasons for the promotion of a historic architecture of ecosystems within city structures, raising awareness of water planning problems and need to plan in comprehensive way. In the article is described a quantitative case study of Szczecin city waters. Every section base on literature, maps, photography and drawings and site visits (e.g. ecology maps, topography maps, wind and water current analysis, political borders, analysis of depth, water use etc.). There is a need to develop water management procedures, describe and qualify transborder water regulations, polders area and protect old hydrological structures from damage to allow it to evolve in time for future settlements. This topic is as spatial and formal (water and flood risk planning, climate change issues) as political (different regulations of waters located in two countries), economic (economical and financial value of water and nature) and social issues (increase of sport events and social activities) with the potential to influence thinking and policy of the governors.

2. Legends and stories of Międzyodrze

One of the legends tells of the war between the major deities of the Slavs and Germanic tribes, Odin and Perun, this war went on for years and disturbed the lives of people who mimicked their gods by fighting with each other[1]. In the end, the wives of Odin's Freja and Perun's Mullein decided to stave off dissent and created the Odra River. When Mullein of Perun went on a cruise together, Odin maliciously turned the Odra River into a viper that drank water from the Baltic Sea. Because there was getting less and less water, the god Perun asked Pluskon for help, who tore a piece off the coast of Scandinavia and stuffed it down the snake's throat, choking him. The lands that got thrown out turned into the islands of Usedom and Wolin, the snake's mouth is the Szczecin Lagoon and the trunk of the sinuous meanders is the river, where water from time to time under the influence of the north wind changes direction and flows into the depths of the river, as if the Odra Viper wanted to drink water from the Baltic Sea.

2.1. Geology of Pobrzeże of Szczecin

There is a theory that the Szczecin Lagoon and Lake Dabie Baltic belonged to the Pomeranian Bay. With time along the coast due to sea currents a split was created which closed the Oder River delta islands to form part of the Gulf Sea, combined with three rivers: Dziwna, Świna (Swine) and Piana (Peene). The narrow isthmus between Roztoka Odrzanska and Lake Dabie was probably due to the application of sludge in the region of the mouth of the Oder River delta by the river Ina. Lower Oder Valley also changes its shape as a result of application of sludge in the upper reaches of the river. The largest complexes of these bogs are located at the mouth of the Oder Valley.

2.2. History of the Oder River Delta in Szczecin

In the lower reaches of the Oder more and more twists and turns emerged as a result of sediment deposition in the bends of the river, which sometimes disconnected in the form of lakes, canals and wetlands adjacent to the river. Since the mid-nineteenth century the river was regulated and the edges have been developed. After 1945, the river began to function as the German-Polish border. After the opening of the borders in 2008 the Lower Oder International Park was created from the merger of the German Landscape Park and the National Park with an area of over 117 ha. In the park live many unique species of animals, plants and fish that are protected in Europe and in the world (white-tailed eagle, water lily, otter).



Figure 2: Szczecin port in the evening (photo made by author 2011)

The largest valley city is Szczecin, in which more than 60% of the city is covered by green areas and is biologically active. Odra River Delta, Lake Dabie and Western Odra

through the center of the city are covered by the blue-green waters and port infrastructure, islands, green and shipyards, factories and manufacturing companies (Figure 2). The Oder River Delta is known mainly by employees of ports, factories and shipyards, anglers, sailors and user's allotment gardens. For the remaining residents, these areas are completely unknown and see them while frequently passing the main road or rail from one side of the delta to the other.

The archaeological findings like a harpoon or a hoe from a deer's antler found in Regalica show history of the development sites dating back to the Mesolithic water Szczecin (5000 BC)[2]. For many centuries on the banks of the Oder River on the Castle hill a village existed of later Slavic ports and piers on the banks of the river. April 3, 1243, Duke Barnim I the Good gave the city rights, and consequently rights to fish and sail both on the river Oder, Regalica and Lake Dabie. The town's development accelerated accession to the Hanseatic League in 1278 as the "capital of the Fish" and the acquisition of port land near Dragør and Falsterboo opening the possibility of free trade in Skåne (now lands Danish and Swedish). At the same time German colonists built the marina Havening near the Long Bridge, which expanded over time and merged with the Slavic haven Kessin (borough area) (Figure 3).

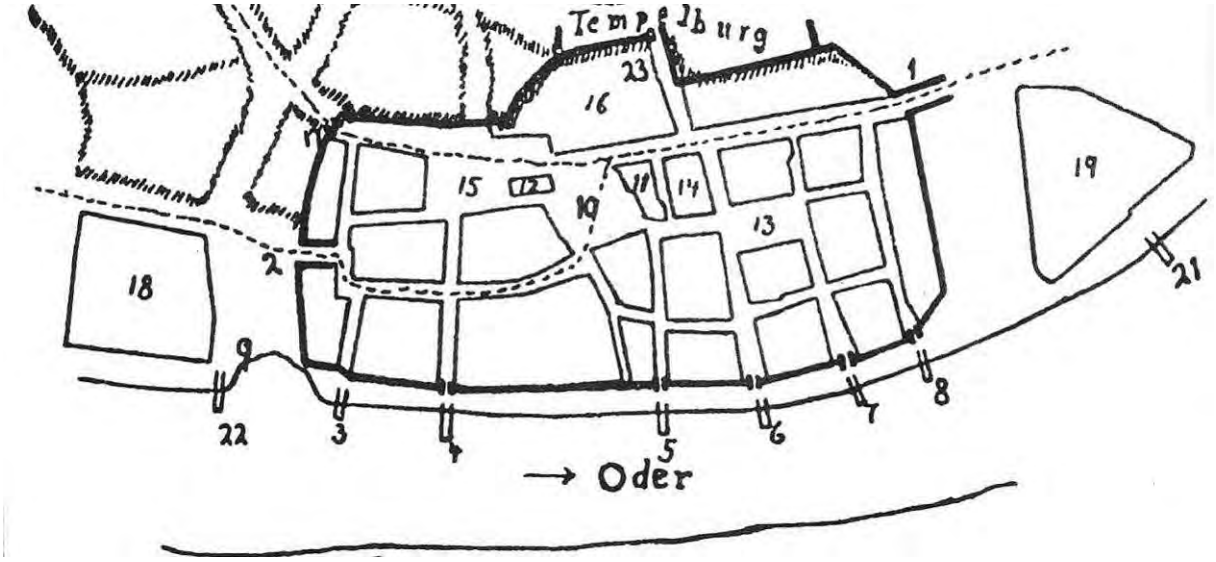


Figure 3: Szczecin with Havening (22, 3, 7) and Kessin (5, 6, 7, 8) in 1237

The gift of Prince Otto I was important for the city in waters adjacent to the city between the Święta (Swante), Ustowo, Regalica (Reglitz), and Międzyodrze between Podjuchy and Dąbie Lake[3]. The city was the owner of the port and fishing areas and shipping routes until April 1, 1923, when they received numerous privileges and imposed obligations related to the patency of the fairway and port facilities for port charges.

The city donated by Otto began to grow rapidly. The first to began developing was the port functions on the Łasztownia Island (1945 Lastadie) lying in the vicinity of the town on the opposite bank of the river. At the same time the Long Bridge was built (Lange Brücke) and Stone Causeway (Gross Stein Damm) leading to the town of Dąbie (city rights 1249). In the fourteenth - sixteenth century warehouses, storehouses, transport and slaughterhouse, workers houses, the church of St. Gertrude and pedestrian Kłodny Bridge and port cranes at the Long Bridge were built on the island. Trees growing on the island were cut down at that time on material for building ships and so far on the island only a few trees planted along major transportation routes grow. In the seventeenth century, the city was conquered by the Swedes, who marked their presence with the building of fortifications, partly in the earlier walls of the city and the Łasztownia Island and Grodzka Island resulting from the Fette Ort Island. In the years 1630 to 1639, based on fortifications built out of stones and rubble, they piled embankments and erected a wooden palisade between Goat and Parnica Gates.

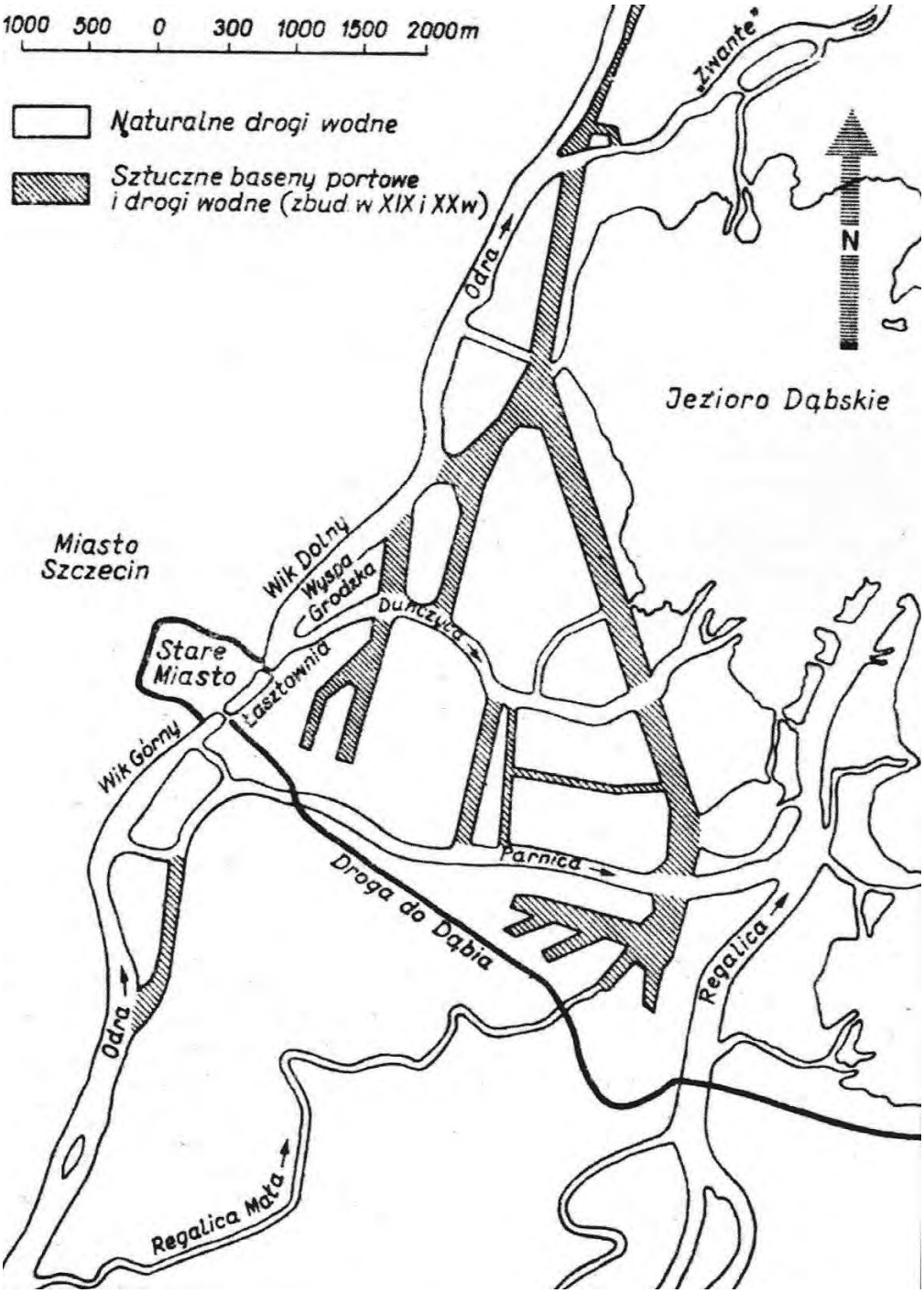


Figure 4: Natural and artificial waters in Szczecin in 30ties of XX century[4]

Szczecin came under Prussian rule in the years 1724 to 1740, a fortress (Festung Stettin) was built under the supervision of the Dutch engineer Cornelius Gerhard van Wallrawe. Earthworks fortress coincided with the fortifications built by the Swedes along the modern Street of Gdansk and Boulevard Street of Władysław IV and the southern part of Grodzka Island. Sheltered city walls enriched with trade and colonial goods were gradually expanded. Despite the wealth of the city it was necessary every year to improve the trail and repair bridges and Stone Causeway which were damaged due to flooding. In 1873 it was decided to liquidate the fortress, which enabled the growth of the city, in the place of Earthen Embankment the streets Wałowa (Wallstrasse) and Parnicka (Parnitzstrasse) were created. At the same time Łasztownia was expanded by covering the arm of the Oder and the

connection of the island of Ostrow Mieleński. In 1894 he began to build a free port (over 60ha including 37.5 hectares of land and 22.5 ha of water) of quay's basin and flushing channel ("Spuell-Channel" height 1.6 and width 1.2 m) from the Parnica (980m long and 100m wide) and turntable (mean 200m).



Figure 5: Main Gate to Free Port in Łasztownia (photo made by author 2014)

Today, the "Land of the former duty free port on Łasztownia" is in register of monuments (number A-904 no. decision PSOZ/Sz-n/5300/68/91 dated 04.29.1991) (Fig. 5).



Figure 6: View of a floating dock built in 1880 (photo made by author 2014)

In 1931 the drainage ditch was expanded and extended by creating a new Grabowski Channel (Grabower Graben) (length 450 m, width 90 m and depth of about 10 m) connecting turntables at the Eagle Isthmus and the Canal of Dębica. Ostrow Grabowski (1945 German Grabower Werder and 1949 Island Green) of the area 175ha is also formed by the division of the Fette Ort Island[5]. A fragment of the Duńczyca was buried to create now operating two docks (Figure 7). The world's oldest repair dock built in 1880 is moored here at the length of 58 m (Figure 6). In the northern part of the island allotment gardens surrounded by wild beaches and destroyed bridges are found, all of which offer a view of the neighboring islands and estuary to Lake Dabie. The southern part serves as an industrial (sewage treatment plant, waste incineration plant, manufacturing and silting fields). Before 1945 the Duńczyca assumed here Waldowshof watering place (owned by Clare Goetzke) and a sport swimming club Waspo Stettin. The local Plans are being considered for the location of new quays for passenger cruise ships and cruise liners. Also planned are causeways across the river Duńczyca with a duct connecting Ostrow Grabowski and Mieleński. In the interwar period many buildings and bridges were destroyed, which were rebuilt after the war in a

different form. Bridge of Żmogus is replaced with a dual Bridge of Port on Parnica, and Kłodny Bridge with the Castle Route acts as a highway between the banks of the Oder River delta over the port area (Figure 4).

After the elimination of the nineteenth century fortifications, the canal had been dug out that separates part of Fette Ort forming Grodzka Island. Along the western shore of the island, opposite the Ramparts the Brave local government set dolphins parking for boats. At the same time many channels were dug out thus creating new islands, most of which are still covered with vegetation or function as industry and port. After 1945, the Grodzka Island has been earmarked for allotment gardens. In 2011 a competition to design the sailing marina was held, which is expected to attract international sailing community to the city. The project proved to be more difficult and more complicated, due to the need to increase the land height, building quays and the process of subsidence of the island. In the development plans of the northern part of the Island is a place for an opera building with a view of the harbor and the Gryfia, where you can still admire the remains of the shipyard for light wooden boats and submarines. The adjacent Mieleński Channel (length 5.5 km and depth 10m) was serving as a parking space for submarines. Between Lake Dąbie and a channel is Great Kępa Island, where for many years Mieleńska Beach communicated with the city center by ships.

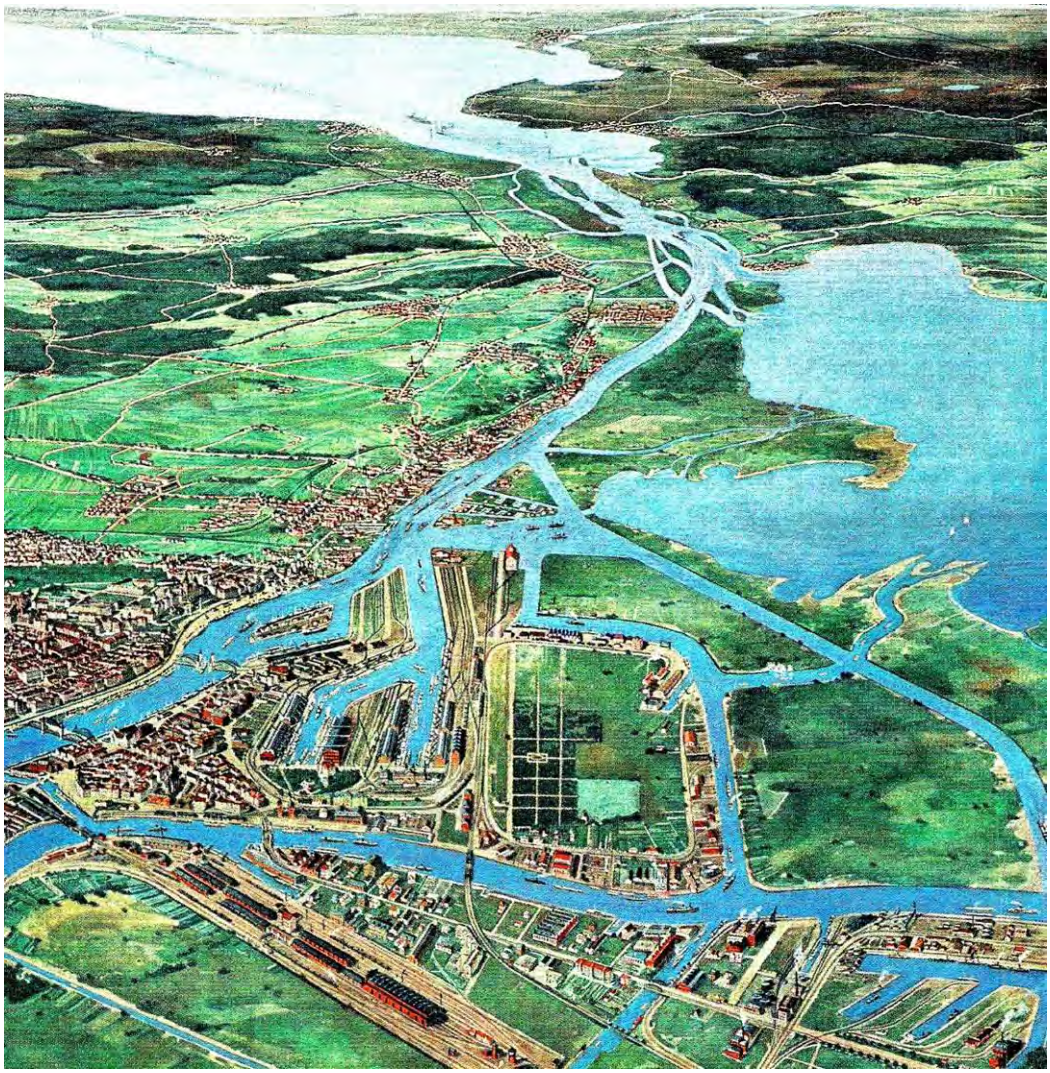


Figure 7: Waterway Szczecin – Świnoujście twenties XX century

Gryfia Island is an area of the repair yard visible from many islands, which was founded January 28, 1903 as the German Oderwerke Shipyard. In the same place there was a small island Tirpitz as the seat for Iceboats Pomeranian Club, Rowing Club and Allemania

Sea Junior Club. During the development of islet combined with the fretboard, the Brodowski Ditch separating the Upper Ship Isle (neck position) from the Lower Ship Island expanded; the waterfront water was strengthened and deepened, resulting in an internal repair pool. The shipyard built and repaired ships and submarines which were submitted (about 290 units in the 4 or 5 submarine-type VIIC). The island has a number of office buildings and warehouses, located at the shelters and bunkers against air raids and shipbuilding equipment (Figure 8).

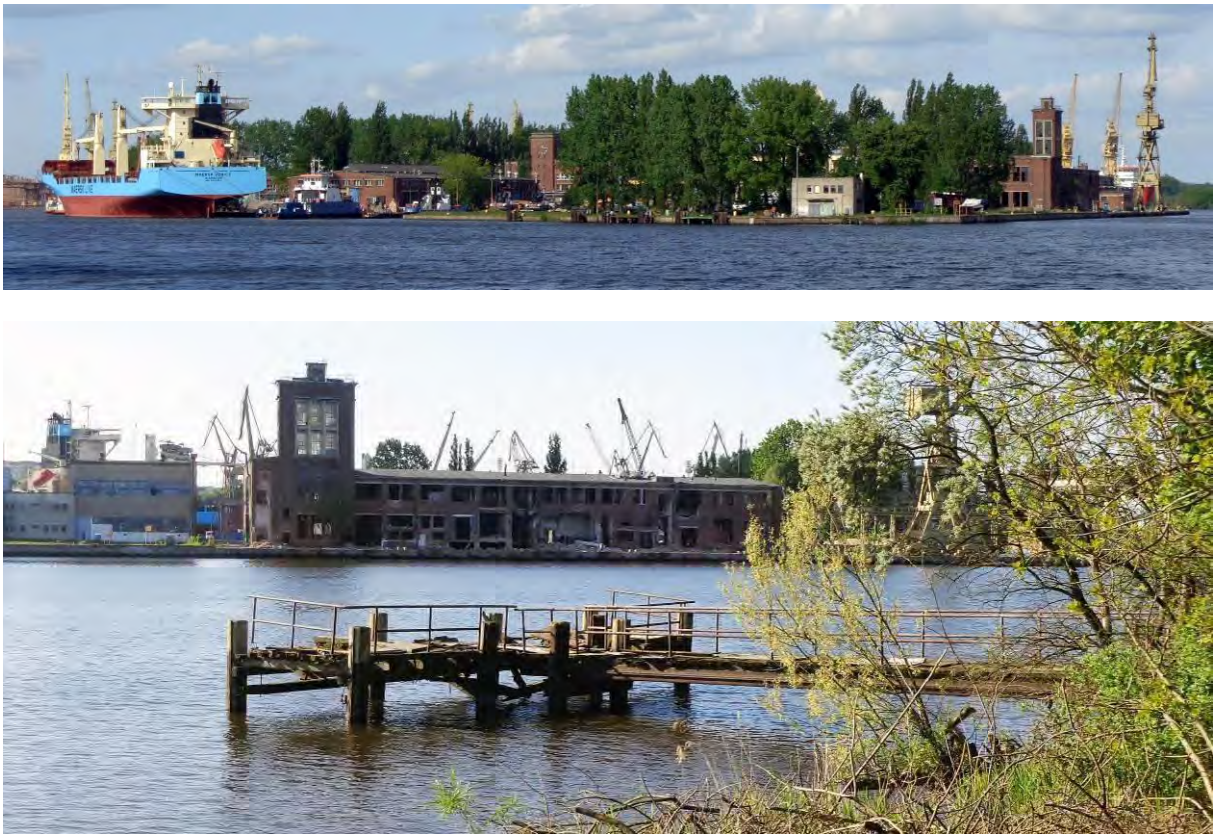


Figure 8: A view towards the island Gryfia from the city center and building periscope from Ostrow Grabowski (photo made by author 2014)

On the Internet you can find a story about adventurers, who while diving at the island of Gryfia found the entrance to the underwater dock with barracks for the builders and crew, which has anti-submarine-up field. The most valuable buildings are: the office building with clock ticking time across the yard and hall of battery with a periscope tower used to calibrate submarine periscopes. This charged batteries for electric submarines motors used during immersion that during ascent flowed from the combustion engine. After the war, Repair Shipyard Gryfia (over 41ha) took the island along with Ostrow Brodowski and Quay Volcano. The island plans to build a factory that produces foundations for offshore wind, which actually threatens the very existence of historic buildings. It was only last year after reporting a desire to demolish these buildings to make room for new investment and buildings, have they been entered in the register of monuments. With this entry, there is a chance that the interesting buildings, which are testimony to the traditions and history of military Szczecin, that survive for future generations and will enrich the architecture of the Oder River Delta. Currently, in the northern part of the island halls and dug piles were demolished for the foundation of new factory facilities. The pontoon bridge was built to be replaced by steel structure. The island will be built at the height of structures from 65 to 76 m and weighing 700 - 900 tons. For this purpose a special economic zone is created and it was decided to bury power lines running above the fairway. Adjacent to the factory rep air dock no. 5 to is to be preserved.

The first railway line was built in the Aug. 15, 1843 led to Berlin, and then in 1845 it was decided to merge the city and port on the eastern shore of Dąbie. Due to the large differences in land, train to cross to the right bank had to back down to 100-meter tunnel, and after moving the crossover drove through the Swallow Island, Kepa Parnicka Bridge, over Parnica, Isle of Puck, a bridge over Regalica to the station in Dąbie. Currently, the railway line was built by the Port Central Station, and the remains of the historic route and iron bridge leading to the Swallow Island, industrial buildings forming Szczecin Venice included into the historical structure of the city (tram depot team. SCP registry no. 1137 decision no. cl.3-5340/117/90 07/20/1990). A working railway crossing over the Regalica with span weighing 163 tons lifted up to let the larger ships pass by. It is a German design based on U.S. Patent registry no. DZ-4140/47/O/K/2008/2009 decision no. 545 dated 07.12.2009). In 1868, the station opened a cargo port on the Isle of Central Puck, allowing transshipment of goods at the port. In 1877 the next station on the left Quay of Wrocław, Parnica, and tracks leading further to the east quay on Duńczyca were opened.

At the end of the war the Germans began to build concrete reinforced ships with a metal mesh because of lack of steel[6]. Tanker "Ulrich Finsterwalder" known as "Betonowiec" was built in 1941 in the yard Warszów - Kazimierzowo (Klotzwert). In 1949, during trial to launch, the ship began to take on water, so it was towed to Lake Dabie and deposited on the bottom. The ship is frequented by birds, boaters and lovers of music of Chopin presenting a concert on board of this ship for sailors and local audiences on cruise ships (Figure 9).



Figure 9: The concert of Chopin music on the deck of "Betonowiec" for sailors (photo made by autor 2010)

3. Analysis of water - island area of Szczecin

3.1. Hydrometeorological processes

Location of a large lake affects the relaxation of the local climate, which makes the winters milder, rainier and colder. Land surrounding waters are mainly deposits plotted by the river, and wetlands that have been partially drained or are home to protected plants and animals (Figure 10). The Odra River in its lower reaches slows down and creates bends in the river, leaving deposits with the headwaters of deposits on the inner banks of these bends. In time this results in an extensive system of meanders, which contributed to the Międzyodrze and separation of the rivers in the two troughs. One of the troughs flows into Dąbie Lake, and the water current flows back into the river through the height Inski Nurt in the northern part of the lake. Thanks to the phenomenon of water in the lake is subject to an ongoing exchange, which prevents the appearance of anaerobic organisms in polluted waters. The lake owes the high water quality and natural sites of the islands, due to the low depth of the lake fairways must be regularly deepened to allow efficient communication for deeper yachts, passenger ships and vessels calling at the port. On the occasion of deepening happens to bring out the traces of Slavic tribes in the area, but there is no accurate inventory of the bottom in this respect. In the area of the Szczecin River, inland water enters the sea waters, which is associated with surge and the lagoon under the influence of the northern and north-westerly winds to the Odra River and Dąbie Lake. Backflow current of water cause large differences in the level of the water and are felt up to

150 km from the sea. Elevated water levels threaten to flood hazard, to navigation by reducing the maneuverability of the vessel, to vertical clearances under bridges or to navigation range aids. The wave on Dąbie Lake due to the size of the body of water, currents and winds can reach 1,4m height and 13m length and be a threat only for small boats, sailboats and kayaks. The currents in the river outside the periods after the spring runoff thaw have minimal speed and very little impact on navigation and the development of adjacent areas.

3.2. Spatial analysis

Delta of Oder in Szczecin is mainly used by fishermen, boaters and anglers. The fishing boats regularly take fish apart from the network at fixed locations on the Dąbie beyond navigation routes[7] (Figure 11). Sailors often sail in trainings and regattas conducted by clubs AZS, Pogoń, Sailing Centre, and Centre for Marine Scouts, Good Marina. The clubs also organize kite trainings. Large sailing ballasts and dinghies participate in regattas organized regularly every week throughout the sailing season from March to October (e.g. Blue Ribbon Dąbie Lake Regatta, Women's Regatta for Bouquet of Dąbie Lake, Epinares Trophy) where the route is always set and dependent on the depth body of water, the direction and strength of the wind, the obstacles on the route. Anglers spend time on their boats or pontoons and prepared positions on platforms at the edge (Regalica). Additionally within the city and Międzyodrze area are several kayak rentals (Dziewoklicz PTTK on south of the city), where people can borrow and sail around all the islands, explore the creeks and canals wildlife and historical heritage of port areas, bridges, wrecks and shipyards.

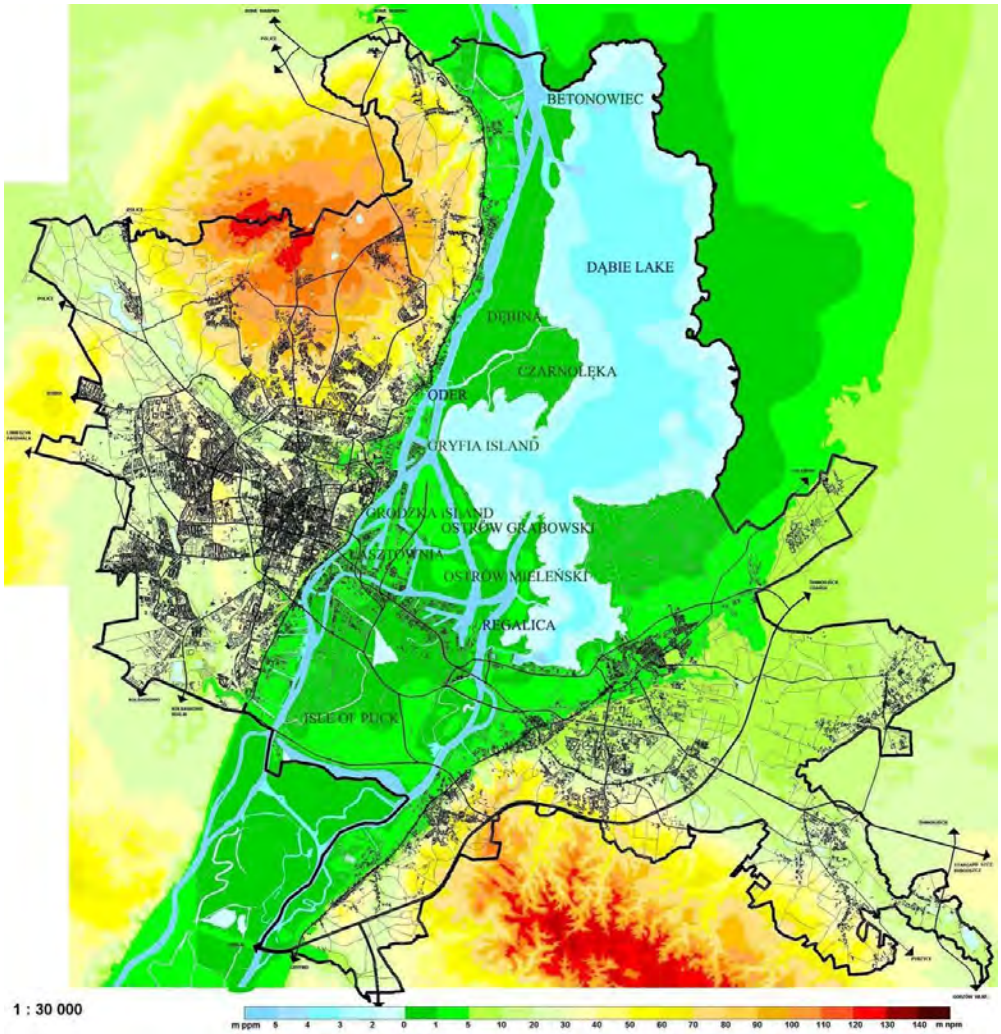


Figure 10: Hypsometric Map of Szczecin with the city borders

Students may belong to the Maritime League Clubs located in schools or join the international regattas on yachts issued by the sailing centers. From the main city quay tourists can go on a cruise for a tour along main waterways around the port areas, Dąbie Lake and Święta to "Betonowiec". On the islands there are several customary moorings for yachts, which are successively adapted to the official yachting visit sites. Water areas have enormous potential for the creation of housing estates on the water, but due to lack of infrastructure and lack of interest this kind of investments is not executed. The islands adjacent to the center function as family gardens or are transformed from the shipyard function for industrial functions e.g. factory constructing foundations for wind turbines. Szczecin will continue to be served as a transit town in the fairway from Berlin through the channel and Niederfinow ship lift to Szczecin and the Baltic Sea. From time to time water also acts as a cultural function for concert bands, choirs and soloists in marinas (AZS) or on the wreck "Betonowiec". The buildings of marinas (Marina Marco) are used for weddings and other private events and meetings.



Figure 11: Removing fish from the nets (photo made by author 2013)

3.3. Ecological analysis

A pre-war naturalist Paul Robień is a local celebrity, who lived on the island of Mienie and attended the bird reserve of Lake Dąbie. Since then, the uninhabited islands bristles are very attractive in terms of nature and the land of islands and waters constitute an enclave for lovers of the environment. The islands are inhabited by wild animals and birds, overgrown unique in Europe plants. These areas are covered by the area of conservation (Dolna Odra PLH320037 area 295.36 km2) and Important Bird Areas (Lower Oder Valley PLB320003 area 616.48 km2) of the Natura 2000 sites. The refuge habitat includes Międzyodrze of the Oder and Regalica up to Szczecin. In this area there are 17 habitats including 5 priorities represented by 450 species of plants (very characteristic floating fern) (Figure 13) and 110 plant communities. The refuge is characterized by outstanding landscape qualities. Influences of the deterioration of habitats have regulatory work, expansion of the waterway Szczecin - Schwedt - channel Hochenzaten and poaching activities.

The main difficulty is the lack of ability to reconcile the requirements of habitat conservation with the economic needs of the city, as can be seen in the lack of continuity preserved ecological corridor along the river delta, which hinders the movement of animals and plants from one protected area to another. Also a significant impact comes from water pollution (factories, municipal sewage), stalling rivers blocking fish migration, release into the wild of alien species disturbing the balance of the ecosystem, climate warming and rising groundwater levels. Other factors include the drainage of wetlands, logging old growth forest habitat for white-tailed eagle, removal of dead and diseased trees, over-exploitation reservoirs and river regulation. Implementations of connectors between adjacent natural refuges in the form of green bridges or tunnels allow collision-free movement of both animals and humans efficient communication.

Refuge on islands is one of the most important places in Poland for breeding white-tailed eagle, red kite and black, black and white-fronted terns and kingfishers. The breeding season can be found bittern, little bittern, crane, and the aquatic warbler. In many places, the birds are scared off and the nests destroyed by tourists, hunters and poachers. The real threats to birds are wind farms, which often are placed on the migration routes of birds. Slots of the largest birds -the bald eagle- on the islands are covered by the protection zone 200m and during the breeding season in March - April 500m from the nest. Kite is a very rare species in Poland (Westpomeranian around 300 pairs, in Poland near 700 pairs); the protection zone covers 100m and 500m during the breeding season.



Figure 13: Floating fern and Water Lilly protected by Natura 2000 (photo by author 2012)

They spend winter in Germany and France. Black kite has similar protection zone while on wintering areas in selected central and southern Africa. Parasol mushrooms choose the crown of 80 year old trees as a habitat.



Figure 14: Location of Dolna Odra refuge[8]

Black Terns are a rare species that nest on the sheepskin coats writhe vegetation, wintering off the west coast of Africa and the Black Sea and the Caspian Sea. Kingfisher is a species associated with water, digging burrows in the steep banks and roots of fallen trees. They are locally rather numerous species, but in Poland it occurs quite rare.

Natura 2000 sites must be included in planning documents: the study of conditions and directions of spatial management in the development strategy of the municipality and local spatial development plan of the municipality[9] (Figure 14). The areas offer the possibility of investment planning, as the more strictly defined species and habitats are protected, but only prohibit the introduction of elements having a negative impact on the habitats of plants and animals. For this purpose, an inventory of habitats, including white-tailed eagle and crane, were made. A network of refuges is an opportunity for the development of eco-tourism in the city and is one of the priorities in the development of sustainable tourism in the European Union. The city can offer the observation of animals and birds, photography of nature, hiking, cycling, canoeing, water sports such as sailing, windsurfing, kite surfing, fishing, and forms of school education as green schools and environmental workshops. The development of tourism and protection of natural values must be developed on the basis of spatial planning vision. It is necessary to regulate tourist traffic to allow contact with nature, which is shaped public awareness and the protection of natural heritage.

3.4. Economic analysis

Financing of planning, protection, monitoring and education comes from the state budget and EU funds under the operational programs providing activities in the field of active protection of habitats and species diversity. Necessary protection measures may be either legal, administrative and result from agreements in order to achieve a compromise between good environment and local requirements of socio-economic development. Natural areas contribute significantly to the health and growth of property values in the neighborhood of natural areas. Furthermore they create places visited by students and scientists and naturalists, and have a significant impact on the growth successes of Polish athletes in water sports. The organization of Szczecin's "The Tall Ships Races" 2007 and 2013 and Match Racing 2014 leads to the city becoming more and more recognizable in the sports arena as a sensational place for water sports and a good mix of inland and sea water.



Figure 15: Waterways and fishing nets on Dąbie Lake

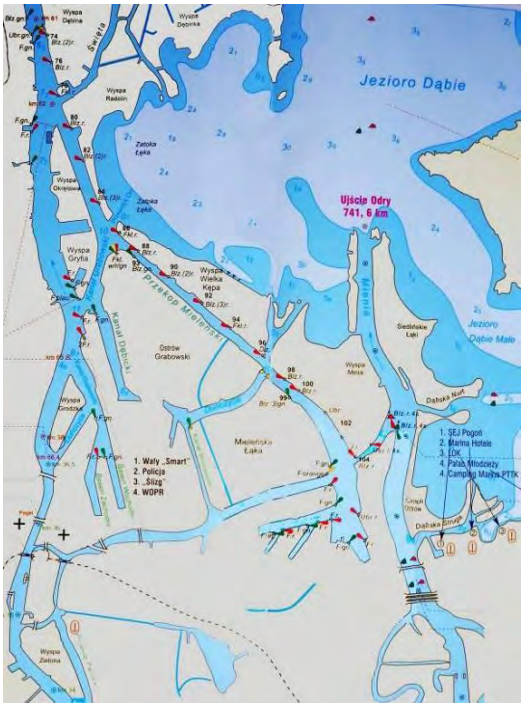


Figure 16: The marking of the fairway at the junction of inland waters and marine waters [10]

3.5. Phenomenon of political, legal and administrative

The Odra River in Szczecin Regional Board (RZWG) within 180km section (from 542.4 to 704.1 km from the source) is a border river between the Polish Republic and the Federal Republic of Germany, and only at the height of Gryfino on Międzyodrze a limit is set right on the area of land skipping Szczecin. It is essential to continue cooperation between the Regional Board and the Directorate of Water Supply and shipping company in Magdeburg, East by the Eberswalde due to various administrative measures and actions aimed river regulation and to prevent the effects of flooding[11].

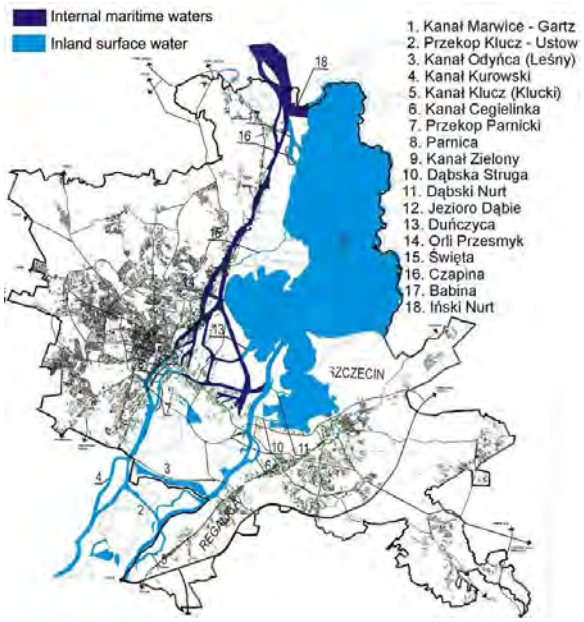


Figure 17: Identification of the fairway at the junction of inland waters and marine waters [12]

Szczecin is also the town where the waters of the sea and inland waters adjacent to each other within a single node watermark (Figure 17). Marine waters are subject to the Marine Office while inland waters under RZWG Szczecin. Marine and inland waterways have different signs, the main difference lies in the color left and right route navigable (Figure 15, 16). The inland trail is oriented relatively to the origin, while the waters of the sea route are oriented relatively to the estuary. Marking the right side is the red sea lane, and the left side the green.

The biggest hurdle is in the fairway bridges (Figure 18):
rail drawbridge span of rotary 35.59 kilometers west of the Oder gauge 3.79,
Road "Long" bridge in the Odra 35.79 km west gauge 3.78 m,
Railway bascule drawbridge span of the 733.6 km Regalica gauge 2.96 m.

On the track lacks the typical yachting marinas for leisure and accommodation and the absence of a ban, there is possible to stop at the former border wharves and customs clearance, or swim towards the Dąbie Small Lake to one of yachting marinas. On Lake Dabie nets are spread to the length of 900m. The most common type are fake nets partition from water surface to the bottom labeled on the ends the white-and-red diamonds, which must pass the white side of the character. Playing sports such as fishing require a permit, just as sailing yachts of more than 7m length.





Figure 18: The bridge over Regalica with movable element (photo by author 2010)[13]

4. Summary

Water Areas of Szczecin are characterized by unique natural and historical heritage, which needs constant protection, development, education and promotion among tourists, residents and students. The islands on the one hand are rich in the history of a duty free port on Łasztownia, Gryfia shipyard of U-boats, iron and lift bridges, industrial Venice and polders south in Międzyodrze and "Betonowiec" in the north of Dąbie Lake. On the other hand, the neighboring islands offer an extremely unique nature, where you can get lost for hours hunting with the camera on a fantastic picture of white-tailed fly.



Figure 18: Historic free port on Łasztownia during a regatta The tall ships Races 2007[14]

In the third part, the same water attracts sailing enthusiasts and professionals who spend their weekends on the water taking part in the regatta, camped, and listening to chamber or official music concerts. In addition, the waters are naturally shaped to prevent the risk of a flood, which further increases their value to the local community. The only thing missing is a full service for city residents and visitors, which would allow the use of all the attractions that the city is able to offer. The canoes can be rented only in one place in the south of the city

however there is no official company to charter yachts to visitors, no possibility of an organized fishing tours and the technical monuments know only enthusiasts. The great historical heritage is underestimated, forgotten and slowly being destroyed, instead of being one of the main attractions of the city, whose history is linked from the beginning with the port and fishing waters. City condition in economic terms is far from similar cities in Poland, while having the most attractive tourist sites, historical and natural water of all the cities in Poland or even in Europe. Temporary events are not enough to give the city an image of the water garden and require continuous information, infrastructure, educational and charter and hotel facilities, which will provide many variants for incoming tourists to spend their free time at any season and weather (Figure 18).

5. Possibilities for the development of aquatic areas

When considering the development of island areas and waters of Szczecin, it is worth to take an action to improve and protect the existing values of these areas:

- Protection of biodiversity and protection from the development of invasive species of plants and animals such as mink. Determination of hiking trails at a safe distance from the habitat and bird protection areas, hindering the ability to leave the route. The connection of separated ecological corridors between Międzyodrze and Dąbie Lake need:

- Reduction of the level of pollution in the river Oder from industrial plants as Police Chemical Plant and Dolna Odra and Pomorzany power plants, by filtering water and wastewater treatment.

- Protection of the lowest-lying areas in the Dąbie, Stołczyn and Skolwin against the risk of flooding during surges combined with high levels of water in the river by levees or dump piling separating floodplains from buildings.

- Protection of the historical heritage of the islands by including them in the registers of monuments, maintenance, revitalization and location of new public functions, in particular buildings on the island of Gryfia, the floating dock and “Betonowiec” wreck.



Figure 19: Shafts of the Brave, place the most important celebration (photo made by author 1014)

- The development, education and infrastructure development of new yacht parking spaces and a marina on the water route Berlin - Szczecin - Baltic Sea along the Oder River and Regalica enabling the launch of small boats, mooring and access to sanitation, electricity, water and municipal sewage from boats. The construction of corners on the lake with the possibility of burning bonfires, camping and access to electricity, water, sewage and

access to credit information on natural and historic attractions situated in the vicinity of the stop.

- Development of the water sports through greater access to the waters, the diversity and quality of charter vessels, diversity and availability of tourist offer for residents and visitors (Figure 19).

The great opportunity of the city is to expose and develop its image with a maritime tradition and historic heritage both tangible and intangible, revitalization of historic buildings and gardens, emphasizing water and wild islands on maintaining respect and admiration for the natural heritage in mind, the development for the consciousness of new generations on the tradition and heritage that will be received in the fall (Figure 20).



Figure 20: Eagle Isthmus between the Gryfia Island and Dąbie Lake (photo made by author)

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REPROGRAMMING THE WIEN RIVER VALLEY

TRANSFORMING A THREAT INTO A RESOURCE FOR ECONOMIC DEVELOPMENT IN VIENNA, AUSTRIA

PEER-REVIEWED PAPER: AUTHOR SILJA TILLNER, ARCHITECTS TILLNER & WILLINGER



Fig.1: The Wien River catchment area from its source to the centre of the city of Vienna extends along a length of 34 km.

Synopsis

The Wien River flows through densely populated districts, the former landscape has become a highway with parallel land resources for buildings and open space. The river and its embankments have deteriorated into a backside with low property values and limited economic acivities. The strategy for stimulating economic development and tourism is on one hand to find a specific suitable approach for each of the six different sections of the river and on the other hand to create a potential linkage of monuments in the Wien River Valley with a ”cultural axis” and an open space network along the river that would renew its identity and strengthen its image.

The significance of the Wien River in the city’s water network

The total length of the Wien River (see fig.1) is 34 kilometres, the catchment area 230 sq. kilometres. After crossing the city boundary, together with the Danube and the Liesing it becomes one of the city’s main water drainage arteries. The outer and inner Wien River Valley with its green open spaces shapes the image of the city.

Introduction – present situation

In cities throughout the world rivers of all sizes are being rediscovered. Until recently, the city of Vienna has had a complex and difficult relationship with its waterfronts (especially along the Wien, which flows into the Danube Canal, which in turn flows into the Danube). In earlier times fear of flooding shaped people’s attitude towards the element of water (see fig.2).



Figure 2: flooding of the Wien River in 1851

Historical development and influences on the area's economy

Historically, the Wien played an influential role in shaping urban development in the late 19th and the first half of the 20th century. Following frequent flooding, the city oriented itself away from the Wien River and only water-related industries (mills, dairies, tanneries, etc.) were located there (see fig.3) *("Das Zielgebiet Wiental als Wirtschaftsraum", Peter Höger,2009*). These industrial uses and the consequential environmental pollution, the floods and related diseases devalued the adjacent areas and the whole river valley for a long time to come.



Fig.3 dominican mill

This situation changed dramatically when, in 1892, after a severe cholera outbreak, the decision was taken to regulate and vault over part of the river to prevent future flooding. Architect and urban planner Otto Wagner was commissioned and a river tunnel (see fig.5) , numerous bridges and an imperial road were planned beside and on top of the river to create a connection from the city centre to the imperial palace, as well as the "Stadtbahn" urban railway line (see fig.4). *("Otto Wagner – Das Werk des Architekten 1860 – 1902", Vol.1, O. Antonia Graf, 1994)*

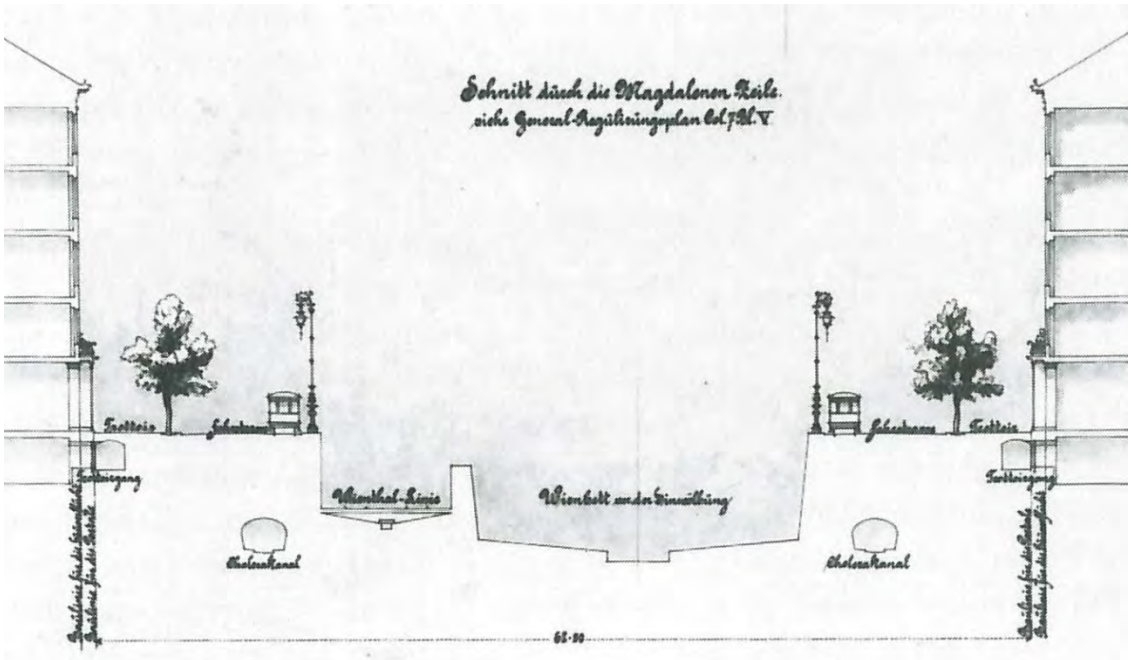


Fig.4: *O. Wagner drawing for Phase I of regulating the Wien by placing it in an open trough with provision for vaulting over at a later point (Otto Wagner – Das Werk des Architekten 1860 – 1902, Vol.1, O. Antonia Graf)*

In historical terms the transformation from a natural river to a regulated watercourse and the planning of a monumental boulevard from Karlsplatz to Schönbrunn, which Otto Wagner carried out in part by culverting the Wien in the area of the Naschmarkt (open-air food market), represent important measures that have had a lasting impact on the appearance of the city of Vienna as well as on the potential economic development of the area.
Wagner designed a "Wiental-Boulevard" from Karlsplatz to Hietzing in a first project dating from 1872/1873. A private consortium consisting of Wagner, Baron Rothschild and Baron

Schey proposed a radical solution: realignment of the Wien River from Schönbrunn onwards, instead of the river bed laying-out a boulevard leading to the imperial palace Schönbrunn, combined with an underground railway (see fig.5). This project was postponed until a general regulation plan for Vienna was developed, laying the foundation for a solution of the Wien and Stadtbahn issue. This consortium represents an early model of a PPP (public private partnership) with even an architect and urban planner as an equal partner to the investor. The expansion of the urban area in 1892/1893 and the competition for the general regulation plan offered an opportunity for Wagner to specify his vision for a Wiental Boulevard, which he named “Zeile”. He proposed that the aligment of the Stadtbahn and the regulation of the Wien should be carried out in such a way that it would be possible to vault over the river (fig.4). The idea of making the river invisible pursued an aim to change the river’s negative reputation that came from its history as a breeding-place for cholera and typhoid fever. The renewal of the collective drainage channel was part of the official program for regulating the river. This impressive public investment in the city’s infrastructure stimulated economic development and the revitalization of the area that was only halted by World War I.
Well aware of the long time frame required for urban planning projects of this magnitude, Otto Wagner calculated that in the near future only a short, inner-city stretch of the river and subway would be vaulted over. Therefore, based on these preconditions, he designed two alternatives for the Wiental Boulevard, one before and one after completion. The drawings for phase I illustrate a centrally positioned Wien River and a parallel railway line both running in an open trough (fig. 4), which still exists today in the area between Margaretengürtel and Steggasse (confirming Wagner’s assumptions that this would be a lengthy process). The two sides of the boulevard, known as the “Linke and Rechte Wienzeile” are laid out symmetrically on either side, with ornate lamp-posts, tram tracks, carriageways, rows of trees and sidewalks. Phase II shows the final version with a landscaped pergola and a promenade with benches above the enclosed river bed, accompanied by a parallel riding-lane and tram-tracks (fig. 5).

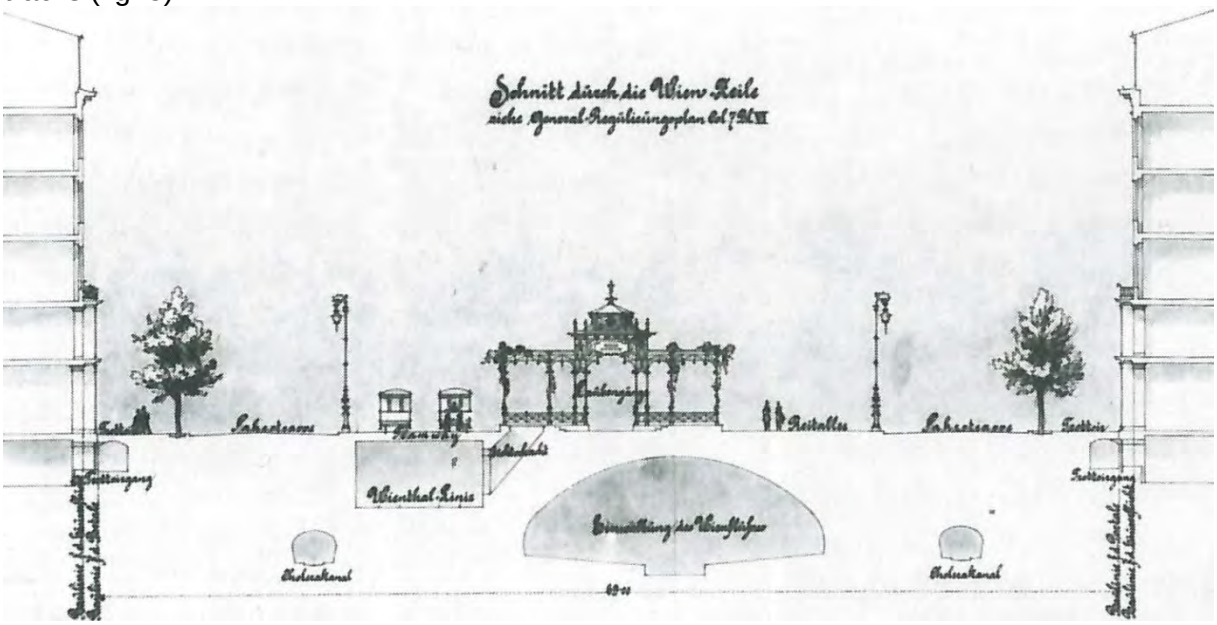


Fig.5: O. Wagner drawing of Phase II of the regulated and vaulted over Wien River with a pedestrian area on top, (Otto Wagner – Das Werk des Architekten 1860 – 1902, Vol.1, O. Antonia Graf)

The similarity to Berlin’s boulevard “Unter den Linden” was entirely intentional. The central leisure area was separated from the streets on either side by lamp-posts. The pergola was never realized, but the Naschmarkt pavillons are reminiscent of the original concept. Finally, still today, the green-painted railings and the white and green subway station buildings lend the Wiental a typical Wagner signature, which has never lost its timeless quality. Next to Kettenbrückengasse Station on the Linke Wienzeile are two famous residential buildings by Wagner, the “Majolikahaus” and the ”Musenhaus”. Both these buildings are popular tourist attractions and illustrate perfectly his vision of a grand ”Wiental Boulevard”, comparable to

"Unter den Linden", for the area between the imperial palace and the Naschmarkt. Wagner's excellent design of public infrastructure and high-quality architecture contributed not only to good city planning but also to an increased property value, illustrating perfectly the significance of planning, urban design and architecture for the public and stakeholders alike. If World War I would not have happened, the positive development of the entire area would have been a showcase for planning with great foresight.
Finally, the element water for the most part played a subordinate role in Wagner's design and was reduced to a decorative function in fountains. One exception is the dramatically orchestrated "mouth" where the vaulted river emerges into an open trough at the western gate of the Stadtpark. The grand portal itself was designed by the architects Ohmann Hackhofer and is a highlight of art deco monuments in Vienna.
Otto Wagner – Das Werk des Architekten 1860 – 1902", Vol.1, O. Antonia Graf, 1994 and Dr. Christa Veigl in „Die Wien", Gebietsbetreuung für den 4., 5. Bezirk, City of Vienna / MA 25

Present situation and challenge: the Vienna Valley as a traffic artery, consequential devaluation and deterioration of adjacent areas leading to more sustainable goals
In the course of history the Wiental (Wien River Valley) has developed from a natural river into a regulated urban watercourse and from the mid-20th century onwards, thanks to the intensive development of road and rail connections, it became the most important traffic artery leading into the city from the west (see fig.6). Worldwide, the edges of traffic arteries offer low environmental qualities and are therefore unattractive for high-quality development, often being sought by unattractive uses as storage buildings, ect.



Fig.6 regular traffic congestion in the Vienna Valley, 2014

Today, the former river landscape is a very busy inner-city highway with parallel land resources, which until recently were reserved for future street-widening projects (Planning Dept. of the City of Vienna, MA 18, Vienna, 2000). As these expensive plans have been abandoned, these areas now represent a potential resource for new buildings and open spaces.
As part of Vienna's urban development, a structure grew up that exhibits highly diverse qualities, deficits and potentials and was identified as one of 13 target areas for urban planning within the framework of "STEP 05" (Stadt Entwicklungsplan city development plan), the Vienna Urban Development Plan programme. The city's planning department identified more sustainable goals for the area in order to upgrade open spaces to raise the environmental quality in general and specifically support pedestrians and cyclists. In order to pursue these goals, a planning study was commissioned in 2009 by the City of Vienna, Tillner & Willinger architects collaborated with Auböck & Karasz landscape architects to analyse the current urban situation of the Wiental and, in a comprehensive catalogue of measures, presented proposals for the design of one of the important focal points in Vienna's future as a city.

Hydrology
The idyllic quality of the Wien in its open trough was deceptive. In fact the river represented a major danger for the constantly growing settlement area of the city. Within a period of just a few hours flooding could cause the Wien to rise to 2000 times its size at low water levels.

The consequences of this were disastrous inundations. For example in 1785 the basement and ground floor of Schönbrunn Palace were flooded.
The flood protection system in Hadersdorf was originally built around 1900 and adapted in the intervening period. In total 1,160,000 cubic metres of water that would otherwise have flowed into the Wien could be retained here.
DI Gerald Loew, Head of MA 45 – Wiener Gewässer

In the course of time the Wien has become an integral part of the system of surface water drainage channels in the city. After long periods of continuous rainfall or snow-melting the ground in the Vienna Woods becomes saturated and can absorb only a small amount of water. Most of the rainwater is carried by small streams that feed into the Wien, causing the water level to rise quickly in the urban area and leading to flooding.
To understand the characteristics of the Wien within Vienna's city boundaries it is necessary to take a regional view of the water economy, especially as regards the flooding caused by heavy rainfall. During a downpour a substantial amount of the surface water in the inner city is led into the River Wien and this can cause the water level to rise by more than a metre within just minutes. This fact imposes formidable limitations on urban design, especially as regards the possibility of accessing the river bed. So far this immediate danger has prevented both the introduction of recreational activities in the river bed in the central city as well as the desirable extension of the Wien River Valley bicycle path (see fig.7), which is very attractive and highly popular but unfortunately now ends at Kennedybrücke, near the imperial palace due to the above mentioned danger of flooding.



Fig.7 bicycle path next to renaturated section of the Wien River in the outskirts

The Wien River's urban planning potential: as an open space resource in a densified growing city and as a chance for economic development of adjacent properties
Vienna's growing population (around 18,000 annually, *Source Statistik Austria, 2014*.) and the fact that the Wien flows through very densely populated districts with an acute shortage of open green space, suggest it is time to awaken the "sleeping" river and to give it a new life. A possible solution to the lack of green space could lie in redesigning existing spaces in-between buildings and along the existing infrastructure to make them into pedestrian-friendly open spaces.
Traffic arteries have left visible scars in the urban grain, often creating "inner edges" that form physical and social barriers. These forgotten and neglected spaces along streets and railways present an opportunity to reweave the torn mesh of the urban fabric and secure urgently needed open spaces. New future uses for these spaces such as recreation, urban farming, energy farming, etc should be explored.
Existing green areas or undeveloped areas that could be used as green spaces play a major role, as does the network of bike and pedestrian paths which, although well developed, could be still further improved, or local accents and linear urban planning elements with a high level of urban quality that could be better integrated in the existing mesh of the city.

The untapped open space resources offered by the Wien make it a highly promising piece of infrastructure. This potential will be further explored below and strategies and proposals presented about how this resource could be exploited.



Fig. 8: The Wien Valley in six typological sections that pay tribute to its different characteristics, ("The Wien Valley Development Plan", Tillner & Willinger, Auböck & Karasz)

The Wien River Valley Development Plan – finding varied adequate strategies for different sections of the valley to upgrade open spaces, link existing attractions and stimulate economic development

The plan focused on a section of the **Wiental** (Wien River Valley), extending 14 kilometres from the western city limits and the retention basins to the east, where the Wien flows into the Danube Canal. It offers an interesting cross section of various Viennese urban landscapes, linked by the river, accompanied by an important traffic infrastructure.
To begin with a comprehensive planning analysis defined urban typologies and six characteristically similar sections of the Wien (see fig.8). The criteria employed in defining these sections were: the size of the planning area, the characteristic city form, the density and the built form, accessibility, comparable challenges and problems, similar strategies for interventions. Critical areas for interventions were selected at a later point.

Along its length the urban context of the Wien River Valley exhibits a number of different characteristics, from the scattered development, commercial areas and extensive green spaces in the west, followed by a gradual, but at places very abrupt, development to densely developed inner city areas. In the outlying area on the western edge of the city the river valley opens and is characterized by a mix of building styles dating from various epochs in history. In the urban area the appearance and character of the river valley changes continually in accordance with the surrounding built fabric. In the city centre, between Naschmarkt and the imperial palace, continuous building blocks of uniform height are located close to the river bed and these define the built form and urban riverscape. Finally, the section of the river with its typical proportions and building materials contributes largely to its overall appearance and image.
In order to define the most significant urban characteristics, the authors looked at the urban diversity and the development that increases in density towards the inner city, while also considering the most important urban deficits and potential. On examination it was revealed that the urban planning deficits lie primarily in the severe separation of the northern areas of the city from the southern areas caused by the Wien River Valley. Here the use of the Wien Valley as an axis for road and rail traffic plays a decisive role. The left-over areas and urban wasteland produced at many places by urban planning and the often visually unappealing transitions between individual urban components also represent a serious urban planning deficit (see fig.9).



Fig.9 unattractive and dangerously narrow left-over spaces for pedestrians and cyclists

Planning strategy and design concept to improve sustainable networks, redesign and create open spaces, link attractions and upgrade properties through aesthetic improvements – following the Otto Wagner model

The targeted improvements to connectivity focus in particular on important routes, the connection of pedestrian and bike paths, including those that need to be optimized, as well as on the shortage of crossings over the Wien.

The principal aim of the design concept is the general aesthetic improvement of the valley, making it more appealing for use by and recreation of local residents, visitors and tourists, while enhancing the distinct urban identities of the different sections along the river.

The plan identifies locations where existing public amenities can be maintained and strengthened and new urban measures initiated.

Critical areas of intervention were selected: the design of the edges at street level can be implemented in the short term, offering a unique chance to upgrade an open space that leads right through the city and changing it from a peripheral zone into a spine. This new identity is to be developed at the river banks and along the parallel streets.

The project proposes converting traffic areas into pedestrian zones, making novel connections between the districts and the river embankments, and introducing green landscaping. The regeneration of brown-field sites and allocation of new building sites should then follow.



Fig. 10: The Wien River Valley – potential for generating new open spaces – 4 terraces above the subway line offer a connection to the river , bridges link the two sides ("The Wien Valley Development Plan", Tillner & Willinger, Auböck & Karasz)

Design guidelines were formulated by means of goals as well as specific measures.

Important urban design goals are: strengthening the awareness of the Wien River Valley and emphasising its overarching linear identity, while also creating local identities, improving its qualities as a place for recreation and leisure, and creating cohesion between bordering urban districts.

Important measures in implementing the goals are: emphasising existing attractors and urban qualities, encouraging activity during all periods of the day (thereby also increasing public safety), creating connections, promoting bicycle and pedestrian traffic, creating new green spaces, upgrading existing ones, upgrading left-over and wasteland areas and restructuring them, formulating the context of old and new (safe-guarding the built heritage while promoting high-quality contemporary design), and developing a lighting concept.

Future Potential

To make the river bed accessible flood protection measures would be required. On the basis of new technologies and intensive cooperation these could in the future transform this idea from a vision into reality.

The Wien River Valley as a cultural axis and a visitor's guide

The city develops along both banks of the Wien, starting from where the Wien flows into the Danube Canal to the retention basins in the west. The areas along the river vary in terms of their urban density, the range and number of their leisure and recreation areas, and in accordance with the developed historic appearance of the city.

The Lainzer Tiergarten (park) in the west of the city is a popular goal for excursions that offers numerous hiking and bike trails for leisure-time activities. The green and open spaces in the Wien River Valley represent important local recreation areas for the inhabitants of Vienna as well as for tourists. Of major importance is, for example, Schönbrunn Palace (fig.11), which with its monumental Baroque buildings, parks and the zoo is the main hub of the area throughout the year.



Fig.11 Schönbrunn Palace

The Wien River is flanked by a significant number of cultural facilities and monuments that help define the identity of the individual urban areas bordering it. The tourist attractions in Wien River Valley include the frequently visited Schloss Schönbrunn, Secession, Musikverein, Künstlerhaus, Konzerthaus, Stadtpark, Urania, Stadtbahn Pavillon, numerous Otto Wagner bridges, Kaiser Pavillon and Art Nouveau residential buildings by Otto Wagner, etc. Currently these famous buildings that represent different eras and architectural styles are not perceived as part of the Wien River Valley or seen in relation to the Wien. The Wien River Valley is not yet viewed as a continuous, linear "cultural axis", even though it offers enormous potential for linking these individual attractions with an attractive network of open spaces, bicycle and pedestrian paths along the Wien. A major part of the Wien Valley Development Plan focuses on linking these cultural highlights to create a "string of pearls" in which the monuments represent the "pearls", the river and the network of open spaces along it the "string". This newly defined cultural axis could become a major attraction for all those visitors who want to explore the cultural highlights of the city in an ecological and sportive way, i.e. bicycling, walking and using public transport – the subway line U4 – or a combination thereof. Maps, in printed form as well as apps for smart phones, internet terminals with wireless hot spots would be created and serve as focal meeting and information points.



Fig. 12 Wien River Valley, selected intervention areas – wooden decks above the subway line connect to the river, the first terrace to be implemented in 2015, (The Wien River Valley Terrace, Architects Tillner & Willinger)

A novel cooperation between the tourism office and the different municipal departments (planning, parks, river, canal, public transportation, streets,…) would be essential in order to implement this in a coordinated and effective manner. International examples illustrate how this approach can work successfully: the culture tram in Essen, where a streetcar line has become a carrier of information on highlights, or the historic trail in Boston, where the city's history can be traced on a walking tour with various informative stations, while the red line in Perm on the other hand is a very simple and effective red line painted on the sidewalk, connecting important historic monuments. All these projects invite visitors or interested local people, school groups, etc. to explore a certain path in the city and to experience history not only by visiting individual historic monuments but also by understanding the connective urban tissue in-between them and tracing the developments over the course of time.
These investments in connecting existing monuments with attractive open spaces would result in a sustainable upgrade of the entire area and a raise in property value. This phenomenon is to be observed in the city of San Francisco, where after the removal of the freeway along the waterfront and the creation of a pedestrian-friendly boulevard in it's place, an economic upgrade of all adjacent properties followed.

The Wien River Valley and the Wien River as an opportunity and a stimulus for economic development

History of economic development in the Wien River Valley

"In the first half of the 19th century increasing numbers of commercial businesses and industries settled along the river, including tanneries, dyers and commercial laundries. Near the factories the well-known *Zinskasernen* (lit. rent barracks, tenements) the workers' housing of the 19th century, were erected. Waste water from the businesses and residential buildings flowed into the Wien, which increasingly became a murky, stinking refuse drain.
"Die Wien", Gebietsbetreuung für den 4., 5. Bezirk, City of Vienna / MA 45

This transformation from a river to a sewer canal damaged the Wien's reputation and caused urban development to be oriented away from the river, with the rear of the buildings generally turned towards the river. In 1892 a municipal decision on the investment to regulate the Wien was taken and this was to change the role of the river in the city for the time to come. The large-scale engineering and architecture project by the city of Vienna engineers and Otto Wagner was a long-lasting catalyst for economic development in the Wien River Valley.
"Up to 1899 the regulation works were carried out parallel to the construction of the main drains on either side of the Wien River and of the Stadtbahn. The works were started by building flood retention basins in Weidlingau. From Mariabrunn to the Danube Canal the Wien River was led in a deep artificial bed with a solid base and sides and part of it was covered over. The plans envisaged vaulting over the entire inner city section of the river from

Hietzing to the Stadtpark. However it was intended to carry out this work in stages in accordance with the financial possibilities." *"Die Wien", City of Vienna / Konrath, MA 45*

The plan for a grand boulevard from the city centre to the imperial palace was never implemented due to the outbreak of World War I and the impoverishment and economic stagnation that followed. In the 1950s the idea of building a city highway in the river became popular and the construction of a clover leaf connection to the Gürtel was even discussed. Fortunately, reason paired with economic restraint prevented the implementation of these absurd plans. In 1958 three alternatives for the "Wiener Westeinfahrt", the main western road link, were discussed: a highway in or above the river, or streets on either side of the river. The last of these options was the cheapest to build and therefore selected, the idea of building a highway in the river was finally officially abandoned in 1972.

Recent economic development in the Wien River Valley

In the last decade a change in attitude towards river embankments and sites along riverfronts in Vienna has occurred. Thanks to excellent flood prevention measures in the city, which have been improved continually over the last decades and are now highly effective, along with today's technical possibilities for exact weather forecasting, the danger stemming from floods has lost much of its impact as a negative deterrent. Internationally, rivers in cities have experienced a revival and have been rediscovered, redesigned in pedestrian-friendly ways, and restored to their natural condition. This trend has not gone unnoticed in Vienna. The City of Vienna is growing rapidly by a figure of around 18,000 people a year. This steady increase in population is a positive development in the light of the many urban and rural areas in Europe where the population is declining. The growing population stimulates an increased demand for housing, social and public services, schools, kindergartens and open spaces. From an urban planning standpoint it is wise to increase the housing supply within the city area also, and not just on the outskirts. This is especially true as large new sites suitable for affordable housing have become scarce and now more remote sites with less favourable public transport access have to be chosen for development. Currently, non-profit developers planning affordable housing projects are confronted by the challenges presented by increasing land speculation and soaring property prices. As a result, private developers with no demand for public subsidies are better able to meet the expectations of higher land prices. Cost-intensive redevelopment projects within the city boundaries have a better chance of being economically feasible – leading to a "rebuilding and renovation boom" of the building-stock from the end of the 19th century to the present. The city planning department aims to achieve an equal distribution of the additional housing needed by building new developments on the outskirts and also increasing density. This concentration on densification in the inner city should, ideally, be accompanied by generous open space design – but in practical terms there are no new sites for green open spaces available.

If one positions the Wien River in a context already established along the Danube Canal and the Danube, where former edges have become prime development sites, it is only a question of time until this potential is tapped into along the Wien as well. The hype of the second municipal district on the "far side" of the Danube Canal and the development of prestigious sites there are recent phenomena, as is the focus of high-rise construction on the banks of the Danube and the Danube Canal. In the near future numerous projects will be developed along the embankments. Given the scarcity of development sites, the Wien River Valley could also be identified as a coveted resource for building sites and the creation of open space, invigorated by its renewed identity. New uses should be explored for these open spaces in the future: recreation, urban farming and energy farming, etc.



Fig. 13 A new pedestrian bridge will connect the two districts on either side of the river, the open spaces are redesigned, implementation in 2015 (The Wien River Valley Terrace, Architects Tillner & Willinger)

1 CONCLUSION AND FUTURE POTENTIAL

A public investment in open spaces would result in a more sustainable densification process of the inner city districts and better integration of growth into the existing communities. The Vienna Valley possesses the asset of world-class monuments that are currently disconnected and not perceived as related to the Vienna Valley. The linkage of these monuments with an open space network would offer a new attraction to visitors and residents and create a unique identity for the area. The urgency and potential to create these attractive open spaces and networks exists due to the edges of the existing traffic artery, which has left scars in the urban grain, often creating "inner edges" that form physical and social barriers. The "space in-between" along the street presents an opportunity to reweave the torn city fabric and secure urgently needed open spaces. Even to the city's water authority, the potential of a renaturation project seems desirable, in accordance with the current appreciation of the value of a river course that is better integrated into the image of the city. The sections of the river that were recently renaturated are located in the outskirts of the city, nevertheless they have become an attractive open space resource for leisure and environmentally friendly commuting alike. In the near future, a continuation could become reality due to a new and more precise technology in weather forecasting.

An "image transformation" achieved by attractive open spaces and linked historic monuments would not only stimulate tourism but also positively influence property values and currently underutilized sites or buildings, i.e. bland warehouses and storage buildings that currently disfigure the Wien River Valley, would disappear and could be replaced by attractive mixed-use buildings.

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The health impact of urban parks along waterways

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Well designed parks along waterways promote health and well-being of local inhabitants. They may integrate the nature into the life of people and bridge the diverse population of city dwellers. Waterfront parks can be used to address the issues of social inequality. The design of urban parks could benefit from studies that examine the therapeutic qualities of nature. The creation of therapeutic landscapes is a relatively new landscape design approach that might bring additional benefits if employed to urban parks design.

1. Introduction

How people spend their time has significant impact on their health. McHarg suspected in 1969 that the presence of street trees, playgrounds, parks and other amenities is contributing to health promoting neighborhoods (McHarg, 1969). He underlined that according to Williamson physical, mental and social health are unified attributes, and moreover aspects of physical and social environment are health corollaries (McHarg, 1969). The presence of waterways inside city fabric provides urban designers with additional challenges. Waterways form a natural grid of green infrastructure, which should be intertwined with streets connective network. The way the human settlements meet waterbodies can influence the habits of local population. The waterbodies have innate soothing qualities, while proper park design can stimulate physical activities. Even moderate levels of activity decrease the effects of sedentary lifestyle and mitigate modern health concerns. The waterfronts provide the possibility to integrate nature directly into human lives. Moreover, public green space including waterfront parks, can be used to address the issues of social inequality. Waterfronts are the most attractive areas of towns due to their cultural heritage and landscape values. They are very attractive and hence are often subject to chaotic fragmentation. The research about therapeutic qualities of nature and the implications for establishing urban parks along waterways are presented in this paper.

2. Benefits of contact with water

Water is a very attractive factor of public space. Waterways are a natural feature which might add value to the adjacent city landscape. The presence of water was mentioned as the most valuable feature of open space by elderly respondents of I'D GO survey conducted in England by OPENspace Research Centre (Incusive Design…, 2003-2013). Most participants (97%) wished to have some water feature in their local open space. "The presence of water features such as a fountain, a river, beach or lakeside, contributed to longer time spent in

outdoor activity" (ibidem). The waterways provide a unique addition to open space and attract people seeking contact with nature.

The concept of *Biophilia* describes an innate bond that humans have with nature. The contact with other living organisms offers many benefits to people. The properties of nature to impact mood and attitude help people disentangle from problems of life. That impact has been proven to be helpful in holistic recovery from stress, therefore accelerating medical healing processes (Cooper-Marcus C, 2011) Often cited Roger Ulrich experiment, related to observation of post-surgery patients, demonstrated that even a view of nature through a window, compared with a view of a brick wall, can speed up recovery process (Ulrich R., 1984). Since this study, plenty of equally interesting research of nature's impact on human health have followed (Diette G.B. et al, 2003; Velarde M.D et al, 2007). People exposed to urban green spaces are more likely to live longer and engage less in aggression and violence (Sullivan, 2011). A team of Japanese scientists has proven that a well designed walkable green spaces are crucial for the longevity of elderly citizens (Takano T. et al, 2002). "The influence of nature (…) on health has been investigated by two large-scale epidemiological studies: a cross-sectional study of the Dutch population and a Japanese longitudinal study among elderly inhabitants of Tokyo" (Health Council of the Netherlands and RMNO, 2004). The research evidence confirms the therapeutic effects of contact with nature on human health.

3. The benefits of open green space

The way people spend their leisure time has significant impact on their health. The design of urban fabric along the waterways which includes significant amount of open green space, could promote health and well-being of local inhabitants. The benefits of open green space can be divided into the following three categories (Cooper –Marcus & Francis, 1998):

1. Physical and mental restoration
2. Social contacts
3. Physical activities.

There is plenty of research confirming that nature can help people in all these three categories.

3.1 Physical and mental restoration

Nature has properties that can stimulate mental and physical restoration, and even initiate natural processes of healing (Health Council of the Netherlands, 2004; Sternberg, 2010). Open public green space offers opportunities for relaxation, self-expression, release of energy, fun and enjoyment (CABE, 2010). The contact with nature can improve mood, reduce stress level among all age groups and even help children with ADHD to concentrate

better (Harting et al, 2003; Faber Tylor & Kuo 2009; CABE, 2010). It was demonstrated that green space can also benefit cognitive restoration and self-discipline (Faber Tylor & Kuo, 2002; CABE, 2010).

3.2 Social contacts

Public parks located along waterways could bridge the natural environment and the diverse population of cities. The parks along waterbodies are often called linear parks as they tend to be relatively narrow and extend along the waterbody banks. The linear parks could extend to connect different neighborhoods, thus enhancing the creation of bridging social capital. The ability of urban space to promote social integration was subject of many research efforts. Local public parks were found to promote place attachment and influence people decisions to stay in a neighborhood, according to Dines (Dines et al, 2006). The hard space of streets and markets were determined to be as important as green space by many people in the study. Location and surroundings of public space matter the most. Linear parks along waterways provide opportunities for strolling and long walks, as well as talking to people. ”For some people a sense that a space offered the freedom to linger was important (ibidem)”. Landscapes have the ability to trigger memories and facilitate a sense of belonging (CABE, 2010).

3.3 Physical Activities.

The physical design of urban fabric matters, because the frequency of park visits depends upon the distance to local park. Residents use more often parks located within walking distance from their housing estates. Respondents living closer than 300 meters to open green space are more likely to be physically active and less likely to be stressed, than those living further away from parks. (Danish study showed that 81,1% of all daily users of parks live within 300 meters) (Stigsdotter et al. 2010) A similar research in Gdańsk, Poland confirmed that majority of park visitors live within walking distance from the park (PKE 2010). It is a common knowledge that even moderate levels of activity, for example walking, decrease the effects of sedentary lifestyle and mitigate contemporary health concerns. Easy access to park makes people more willing to walk (Takano et al. 2002). The connections between urban fabric and water are crucial to invite people to visit parks along waterways.

4 The experience of healing gardens

The pursuit of therapeutic landscapes is a relatively new landscape design approach that could be applied to urban design. The experience of creating a healing gardens in healthcare settings might be a helpful tool for development of public open space. Initially, their design was rather a trial and error method, but gradually it became more scientifically proven, and nowadays many guidelines are available. The most explicative definition of a therapeutic

garden has been provided in the ASLA's [American Society of Landscape Architects] spring 2010 newsletter : "A healing garden is a somewhat vague term lacking precise design implications, but its purpose is to support generalized healing by helping patients become healthful, well, and whole. A meditation garden is likely to encourage inwardly focused attention for the purpose of deepening personal knowledge and attaining peace with oneself. A contemplation garden provides an ambience conducive to examining issues beyond and/or larger than oneself in a thoughtful, deliberate, perhaps religious or mystical way. (…)The term "therapeutic," however, suggests more than healing, meditation, or contemplation. The therapeutic garden may, and most likely should, include aspects that promote restoration, but it is more than any of these other garden types" (Gerlach-Springs and Healy 2010). The benefits of contact with nature should extend beyond the healthcare facilities, into the place of living of all people, healthy and ailing, disabled and able-bodied. A place for healing, meditation, contemplation, or a public therapeutic garden could be provided along the waterbanks to make good use of soothing qualities of water.

5 The idea of Biophilic city

Furthermore, the entire city could be envisioned as a healing garden environment. The concept of biophilic cities could be regarded as an attempt to create a health-promoting urban design with therapeutic qualities that can counterbalance the effects of stressful life conditions in congested modern towns. Nowadays, urban residents need nature even more, as towns are growing and pushing the open landscape and wildlife further away from city centers. However, the concept of integrating nature into the design of our cities is still not regarded as an important issue. The role of nature in our life should be better recognized. The concept of biophilic cities could be utilized to make our cities more human friendly. This idea is about "redefining the very essence of cities as places of wild and restorative nature, from rooftops to roadways, to riverfronts." The concept of biophilic cities is about expanding existing greenery, in order to harbor more abundant nature in a close proximity to city dwellers. There is a need for public parks and healing gardens within walking distance from each dwelling and place of work. The benefits derived from knowledge of local nature extend to place–strengthening and place-commitment (Beatley T. 2011, *www.biophilicities.org*). The idea of biophilic city is easily applicable to cities along the waterways. The waterways could serve as a natural skeleton of green infrastructure which can expand into urban fabric with green corridors.

5.1 Continuity of walkable green waterfronts

An interesting question might be how to transform modern waterfronts into friendly walk-able green public spaces. People are willing to spend more time outdoors, if the facilities provided

in public space meet their needs. The participants of I'D GO survey conducted in England underlined that good paths (easy to walk on and enjoyable) and available facilities, such as benches, toilets and shelters made a big difference on how often and how much time they spent outdoors (www.idgo.ac.uk). Additionally, one of the key factors is to guarantee the continuity of paths and loops along the waterways. Continuity is not only important for ecological corridors, but also for human perception of restorative qualities of waterbodies. Continuous paths promote walkability of paths, thus helping people to fully enjoy walking along the waterbanks. Any development, which occupies the waterfront and disturbs access to the waterway, breaks that continuity and hinders walkability. Social and environmental justice demands the continuity of paths that span through various income neighborhoods, binding different groups together and providing a space for unforced social contacts.

6 Social and environmental justice

Frequent contacts with nature encourage people to nurture a deeper engagement in a community. However, the access to greenery is often reduced in lower-income communities. The study by Mitchell & Popham (2008) showed a correlation between a green space exposure and the likelihood of death in the middle and low-income group. "The poorest income group was found to benefit the most from proximity to green spaces in terms of reduced mortality (CABE, 2010)". What is perplexing, at the same time, this relationship in the highest-income category was insignificant. William Sullivan provides explanation for this observation. He suspects that high-income earners are more likely to travel, or engage in other activities in more distant environments that are surrounded with greenery. The lower income groups rely more on nature in their neighborhood and they need it the most. However, at the same time, the most vulnerable, low income groups do not have equal access to natural environment (Capacity global; CABE, 2010). Low income areas are often deprived of high quality green space (CABE, London 2010). Access along the waterways is often disturbed by gated communities, fences, as well as, pay per entry sport and leisure facilities.

6.1 Connections of urban fabric with water

Waterfronts in city centers are among the most attractive land properties. The developers in Poland also perceive them as one of the best investment options. The estates which border the waterfront offer unobstructed view of waterbody from the first line of buildings. Thus, natural banks, previously riparian areas, or sandy beaches can be a very valuable investment for real estate players. Therefore, the city authorities are often prone to surrender to economic incentives. Sometimes, the local communities fight back, as it was in the case of Gdansk Coastal Belt (PKE, 2010), publicizing the injustice of planned development, and

offering alternative concepts. Unfortunately, local Authorities often surrender unaware of consequences. The worst scenario leads to limiting access to waterfront only to those who can afford the price of luxurious real estates, excluding the communities with lower income. Thus, for the low income groups contacts with nature could be limited only to fragmentized, less welcoming waterbanks, further away from city centers. For the poorest communities not only the quantity of green space, but rather the quality of that space matters the most.

7 Two different approaches

In this paper I would like to discuss examples of two polish cities situated along the waterbodies: Gdańsk and Poznań. They represent two different approaches. Gdańsk is located by the seashore and Poznań is located by the riverside. The discussed cities have relatively high general green space ratio – Gdańsk 29 % and Poznan – 42%. In Gdańsk there are 747,3 ha of public green space, Poznań 1109,2 ha. The area of public parks in Gdańsk amounts to 210,2 ha, in Poznań 347,3 ha (GUS, 2012, www.stat.gov.pl). In Gdańsk there are 785 citizens per 1 hectare of public green space, in Poznań 497. The area of open green space per inhabitant is larger in Gdańsk 118,8 m^2/inhabitant than in Poznań 93,6 m^2/inhabitant (Urbański, 2009).

7.1 Gdańsk

The open green areas in Gdańsk are divided into two large parts: the first one along the Gdansk seashore [*Pas Nadmorski*] and the second large area of Tri-city Landscape Park [*Trójmiejski Park Krajobrazowy]* as well as a handful of smaller parks and community gardens (Urbański et al, 2009). Gdańsk Coastal Belt [*Pas Nadmorski*] forms a strip of sandy dunes, green areas and undeveloped open space along the sea cost. It extends from the former Vistula river bed in Gdańsk Nowy Port to Gdańsk northern city borders and further to the adjacent cities: Sopot, Gdynia, and even further to Hel Peninsula, along the coast of the Bay of Gdańsk. The Coastal Belt is inhabited by various forms of wildlife.

The recreational facilities built in the Coastal Belt should serve inclusively all income groups of inhabitants and tourists. In 2010, Polish Ecological Club (PKE) conducted a social survey, which demonstrated that people are flocking to this space not only from bordering neighborhoods, but also from more distant parts of the agglomeration. Majority of coastal belt visitors (63%) would leave their cars at home and use a public transport, if only it would be more efficient. The respondents indicated the Coastal Belt as the most attractive area in the agglomeration. They often mentioned walking and cycling as their preferred activity. The maximum number of bicycles observed in spring 2014 within the area of Coastal Belt in Gdańsk was approximately 10429 bicycles per 24 hours. There are 105,9 km of dedicated

bicycle paths in Gdańsk, however the City Authorities estimate that the network of roads available to bicycle traffic sums up to 466 km (www.gdańsk.pl, www.rowerowygdańsk.pl).

The bicycle paths leading to Coastal Belt are among the most attractive for the bicycle users. They are well connected to surrounding housing districts and SKM train stations.

The health impact of Coastal Belt on local residents should not be underestimated. The sea beaches and coastal forest together with recreational infrastructure were cited as great features of this area. The Coastal Belt offers inhabitants of Gdansk's most populated districts (approx. 9736 people per km²) a possibility to have contact with nature in public green space within walking distance from their homes (Trojanowska & Sas-Bojarska 2013). Even during cold winter months people are walking, jogging and relaxing in that space. On the other side, negative features, mentioned by visitors, included primarily the threat of urbanization with high rise buildings and deforestation, as well as insufficient sport infrastructure (PKE, 2010) Those fears are well-grounded. The coastal belt is exposed to strong economic pressure for further development (Sas-Bojarska, 2013). It spans along the seacoast and borders various neighborhoods, from working class neighborhoods build in 1970's, to new upscale apartments and gated communities. New gates and fences hinder the possibility to wander freely along the coast clearly marking economic divisions and dividing the previously open public space. The plans for development should be revised because there is no other open area that could accommodate the needs of Coastal Belt visitors.



Figure 1: Gdansk Coastal Belt in the summer

7.2 Poznań

Poznań used to be one of the greenest city in Poland. The open green space of Poznan forms a system of green belts and wedges (Urbański et al, 2009). The City of Poznan is divided into four parts that are separated by cross-like green structure of the Rivers Warta, Cybina and Bogdanka. This spatial structure of 'green cross' might offer Poznań citizens an easy access to green space from their homes and workplaces. The rivers used to play an important role in the identity of Poznan inhabitants. Nowadays, the city of Poznan is striving to reestablish its historical relationship with the riverfront and waterways. In 2012, after public consultations with local community, a strategy entitled "Development Strategy River Warta, Poznan 2012-2030" was proposed. The waterways are promoted as connecting elements in

the city green infrastructure that links a variety of city parts and elements by a network of green spaces, roads, paths, etc. The goal of this policy is to link the river zone with city districts, rendering the river zone accessible to people and making it a part of a larger network of green and water areas. ”Connections (green, pedestrian, cycling) are to be made between the built-up areas and Warta to link residential and work areas with the green river zone. These connections will facilitate easy access to the river and improve the interaction of people (and flora / fauna) between the living and working areas and the Warta”(Development…2012). The document considers the needs, health and well-being of local people. Attracting citizens to a green area of Warta River can offer huge benefits to society. Open green space provides a place for: physical and mental restoration, social contacts and physical activities within easy walking distance would be created. The health impact of creation of necklace of well-connected parks and paths should be stressed. According to local poll conducted by the Poznań Authorities, one third of citizens claims to participate in physical activities once a week. When asked about long walks, every other respondent claims to go for a long walk at least once a month (Urząd Miasta Poznania, 2013). There are over 120 km of bicycle paths, but so far they seem not to take advantage of the river scenic views. One can hope that the implementation of this strategy would lead to increase in physical activity of city dwellers. It should also improve the interconnections between the riverfront and the bicycle paths in existing beautiful parks.

This plan is also important to improve flood safety by creating more „room for the River”. „New river branches will be created (e.g. Chwaliszewo, Portowo, Lecha Bridge, Ostrow Tumski) to further increase urban qualities”(Development…2012). Hopefully the new document will bear good results with renovated waterfronts and waterways in Poznań. However, there are threats of fragmentation and chaotic development, similar to those in Gdansk. They should be avoided, if the health impact of open green areas would be taken into consideration.



Figure 2: Poznan Malta in the summer

8 Conclusions

The open green space of waterfront available to all is a slogan which best summarizes the scope of this paper. The health impact of green space should benefit all social groups.

Although healing landscape was proven to soothe the negative effects of stressful life conditions, it is not a medicine or remedy in traditional sense. Instead, development of open green areas should be regarded as a chance to improve the quality of human life. The tradition of meditative and leisure gardens is centuries old. From ancient times parks and gardens were regarded as peaceful oasis in a hectic world. All the research on therapeutic qualities of nature have proven the importance of nature for our health. The need for a healing contact with nature should be fulfilled through easy access to open green space from places of living and work. As waterfronts offer a very attractive place for human and nature interaction, they especially should be available to all people The question is what should be done to secure inclusive design and open public access to the waterfronts. The biggest threats to connectivity between urban fabric and waterways are: chaotic development, construction of gated communities and closed continuous line of new buildings. All those developments could limit access of lower income social groups to waterfronts. Even wild riverfronts have their unique values, which should not be lost. The health impact of open green space should be an important factor on designers checklist and should come first, ahead of economic and political issues.

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Urban Revitalization through studying the patterns of activities and its geometries in cities

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1. Abstract

Despite the availability of detailed data for describing cities, there is a shortage of tools that enable standardized analyses of urban areas, associated with future needs. Many regions are struggling to maintain standards of living. Rural municipalities, schools, and health boards are unable to invest in necessary infrastructure. We are particularly interested in whether and how the distribution of these activities is affected by the spatial configuration of the built environment – the physical pattern of urban infrastructure, the spacing and sizes of urban geometry and circulation routes. Community connectivity theory encourages supporting Community Economic Development initiatives that create social, economic, and environmental sustainability.

We argue that understanding social & economic networks patterns in urban settings is not only important for improving urban zoning theory, but also essential for designing economically, socially, and environmentally sustainable urban neighborhoods. The objective of this research is to contribute a standardized method for the social & economic networks patterns and the urban consumption analysis including material, water and energy consumption can be quantified, with properties that can be described mathematically.

This research investigates patterns that emerge in cities socially and economically and proposes a link between these patterns and future plans – a domain that has received relatively little attention in recent decades. Building an alternative paradigm that includes three elements: Context, Economy and Sociology by linking the economic and social theories with the practice of urban planning. Major attention is paid to the integration of economic and noneconomic activities in the community connectivity approach.

1. Introduction

The world witnessed an exponential growth in demand with rapid economic development, industrialization and urbanization increasing demands for the scarce resource "land". However, there are many problems in urban construction land use, such as poor structure and distribution, lack of land use intensity and low efficiency. The current extensive urban land management style must be changed and reformed in order to build up a harmonious society.

More and more, in recent times, with the rapid expansion of cities, such newly developed housing estates are being located farther and farther away from the urban centers. However, this has resulted in increasing the time needed to commute from residential zones to business and production zones. Needless to say the environmental impact of such a city is reaching unsustainable levels. As cities grow in size, they change in shape and this changes the energy balance used to sustain them. The research finds that Network science provides a way of linking size to the network forms that enable cities to function in different ways.

Community connectivity development occurs when people in a community analyze the economic and social conditions of that community, determine its' needs and unfulfilled opportunities, decide what can and should be done to improve the conditions in that community, and then move to achieve agreed-upon its goals and objectives. Community connectivity development is not a rationale for maintaining the status quo but is a comprehensive concept for changing the economic & social situation within the community. The community's initiative and leadership are resources for change. The community can use both internal and external resources to achieve change, drawing on its own strengths and capabilities and looking beyond its boundaries for supplemental resources.

Goodwin argued that economic growth, once considered by economists as subsumed by enhanced well-being, can now be a source of diminished well-being. Growth is

more jobs, more buildings, more equipment, and more sales. With growth comes a negative side effect, such as pollution, that may actually detract from the more general improvement in human welfare. (Goodwin, 1997)

Development tends to imply more understanding, more insight, more learning, more nuances, and some semblance of structural change. Structural change reflects changes in technology, ownership patterns, occupational mixes, product mixes, industry mixes, and institutions. Development reduces vulnerability to outside-the-community changes. Development is a larger concept and encompasses growth, but in practice the distinction is seldom clear.

The research open multiple question regarding what effects on other urban activities can be tracked using the network dynamics and, and how urban policies can be linked the size, the scale and shape through information, material, with social networks that constitute the essential functioning of cities. The research goal is to build theories of how cities function as complex systems. This new physics makes us much more aware of the limits of planning. It will lead to learn more about the functioning of such complex systems.

A general methodology is proposed and applied using data of Chicago city. The results of this analysis are visualized spatially providing an intuitive way of understanding these patterns. In order to test the statistical significance of these different metrics on location choices, we will adopt the strategic interaction methodology from spatial socio-econometrics and apply it for the first time in the context of location studies.

This research has the potential not only to join some of these together but also to improve theories to the point where city planners can develop operational tools theoretically and practically grounded in extensive empirical data. The findings will inform economists, sociologists and planners about factors that attract NGOs, retailers in urban settings, and urban designers about how the seemingly basic act of laying out streets, parcels and buildings can affect the location choices of services land uses, thereby shaping the structure of the city in important ways.

2. Background

Historically, development focused on jobs, income, and business growth, whereas community development tended to focus on equal rights, institutional organization, and political processes, among others. We record and analyze 'the city', cities and their futures, and urbanization from multiple perspectives including, it could be presented in terms of "waves":

a) First - Community as a place: where space is a dominant part of the definition, such as the political boundaries of a municipality or county.
b) Second - Community of interests: where space has very little role in the definition, such as a community of scholars or Packer fans.
c) Third - Community as a logical decision-making.

This latter approach incorporates the first two definitions but emphasizes the point that a community can make and implement decisions. Generally, this approach refers to some political entity such as a village or municipality, but it can also include a trade area in which collective action can take place through a chamber of commerce or an urban neighborhood through neighborhood associations, school-based parent-teacher organizations, or church-based efforts. In human communities, intent, belief, resources, preferences, needs, risks, and a number of other conditions may be present and common, affecting the identity of the participants and their degree of cohesiveness. We will focus on the third wave:

3.1 Community as a logical decision-making

It focuses on collaboration and partnership within and across communities. The focus on cluster development today has its roots in agglomeration economies and the ideas flowing from endogenous growth theory. (Marquez, 2003) (Thisse, 2002) Indeed, the idea of cluster development has brought the idea of collaboration across communities to the forefront (Bradshaw, 1999) (Cumbers, 2004) (Eisinger, 1988) (Eisinger, 1995) (Porter, 1995)

Community as a logical decision-making starts bridging economic growth and community development into Community Economic Development (Beauregard, 1993) (Boothroyd, 1993) (Christenson, 1993) (Reese, 1996). Community clustering, range from informal family or kinship networks, to more formal incorporated associations, political decision making structures, economic enterprises, or professional associations at a small, national or international scale.

Community Economic Development (CED) is a broad term given to the practices of civic activists, involved citizens and professionals to build stronger and more resilient local communities. It seeks to empower individuals and groups of people by providing them with the skills they need to affect change in their own communities. It often linked with community work or community planning, is often formally conducted by non-government organizations (NGOs), universities or government agencies to progress the social well-being of local, regional and, sometimes, national communities. (Kelly, 1988)

We maintain that community connectivity development, which is the blending of economic & social development with urban fabric, is a holistic approach to community problem solving. The problem is that it is very difficult to operationalize it from a theoretical to practice approach. Urban practitioners focus their attention on such elements while ignoring other parts, holding all else constant. We offer a new paradigm embodied in (see Figure 1).

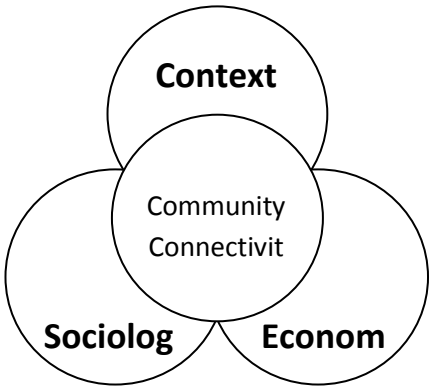


Figure1: Community connectivity

Around the nodes of the star, we have three elements that are typically associated with community:

1) Economy includes (resources and markets),

2) Urban Context includes (urban fabric, and decision making)

3) Sociology includes (society/culture, and rules/institutions).

The three elements are associated with our broader definition of community connectivity development.

i. Urban Context

The space and community as a notion is complex. The physical aspect of urbanism, emphasizing building types, thoroughfares, open space, frontages, and streetscapes but excluding environmental, functional, economic and sociocultural aspects Where to start an activity, where to expand as growth occurs, where to buy inputs, where to market production, where to live, where to shop, and where to work. Each of these questions has a spatial connotation, and different location factors will influence the decision. The phrase "location decision" refers to any economic & social transaction with a spatial dimension, not just the traditional relocation decision.

The importance of networking within and across communities has become readily evident in the community and economic development literatures. Each community, at any given time, is faced with a range of issues, and effective decision making requires the community to not only identify issues but also rank them in terms of priority (Stöhr, 1989). Decision making translates into how the community goes about making decisions and sets up and implements policies and strategies (Swanson, 1996) (Turner, 1999). Social capital consists of the social networks in a community, the level of trust between community members, relationships, and local norms. These networks, norms, and trust help local people work together for their mutual benefit (Flora, 1998) (Swanson, 1996).

ii. Economy

Typically, we think of markets in the form of supply and demand for goods and services, and factor inputs for supply and demand capture the forces that are at play in a

capitalist economy. In the context of a community, the markets node represents local and nonlocal markets in the spirit of export-base theory. The local market is composed of businesses buying and selling locally to other businesses and households. It is important to remember that the local market is composed of two distinct parts—households and businesses. The nonlocal market refers to those goods and services that the community produces locally and sells to nonlocal households and businesses. (Feser, 2000) (Johansson, 2004)

Resources is a primary factors of production, include land, labor, capital, and the technology that the community uses to produce output. These factors of production have been the focus of traditional economic development policies. Public capital refers, among other things, to roads, schools, parks, and landfill sites. Amenities can involve cultural, historic, natural, or built environmental resources that increasingly contribute to our notion of quality of life. Amenities and publicly provided goods and services serve as important latent inputs to production in amenity-rich communities. They exist as latent inputs and present a complex mixture of market-based and nonmarket goods and services into the analysis of community economic development (Marcouiller, 2005).

iii. Sociology

Urban sociology is the sociological study of life and human interaction in metropolitan areas. The sociological study of cities and their role in the development of society like most areas of sociology, urban sociologists use statistical analysis, observation, social theory, interviews, and other methods to study a range of topics, including migration and demographic trends, economics, poverty, race relations and economic trends. In the end, business climate speaks to the social capital of the community, the ability of the public and private sectors to work together, and the flexibility of rules, both formal and informal, to be adjusted when economic opportunities present themselves.

Institutions are basic to any form of social interaction; Institutions are the rights and obligations or social, political, and legal rules that govern what has to be taken into account in the use of a community's factors of production, exchange, and the distribution of rewards (Davis, 1971). Institutions can include local churches, civic and business organizations, and social organizations. But here, differences in formal and informal institutions become apparent. Formal institutions such as local governments have police power that sets them apart from informal institutions that may be able to enforce rules only through peer pressure. Rules need to be in place to help resolve conflict about which set of values governs the goals the community is going to pursue. Institutions also affect economic markets as they set the framework for the bargaining process and the resolution of inevitable conflicts. Institutions that focus on the enforcement of agreements, such as contracts, affect the functioning of markets especially over great distances with unfamiliar actors.

3. Community Connectivity

While we approach the problem from a social & economic perspective in this proposal, we suggest that the interdisciplinary nature of the problem can be thought of as removing the all-else-being-equal elements that break down as regions become smaller (community level). We offer a new paradigm that we suggest will provide the developer of a community with a more comprehensive view of the problem. To a large extent, there are two fundamental issues in community connectivity development:

- Understanding the full range of choices available to alter economic & social circumstances and engaging willing (and even unwilling) collaborators in building a long-term strategy (Halebsky, 1999)
- Understanding choices means that the community is exploring all options, not just falling back on old-school approaches of equating economic development with growth. When striving to build strategies, people are often more interested in short-term projects than in long term strategies, although both are important.

Before we present and discuss our new community connectivity development paradigm, we will provide a working definition of community connectivity development within a historical context and offer a more contemporary definition. Our paradigm is then presented and discussed, and we offer a set of community connectivity development strategies that directly flow from the new paradigm. Finally, we provide our definition of community connectivity development and summarize how the new paradigm we offer captures the interdisciplinary nature of the problems communities face.

4. Research Problem

Urban settlements have become the dominant habitat. In less than two generations "urban" will be globally synonymous with "society". Much as this process tends to pronounce a demographic and geographic shift, the significance of this paradigm shift for the destiny of humanity and to the configuration and sustenance of the world as a whole are quite profound. By the middle of this century it is expected that seven out of every ten persons on the planet will be urban dwellers thus marking the advent of a new "urban millennium" . The 21st Century will therefore be known as the century of the city. (UN-DESA, 2010)

Cities stand at the very center of each and every one of the biggest challenges we face: climate, pollution and energy; jobs and economic opportunity; poverty and inequality; sustainability and resilience; curbing violence and ensuring personal safety and security; accelerating the spread of personal freedom, tolerance and democracy; and of course spending trillions upon trillions of dollars on infrastructure, housing and city services in the most effective way.

1) Because cities will need to become even more productive and generate much-needed jobs.
2) Because reducing inequality and achieving greater equity must be a worldwide effort.
3) Because slum dwellers are ready to help themselves.
4) Because cities play the central role in Energy Consumption.

5. Our research concerns

Cities are more complex with global and local interconnections which produce multiple of social, cultural, political, and economic spaces and forms (Watson, 2003). So, we discuss this issue within the following context:

i. **Social characteristics**: The functionality of both public and private social spaces are colored in many cases bluntly and sometimes softly by the security factor.
ii. **Economy characteristics**: The functionality of both public and private spaces which is an engine of economic wealth creation, as well as an enduring human institution for self actualization through employment generation.

We will investigate the role of certain services in any community which contact directly with the residents' community and present the connection between the producers and services providers. These services were identified using the North American Industrial Classification System (Anon., n.d.) (Table1).

Services		
Bank	Laundry	Restaurant
Child care facility	Library	School
Community /civic center	Medical/Dental office	Senior care facility
Convenience store	Pharmacy	Supermarket
Hair Care	Place of worship	Theater
Hardware store	Police/Fire Station	
Health club	Post-office	

Table 1: List of services in study

These kind of services occupied about 61% of the available employment according to Chicago Cook Workforce Partnership 2012 as the following (table 2)

	Service	Percentage %
1	Business & financial	8
2	Food Preparation and Serving	4
3	Arts, Entertainment, Sports	4
4	Education	3
5	Installation, maintenance & repair	3
6	Production	2
7	Healthcare (support + practitioners)	8
8	Life, Physical, and Social Science	2
9	Personal Care and Service	2
10	Grounds Cleaning and Maintenance	1
11	Retail salesperson	12
12	Supervisor of retail sales workers	12
	Total	**61%**

Table 2: Jobs postings by occupational group

iii. **Growth and development:** economic growth and development is a two-way relationship. Economic growth is benefiting human development with the rise in economic growth.
iv. **Community competition:** One unintended consequence of economic & social development is the intense competition between communities, states, and nations for new economic development projects in today's globalized world. Competition is further intensified by the use of many variations of economic incentives to the potential business. However, the reality is that economic & social developers do not typically create jobs, but facilitate the process for existing businesses and start-ups to do so.

The review of urban & economic literature on activities location choices and morphological literature on the effects of urban spatial configuration has outlined several important forces that shape the activities' distribution in a city. Real-world location choices include many more factors, some of them explored and others remain yet to be confronted by research. The diverse forces that we discussed, we need a more comprehensive picture by combining the economic and social perspective with a configurationally study of the built environment. The three dominant theories explaining the location patterns are:

1) **Central Place Theory**, which describes the aggregate pattern of stores and social centers. This Theory argues that retailers are expected to divide up a given market area in a regular pattern, with stores of the same type located at equal distances from each other, forming uniform hexagonal market areas (Lösch, 1954) (Christaller, 1966).
2) **Multipurpose shopping and community centers**, which explain the clustering of complementary activities. Which demonstrates that multipurpose centers, can lead to savings in transportation costs and unplanned purchases, offering key insights into why stores of different types would locate close to each other (Eaton, 1982) (Brueckner, 1993).
3) **Price comparison**, which explain the clustering of competitive locations. The agglomeration of competitive locations is explained by three additional factors:
   a. Uncertainty and competition between competing stores (Hotelling, 1929).
   b. The fact that people like to compare prices and products and thus prefer to shop at locations that allow them to do so (Eaton, 1975)
   c. The competition in clusters leads to lower prices, which attracts more customers (Dudey, 1990).

6. Hypotheses and expected findings

We investigate which factors important for activity location choices. Central Place location theory suggests that an establishment's location decision can be strongly influenced by the location choices of other retailers. Data from urban experiential evidence suggest that spatial inter-relationships between urban forms an important factor to consider. In this research we will be focusing on three mechanisms, where urban spatial configuration contributes to insecurity by constraining access to economic opportunities. They are as follows:

1. *The spatial configuration of the built environment affects location choices of social and economical activities establishments:* built environment studies suggest that location factors could also influence activities location choices in effective ways. We expect that there is an influence of exogenous factors in urban contexts, since social & economic land uses in a city are embedded amidst other land uses of urban form. Rather than optimizing the mixed use development to attract the largest possible demand to the cluster as a whole.
2. *Integration of activities networks with street networks and neighborhoods, in order to create an urban opportunity and enhance local and city-wide cohesion:* Advantages in accessibility that result from favorable proximity to all surrounding built form are positively related to location choices, controlling for land use distribution and clustering.
3. *Inaccessible services: unplanned physical growth creates areas of poor road access, without electricity & water infrastructure otherwise Accessibility that results from favorable proximity to residents, jobs, and transit stations are positively related to activities locations choices:* "Spatial mismatch": locations of residences, jobs, and transit stations especially for poor people are divorced from locations of employment, thus hindering economic opportunities. Pedestrian's route choice behavioral studies have suggested that the geometric layout of a city generate favorable accessibility at certain locations, and also, the notion of proximity and the perception of a location's accessibility.

7. Methodology

We can explore the diversity of approaches to mapping the social economy beginning with the most common approach – developing a list of all social economy organizations in a designated area and identifying a range of characteristics of those organizations – thus creating a portrait of the state of the social economy in that domain.

- **First:** From the macro view, we move to the local level where it can be helpful to know who is in our community and, what are the possibilities for building strong partnerships around shared concerns and opportunities? We briefly touch on some of the common findings around social and economic impacts as well as shared challenges named in these studies.
- Second: examines a variety of innovative ways that researchers approached "mapping" the social economy: by doing inventories of financial and other infrastructure supports in the region; by looking at how social economy players are addressing specific issues; by examining how marginalized populations are impacted and/or participating in the social economy; or by examining current and future best practices around social accounting, social capital, capacity building, and even policy recommendation.

8.1 Methodology Approach

First: Chicago as a case Study, Chicago has a wide range of community and economic development strategies to advance its communities' vision for prosperity.

Second: Exploring urban forms: urban context, resulting in second-order urban form that is reproduced physically as cultural landscapes or mentally as imaginary ones. The physical environment is never constant nor fixed is a demonstrated truth, and it is due to the fact that

even through the perception of the physical environment as landscape such environment is altered, and the successive and cyclic human usage. The impact factors:

- **Locality analysis:** Analyzing urban forms locality in the urban context vis-à-vis its location within the city and/or in relation to the city including mobility, access to various urban uses and other conditions impacting on the lives of its inhabitants and those in its surrounding areas.
- **Urban layout or master plan**: to provide an analytic overview of the existing spatial features inside the area and its immediate surroundings: various land uses, open spaces, connections, transportation nodes, infrastructures and mobility; community related aspects; program of the activities; processes, participation and involvement, timeline and other soft features; residents and their backgrounds.

Third: Mapping the Social Economy networks: "Mapping" the social economy network is a structure made up of a set of actors (such as individuals or organizations) and a set of the dyadic ties between these actors. The goal of this analysis is to identify local and global patterns, locate influential entities, and examine network dynamics.

Fourth: Data source & analysis:

A. Data from the world population and cities road vector files (TIGER line files) (Anon., 2009) will be used. All calculations involving population data were performed on data at the census block level (the smallest level of aggregation). The community connectivity development was defined as the area with the certain services density, using point data that identified the location of services.
B. Analysis Tool: Place Syntax Tool (PST): the Place Syntax Tool (PST) and the theories of Place syntax are the shortcomings and strengths of space syntax methodology. The strengths consist of a strong empirical theory of cognitive space and cognitive distance, measured in changes of directions, so called axial line steps. However, within space syntax research accessibility is measured only within the network of axial lines with no attractions. This led to the idea to add attractions such as density or transit points to the spatial model to get better predictions of pedestrian flow but also new interesting measures of accessibility. (Alexander Ståhle, 2012)

8. Discussion:

9.1 Case Study and data collection:

Our case study is Chicago. Chicago is the urban laboratory par excellence, Large enough to intensely manifest big-city problems, but not so different as to suggest a lack of generalizability. A focus on this Midwest giant makes particularly good sense in the case of sprawl.

Given its rising per capita incomes, flat geography, and long-standing racial tensions, Chicago provides a likely setting for sprawl. And the Chicago region has sprawled. Despite slow population growth, the Chicago urbanized area has spread out. Over the last twenty to thirty years, this process has been encouraged by a pre-existing highway system, continuing federal subsidies for housing, permissive local governments, and politically weak regional planning agencies. Chicago provides a classic case study of how a relatively dense city can develop into a sprawled region, not so much at the instigation of the public sector, but with its general assistance.

In recent decades, some cities have seen their urban centers lose population density, as residents spread to suburbs. Others have kept populous downtowns even their urban have grown. Population density in general has economic advantages, so losing density may be a symptom of negative economic shocks. We look at three decades of census data and show that growing cities have maintained dense urban centers, while shrinking cities have not.

8.2 Exploring Chicago urban forms

Both the historic Loop and the newer development north of the Chicago River, especially along North Michigan Avenue have the most iconic structures in US. Yet these vertical monuments mask a less celebrated reality: that of dispersing, low density urban area.

Chicago Combined Statistical Area**:** by the 2010 census data, Overall, the combined statistical area, which includes the metropolitan area and two exurban counties added nearly 365,000 people, for a growth rate of 3.9 percent. This is well below the national growth rate of approximately 10 % (Figure 2). Chicago followed the general trend of with growth being greatest in the outer suburbs while declines took place both in the inner suburbs and the historical core municipality (Figure 3) (Figure 4) .

Massive Core City Loss: The historical core city of Chicago lost but 200,000 people, and fell to a population of 2.7 million, the lowest count since the 1910 census. The population is down 925,000 from 1950 and at the current rate would drop at least 1 million from the 1950 peak by the 2020 census.

Inner Suburbs: Chicago's inner suburbs grew slowly. The inner suburbs include the part of Cook County that is outside the city of Chicago as well as Lake County, Indiana (home of Gary), which shares the city of Chicago's eastern border. The inner suburbs added fewer than 30,000 residents and grew only one percent.



Figure 2: Chicago changing in Population

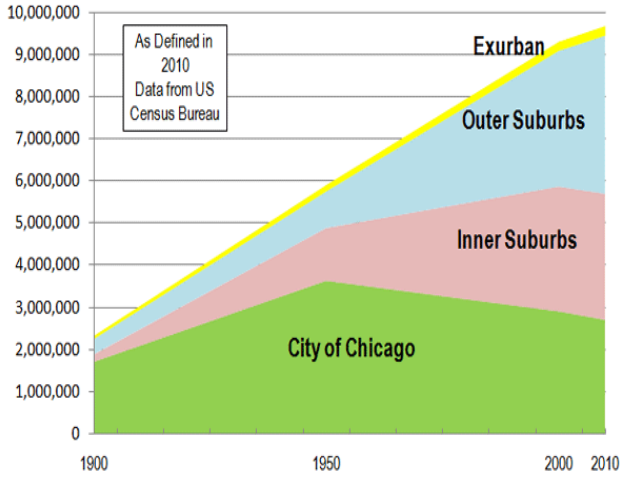


Figure 3: Chicago Metropolitan Region 1900-2010

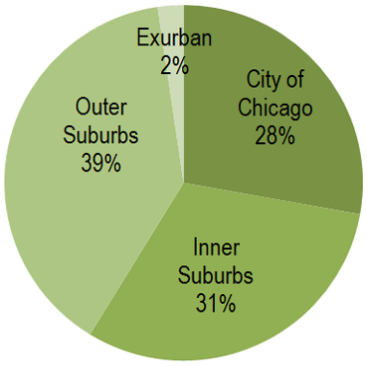


Figure 4: Chicago Metropolitan Population by sector 2010

Outer Suburbs: The outer suburbs, which include the remaining counties of the metropolitan area, grew at a rate of 16.5 percent, actually grew faster than the national average of approximately 10 percent. The outer suburbs added more than 500,000 people. The largest growth, 175,000 was in Will County, to the south, one of the five "collar counties" that used to define the boundaries of the metropolitan area. McHenry County, the most distant of the collar counties added 100,000. The fastest growth was in far suburban and also southern Kendall County, which more than doubled in population.

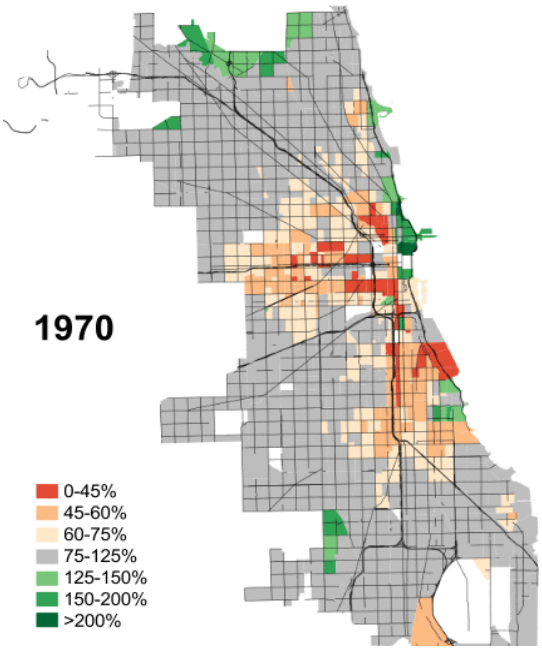


Figure 5: Chicago Jobs distributions in 1970 (Hertz, 2014)

Chicago Metropolitan Area: Overall, the Chicago metropolitan area added approximately 360,000 people and grew 4.0 percent from 2000. This is well below the national average population growth rate; however was above that of the Los Angeles metropolitan area, once among the nations of leading growth areas until the last decade. By 2000, both inner suburbs and the outer suburbs each had more people than the city of Chicago. Today the outer suburbs, with forty percent of the region's population, represent the largest demographic force in Chicago. Chicago now stands as the third largest urban agglomeration in the world in land area, trailing only New York and Tokyo. The Chicago urban area covers more land than Los Angeles, which has a far higher urban density.

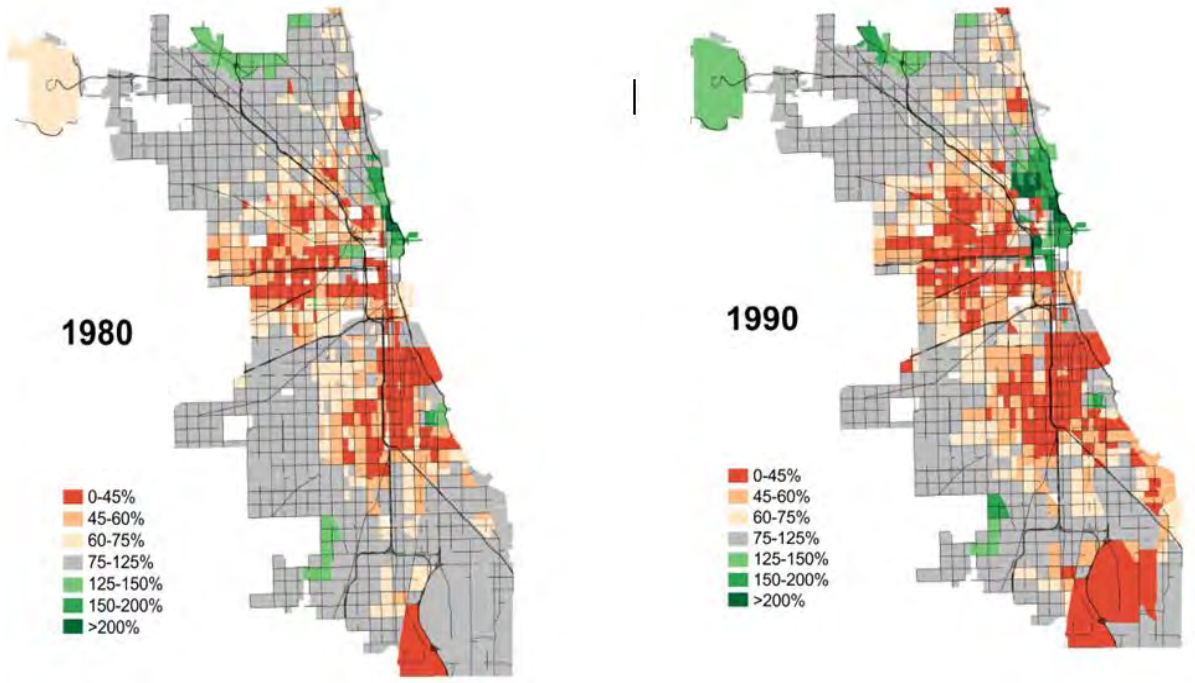


Figure 6: Chicago Jobs distributions in 1980 and 1990 (Hertz, 2014)

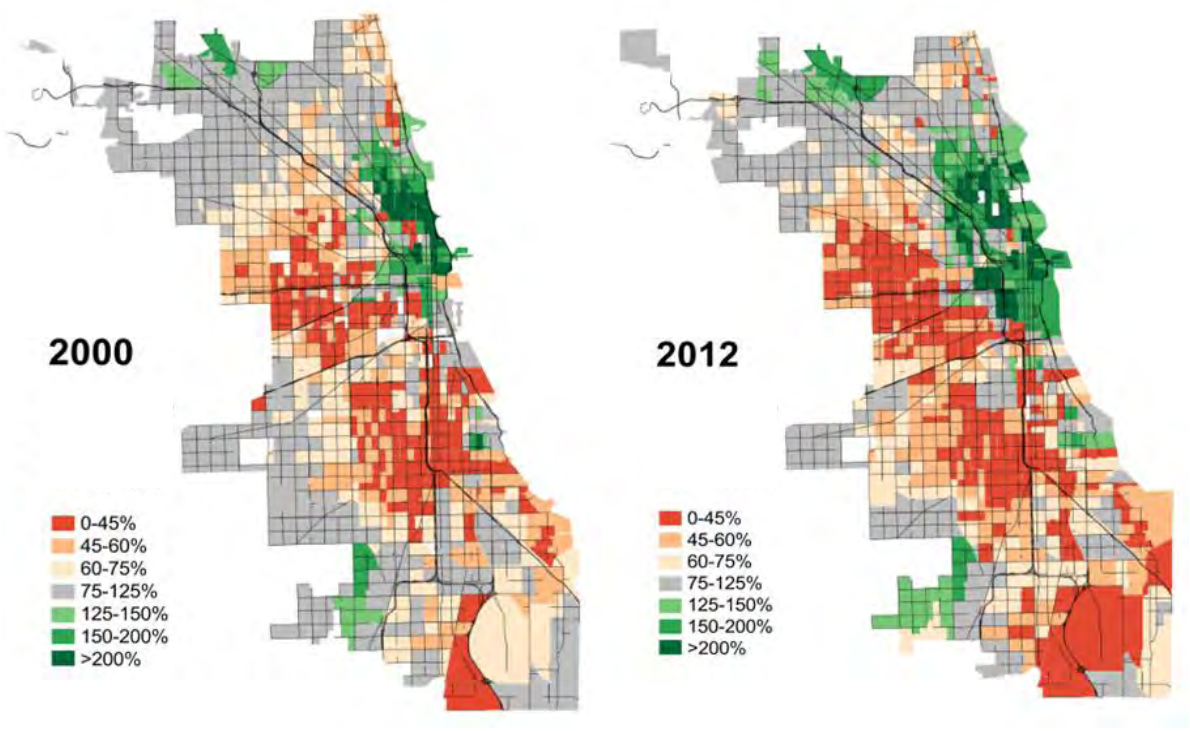


Figure 7: Chicago Jobs distributions in 2000 and 2012 (Hertz, 2014)

***9.3 Mapping the Social Economy networks*:** In a broad sense this research is intended to survey some aspect of the social economy thus, they are mostly descriptive studies intended to capture a picture of the current state of employment through the selected services which we can explain why that happened through the history of Chicago:

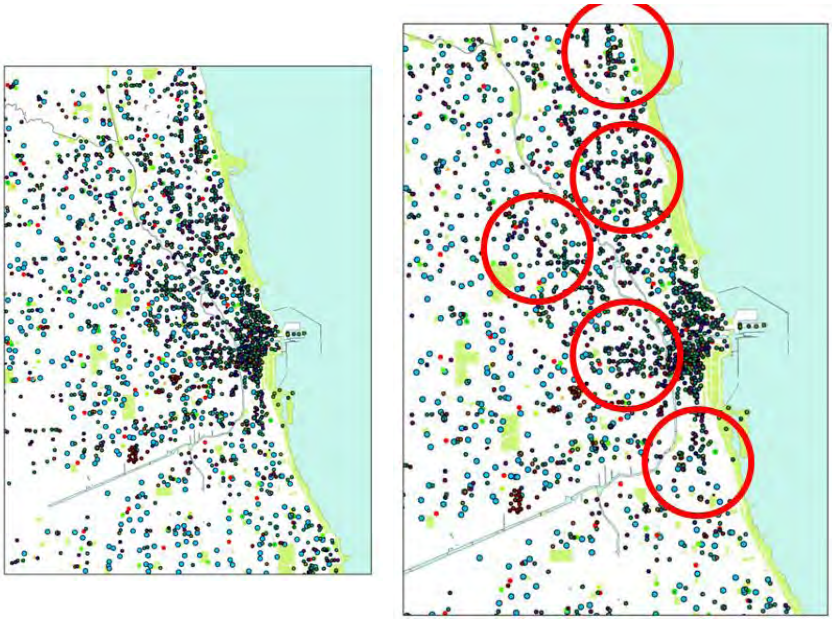


Figure 8: Chicago's services density

This Study can be analyzed within either an urban or regional socioeconomics framework as some socioeconomic phenomena as will primarily affect localized urban areas while others are felt over much larger regional areas (McCann, 2001). We can divide this study into six related themes: market forces in the development of cities, land use within

cities, urban transportation, urban problems and public policy, housing and public policy, and local government expenditures and taxes, as stated in the O'Sullivan's book "Urban Economics" (O'Sullivan, 2003)

a) Market forces in the development of cities:

Market forces in the development of cities relates to how the location decision of firms and households causes the development of cities. The nature and behavior of markets depends somewhat on their locations therefore market performance partly depends on geography (McCann, 2001). In Chicago, As groceries crop up in more and more places, traditional supermarkets are feeling the pinch — so much so that a grocery consultancy predicts non-traditional retailers will be selling more food than supermarkets by 2018. by 2005, traditional grocers had just over 50% of the $818-billion U.S. retail food market, but Barrington-based market watcher Willard Bishop Consulting Ltd. share falls to 40% in 2013. By then, alternate food purveyors like mass merchandisers, club stores and dollar stores increase their market share to 44% from an estimated 33% last year.

Otherwise, By looking at location decisions of firms and households, the urban economist is able to address why cities develop where they do, why some cities are large and others small, what causes economic growth and decline, and how local governments affect urban growth (O'Sullivan, 2003). Because urban economics is concerned with asking questions about the nature and workings of the economy of a city, models and techniques developed within the field are primarily designed to analyze phenomena that are confined within the limits of a single city (McCann, 2001).

b) Land Use

Looking at land use within metropolitan areas, the urban economist seeks to analyze the spatial organization of activities within cities. In attempts to explain observed patterns of land use, the urban economist examines the intra-city location choices of firms and households. Considering the spatial organization of activities within cities, urban economics addresses questions in terms of what determines the price of land and why those prices vary across space, the economic forces that caused the spread of employment from the central core of cities outward, identifying land-use controls, such as zoning, and interpreting how such controls affect the urban economy (O'Sullivan, 2003). Land covers change of the Chicago metropolitan region, 1972-1997 (Wang, 2002) as (table 3)

	1972–1985 (hectares)	1985-1997 (hectares)	1972–1997 (hectares)
Urban Land	+33,011 (14.5%)	+78,114 (30%)	+11,1125 (48.85%)
Natural Area	-17,251 (7.6%)	-30,735 (14.65%)	-47,986 (21.13%)
Agriculture	-130,658 (21.8%)	-93,267 (19.89%)	-223,925 (37.35%)
Unassociated Vegetation	+118,711 (147.2%)	+45,361 (22.75%)	+164,072 (203.45%)

Table 3: Land covers change of the Chicago metropolitan region, 1972-1997

c) Economic policy

Economic policy is often implemented at the urban level thus economic policy is often tied to urban policy (McCann, 2001). Urban problems and public policy tie into urban economics as the theme relates urban problems, such as poverty or crime, to economics by seeking to answer questions with economic guidance. For example, does the tendency for the poor to live close to one another make them even poorer? (O'Sullivan, 2003).

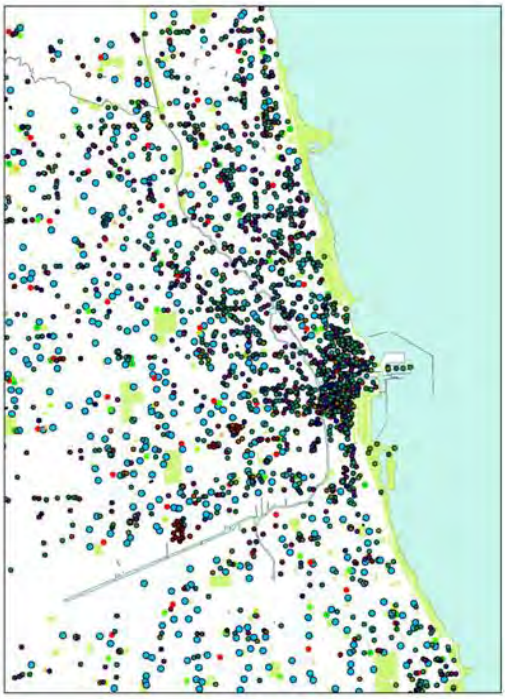


Figure 9: Socioeconomic Services Locations in Chicago

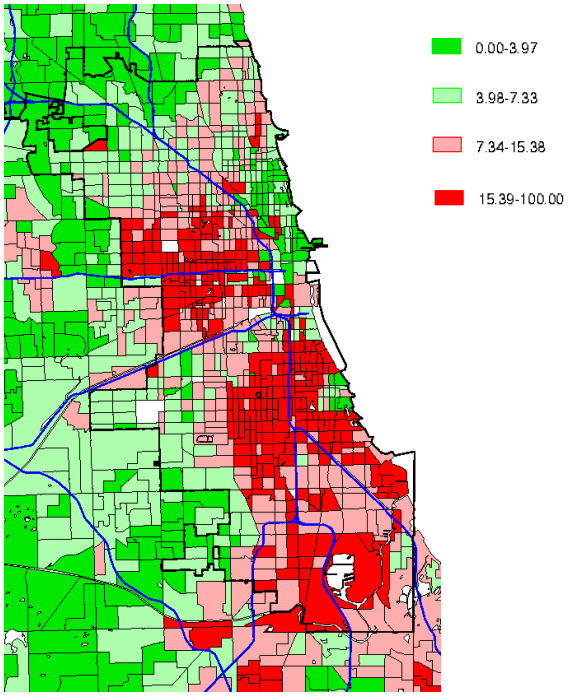


Figure 10: Unemployment rate Chicago (Chicago, 2014)

d) Transportation and economics

Urban transportation is a theme of urban economics because it affects land-use patterns as transportation affects the relative accessibility of different sites. Issues that tie urban transportation to urban economics include the deficit that most transit authorities have, and efficiency questions about proposed transportation developments such as light-rail. Megaprojects such as this have been shown to be synonymous with unexpected costs and questionable benefits. The Transportation Sector in Chicago Economic Impact (Council, 2000)

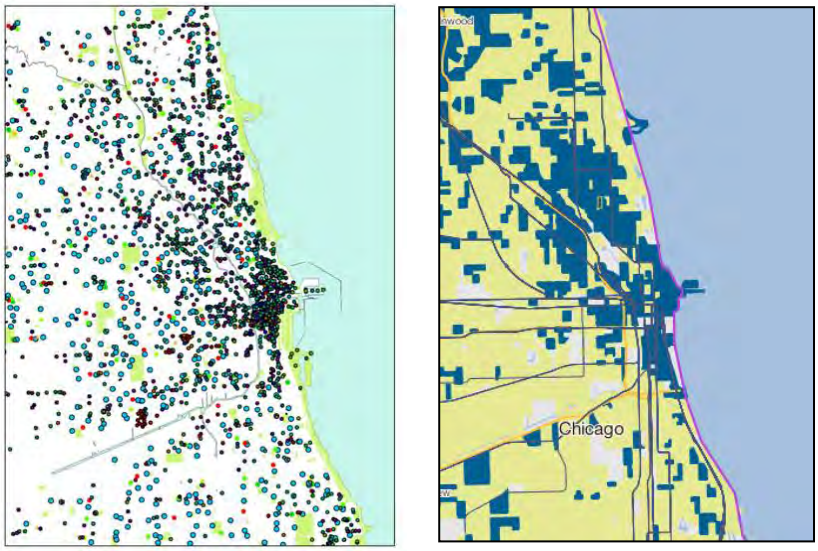


Figure 11: urban social and economic networks on the left and Distribution of housing + transportation costs % income 2014 (Chicago, 2014)

e) Housing and public policy

Housing and public policy relate to urban economics as housing is a unique type of commodity. Because housing is immobile, when a household chooses a dwelling, it is also choosing a location. Urban economists analyze the location choices of households in conjunction with the market effects of housing policies. In analyzing housing policies, we make use of market structures e.g., perfect market structure. There is however problems encountered in making this analysis such as funding, uncertainty, space, etc.

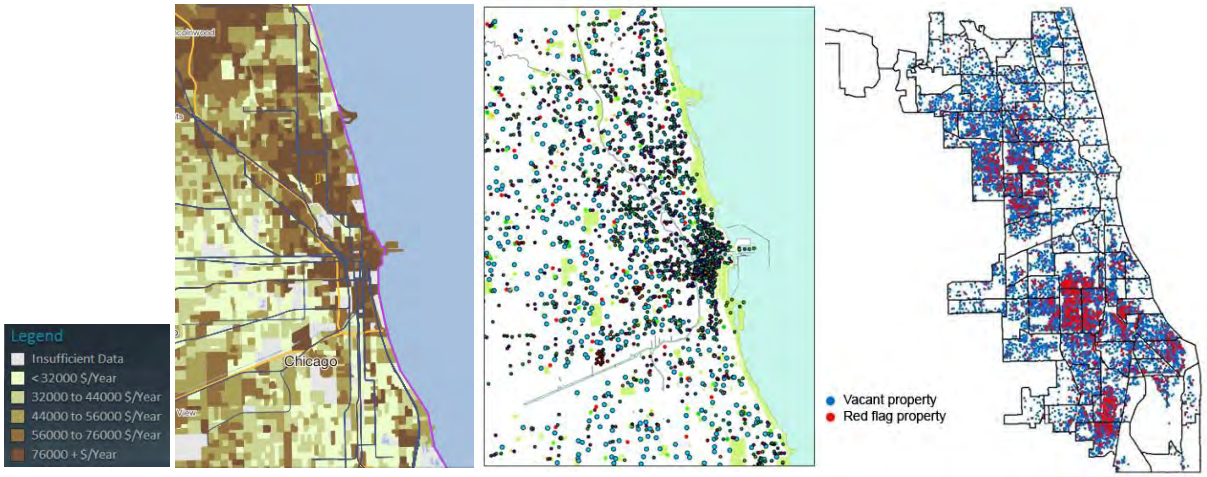


Figure 12: urban social and economic networks on the left and Distribution of vacant properties and red flag properties in city of Chicago on right as September 2010 (Chicago, 2014)

f) Government expenditures and taxes

The final theme of local government expenditures and taxes relates to urban economics as it analyzes the efficiency of the fragmented local governments presiding in metropolitan areas (O'Sullivan 2003:15).

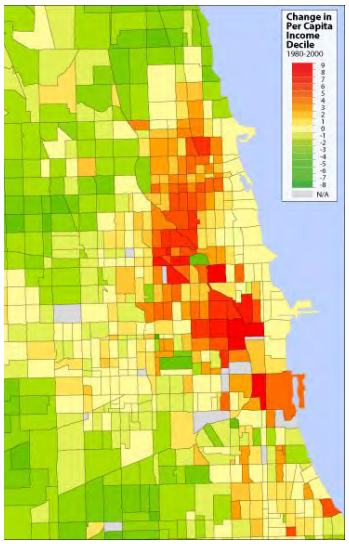


Figure 13: change in real per capita income by census tract 1999 to 2000 average (Chicago, 2014)

9. Results

Understanding social & economic networks patterns in urban settings is not only important for improving urban zoning theory, but also essential for designing economically, socially, and environmentally sustainable urban neighborhoods. Major attention is paid to the integration of economic and noneconomic activities in the community connectivity approach. The objective of this research is to contribute a standardized method for the social & economic networks patterns and the urban consumption analysis including material, water and energy consumption can be quantified, with properties that can be described mathematically. We can summaries the results as following:

First: City Typologies: Classifying the Socio-Economic Network: Through studying different the social networks and economic network we may find some patterns that control the growing or shrinking cities. From studying how the growing or shrinking happen we may find the way to predict how cities actually work and find the right solutions that to keep city networks alive and active. The research supposes that we may find three types of city social and economic networks:

i. **Random Pattern:** Random Pattern Where activities and nodes are spread with no pattern or predictable events. This concept of randomness suggests a non-order or non-coherence in a sequence of symbols or steps, such that there is no intelligible pattern or combination.

ii. **Streaky Pattern:** Streaky Pattern Where activities and nodes are spread on the certain Streaky form. It may there will be multiple streaks in cities. A Streaky pattern is a pattern which exists when two points examined forms a straight line. They usually repeat indefinitely in either direction along a line. The general pattern is described as linear because of the direct relationship between generalizations and their supporting points.

iii. **Colony pattern:** The term colony is used by where activities and nodes are concentrated in certain areas in city. The colony pattern happens if there demographic differences in cities or different economic classes or political conflict.

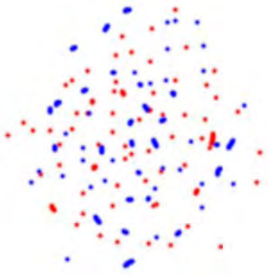


Figure 14: Random

Figure 15: Streaky Pattern



Figure 16: Colony Pattern



Second: Opportunities for New Urban Planning Responses: effective urban planning is less and less about defining land use and zoning. This approach will address ways to create cities that work for all citizens, offer opportunities to rich and poor alike, where communities and their concerns are at the heart of decision making on development, and where risk and vulnerability is effectively addressed for all citizens, particularly the urban poor.

Third: Learning to work with informality, instead of contrasting it: This approach will give a new imperatives and demands on policy and practice, by different actors and authorities. This approach suggests that location factors could also influence activities location choices in effective ways. We expect that there is an influence of exogenous factors in urban contexts, since social & economic land uses in a city are embedded amidst other land uses of urban form. Rather than optimizing the mixed use development to attract the largest possible demand to the cluster as a whole.

Forth: Concept upgrading in dealing with unplanned physical growth which creates areas of poor road access, without electricity & water infrastructure: This approach suggest an upgrading of informal settlements and the strategic use of planning tools such as the construction of trunk infrastructure, guided land development or land readjustment are all possible avenues for this. The collaboration with the informal sector can also strengthen the legitimacy of planning and regulatory systems and progressively achieve more adequate standards and regulations.

Fifth: Bridging the green and brown agenda through environmental management and planning: This approach goal is to reduce or manage the ecological footprint of cities and consider alternative development paths to the 'carbon economy' offer another opportunity for innovation. Working in synergy with local ecosystems, innovating the use and demand for energy for transport and other urban activities, and improving overall consumption patterns, are all ways in which urban planning can become the lead tool in promoting a robust and integrated response to climate change.

Sixth: enhance the urban economic opportunities by connecting the concept of Accessibility to residents, jobs, and transit stations are positively related to activities locations choices: "Spatial mismatch": locations of residences, jobs, and transit stations especially for poor people are divorced from locations of employment, thus hindering economic opportunities. Pedestrian's route choice behavioral studies have suggested that the geometric layout of a city generate favorable accessibility at certain locations, and also, the notion of proximity and the perception of a location's accessibility.

Seventh: Addressing safety and security, and disasters through prevention and adequate inclusive planning models: This approach will help in preventing urban violence and insecurity, and promoting inclusion, through a focus on the quality of the public realm in cities, and by supporting civic interactions.

10. Conclusions

This work develops a method to examine spatial data describing the physical form of cities, and explains how the form can be related to resource consumption measures including materials and energy, Also interest in the impact of the community connectivity on the labor market and housing.

Community connectivity development is about how economic, social, and political theories explain community change. It is about how community structure influences the choices that we can make. It is about increasing community wealth, both monetary and nonmonetary. Community connectivity development represents a conscious attempt to improve the decision making associated with community economic development rather than simply waiting for fortuitous circumstances. The emphasis in community connectivity development is on the technical and structural analysis of community versus individual decisions. This means consideration of the interaction of the economic, political, social, and institutional components of a community. Community connectivity development is a dynamic concept concerned with movement and change, with overcoming obstacles and capturing opportunities.

In this paper, we presents a paradigm that incorporates three elements we feel need to be considered in trying to understand a community's economy or to initiate some change. The elements are economy (resources, land, labor, capital, amenities, public goods, and technology), Context (internal and external), Sociology (institutions and rules, culture, and decision making). Although all elements need to be considered, the importance of each varies over time and with the situation.

The overall objective of this work is to identify gradients, and parameters of these gradients, so that they can be used to explore the functional performance of cities around the world. This methodology was illustrated using one case study; it is intended to apply this method of analysis to other cities, both in the US and other countries.

Strengths and limitations of this tool:

We believe that this approach has great potential for the development of new tools for urban planning and design, not only for predicting pedestrian flow or estimating urban accessibilities, not least to redefine the concepts of densities and areas. The aim of the research is to find new and possibly more informative ways or presenting place data in general. Even so we would like to sketch some rough categories of application.

- Extending integration analysis to other categories of spaces than those represented by axial lines, such as points (e.g. address points) and districts (e.g. plots). It offers the possibility to for example analyze 'configurative constitution', i.e. the number of entrances within a certain radius, or 'plot configuration', which would be the number or the total size of 'accessible' plots within a certain radius;
- Calculating the number or the sum of the value of a specific attraction within a specific radius from all places. It could for example concern the number of shops, or the amount of green space. These could furthermore be combined into a possible measure of urban attraction;
- Calculating the number or the sum of the value of a specific attraction within a specific radius from the attractions. This could be a measure of 'clustering' of attractions or possible competition/cooperation between businesses. Also, This can be for example used for linking households and jobs, people's accessibility to work etc;
- Calculating the number of people within a specific radius from all places. This can, as shown in this article, be used for pedestrian movement prediction. But it could also be a means to analyze for example the size of local economical markets;
- Calculating the number of people within a specific radius from an attraction. This obviously is an extension to the category above and could be used to analyze for example the number of potential customers to a particular shop location or the potential amount of visitors to a park.

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Exploring the Characteristics of Shoreline Development and Utilization in Coastal Tourism Cities at the Stage of Rapid Urbanization

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Abstract: in the stage of rapid development, faced with the pressure of many contradictions like functional requirement and resource supply. China has the scarce coastal shoreline resources in the world. Based on the original urban development, some coastal cities with superior resource endowment take the function of coastal tourism and vacation as an important utilization method of shorelines and a breakthrough point of urban development. Qingdao City in Shandong Province and Sanya City in Hainan Province belong to famous destination cities of coastal tourism in China and take different strategies and methods in developing and utilizing coastal shorelines due to climate difference and the different types of urban development. The paper takes Sanya and Qingdao as the research objects, starts from the perspective of utilizing and allocating coastal shoreline resources, and adopts the methods of comparative analysis, generalization and summarization. And it then firstly compares the course of development and utilization and function allocation of coastal shorelines between two cities, then analyzes the methods adopted by the two cities in the aspect of coordinating urban function with tourism and leisure vacation function, namely the optimization and adjustment of shoreline functions, the spatial expansion of shorelines and the space usage of shorelines, and finally summarizes the critical problems which need attention for the different types of coastal tourist cities in the aspect of developing and utilizing shorelines at the stage of rapid urbanization. It in the end provides certain reference for solving the problems such as strategic positioning, functional organization and resource allocation of developing and utilizing shorelines for coastal tourist cities in the areas of rapid urbanization.

1 Introduction

1.1 Concept Definition

The coastal tourist cities in the paper refer to the destination cities of coastal tourism. Namely, the function of coastal tourism leisure and vacation is an important function of cities. Tourism industry plays a crucial part in urban economic structure and reflects urban characteristics and style.

The shoreline in the paper refers to a concept of space, including the water area and land area within certain realms, and is the joint of water area and land area. The utilization of shorelines mainly means the reasonable layout of water area and land area along coastal cities and determines the property and range of applying shorelines, so as to better serve the construction of coastal cities. (ZHANG Qianyi, 1998)

1.2 The Background of Utilizing Coastal Cities

As a special resource of coastal cities, coastal shorelines belong to a precious scarce resource and play an important role of differentiation in the different stages of the development of coastal cities. From the perspective of space, the difference is manifested in the different functions of utilizing shorelines during the same period, namely the utilization types including port shorelines, urban life shorelines, maritime industrial shorelines, coastal

tourism shorelines and special use area shorelines. From the perspective of time, the difference is reflected in the different functions undertaken by the same urban shoreline during different periods. At pre-industrial and industrialization stage, coastal ports are usually portals, trading centers and transport hubs of cities and even regions and determine the prosperity and decline of cities and even regions. At post-industrial age, the ecological protection and functions including leisure life and resort landscape of coastal shorelines have aroused increasing concern. Boosting the renaissance of declining ports has turned into an important issue of a new developmental stage.

China has scarce and valuable coastal shoreline resources in the world. In recent years, the rapid urban construction expansion of urbanization and the gathering of large population in coastal cities pose a severe challenge to the nearly non-renewable resource. The unreasonable utilization of shorelines is a waste of resources and will also influence the economic and social development of coastal cities and urban construction level. Whether urban development can coordinate with the development and utilization of shorelines becomes a problem which concerns China's coastal cities, especially coastal tourist cities. For this purpose, the paper chooses two famous coastal cities including Sanya and Qingdao in China, generalizes and summarizes the relationship between the utilization of coastal shorelines and urban development through comparison and analysis, which is of greatly strategic significance for the cities in rapid development to reasonably discriminate the functional suitability of coastal shorelines and rationally utilize them accordingly.

2 Urban Development and the Development and Utilization of Shorelines

2.1 City Overview

By virtue of coastal tourism, both Qingdao and Sanya enjoy a high reputation at home and abroad. The two cities also possess very evident differences. In the aspect of climate condition, Qingdao is located in the temperate monsoon climate zone with four distinctive seasons. Every year, around three months are very suitable for coastal leisure. Sanya is situated in tropical maritime monsoon climate zone, with yearly average temperature about 27 degrees, and is suitable for coastal recreational activities throughout the year. From the perspective of urban development history, the construction of Qingdao has gone through one hundred years, formed life and vacation leisure shorelines with rational division of labor and port and industrial shorelines in the early days and successively exploited the functions like heavy chemical industry, port and tourism and vacation service in recent years. Sanya City is a rare tropical coastal city in China, but its development history of urban construction is obviously short. For the past few years, Sanya has mainly and greatly exploited many functions like coastal vacation and become the most famous life and vacation leisure destination. From the perspective of urban nature, Qingdao has more comprehensive functions while the core of urban development for Sanya is tourism. According to *The Urban Comprehensive Planning of Qingdao (2011-2020)*, the urban nature of Qingdao is defined as: national coastal important center city, international port and coastal tourism resort city, the leading city of blue economy and national historic and cultural city. In 2012, the tourism revenue of Qingdao was 80,795,000,000 Yuan which occupied 11.1% of total national economic income. The urban nature of Sanya is an international tropical coastal scenic tourist city. In 2012, the tourism revenue of Sanya was 19,222,000,000 Yuan which took up 58% of total national economic income. (Statistical data in 2012)



Figure 1: Location of City Cities as Cases

City	Qingdao	Sanya
Location	North latitude 35°35′～37°09′ The eastern coasts of Shandong Province	North latitude 18°9′—18°7′ The Southernmost of Hainan Province
Climate	Temperate monsoon climate	Tropical maritime monsoon climate
Resident Population (Ten Thousand)	886.85	70.2
Area (square kilometers)	11282	1918.37.
Population Density (person/square kilometers)	786	366
Length of Shoreline (kilometer)	730.54	258.6
Time suitable for coastal tourism	3 months	Throughout the year

Figure 2: The Basic Information of Cities as Cases

2.2 The Comparison of Utilizing Shorelines

According to the dominant function types of coastal shorelines, the coastal shoreline resources of Qingdao City and Sanya City can be mainly divided into port and industrial shorelines, city life service shorelines, life and vacation leisure shorelines, vacation leisure shorelines, ecological and sightseeing shorelines. The difference of the latter four types lies in that urban life service shorelines with complete life supporting service function are adjacent to urban living quarters and usually the places of daily leisure activities for local residents. Vacation leisure shorelines are separated from the main residential areas of cities, usually lack necessary life supporting service facilities, mainly focus on tourism reception facilities of hotels and satisfy the service need of people outside the city. Life and vacation leisure

shorelines usually have the functions of the former two and are the coastal shorelines shared by urban residents and travelers from other places. Due to the need of ecological protection, ecological and sightseeing shorelines are often isolated from living areas of cities, maintain the previous natural appearance and mainly meet the demand of ecological protection, with certain sightseeing function. Under normal conditions, the utilization methods of shorelines accord with the historical development process of cities and the function distribution of shorelines is consistent with urban function. In coastal tourist cities, when the distance between shorelines and urban areas is further, life service, productive and leisure shorelines related to city production and life reduce, functions get more independent and vacation shorelines increase. A comparison and analysis of two aspects including the development process of shorelines and function division is conducted.

2.2.1 The Comparison of the Development Process of Shorelines

From the perspective of development process firstly, the utilization of coastal shorelines in Qingdao dated back to the period of German occupation a hundred years ago. At first, it started with the east coast of Jiaozhou Bay, generally formed the urban life and vacation leisure shorelines to the east of Tuandao and the port to Cangkou on the north side of Tuandao and the layout of industrial shorelines. Later in the 1980s and 1990s, Huangdao heavy chemical industry and specialized wharf shorelines to the south coast of Jiaozhou Bay were utilized and life service and sightseeing and vacation leisure shorelines to the east side of old urban districts were developed to the foot of Laoshan Mountain in succession. After the new millennium, life, vacation leisure and port shorelines in Huangdao District of the West Coast were developed respectively and spa theme vacation leisure shorelines to the north of Laoshan Mountain, namely the east side of Moshi City, were exploited. Different from Qingdao, the development and utilization of coastal shorelines in Sanya mainly focused on tourism and experienced three stages. Firstly, life and leisure vacation shorelines represented by Dadonghai were developed and utilized in the 1980s; secondly, leisure vacation shorelines represented by Yalong Bay were developed in the 1990s; thirdly, compound leisure vacation shorelines and life and vacation leisure shorelines in the newly developed areas of Haitang Bay and Sanya Bay were mainly developed after the period in which Hainan constructed “international tourism island” in the 21st century. With the increase of development stages, the distance between shorelines and main urban districts is getting further. “Dwelling life” of shorelines is gradually deprived and “vacation life” gradually becomes the dominant function.

2.2.2 The Comparison of Function Distribution of Shorelines

The utilization type of the coastal shorelines of Qingdao in the early days mainly has two kinds, namely industrial and port shorelines and urban life service shorelines. Due to favorable regional advantage, port economy has always been playing a vital role. With the increase of industrial level and adjustment of urban development strategy, Qingdao has adjusted the layout of ports, planned and constructed Dongjiakou Port based on maintaining Qingdao Port, remolded small ports and improved the environment of productive shorelines. In the meanwhile, Qingdao has built seashore sidewalks, increased coastal landscape greenbelts and improved the quality of life shorelines. With the development of coastal tourism, some coastal vacation areas are developed one after another. Vacation leisure shorelines and life and vacation leisure shorelines are taking up an increasing proportion. The utilization methods of coastal shorelines in Sanya are relatively simple, mainly including life and vacation leisure shorelines and vacation leisure shorelines. The two types of shorelines are closely related to tourism industry. The increase of development stages in tourism leads to the transformation of development modes of shorelines.



Figure 3: Function Distribution of Shorelines in Sanya

2.3 A Brief Summary

It can be seen from the comparison of utilizing shorelines: Compared with Sanya, Qingdao has more utilization methods of shorelines, involved with various types including production, living, tour and sightseeing, leisure and vacation, which are related to the fine port water depth conditions, important regional economic status, comprehensive urban functions and high scale of service population of Qingdao. The population density of Qingdao is far more than that of Sanya. Restricted by climate, the time of peak season for coastal tourism is relatively short. Therefore, most of service population of leisure shorelines is urban residents and only a few are foreign visitors. Thus, Qingdao will pay more attention to the perfection of urban functions in utilizing, updating and remolding coastal shorelines, the coordination of the relationship between urban development and tourism development, the optimization and adjustment of urban spatial pattern and the upgrade of tourism service. Due to small population size and obviously dominant tourism function, the utilization of coastal shorelines in Sanya should consider driving the urban construction through improving tourism service ability.

3 The Coordination between Urban Development and the Utilization of Shorelines

Coastal cities are at the developmental stage of rapid urbanization. Population aggregation, the expansion of urban size, economic industry development and resource development all pose huge pressure on urban development. Coastal tourist cities are faced with double pressure of serving local residents and foreign visitors. The exploitation of coastal shorelines should consider the activity characteristics of the two types of crowds, coordinate their relationship and avoid the appearance of contradictions and conflicts. Extremely limited, shoreline resources will find it difficult to adjust once occupied. The sustainable utilization of shoreline resources and environment demands to strengthen the protection of shoreline resources and environment, which promotes the transformation of economic growth in the areas of rapid urbanization from the extensive expansion in number to intensive quality

improvement to some degree. Take Qingdao as an example. The coastal shorelines of new urban districts in the eastern part of Qingdao have high development intensity. Towering buildings obscure vision. The vestibules perpendicular to shorelines are lacking. The public openness of shorelines is not high. Due to serious water pollution and the state of not protecting industrial heritage for a long time, the coastal areas of the west Jiaozhou Bay are faced with the dual task of protection and update. Qingdao is taken as an important portal of an area. The handling capacity of ports is increasing year by year. The port function of shorelines will play an important part for a long time. The above problems need to be solved in the practice of urban development and the utilization of shorelines.

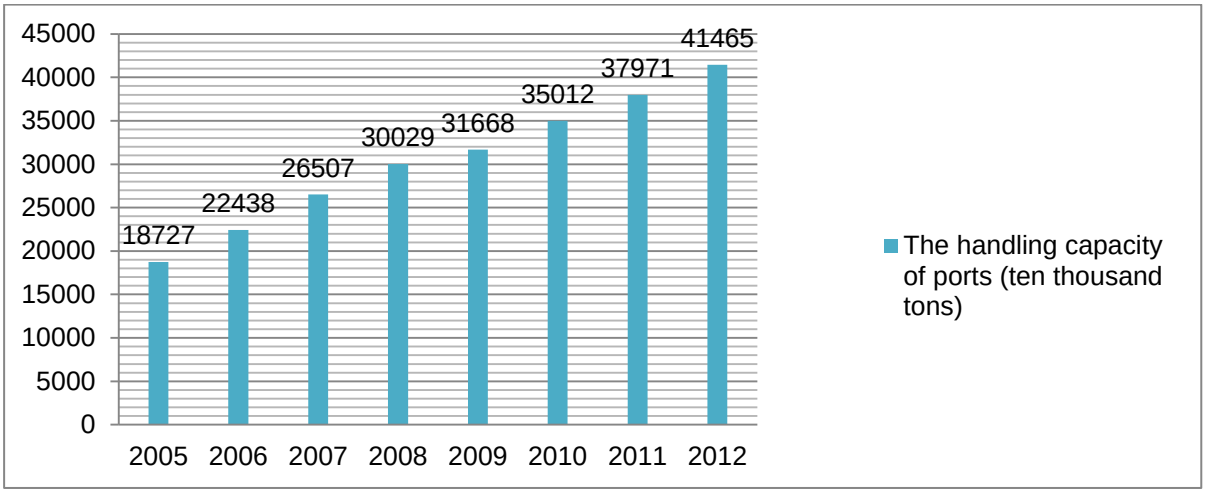


Figure 4: The Handling Capacity of Ports in Qingdao in Recent Years

3.1 The Optimization and Adjustment of the Functions of Shorelines

The combination of urban development with coastal tourism function needs to adjust the utilization method according to shoreline resources endowment, combines the perfection of urban function and meets the development demand of a new period. In recent years, Qingdao has conducted a number of practices. Firstly, Qingdao has adjusted the spatial arrangement of port shorelines, greatly constructed Dongjiakou Port in the west coast to share the load of the previous port, made some changes about the functions of small ports nearby main urban districts, developed tour and sightseeing and built marinas. Secondly, Qingdao has raised the strategy of “protecting bays and developing by depending on bays”, moved all polluting firms and switched them to other production, treated industrial pollution, extracted the historical and cultural value of previous industrial shorelines by combining the transformation of ports with industrial parks, developed creative industries and hydrophilic city public space. In addition, Qingdao has adjusted the land usage and building function of shorelines and gradually improved the public openness of coastal shorelines in old urban districts. Through several measures, Qingdao has improved the coordination degree of the utilization of shorelines and urban function and promoted the sustainable and healthy development of cities.

3.2 The Spatial Expansion of Tourism Shorelines

With the establishment of urban development pattern of New Qingdao, Qingdao has teased and integrated coastal shoreline resources in the whole city. The construction of submarine tunnels and cross-sea bridges more closes space-time connection in various regions. After tunnels are open to traffic, the distance between Tangdaowan Coastal Park along the west bank of Jiaozhou Bay and Qingdao Railway Station on land is shortened to 19 kilometers from 93 kilometers. Leisure vacation shorelines are located in the suburbs that keep convenient transportation with main urban districts, which can not only guarantee the ecological environment and landscape quality of shorelines, relieve the pressure of tourism in main

urban districts, but also realize the accessibility and service efficiency of shorelines. In recent years, Qingdao has successively exploited Aoshanwan Tourism Leisure Resort taking hot spring as the theme and Lingshanwan Leisure Resort Area taking cultural leisure as the theme. Through holding the activities like “Drag Fishing Festival”, “Sand Beach Music Festival” and “Golden Phoenix Award Ceremony” and taking cultural tourism as the link, Qingdao has expanded the tourism spatial pattern of the city. Such spatial expansion not only fully takes advantage of various coastal shoreline resources and drives the economic development and urban construction of surrounding areas, but also effectively relieves the pressure of main urban districts and enhances the competitiveness of regional tourism. For the past few years, Sanya has also developed Haitang Bay, determined its high-end development mode of “compound resort”, shaped “a national seashore” and avoided repeating the function of previous tourism shorelines of cities, which displays dislocation complementary advantage and optimizes the whole layout of utilizing shorelines.



Figure 5: The Spatial Expansion of Qingdao

3.3 The Spatial Utilization of Coastal Shorelines

According to different types of shorelines, the use function, space form and facility layout of shoreline interface can be determined so as to improve the utilization efficiency of shorelines

and the quality of space environment and better serve local residents and visitors. In the aspect of space usage of coastal shorelines, Qingdao and Sanya have conducted some good practical explorations.

3.3.1 Coastal City Parks

Whiling raising the quality of tourism shorelines, coastal tourist cities also need to attach great importance to the coastal activity demand of local residents. In recent years, Tangdaowan Coastal Park in Qingdao has been a good practical case. Tangdaowan Coastal Park is positioned as a city park, all the resources of which are open to citizens. The park is divided into South Park and North Park. South Park has 3.9 kilometers, covers an area of 30 hectares and develops pier recreation areas with different functions, cultural activity areas focusing on culture and art, tidal-flat scenic areas showing romantic leisure and wetland experience areas making ecology and nature reappear. Combining the function of leisure, entertainment and fitness, the park has set up a greenway system of bicycles and walking tour. Facility design has applied many local cultural elements such as fishing net, trellis, paper-cut and sea grass and accorded with the cultural customs of nearby residents. In terms of field investigation, Tangdaowan Coastal Park is extremely popular with the high service efficiency of all kinds of facilities, apparently improves the quality of life and leisure for surrounding residents and becomes an important landscape along Qingdao Coastal Avenue, which attracts countless visitors. According to interviews, residents have really enjoyed the benefits brought by precious coastal public resources and gradually changed their old idea of “Developing coastal tourism only brings interference instead of benefits”.





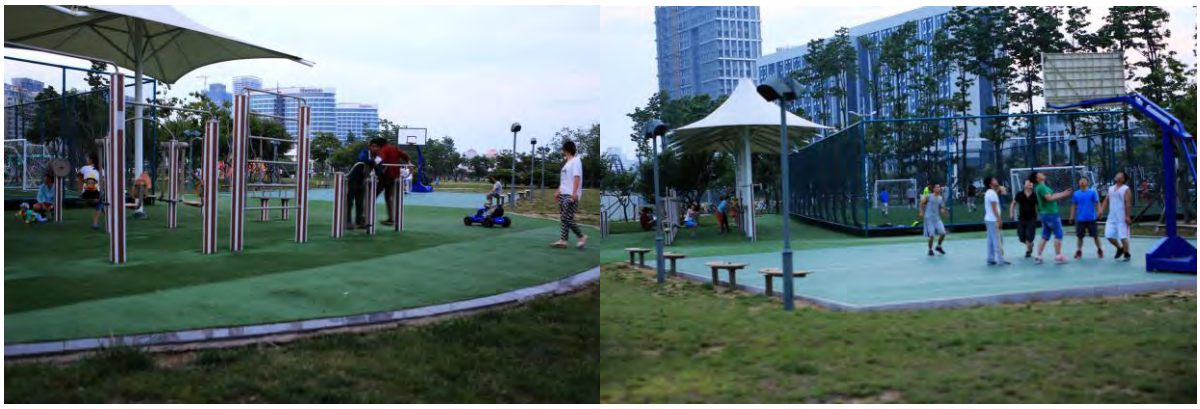



Figure 6: The Tangdaowan Coastal Park

3.3.2 Coastal Sidewalks

Along the shorelines of urban areas in Qingdao, Coastal Landscape Sidewalk which is around 36.9 kilometers is planned and constructed and integrates the coastal landscape of several shorelines. Coastal sidewalks are not pure traffic structure organization, but the simplest improvement strategy under the condition of fragmented tourism resources and space landscape. Through setting up coastal public space landscape zones, landscape zones are constructed into urban coastal parks with the comprehensive function of natural landscape, cultural heritage appreciation and playing on the sea and combine various public space system including gardens, parks, squares and sidewalks, which greatly reinforces the public openness of coastal shorelines and benefits local residents and visitors.



Figure 7: The Attractions of Coastal Sidewalks





Figure 8: The Coastal Sidewalks of Qingdao

3.3.3 Coastal Avenue Landscape Zones

Sanya Bay Road in Sanya belongs to coastal road. Through constructing green landscape zones along the road and combining main open space, coast protection zones, a series of small squares, lakeside terraces, landscape walkways and relevant supporting facilities are completed and a variety of activity space are provided including public urban leisure, sightseeing, vacation and entertainment. Coastal avenue landscape zones attract large pedestrian flow. In the daytime, visitors have a sightseeing and vacation here; in the evening, citizens sing, dance, play instruments and engage in social activities on the leisure square. This area becomes a coastal activity area with the high utilization rate of facilities and is deeply favored by local residents and visitors.

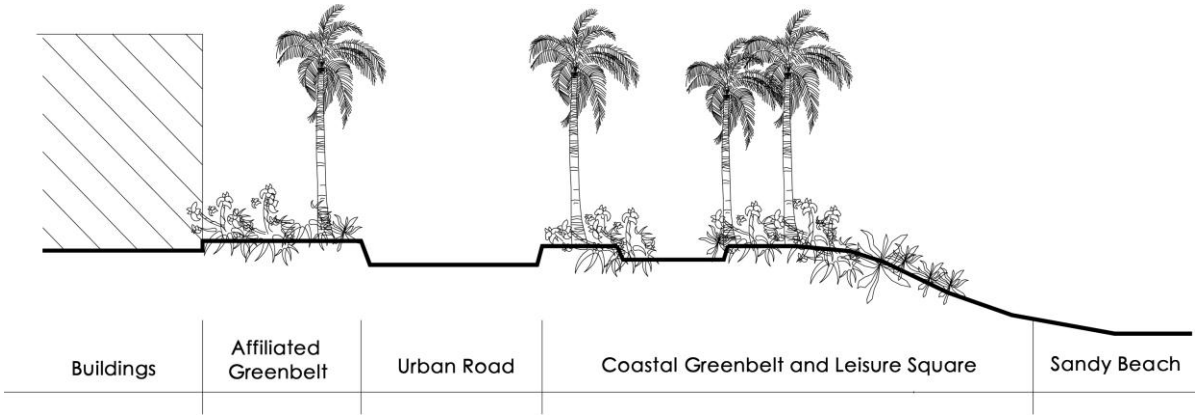
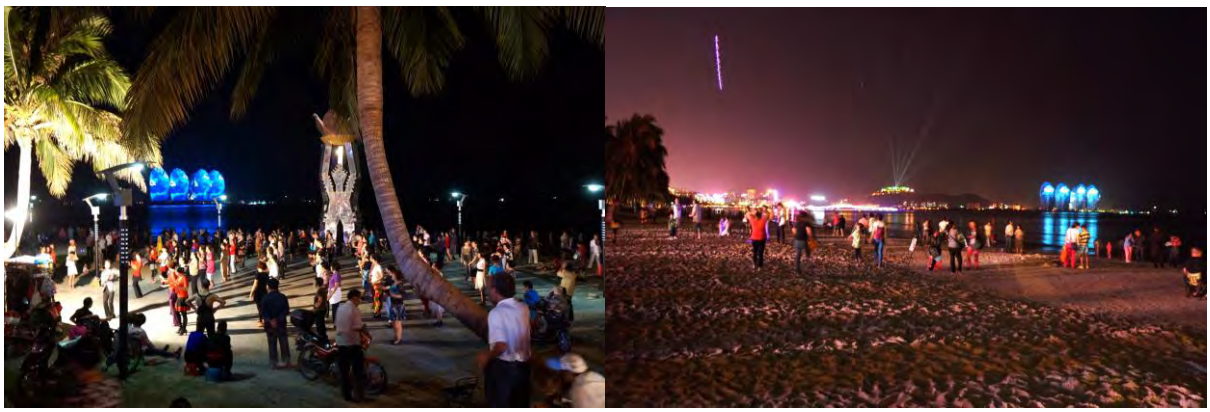


Figure 9: Schematic Diagram of Section of Sanya Bay Road



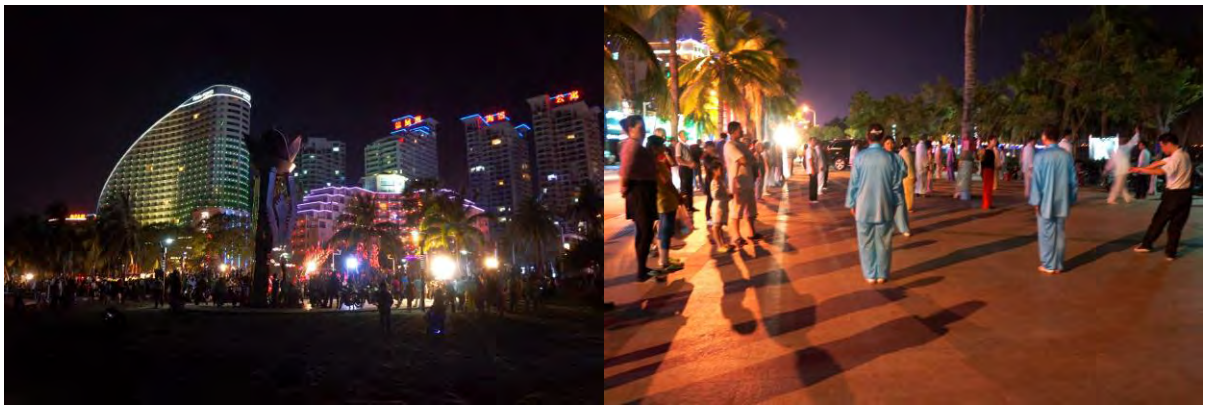


Figure 10: Leisure activities in Coastal Avenue Landscape Zones

4 Conclusion

The utilization of shorelines should accord with urban developmental stages. The utilization of shorelines is restricted by the natural condition of shorelines and also influenced by the orientation of urban development and development phase. Therefore, it is necessary to consider the reasonable use function of shorelines and the matching between shorelines and the process of urban construction and development to avoid unreasonable utilization and destruction because of lacking a long-term perspective.

The utilization of shorelines lays an emphasis on the rationality of resource allocation. The shorelines with different functions should form a favorable matching relationship with urban spatial resource allocation, urban ecological resource allocation and city public space system to avoid the low efficiency of utilizing shorelines for only pursuing tourism benefits.

The utilization of shorelines should pay attention to the combination of functional grouping and space quality, which not only ensures the reasonable distribution of use function of whole shorelines and forms good functional complementation, but also emphasizes on the planning and construction ways of specific shorelines and reasonably determines use function, space form and facility layout to satisfy many kinds of needs of local residents and visitors.

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Conservation and transition: the Industry Chosen of the Historic Towns of China of Shaxi Town in Jiangsu Province Riverside Area

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Abstract: Cultural heritage and urban development have always been popular concerns, especially under current background. The urbanization rate in China has exceeded 50%. China has formally entered an urban age. Urbanization is advancing quickly nowadays. The protection and development of historic and cultural towns becomes a serious problem. In this context, this article attempts to take Shaxi Town for example, to discuss the industrial development path for historical and cultural towns, how to coordinate the relationship between protection and development, how to drive the town development through the revitalization of riverside culture and how to promote the harmonious and sustainable social and economic development of the town better. This paper also attempts to provide a reference for the development of other famous Chinese historical and cultural towns.

Keyword: Historic and Cultural towns, Riverside Culture, Industrial Development

1 Research Background

Cultural heritage and urban development have always been popular concerns, especially under current background. The urbanization rate in China has exceeded 50%. China has formally entered an urban age. Urbanization is advancing quickly nowadays. The protection and development of historic and cultural towns becomes a serious problem.

Shaxi Town is one of the ancient towns in the Yangtze River Delta, which has long history and cultural tradition. In 2005, it was named “China’s Famous Historic and Cultural Town”. Shaxi is located in Taicang City, 50 km south to Shanghai downtown, about an hour’s drive, 13 km east to the main national container port--Taicang Port. Riverside freeways, Suzhou-Kunshan-Taichang Freeway, 204 National Freeway and Xitai Freeway pass through here. In the past, Shaxi was the only way from Suzhou to Shanghai by water. So it has a reputation of “reaching the Lou River in the south, resting Mount Yu in the north, adjoining Yantie in the west and commanding ocean in the east”. “The town can stretch to several miles. There are many wealthy families and mansions here. Half of the townsmen are government officials and scholars. “This is really an incredible metropolis!” The extremely developed land and water transportation have made Shaxi a prosperous river town in the Yangtze River Delta in history.

In a manner of speaking, Shaxi Town flourishes with water and declines with marine traffic. In recent years, Shaxi swing between protection and development. Since it deviates from the axis of Shanghai-Nanjing development, the town no longer possesses outstanding traffic advantages.

In order to develop town economy, Shaxi keeps increasing its investment on the secondary industry and seeks economic growth. But due to the development conditions in

various aspects, its industrial strength is not very outstanding. Meanwhile, it invests a lot of financial and material resources in the protection of town resources. But its ancient town characteristics are not very outstanding among the ancient town groups in the Yangtze River Delta. Its tourism development lags behind, which has, to a certain degree, affected the overall development of the town. Here, it seems to be difficult to find an appropriate balance between protection and development. Riverside culture often seems to be quiet, without any noise. It elapses slowly with river silently. In this context, this article attempts to take Shaxi Town for example, to discuss the industrial development path for historical and cultural towns, how to coordinate the relationship between protection and development, how to drive the town development through the revitalization of riverside culture and how to promote the harmonious and sustainable social and economic development of the town better. This paper also attempts to provide a reference for the development of other famous Chinese historical and cultural towns.

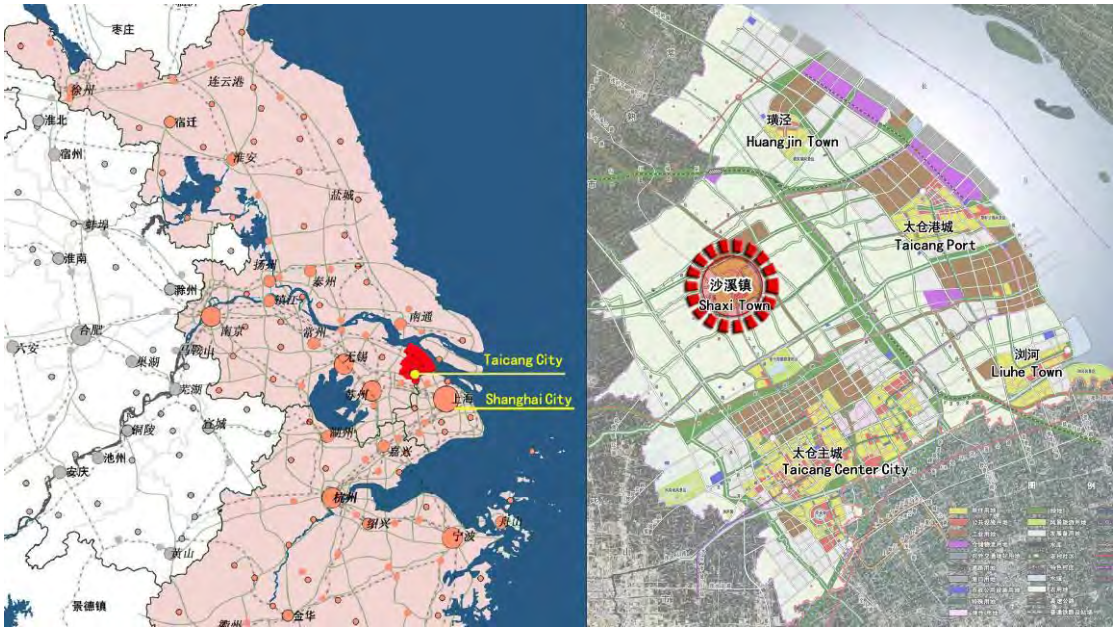


Figure 1 Location of Shaxi Town

2 Present Situation and Problems with the Industrial Development of Shaxi Town

2.1.1 The Direction of Industrial Development is Unclear

Shaxi Town gives priority to secondary industry for a long time. Its traditional competitive industry is chemical fiber textile industry. However, many towns in the Yangtze River Delta gives priority to chemical fiber textile industry. The entry barriers for companies are low. They are faced with great pressure from competitions. And the decline of water transportation also takes the previous vitality of Shaxi Town away. The tertiary industry is mainly about wholesale, retail, real estate, warehousing, logistics and catering. Ancient town tourism is almost a blank sheet of paper. The ancient town has not been protected as a whole. Only historical buildings has been protected. There is very little correlation between the secondary and tertiary industry. Some industrial land is blended in the ancient town, too.

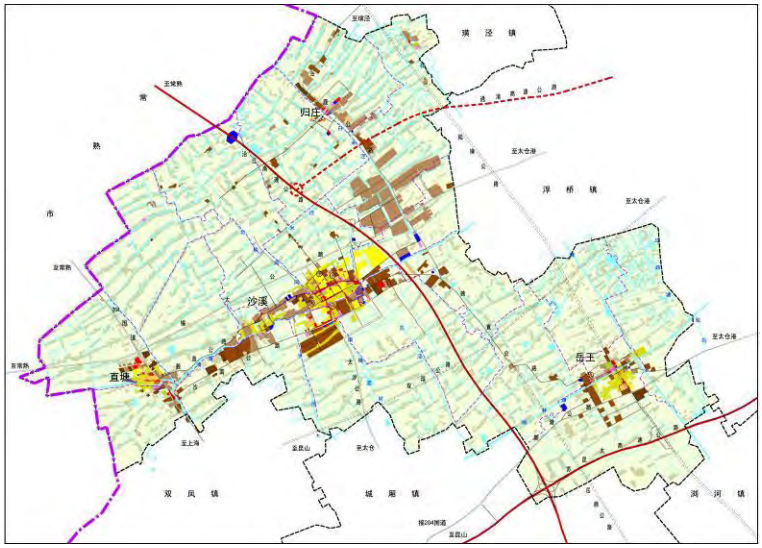


Figure 2 Status Quo of Shaxi Town Land Use

2.1.2 The Land Output Benefits Remain to be Improved

Ever since 2003, the land output benefits of Shaxi Town have been improving, from 0.023 billion yuan/square kilometer to 0.058 billion yuan/square kilometer in 2009. The annual growth rate was 16.8%, but still lower than the average level of the entire Taicang City. In 2009, the land output benefits were only slightly higher than half of the land output benefits of the entire city.

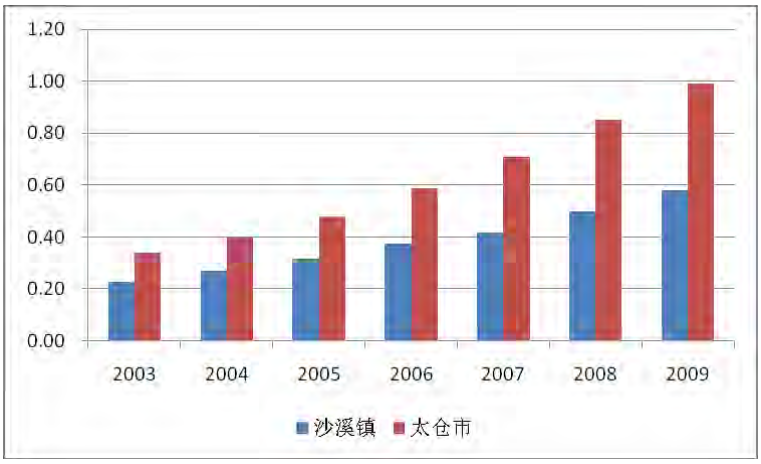


Figure 3 Comparison of Land GDP Growth between Shaxi Town and Taicang City
(Unit: Billion Yuan/Square Kilometer, The blue is Shaxi Town, The red is Taicang City)
Source: Taicang Statistical Yearbook (2004-2010)

2.1.3 Industrial Characteristics are not Outstanding

Shaxi Town invests a considerable amount in the secondary industry, but compared with other towns in Taicang, the industrial structure of Shaxi is equivalent to Taicang City. The proportion of the secondary industry is also lower than that of Fuqiao, which depends on port industry, Huangjing, which depends on chemical fiber industry and Ludu, which depends on high and new technology industry. The proportion of the tertiary industry is lower than that of Chengxiang, where the major city is located, Liuhe, the estuary of river and sea and Shuangfeng, which is adjacent to the major city.

Either in Taicang City or in the whole southern area of Jiangsu, the industrial

development characteristics of Shaxi Town are not outstanding and powerful enough. Even the chemical fiber textile industry, which has traditional advantages in Shaxi, is inferior to Huangjing Town in popularity and features (Huangjing Town is “China’s famous chemical fiber texturing town”). The town is short of well-known brands, too.

Table 1 Comparison of Industrial Structures between Shaxi Town and Taichang City

Area	Primary Industry	Secondary Industry	Tertiary Industry
Shaxi	3.8%	62.3%	33.9%
Chengxiang	1.5%	49.1%	49.4%
Liuhe	7.7%	50.1%	42.2%
Fuqiao	2.2%	80.4%	17.3%
Huangjing	2.1%	69.4%	28.5%
Shuangfeng	8.6%	52.7%	38.7%
Ludu	1.1%	67.5%	31.4%
Taicang	4.0%	58.1%	37.9%

Source: Taicang Statistical Yearbook (2010)

From the development of surrounding towns, ancient towns are intensive in the Yangtze River Delta. Their resources endowments are similar and their cultural bases are equivalent. Ancient Shaxi Town develops late. A stable tourist market has not been formed yet. Its popularity is inferior to other towns in the Yangtze River Delta. It has very little appeal to tourists and is almost forgotten by history.

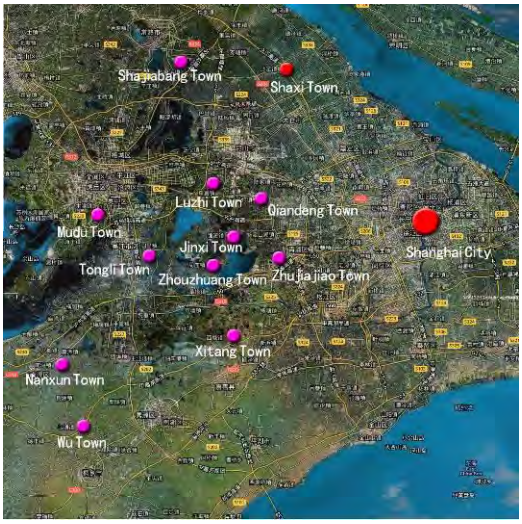


Figure 4 Sketch Map of Major Ancient Towns in the Yangtze River around Shaxi Town

Table 2 Development Characteristics of Major Ancient Towns in the Yangtze River around Shaxi Town

Area	Town	Rank	Slogans
Shanghai	Zhujiajiao Town, Qingpu District	China’s Famous Historical and Cultural Town	Shanghai Venice and Oriental Water City
Zhejiang	Wu Town, Tongxiang City	China’s Famous Historical and Cultural Town	The Same Old Town, A Different Wu Town
	Xitang Town,	China’s Famous	A Living Town for Thousands

	Jiashan County	Historical and Cultural Town	of Years
	Nanxun District, Huzhou City	China's Famous Historical and Cultural Town	Birthplace of China's Private Capital
Wuzhong District, Suzhou City	Mudu Town	China's Famous Historical and Cultural Town	A Place Where Emperor Qianlong Have Travelled to During His Yangtze River Delta Voyage for Six Times
	Luzhi Town	China's Famous Historical and Cultural Town	No.1 Water Town in China
Kunshan City	Zhouzhuang Town	China's Famous Historical and Cultural Town	No.1 Water Town in China
	Jinxi Town	China's Famous Historical and Cultural Town	Hometown of Chinese Folk Museum
	Qiandeng Town	China's Famous Historical and Cultural Town	Famous and Glamorous Town in China
Changshu City	Shajiabang Town	China's Famous Historical and Cultural Town	Red Shajiabang and Green Reeds
Wujiang City	Tongli Town	China's Famous Historical and Cultural Town	Global Tongli, an Ancient Town for Thousands of Years

Table 3 Comparison between China's Famous Historical and Cultural Towns in Suzhou

Famous Historical and Cultural Town	Gross GDP (Billion yuan)	Fiscal Revenue (Billion yuan)	Number of Tourists (Thousand people)	Industrial Structure
Shaxi	77.1	7.48	250	3.8:62.3:33.9
Mudu	63.8	12.1	—	0.3:51.1:48.6
Zhouzhuang	19.7	2.4	3365	2.1:19.2:78.7
Luzhi	47.2	7.1	—	—
Tongli	36	—	—	2:45.8:52.2
Qiandeng	62.3	11.53	636	1.6:69:29.4

Notes: The numbers of tourists in Shaxi, Zhouzhuang and Qiandeng were data in 2009. The economic data of Shaxi Town was gathered in 2009. The data of rest towns was gathered in 2008.

So in a new development environment, should Shaxi stick to the secondary industry, or transform actively to revitalize its glamour? As far as the current development is concerned, either in the secondary industry or the tertiary industry, the development direction has not

been clear yet. The emphasis is not very outstanding. In future development, the direction of industrial development remains to be clarified and selected.

3. Reference from Typical Areas

In order to look for a better development path for the water town Shaxi, this paper analyzes the development characteristics of ancient towns in the Yangtze River, to absorb the successful experience of current areas and explore an appropriate development road for Shaxi.

3.1 Development of Ancient Towns in Yangtze River Delta

With the rapid development of economy, expansion of cities, serious pollution of the environment and increasing pressure from work and life, many urbanites choose to travel around during holidays and festivals, to seek spiritual comfort and psychological balance. In this context, simple, graceful and nostalgic Yangtze River towns, as described in the poem, characterized with “small bridge, flowing water and cottages” soon attract modern urbanites. An upsurge of native culture regression sets off in China. Ancient Yangtze River town tourism becomes a common practice. Among them, “six Yangtze River towns”, Zhouzhuang, Tongli, Wu Town, Xitang, Nanxun and Luzhi develop fastest.



Figure 5 No. 1 Water Town in China—Zhouzhuang

From the location (see Figure 2), “six Yangtze River towns” are adjacent to and distributed around Shanghai. Zhouzhuang is 38 kilometers from Suzhou, while Tongli is only 18 kilometers from Suzhou. Luzhi and Zhouzhuang lying between Shanghai and Suzhou, while Xitang, Nanxun, and Wu Town lie between Shanghai and Hangzhou. On the one hand, the Yangtze River Delta, with Shanghai as the core, is one of the most fast-developing, competitive and prosperous regions in China. This region has convenient transportation, dense population, high per capita consumption level and strong tourism demand. It is the most important customer market in domestic tourism. On the other hand, Suzhou and Hangzhou tourism circles, with Shanghai as the center, are also one of the most competitive tourism circles in China. As the most competitive economic, commercial, financial and logistic center in China, Shanghai is an important distributing center in international tourism and also a leader in domestic urban and business tourism. Suzhou and Hangzhou paradises are two

brands with thousand years of cultural accumulation. They have immeasurable market appeal and motive force. Their unique locations create another glory for the six Yangtze River towns.

From the perspective of ancient town characteristics, the six Yangtze River towns always pay attention to the protection of ancient towns, retain the features of Yangtze River water towns, restore historical memories and create a recreational atmosphere. Represented by Zhouzhuang and Wu Town, ancient Yangtze River towns are warm, graceful, simple and nostalgic, with winding waterways. High streets and small lanes, shuttling boats, concentrated houses and opposite arch bridges make people feel as if in a picture. Although the six Yangtze River towns have their own distinct features, they highlight the images and elements of “Yangtze River water towns” and “ancient towns”. They are protected and developed by water, associated with water town culture and run through ancient and modern times.

From the perspective of ancient town protection and development, the six Yangtze River towns have their distinct features. The secondary and tertiary industries develop harmoniously. The development core of Zhouzhuang is aiming to protect the ancient town with tourism. In spatial structure and form, a pattern of “ancient town+ new ancient town+ new town” is adopted. The ancient town and new town are given different tourism projects. Not only the ancient town is protected, problems with the town development can be solved, too. It can protect the lifestyles of original residents quite well. Meanwhile, Zhouzhuang combines tourism with non-pollution high-tech industry, promotes the town popularity through tourism and introduces relevant high-tech industry. At the same time, capital from industrial development is invested in the protection of ancient town. Wu Town obtains effective protection by “opening the door to look for history and closing the door to protect the town”. On the basis of protection, folk culture with most distinctive local features is integrated. “Draw upon the experience in a small area and restore the town step by step”. Once visitors enter the town, they can get away from modern and urban noises. What they see are local-style dwellings in the Ming and Qing Dynasties that have disappeared for ages.

3.2 Enlightenment on Development

3.2.1 Ancient Town Development– Small Bridge and Flowing Water

From location, Shaxi Town is located in a concentration area of ancient Yangtze River towns independently. It is nearer to Shanghai than the six Yangtze River towns and has more advantages to attract customers. From ancient town characteristics, Shaxi Town is quite similar to ancient Yangtze River towns. Ancient towns in the Ming and Qing Dynasties have natural and unsophisticated folk custom. They used white walls, dark green tiles, small bridges and flowing water. Besides, since they are almost forgotten, Shaxi Town heritage become even purer.

However, from the perspective of ancient town protection and development, Shaxi Town develops later than the six Yangtze River towns. The operation of the ancient town lacks striking local features. There are still some deficiencies in the creation of historical and nostalgic atmosphere. Shaxi Town should learn from the operation and management model of the six Yangtze River towns, combine with the characteristics of its own resources, achieve dislocated development with other ancient Yangtze River towns, make full use of its geographical features, to create an ancient Town brand--Shaxi. At the same time, it also needs to coordinate the relationship between the secondary and the tertiary industry

development to make both industries rely on each other and work together to promote the economic and social development of Shaxi

3.2.2 Tourism—Ancient Water Town

As far as tourism features and development advantages are concerned, the spatial pattern of “alternate rivers and islands and paralleled rivers and streets” in Ancient Shaxi Town, the water town architecture of “riverside sheds, cornices and outriggers” and the cultural accumulation of “Shanghai-style culture and numerous celebrities” have certain advantages and peculiarity. But at present, tourism development is weak. There is a lack of planning. The characteristics of water ancient town are not outstanding. From the tourism development in Lijiang, Pingyao and Phoenix, whether led by the government or enterprises, it is necessary to make full use of the ancient town resources, enlarge the characteristics of unique resources, manage the ancient town from “tourism, purchase, entertainment, food, living and traffic” etc., to attract passenger flow and drive the development of relevant industries.

4. Development Road of Shaxi

4.1 Selection of Industrial Development Model

4.4.1 Existing Development Model

Southern areas of Jiangsu where Shaxi is located are the core of the Yangtze River Delta. Ever since reform and opening-up, it has taken an export-oriented economic development road. The manufacturing industry participates in the global economic division of labor. It mainly relies on export and is easily affected by international economic environment. Meanwhile, the costs of land, labor, resources, business services and other production factors that industrial development relies on keep rising. However, the contribution of manufacturing development to employment is not as large as the tertiary industry. For example, the employment ratio of the secondary industry in Jiangsu Province have maintained at about 32% since 1985. Newly added jobs are mostly from the tertiary industry.

Therefore, in a new development environment, it is urgent for Shaxi Town to transform from the current situation in which the secondary industry are taken as the principal thing and traditional competitive industries rely too much on exports.

4.1.2 Selection of Industrial Development Model

Shaxi Town should fully absorb the development experience of other areas, integrate the urban development of Taichang City, draw support from the integrated development of the Yangtze River Delta and coordinate the relationship between the development and protection of ancient towns, to drive the development of the primary and secondary industry with ancient town tourism. Strive to make Shaxi a typical Yangtze River ancient town, with the unique water town cultural endeavors, protect “the ancient town in history”, construct a “livable new town” and cultivate a “famous cultural town”.

First of all, strengthen ancient town planning, protect the historical ancient town and implement franchising for profit-making activities, which should be authorized by the government. Center on river systems which run through the ancient town, such as Qipu Pond, etc, integrate the folk culture of Shaxi, such as Rolling Lanterns, Litai Stilts, Kunqu Opera and

other traditional entertainments, carry forward Wu Xiaobang Dance Art, etc., carry out a series of activities and cultivate cultural atmosphere. The overall design of the ancient town reproduces the styles and features of the water town in the Ming and Qing Dynasties, creates a recreational historical atmosphere, shapes a habitable environment, touches the historical memory of people, experience unsophisticated folk custom, feel the amiable environment, design water and land tourist routes carefully and develop featured tourism products and cultural industry.

Secondly, combine the ancient town protection with the secondary industrial development. Promote the town popularity through the protection and management of ancient towns, create better opportunities for the development of the secondary industry, improve the high-tech content of the industry, introduce pollution-free high-tech industry, arrange the layout of the new town and promote the transformation of town industry. Meanwhile, invest capital from industrial development on ancient town protection, to form a situation that both the secondary and the tertiary industry grow simultaneously and interact positively.

Thirdly, combine ancient town tourism with the development of primary industry organically, to develop sightseeing tourism, experience tourism, leisure tourism and town development tourism and blend the town in Taicang tourism routes.

4.2 Industrial Development Strategies

4.2.1 Tertiary Industry: Rely on Water Town Tourism and Promote Modern Services

Strengthen the cultural characteristics of Shaxi and strengthen the development of tourism, based on the development and construction of Shaxi water town tourism. Meanwhile, improve leisure, holidays and shopping environment, etc., to make Shaxi Town a comprehensive center of tourism, leisure and consumption, etc. in the northwest of Taicang City.

Combine with tourism development, expand cultural industry, etc. actively and explore new tourism products. Coordinate the relationship between the ancient town and new town. Develop service projects which integrate catering, accommodation, conference and leisure into one, to enhance Shaxi modern service industry.

4.2.2 Secondary Industry: Optimize Traditional Industries and Cultivate New Industries

Optimize and upgrade current completive industries, such as chemical fiber textile industry, combine with the ancient town tourism characteristics, to create new industrial growth points and promote the interactive development between the secondary and tertiary industry.

Choose emerging industries according to market changes and technological development constantly. Aimed at the demand for Taicang industrial development, take new materials, biological medicine, precision machinery and electronic information industry as the new development directions and cultivate emerging industries actively.

4.2.3 Primary Industry: Leisure, Branding and Intensification

Build agricultural and ecological demonstration parks and agricultural sightseeing parks, to integrate agricultural production, agricultural tourism and agricultural demonstration into one. Combine with Shaxi Town tourism, promote the fusing between traditional primary industry and tertiary industry, give full play to the ecological and recreational functions of

agriculture and create new growth points for agricultural economy.

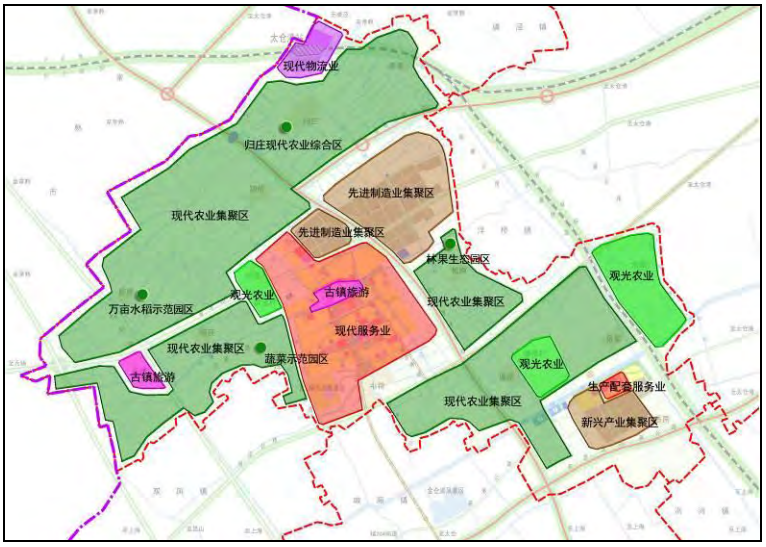


Figure 6: Sketch Map for the Industrial Spatial Distribution of Shaxi Town

4.3 Guidance on Industrial Development: Prosper by Water

4.3.1 Ancient Water Town Tourism

With Shaxi Town as the core, pay attention to the protection of ancient towns. Carry out reasonable development and utilization within the scope of ancient town environment. Combine with the ancient town resources to develop tourism, with Qipu Pood and other water systems as the core, to attract visitors to experience ancient town life, reinforce the joint development between Shaxi Town and the surrounding scenic spots and blend the town in the Yangtze River Delta tourism circle actively, through tourism promotional exhibitons, tourism industry associations and other platforms.

4.3.2 Cultural Industry

Make full use of the celebrities, sceneries, folk customs, dwellings and temples to develop creative cultural industries in Shaxi. Introduce cooperative enterprises, develop cultural industrial projects, such as “comic strip village”, etc. vigorously and promote the combination between cultural industry and urban commerce and trade.

To repair the “riverside paradise” in Shaxi, restore the “one town and two cities” vision in ancient times, namely, to restore the bridge door and lane door. The inner town is business district. The outer town is marketplace.

Accelerate the development of olive island scenic spot and repair Gong’s ancient house;

With the development history of Hongjing Village, Shaxi Town since liberation as the background, build Gu Atao and Hongjing Exhibition Hall. Based on typical water town styles, combine with the cultural assets of Shaxi in history, it is essential to establish a movie and television photography base in the water town;

Carry forward the tradition of “hometown of Chinese folk art (dance)” , on the basis of the 1st “Xiaobang Cup Invitational Tournament” in 2010, hold “Wu Xiaobang Dance Festival” and other activities and organize conventions and exhibitions, etc.;

Explore local gourmets in Shaxi and launch Shaxi gourmet festivals and other traditional folk activities.

Through a series of industrial planning on Shaxi water town culture, promote the popularity and influence of Shaxi Town, attract more investment and jump out of industries which have little pollution. Not only inherit ancient culture, but also transform the development model of the town.

5. Conclusion and Discussion

Through an analysis into the industrial development of Shaxi Town, this paper discusses how to strike a balance between the protection and development of history and culture and how to drive the transformation of town through the heritage and development of water culture. It is believed that the revitalization of famous historical and cultural towns need to handle the following three kinds of relationships correctly.

5.1 Protection and Development—Interdependency and Reliance

Protection and development is not a pair of contradictory propositions, but rather, mutually interdependent and mutually reliant. The protection of historical and cultural resources is to develop better famous historical and cultural towns. Only when the towns are fully developed can they provide better protective measures for historical and cultural resources. As long as we plan and design industrial development paths reasonably, we can achieve development in protection and find an appropriate balance between protection and development. We can not only inherit Chinese history and culture, but also absorb the spirit of the new era.

5.2 Competition and Reference : Reflection and Discovery

The development of towns will inevitably involve many competitions, especially from the surrounding areas. Their resources endowments are similar. A temporary backwardness is not terrible. What is important is to reflect on our own development path, find our own characteristics and be ourselves in competition. We can go our own way for sure. Although in the Yangtze River Delta where Shaxi is located in, there are numerous ancient water towns, Shaxi has Shanghai-style culture and dancing culture etc. that are bred with its unique water and soil. In the competition with other ancient towns with higher popularity, it finds out its own water town characteristics, carries out a series of industrial planning about water and drives the revitalization of the town.

5.3 Inheritance and Transformation: Mission and Future

Famous historical and cultural towns are cultural heritage that cannot be copied. Ancient town streets not only preserve history traces, but also contain profound culture. History and culture undertake the mission of cultural inheritance.

History is developing too. Under the background of urbanization, famous historical and cultural towns need to find their own ways, transform their development model and explore harmonious industrial path while absorbing eligible agricultural immigrants.

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Track 4: Water Management

50th ISOCARP Congress Proceedings



50th ISOCARP
International Planning Congress
Urban Transformations - Cities and Water
GDYNIA, POLAND, 23-26 September 2014

Residents' Water Needs in the Indigenous Core of Ibadan

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Synopsis

The physical availability, accessibility, sufficiency and safety of water and sanitation efforts is a major challenge in Bere, a notable slum in Ibadan, Nigeria. This has resulted to indiscriminate waste disposal, health challenges such as malaria and diarrhea. This paper therefore aims to assess the availability of portable water and sanitation practices in Bere, Ibadan.

1.0 Introduction

Water is the most basic natural resource. More than 97% of the earth's water, for example, is saline ocean water. Another largely unavailable reservoir of water is the 2% of the earth's water frozen in polar ice caps and glaciers. Of the remaining 1% of' the earth's water, more than half (0.6% of the total supply) is contained in groundwater (Shiklomanov, 1993).

Water is needed for the maintenance of health. Its importance is not only related to the quantity, but also the quality. Access to water in the required quantity is needed to achieve good personal and domestic hygiene practices (Huttly, 1997); while availability of good quality water ensures that ingested water does not constitute a health hazard, even in a life time of consumption (Ezzati et al, 2003).

Water is vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities.

Providing safe and secure water to people around the world and promoting sustainable use of water resources are fundamental objectives of the Millennium Development Goals. It is most closely tied to specific targets of the goal 7: to ensure environmental sustainability which are; to integrate the principles of sustainable development into country policies and programmes and

reverse the loss of environmental resources; halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation; significantly reduce biodiversity loss by 2010; and achieve significant improvements in the lives of at least 100 million slum dwellers, by 2020.

However, Nigeria is currently not on track to reach the MDG targets of 75% coverage for improved drinking water and 63% coverage for improved sanitation by the year 2015 (Laah, J.G., 2013). According to the World Health Organization/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP), 36% of the developing world's population- 2.5 billion people lack improved sanitation facilities, and about 768 million people still use unsafe drinking water sources. Inadequate access to safe water and sanitation services, coupled with poor hygiene practices, kills and sickens thousands of children every day, and leads to impoverishment and diminished opportunities for thousands more (WHO,2013). The WHO and UNICEF report for 2012 ranked Nigeria third behind China and India, as countries with the largest population without adequate water and sanitation.

The crave for portable water has been on the increase in every community as population increases. This is the same with the inhabitants of Bere, Ibadan. Assessing portable water has been a major challenge in this area over the years as little attention is paid to the residents water needs, not in words, but in action by the Government and Non-Governmental Organizations.

1.1 Study Area

Ibadan, located in Western Nigeria is the country's second largest city and capital of the Oyo state. It covers an area of nearly 200 km2 with a 2014 population estimated at 7,445,995 million. Ibadan is located on the longitude 3^{O} 55' 0'' and latitude 7^{O}23' 47''.It is linked to Lagos by a major dual carriage highway. Although it has an airport, its use commercially is very limited as a result of its proximity to Lagos the hub of air transport in the country. Ibadan is supplied water from two sources namely the Asejire and Eleiyele dams that feed three existing treatment works. The Asejire dam supplies water to Asejire and Osegere treatment works, while the Eleiyele dam supplies water to Eleiyele treatment works. (Ibadan Water Supply II Project, 2004). Bere which stands as the focus area is found in the Ibadan North West local Government area surrounded by OdoOsun, Oke ado, Orita- aperin and Olaogun with a 1996 population of 1315 persons. However, the population over the years have grown at a geometric rate rather than

arithmetic. The community is likewise an organic settlement with a history connected to the overall capital city growth.

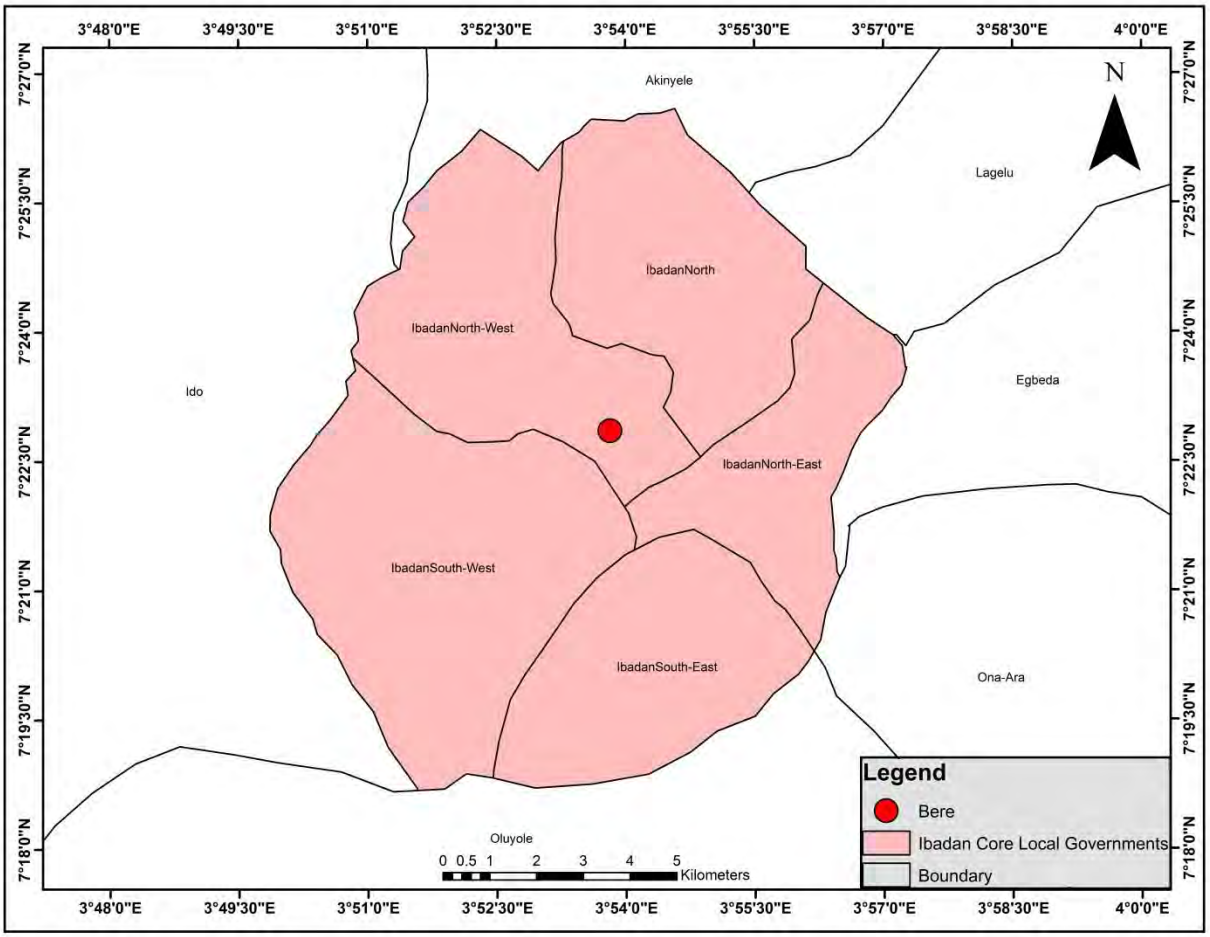


Figure 1: Core Local Governments in Ibadan locating the Study area

Source: Author (s), 2014

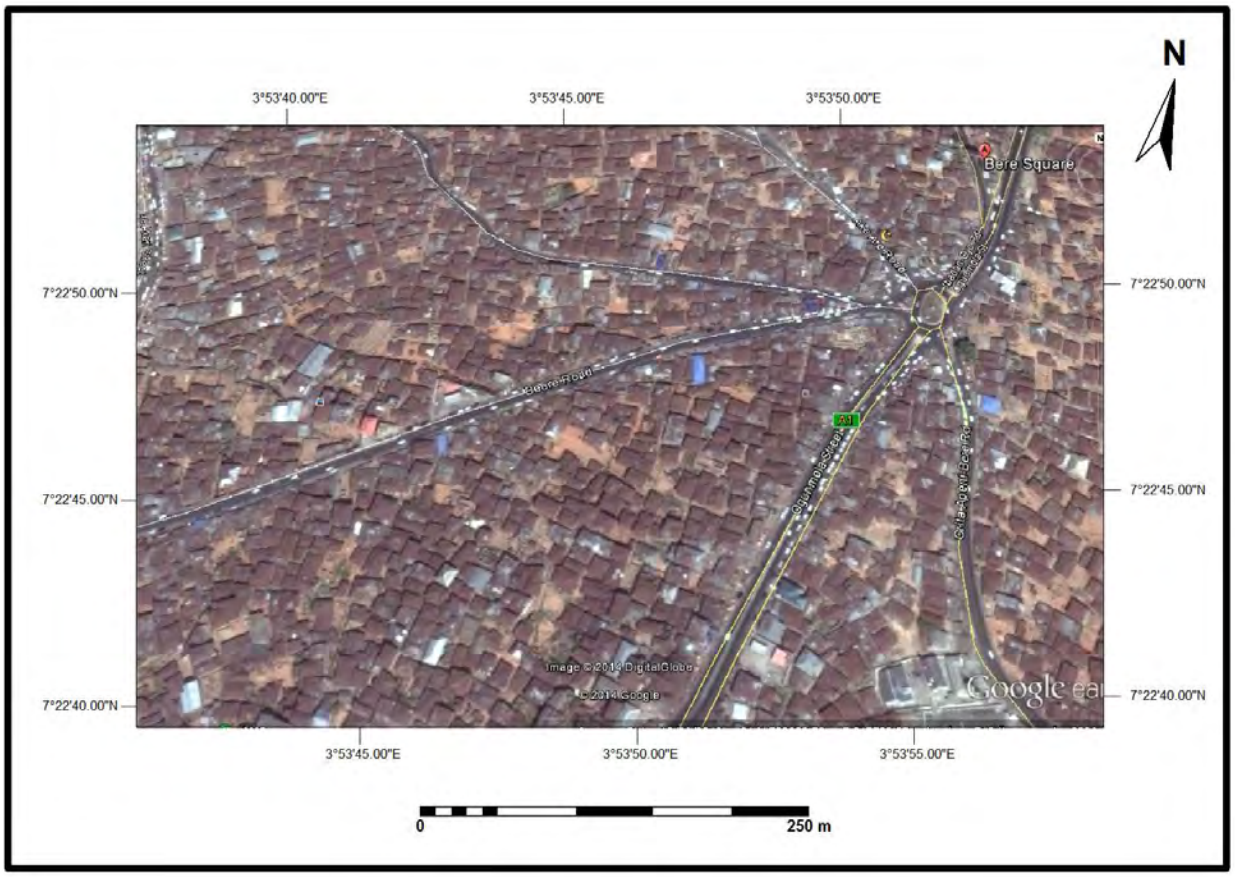


Plate 1: Google Image of Bere

Source: Author (s), 2014

The aim of this paper is to assess the availability of portable water and sanitation practices in Bere, Ibadan and the focus is on the physical availability, accessibility, sufficiency and safety of water and sanitation efforts in Bere. Specific objectives include:

- To identify the existing sources of water at Bere,
- To assess the problems of water and sanitation at Bere,
- To give recommendations that would address the problems of water and sanitation at Bere.

1.2 Methodology

Both primary and secondary data were used for the purpose of the study. Questionnaire was used to obtain primary data. This was randomly administered to about 2 percent of the entire population and those retrieved were analyzed using the Statistical Package for Social Sciences

20 (SPSS 20) software. Also, interview was carried out involving the Chief Engineer of the Agodi Water Booster Station and some workers at the Oyo State Water Corporation. The Google image of the study area was also acquired from Google Earth to give a spatial overview of the area under study.

The secondary sources of data include map showing the water distribution network within the study area obtained from the Agodi Water Booster Station as well as data from published and unpublished works of other authors.

1.3 National efforts at providing portable water to inhabitants of the country

Accurately assessing the status of Nigeria's progress towards its Millennium Development Goal (MDG) targets is difficult, due to inconsistent data. For instance, the United Kingdom's Department of Foreign and International Development (DFID, 2014) classified Nigeria as "one of the four most off-track MDG countries in Africa." In May 2005, the Nigerian Minister of Water Resources reported that increased spending on water programmes resulted in a huge increase in access to safe water supply, from 35 percent in 1999 to 65 percent in 2004. A year later, the Ministry revised its access figure upwards to 68 percent. The World Health Organization (WHO), however, estimated that the figures are closer to 58 percent for improved drinking water and 32 percent for improved sanitation (WHO, 2008).

While the total volume of water available in surface and groundwater resources is sufficient to meet current drinking water demands in Nigeria, the lack of distribution capacity, coupled with highly variable rainfall patterns, has led to water scarcity in some areas. In addition, the water infrastructure has suffered from years of poor maintenance (World Bank Report, 2010).

To address these problems, Nigeria launched a National Water Supply and Sanitation Policy. Efforts and initiatives have included the completion of hydro-geological mapping of the country, establishment of water-quality laboratories, encouraging private-sector development, and expanding rural water and sanitation systems. However, numerous other factors hamper efforts to expand sanitation and drinking water access, including weak and inefficient institutions, unsustainable public sector spending, poor water quality, and conflicts over water use and management (World Bank Report, 2010).

Water supply coverage rates in Nigeria are amongst the lowest in the world. Access to an improved water source stagnated at 47% from 1990 to 2006, but increased to 54% in 2010. In urban areas access actually decreased from 80% to 65% in 2006, but it then recovered to 74%

in 2010. However, in urban areas access to standpipes substituted to a large extent to piped water access (Oyebande, 2011).

According to the World Bank, in 2010 water production facilities in Nigeria were "rarely operated to capacity due to broken down equipment, or lack of power or fuel for pumping." The operating cost of water agencies is pushed up by the need to rely on diesel generators or even having to build their own power plants, since power supply is erratic. Equipment and pipes are poorly maintained, leading to intermittent supply and high levels of non-revenue water. As of 2000, about 80% of all government-owned water systems in small towns were non-operational. Through investments and capacity building for communities, the functionality of water points can be increased in the short term. For example, in focus communities supported by UNICEF in Kwara State, functionality has improved from 53% to 98%, and in Kebbi State the functionality of boreholes has improved from 12% to 88%. However, it is not clear what the long-term functionality of these facilities is (World Bank Report, 2010).

1.4 A Glimpse into Water Management in the Country

Three tiers of government share responsibility for managing the country's water resources. At the national level, the Federal Ministry of Water Resources (FMWR) is responsible for developing policy, collecting data, monitoring and coordinating water supply development, and funding research and development. FMWR also collaborates with the Ministry of Environment on water sanitation activities including sewage, storm water control and quality control of water supply sources. The 12 River Basin Development Authorities (RBDAs) are responsible for the development, operation and management of reservoirs for the supply of bulk water in their areas of jurisdiction. RBDAs report to the FMWR on the quantity of water harnessed, sold or released for water supply.

At the State level, the state water agencies (SWAs) are responsible for the establishment, operation, quality control, and maintenance of water supply in urban and semi-urban areas. There are 37 SWAs in the country – one for each State and one in the Federal Capitol Territory. Most are established a corporate bodies that are fully owned by their respective State government, but run according to civil service rules. SWAs are intended to be autonomous and self-accounting, but they often find it difficult to be operationally and financially autonomous from the State government.

At the local level, Nigeria has 774 Local Government Authorities (LGA), which are administered by local councils. The LGAs are responsible for rural water schemes in their areas and for establishing local Water, Sanitation and Hygiene (WASH) departments. However, only a few LGAs have the resources and skills to address local needs and construct small water systems, and the majority of the LGAs have not established WASH departments (Oyebande, 2011).

In 2000, Nigeria's federal government launched a National Water Supply and Sanitation Policy. The policy encourages private-sector participation, expansion of rural water supply systems, and reform of urban water service providers (Oyebande, 2011).

Table 1: Key Government Agencies Involved in Water Management in Nigeria

AGENCY	DESCRIPTION
Federal Ministry of Water Resources (FMWR)	• **Formulation and implementation of policies for overall water resources management;** • **Monitoring and coordination of water resources development.**
Rural Water and Sanitation Agency (RUWASA)	• **Improve the quality of life through a sustainable reduction in water related diseases by the provision of clean water, promoting sanitation facilities and hygienic practices.**
State Water Agencies (SWAs)	• **Manage and operate systems for water service delivery in urban areas;** • **License and monitor private water supply and monitor water quality;** • **Provide technical assistance to the LGAs.**
Local Government Authorities (LGAs)	• **Rural WSS service;** • **Establish, fund, and equip Water and Environment Sanitation (WES) departments.**
River Basin Development Authorities (RBDAs)	• **Suppliers of bulk water in 12 jurisdictions.** • **Reservoir and water resources management.**

Source: Adapted from Oyebande, 2011; Overview of Water Sector Development in Nigeria

2.0 Findings and Discussions

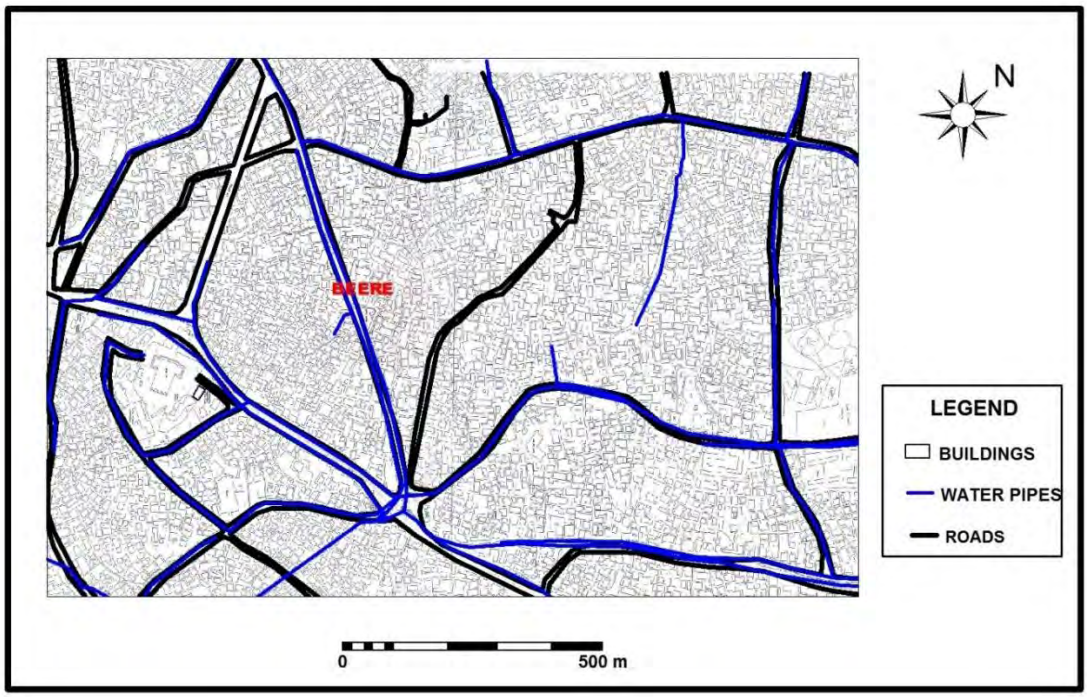


Figure 2: Ibadan Water Pipeline Network

Source: Agodi Booster Station, 2014

2.1 Portable water: Source, Need, and Availability

Safe water is a precondition for health and development and a basic human right, yet it is still denied to hundreds of millions of people throughout the developing world (UNICEF, 2008). The supply of portable water to Bere is handled by the Agodi Booster Station under the Oyo State Water Corporation. The aim of the corporation is to supply water to the nooks and cranny of Oyo State. The Asejire waterworks which takes its source from the Osun river is responsible for the supply of water to the Agodi Booster Station which in turn supplies water to some areas in Ibadan such as Basorun, Iwo road, Molete, Challenge, Apata, part of Eleyele and Bere. The booster station houses two reservoirs with a capacity of 450,000 cubic meter each (Agodi Booster Station records). Water travels the underground pipe over 25km from the Asejire waterworks to reach the Agodi Booster Station which in turn distributes to consumers using gravity, based on available power supply and the state of distribution pipelines.

The inhabitants of Bere require water simply for their daily basic needs like drinking, cooking, bathing and cleaning, yet, the supply and demand rate are yet to be at par. Of the respondents

who participated in the questionnaire administered, only about 20% have access to tap water. The water pipelines linking some areas within the study area are damaged and even the collection points within the households and neighborhood have been cut off. According to the respondents, this problem has lingered for over 10 years now and no effort has been noticed on the part of the Government and private organizations to remedy this problem. The residents therefore depend on water from wells, and water vendors and occasionally bore-holes. About 80% of the population travel about 11 to over 30metres distance to fetch water while only about 20% assess water within the range 1-10m distance from their abode.

The United Nations suggests that each person needs 20-50 litres of water a day to ensure their basic needs for drinking, cooking and cleaning. About 75% of households in Bere use three kegs of water, equivalent of 60 litres daily and the remaining 25% use between 4 and 6 kegs of water (80- 120 litres), sources of which cannot be adjudged portable. It should be noted that household comprise between 6 to 12 persons in the study area which further implies that the UN standard is far from being met in the area under study.



Plate 2: Household Disconnected Tap

Source: Author (s), 2014



Plate 3: Billboard of Promises

Source: Author (s), 2014

The picture shown in Plate 3was captured around the Bere roundabout and it shows the present State Governor drinking water from a glass and with the inscription: "Our People Will Never Lack Portable Water Again". It is however noteworthy that this promise has not been in any way matched with adequate effort to achieving it. Most times, on the part of the government, promises of this nature are made during campaign activities, targeting the major needs of the community in question to encourage maximal support from these people to acquire a Political

portfolio but it is painful that when these men get to power, they rarely fulfill their promises, and when they do, the effects are at minimal compared to the population of the people expected to be provided for. At the foot of the billboard are litters whose sight also negates the inscription on the board.

The role of private Organizations and NGOs is likewise not distinct in water provision in Bere. For adequate provision of water infrastructures and water supply in Bere, government may have to collaborate with the Private Organizations and concession some responsibilities to achieve a notable result.

2.2 Water Infrastructures and Distribution

The Agodi Booster Station was officially commissioned in 1996 during the regime of General SanniAbacha, the then President of the Federal republic of Nigeria. The station stands as the phase II of the Ibadan Water Supply Scheme, Asejire. The station's control room houses four pumps responsible for pumping water from the two reservoirs to areas of lower elevation like Bere and Molete and areas of higher elevation like Iwo road and Basorun in Ibadan. Two surge tubes/ tank lie just outside the control room, with each of it attached to two pumps. The Surge tank is an air filled safety device that resists pressure to protect the pumps when water rushes back towards the pump due to power outage.

According to the interview carried out with the Chief Engineer at the Booster station, the infrastructures on ground are enough to service the population that the water supply is directed at, but the people at the receiving end (people in the study area) do not agree with this affirmation as little or no water is supplied to their community. Many inhabitants from Bere fetch tap water from their neighboring settlements. The BereBooster Station stands as an intermediary between the Agodi Booster Station and the consumers.



Plate 4 : Surge tanks

Source: Author (s), 2014



Plate 5: Water pumps

Source: Author (s), 2014

2.3 Availability and Distribution Problems

The problems associated with portable water availability and its efficient distribution range from damaged/old/evacuation of pipelines due to road dualization, to irregular power supply, insufficient operational vehicles, poor equipment maintenance, insufficient personnel, few boreholes, shallow wells, poor sector monitoring and accountability, inadequate monetary support from the government, lack of political will to support the cause and the unwillingness of consumers to pay for water supply- this is because water is seen as a social service by the inhabitants of this area rather than as an economic good.

2.4 Water and Sanitation

Sanitation literally means measures necessary for improving and protecting health and well-being of the people. Sanitation is any system that promotes proper disposal of human and animal wastes, proper use of toilet and avoiding open space defecation.The term sanitation as defined by United Nations Children Fund (1997) refers to a process whereby people demand, effect, and sustain a hygienic and healthy environment for themselves by erecting barriers to prevent the transmission of disease agents. Such an approach is needed not only to prevent disease and promote health, but also to lay the foundation for sustainable development. 2008 was declared International year of sanitation by the United Nations General Assembly because Sanitation had been neglected for a long time and this has resulted into high level of sickness and death especially among infants.Sanitation facilities must be culturally acceptable, affordable and assessable by people.

Bere is a notable slum in Ibadan with a poor sanitary condition; also, the area is not well connected with drainage facilities and where there are, they often end abruptly. About 88% of respondents throw their sanitary waste to the open space and which promotes the spread of excreta-related diseases such as typhoid, cholera, diarrhea and dysentery; majority of the houses lack toilet facilities. Water and sanitation go hand in hand as the availability of one enhances the other and the lack of one equally tells on the other. For an effective improvement in Water and Sanitation, there is need to consider the following options for strategic planning: community identification; community participation; technology options; financing, institutional arrangements; and political will. Poor drainage network, poor sanitary condition and insufficient portable water contribute to the health issues experienced by the residents.

Lack of basic sanitation indirectly inhibits the learning abilities of millions of school- aged children who are infested with intestinal worms transmitted through inadequate sanitation facilities and poor hygiene (World Health Organization/ United Nations Children Fund, 2004). Safe drinking water, good hygiene and sanitation are fundamental to health, survival, growth and development.

2.5 Effects of Poor Sanitation Practices/Water Quality

The consequences of poor water quality go beyond health. Poverty alleviation and the other Millennium Development Goals will be difficult to achieve without improvements in water quality (UNICEF, 2008).

Poorly controlled waste also means daily exposure to an unpleasant environment. The buildup of faecal contamination in rivers and other waters is not just a human risk: other species are affected, threatening the ecological balance of the environment. Poor Sanitary condition exposes people to diseases; Child Abuse is heightened as children and women are mostly responsible for fetching portable water from the source (far or near) or selling water- Water Vendors; Lack of access to basic services is also promoted by the rate of water insufficiency as children are sometimes denied the opportunity to go to school.

Table 2: Bradley classification system for water-related diseases

Category	Example	Intervention
Water-borne	Diarrhoeal disease, cholera, dysentery, typhoid, infectious	Improve drinking-water quality, prevent

	hepatitis	casual use of unprotected sources
Water-washed	Diarrhoeal disease, cholera, dysentery, trachoma, scabies, skin and eye infections, ARI (acute respiratory infections)	Increase water quantity used Improve hygiene
Water-based	Schistosomiasis, guinea worm	Reduce need for contact with contaminated water, reduce surface water contamination
Water-related (insect vector)	Malaria, onchocerciasis, dengue fever, Gambian sleeping sickness	Improve surface water management, destroy insect breeding sites, use mosquito netting

Adapted from UNICEF, 2008 handbook on water quality

The discharge of untreated wastewater and excreta affects human health by different means; by polluting drinking water, entry into the food chain via fruits, vegetables and fish, bathing and other contacts with contaminated water and by providing breeding sites for insects that cause diseases.The major health challenges in Bere range from malaria, dysentery, diarrhea, fever and typhoid courtesy of incumbent portable water supply and poor sanitation efforts and facilities.

2.6 Combating strategies

- **Water Need Planning and Management**

The greatest opportunity to influence project outcomes, minimize risk and reduce costs exists in the early stage of an initiative. For the optimal achievement of a financial, social and environmental result in addressing the water need of people in Bere, good planning is paramount. Planning should be an iterative process which attempts to balance service needs with infrastructure, operation and maintenance, financial and environmental options.

- Key stakeholders should be identified and involved up-front in the planning stage as their involvement can beneficially influence the planning process as well as the project outcome and they should be supplied with the appropriate information suitable for their overall involvement and responsibilities.

- Non-asset solutions, full lifecycle costs, risk and maximising existing infrastructure capability should be considered before deciding to either construct new assets or replace assets.

- The components of water loss should be identified and actions required minimizing or ruling out the identified components embarked upon. For example, leakages.

Existing and future water demand should be separated into internal and external components so that the impact of demand management changes can be properly assessed.

It is essential that planners examine the underlying basis for current and future water demand particularly in terms of the many variables affecting internal and external demand components. Effective planning outcomes can only result from rigorous analysis, the application of strategic thinking skills and the adoption of an integrated approach to urban water planning which considers, where appropriate, water supply, sewerage and management of storm-water as a single system (Queensland Department of Energy and Water Supply, 2014).

- **Effective water supply planning**

Planning should include a comprehensive and rigorous identification of all options to meet the defined service levels, including options based on non-asset solutions. In Planning for an effective water supply for Bere, the following should be included:

1. Protect the quality of ground- and surface-water supplies.
2. Inform the people of Bere about the importance of water-resource stewardship.
3. Manage withdrawals from water sources to protect long-term productive yields.
4. Foster intergovernmental communication for water conservation and planning.
5. Meet data collection needs so as to continue informed and effective water supply planning.
6. Improve integration of land use and water use planning and management.

- **Integrated Water Resource Planning (IWRP)**

IWRP evolved from a growing recognition of the interconnection of environmental systems and society's impacts within them (Beecher, 1995). In many areas, increasing populations and water demands have exceeded regionally-minded planning; by sharing resources with neighboring areas, planners have found more cost-effective solutions to water scarcity. Multiple stresses on areas have also necessitated multidisciplinary responses.

Integrated Water Resources Planning (IWRP) is a holistic approach to the management of water systems combining water supply, water demand, water quality, environmental protection and enhancement, rate structures, financial planning, and public participation which if adopted for Bere will help address the problems earlier identified in this study as relating to water availability, supply, demand and management. IWRP was created because of the growing recognition that water resources planning is a complex activity and that society's needs are changing. IWRP emphasizes consideration of the feedbacks that exist in water resource management, and uses new techniques to cost-effectively balance system side and demand side needs (Palmer & Lundberg, 2003).

There are numerous characteristics of IWRP, but the most important are:

1) Public involvement isemphasized throughout the planning process,

2)Water demands are forecasted with care and with attention to the impacts of price, water policy, and water law,

3) Water supply is forecasted recognizing the role of synergistic gains and the role that operations play in system yield,

4) Reliability is considered a parameter to be evaluated rather than a constraint and management alternatives are considered in defining reliability,

5) Source strategies encourages consideration of unique combinations of solutions and careful consideration of planning objectives,

6) Financial planning always considers the impacts the rate structure, and

7) Drought contingency planning is included as an essentialelement of the IWRP process.

An integrated Water Resource Planning adopted and practiced as due might just be a key answer to the water demands and needs of the inhabitants of Bere, the capital city of Ibadan and Nigeria at large.

Guidelines must be appropriate for national, regional and local circumstances, which requires adaptation to environmental, social, economic and cultural circumstances and priority setting.

The WHO Guidelines outline a preventive management "framework for safe drinking water" that comprises five key components:

- health-based targets based on an evaluation of health concerns;
- system assessment to determine whether the drinking-water supply (from source through treatment to the point of consumption) as a whole can deliver water that meets the health-based targets;
- operational monitoring of the control measures in the drinking-water supply that are of particular importance in securing drinking-water safety;
- management plans documenting the system assessment and monitoring plans and describing actions to be taken in normal operation and incident conditions, including upgrade and improvement, documentation and communication; and
- a system of independent surveillance that verifies that the above are operating properly.

3.0 Recommendation

The quality of drinking-water may be controlled through a combination of protection of water sources, control of treatment processes and management of the distribution and handling of the water. The following recommendations can be adopted for effective water distribution and management in the study area as well as in similar communities:

- Preparation of a Water and Sanitation Plan for Bere for a sustainable demand and supply program.
- Improve and increase portable water sources including rainwater harvesting, protected dug-well, bore-holes, public taps and tapped water into dwellings should be introduced.
- Introduce improved sanitation systems including flush sewer system, pit latrine with slab and composting latrine.
- Alternative energy source should be adopted by the water cooperation board in Ibadan so as to address the problem of incessant power outage. This will go a long way in ensuring constant water supply by the water cooperation.
- GIS Mapping of urban water distribution network & leakage detection;
- Repair, laying and monitoring of pipe bursts, and pipes in filthy drains;
- Water users associations and their training- rural and semi-urban areas.

- Role of NGOs, Civil societies & private sector in water sector. Private (NGOs) and public sectors should be encouraged to invest in the water and sanitation sector to achieve laid down targets.
- Stakeholders and community heads should be integrated in the preparation of a water and sanitation plan for Bere for sustainability of the plan.
- Collaboration of the Government and Private Organizations (Concession) on Water Supply or Privatization of Water Corporation.

4.0 Conclusion

About one-third of the world's population lives in countries suffering from moderate-to-high water stress — where water consumption is more than 10 per cent of renewable freshwater resources.

In the course of this research, it was established that over 50% of the residents of Bere do not have access portable water supply and sanitation facilities. With this prevailing need gap, the people of Bere are often forced to trek for miles in search for portable water, more so the untidy nature of the neighbor-hood can be attributed to poor drainage system, uncollected waste, inadequate waste bins and lack of adequate sanitation facilities. On this basis a water and sanitation plan will be a good start-up option to address these problems; where additional water sources and sanitation facilities will be introduced so as to meet the needs of the people/residents.

It is important to note that access to portable water and sanitation facilities will go a long way in promoting the public health and ensuring good hygiene which will in turn reduce water borne diseases more so, Improved water supplies will lead to reduced expenditure on the part of the residents (purchase of water from vendors).

Having adequate Knowledge about water consumption is a prerequisite to establishing a sustainable water policy and protection (E-Source, 2011). This Information is pertinent to evaluate the water needs of the residents of Bere in creating new facilities. To assure the durability of water resources, integrated suitable water management should be the priority of the government so as to meet the need of the future population.

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Spatial Impacts on Water Systems and the transition of planning in the Urbanized Areas ---- Wuhan as a Case Study

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Abstract:

The extensive urbanization and urban expansion in China has resulted in land development intensity and has created various negative impacts on the urban water environment. This article analyzed the present urban planning and water management activities together with its efficiency and failure through the quantitative measurement of the dynamic changes of water-related space based on the case study of Wuhan by application of GIS/RS technology. The result shows that it is effective to integrate water management into spatial planning. Therefore, it is essential to integrate the space for water system into spatial planning. An integrated water-spatial planning framework is established for the future urban development. This research is expected to put forward the suggestions of the transformation in spatial planning in China, such as paying more attention on spatial requirement for water systems, demarcating water space, expanding the study on water spatial integrated planning at different scales.

Key words: Natural Water System; Water-spatial Planning; Urbanized Areas

1. Introduction

Integrating water management in spatial planning is considered to be of importance in keeping the balance between urban development and the water system so as to attain a sustainable urban system. In one way or another, many water related problems are the outcome of disordered or ill-conceived land use development. The extensive urbanization and the interrelated land use change may result in irreversible disturbances of hydrological systems via reclamation, alteration and pollution. Leopold (1968, p.51) summarized the hydrological effects of urbanization, as a change in total runoff with an alteration of peak flow characteristics, a decline in the quality of water and changes in the hydrological amenities of streams. Randolph (2004, p.45) demonstrated that the increase of impervious surfaces associated with urban development affects the hydrologic system and pollutes surface and ground-water. The negative effects of this anthropogenic intervention may not be immediately visible at an early stage. Only when the extreme weather events, such as heavy storm, happen and bring on disasters, the attention may be aroused from the public and policy-makers. Nevertheless, it is always too late to provide the compensation to the loss. Especially at present time, due to the global climate change, such extreme weather events may increase in frequency and intensity.

The capabilities of water storage or maintenance, runoff mitigation, infiltration and water purification all have a close relationship with the condition of surface land use. For the cities which can have more space to collect and store water, more chances will be created not only

to mitigate the pace and ultimate magnitude of the negative effects of the water systems, but also to have the advances for the unique water landscape for citizens in the urban region. The limitation of former end-of-pipe measures and the essentiality of spatial and ecological measures require a positive relationship between spatial planning policy and surface water systems. Because spatial planning determines the land use structure, land use pattern and land use intensity, it is essential to integrate the space for water system into spatial planning. However this view is still a relatively new topic in many developing countries. The spatial aspects of the surface water system are often outside of the main planning themes. There still lacks a theoretical and operational foundation of water space management in urban and rural planning.

Chinese urban planning and water management are at present experiencing a complex transformation process in concepts, contents, working approaches and institutionalization. With the new City and Country Planning Act been effective since 1 January 2008, both the Regulations and the Act give extra attention to environmental values in planning, reflecting a major change in urban planning principles. Environmental and ecological issues now are widely recognized in national and local development policies. On the other hand, urban water management in many Chinese cities is undergoing institutional reform to face water-related challenge due to rapid urban expansion. By 2004, most cities had established a new agency, the Water Affairs Bureau (WAB), or expanded the functions of the former Water Resources Bureau (WRB) (Chen, 2006, Shen and Liu, 2008). Combining the efforts is urgently needed from Water Affair Bureau and the Urban Planning Bureau to tackle the spatial water-related problems in urban region. It is necessary to have more creativity and innovation for the new concepts and new approaches both in spatial planning and in water management.

This article examines the experience of Wuhan's case located in alluvial river plains on how spatial planning and water management on water systems. Based on the analysis of the dynamic changes of water-related space after 2000s, the present urban planning and water management activities together with their efficiency and failure is analyzed. Finally, an integrated water spatial planning framework is established in adaptation to the requirement of spatial planning under the circumstances of the present Chinese system.

2. Materials and methods

2.1 Study area

In this research, Wuhan was selected as the case study. It is the capital city of Hubei Province in central China, located at the confluence of the Yangtze River and its longest tributary, the Han River. The '1+8' Wuhan Region was proposed by the provincial government in 2003 and specifically refers to the extended urban region that includes Wuhan municipality and its neighboring eight medium-size municipalities (Figure 1). Wuhan region occupies more than 57, 800 km^2 (31% of the total territory of the province) with the population of 30.6 million (52.8 % of the province).

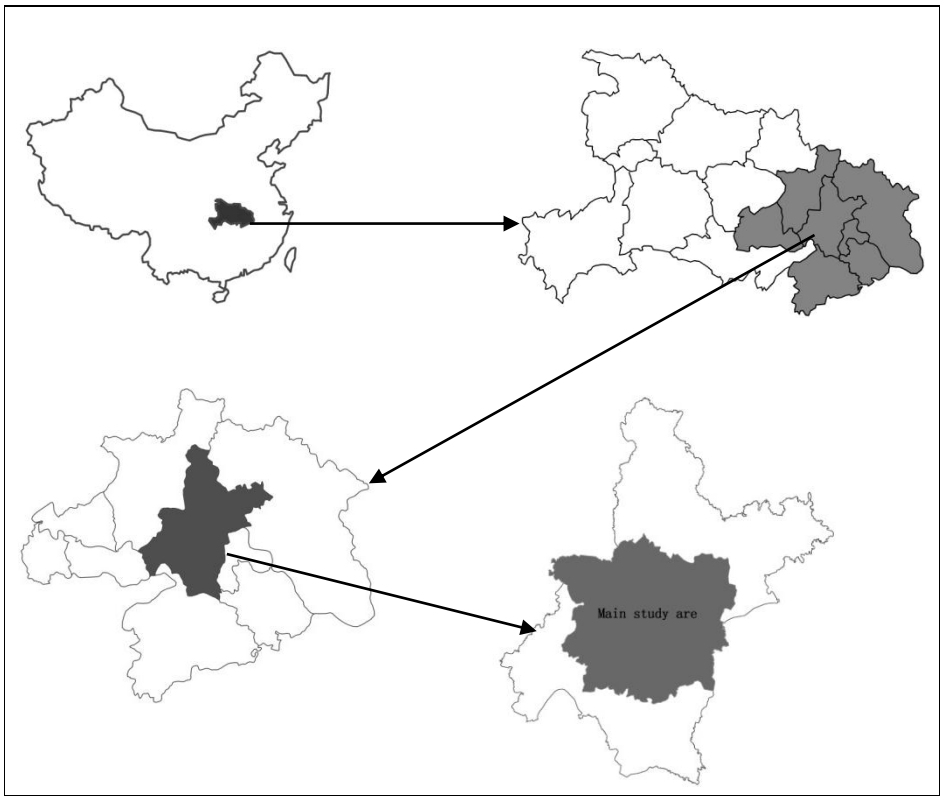


Figure 1: Location of the study area

Wuhan Municipality is 8,494 km^2, of which 2,117 km^2, nearly 25%, is covered by surface water bodies. This area has a subtropical humid monsoon climate with a very distinctive dry and wet season. The annual average precipitation is 1140-1265 mm, of which 80% falls from April to October (LEC, 2006). Due to its special landform, the two main rivers and the large number of lakes, pools and ponds in and around the city, Wuhan is nicknamed 'Water City' (Jiang Cheng).

In 2013, the total population in the Wuhan municipality was 10.22 million, and the GDP is about 905.127 billion RMB (145.09 billion US Dollar). It represents 36.7% of the Hubei's GDP, though it only has 17.6% of the total population and 4.5% of the total territory of the province. It attracts more than 1.5 million tourists a year in 2012. The planned urban development area (mainly within the forth ring road) was determined in the new version of master planning in 2010 (Figure 1). Wuhan urban core is within the third ring road, which has a density of 2317 people per square kilometer, higher than the average in many Chinese cities. It is one of the rapidly developing urban areas in China.

In the recent two decades, the city has experienced rapid urban expansion and witnessed many land use changes that have affected its surface water bodies, such as reclamation of lakes. The research of Du, Ottens and Sliuzas (2010) showed that the substantial change of surface water bodies (such as lakes) happened during 1990s to 2000s. Some irreversible damage has been done to the city's surface water systems, both qualitatively and quantitatively. Several countermeasures have been taken after 2000, such as the promulgation of local regulation on lake protection and the project of lake ecological rehabilitation. The effect of lake protection has been initially apparent, but the lack of integrated approaches has not radically solved all the water-related problems. Therefore, Wuhan is a relevant case to examine the water-land relation in a rapidly urbanizing area.

2.2 Data sources and processing

In this study, the 30-m spatial resolution of Landsat Enhanced Thematic Mapper (ETM) images (path: 122-123, row: 38-39) at three time periods, 2000, 2008 and 2012, are selected and interpreted to get the land use datasets. All the ETM images data sets are obtained from Geospatial Data Cloud provided by Computer Network Information Center in Chinese Academy of Sciences. In order to get the high data quality and make the results in different years comparable, the best time for obtaining suitable images for each region is determined and tabulated according to the weather situation in Wuhan. All the cloud-free images were chosen in the season of the beginning of the spring when the raining season does not start. Finally, the time of imagines in 2000 and 2008 meet the requirement. But unfortunately, because the cloud-free images in 2012 were not easily available, only the images in the end of spring can be used. This season has more rain than in the beginning of spring, but the result is still comparable. There are 4 scenes needed to cover the whole area of Wuhan municipality and one scene can be used to cover the urban core area which is selected as the detailed case study.

In the meantime, the vector data of urban road systems, planning road system and the boundary of planned urban development area have been obtained from the Wuhan planning and design institute. These datasets are used to analyze the urban expansion within the specific region.

ENVI 5.0 (ENvironment for Visualizing Images) software is used to process remote sensing images and ArcGIS 10.2 is used to analyze the data. Firstly, image pre-processing was done, including image enhancement, radiometric and geometric correction and image registration. For all the vector data of road systems and boundary, using the goereferenced images, the control points were selected according to the cross-roads and easily identifiable points to make spatial adjustment and be projected onto the uniform coordination system. Then, subsets of the images within the Wuhan municipal boundary in different years have been obtained via ROI (Region Of Interest) based on the adjusted images and geo-coding boundary map. After that, all the images are converted to NDVI (Normalized Difference Vegetation), MNDWI (Modified Normalized Difference Water Index), and MNDBI (Modified Normalized Difference Built-up Index). In the process of supervised classification, Maximum likelihood classification (MLC) was used to extract the proper information of built-up area (i.e. impervious area), water and vegetation in the images. By comparison with the Google Earth images and the historical maps of Wuhan, the information of built-up area, water and vegetation was interpreted, checked up and finally determined.

After classification, three epochs of ETM images in 2000, 2008 and 2012 were employed to interpret the dynamic changes of three types of land use cover. The results of raster maps of built-up area, water and vegetation land in different years, and the changes in the period were produced through ArcGIS software. Based on these results, the discussion has been carried out concerning to the active effects of the planning and water management implemented since 2000.

3. **Dynamic land use changes**

Since 2000, Wuhan has experienced the rapid urban expansion, which witnessed land use changes that have affected its water bodies. However, such changes are provided with different characteristics in two stages before 2008 and after 2008.

3.1 Overall changes of the different land use

Table 1 indicates the degree of the changes of three types of land use cover. The general tendency is the rising with the urban built-up area and vegetation area, while the decrease in water bodies. Nevertheless, the water change revealed in Table 2 has different characteristics within the different regions in different period of time. During 2008-2012, the reduced rate of water is less than that in the period of 2000-2008 either within the third ring road or between the third and forth ring road. Moreover the water area occupied by built-up area has been lessened too. The water outside the forth ring road has been decreased less during 2008-2012 than that during 2000-2008, even started to be increased.

Year	Built-up Area (Km^2)	Water Area (Km^2)	Vegetation with the built-up land (Km^2)
2000	213	1167	73.8
2008	452	956	176
2012	520	946	203

Table 1: Changes of land use cover within the planned urban development area

The location of regions	Within the third ring road		between the third and forth ring road		Outside the forth ring road	
Time period	2000 - 2008	2008 - 2012	2000 - 2008	2008 - 2012	2000 - 2008	2008 - 2012
Total area (Km^2)	**-21**	**-2**	**-61**	**-10**	**-107**	**4**
Occupied by built-up Area(Km^2)	-15	-2	-12	-2	0	0

Table 2: Changes of water bodies within the different regions (-: decrease, +: increase)

3.2 Built-up Area expansion

As showed in Figure 2, from 2000 to 2008, urban expansion followed the main road axes to the south-west, south and south-east, while from 2008 to 2012, urban built-up area not only spread along the same directions, but also generates more urban land functions near and within the third ring road. Built-up area expansion makes the space filled up with urban functional land and the development density has been increased especially within the urban core area. It is clearly illustrated that the impervious area is increasing along with the urban development.

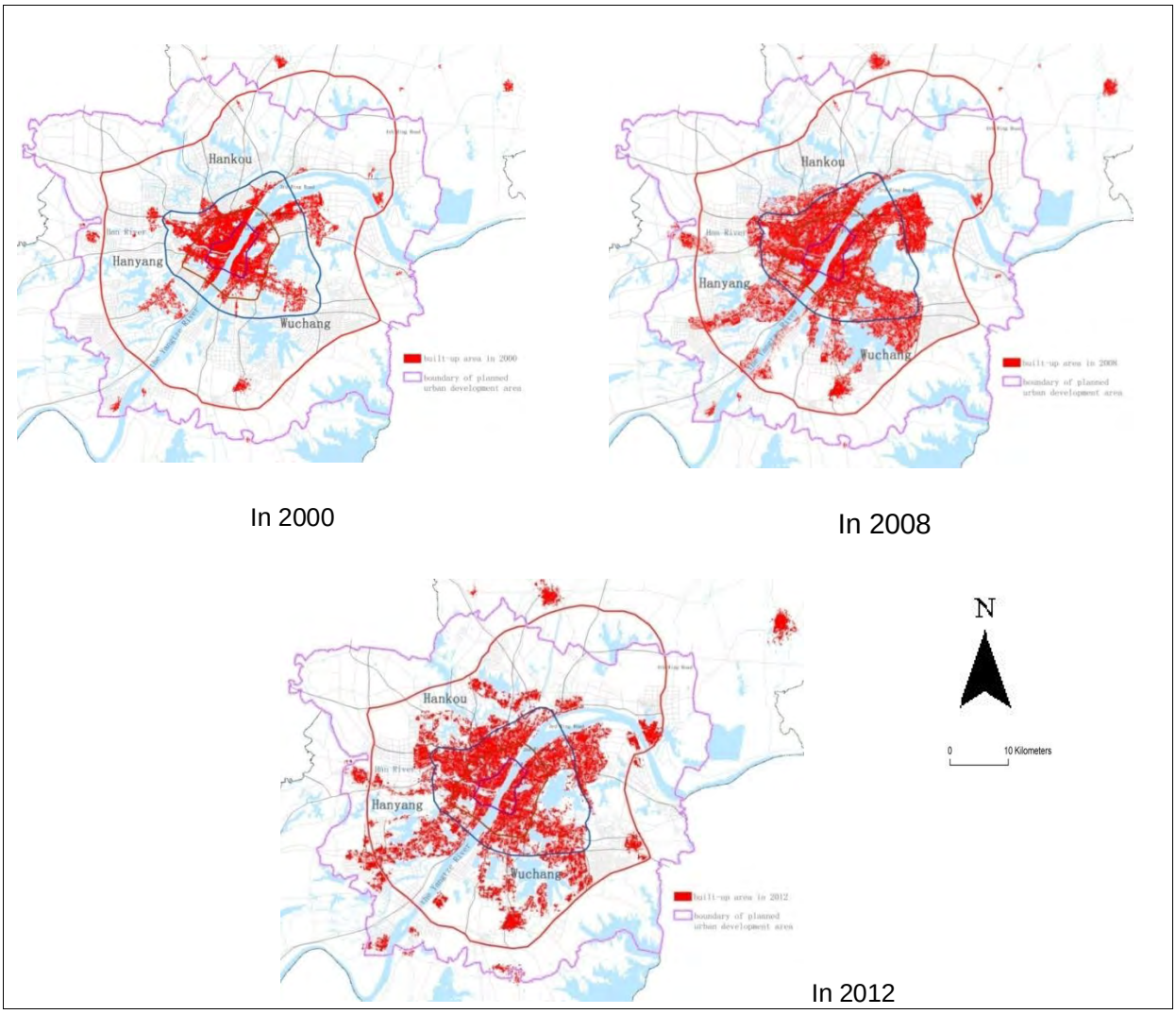


Figure 2 Built-up area expansion in 2000, 2008 and 2012

3.3 Changes on the water bodies

Figure 3 shows there are abundant surface water bodies, including lakes, rivers, streams ect. which in the past were regarded as obstacles for the urban development. From 2000 to 2008, water bodies did decrease. Although the images in 2012 in this study were selected in the end of spring, the result still shows the decrease trend in some area. Fortunately, the pace of decline was decelerated in the large water bodies and the water bodies within the urban core.

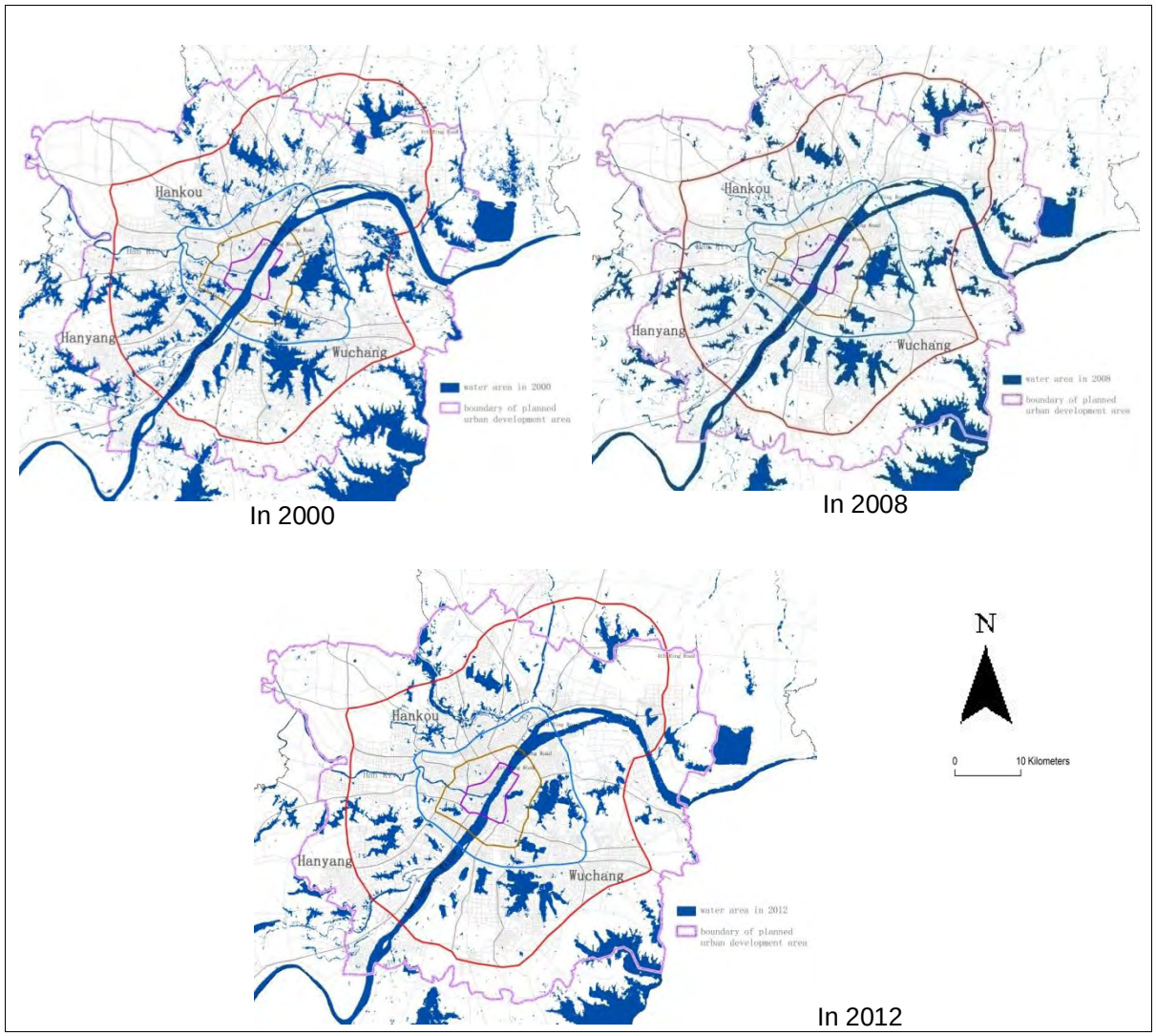


Figure 3 Distribution of and changes on water bodies in 2000, 2008 and 2012

3.4 Changes on the vegetation area

Due to the complicated situation of vegetation, only the man-made vegetation (i.e. green land) is extracted in this study. Figure 4 shows that the vegetation area has been expanded along with the expansion of the built-up area. It is clear to see the same spatial trend of the growth of green land with the urban land. This fits the fact that in recent two decades green land construction has received more attention in the new developed area and moreover, old city area regeneration has squeezed the land for vegetation as possible as it can be.

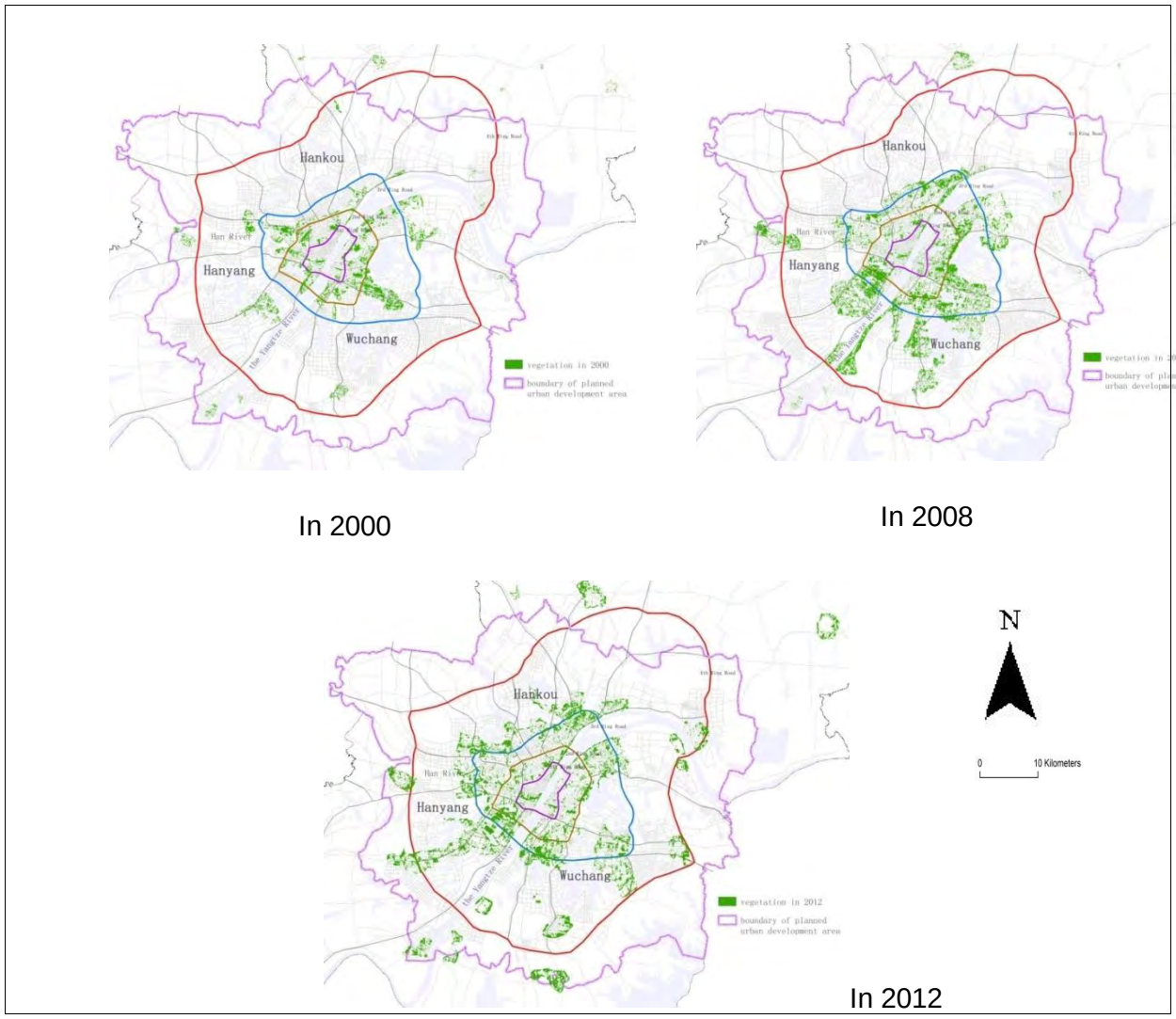


Figure 4 Distribution of and changes on the vegetation land in the built-up area

4. The role of spatial planning and water management for water systems

4.1 Measures of water management

Under the pressure of the deterioration of water quality and the increasing reclamation of lakes and hills, several local regulations were decreed at the beginning of 2000s, such as 'Wuhan Lake Protection Regulation' in 2002, 'Wuhan Sewage Drainage Regulation' in 2002, 'Wuhan Building Regulation on the Three Edges (rivers, lakes, hills)' in 2003, and 'Wuhan Urban Green Regulation' in 2002.

The 'Wuhan Lake Protection Regulation' was brought into effect on 1 March 2002. It was the first time for Wuhan to specifically regulate lake protection. 38 lakes inside and 144 lakes outside the urban core were officially listed and it regulated at the first time that the protection area of lakes should be divided into water body, green buffer zone and periphery control zone respectively, the boundaries of which are called the three lines, i.e. 'blue line', 'green line' and 'grey line'. Several regulations were put forward, such as the reclamation prohibition

of the water body of lakes, prohibition of unnecessary buildings and structures in the green buffer zone ect.. It is the milestone in the history of lake protection.

4.2 Measures of urban planning

Wuhan has experienced several specific development stages after 1980s. Several versions of master planning have been done as the needs of the urban development. Each the city's master plans encountered different problems and contained different planning key issues. With the ideological changes of the 1980s, master planning in 1982, 1988 and 1999 has evolved to be more concerned about efficiency of economic development. Even though the quality of ecological environment and social equality was mentioned in the planning documents, actual operations have faced implementation obstacles in the context of a transforming society in the practice. Planning has also been facing knowledge limitations for the new challenge of rapid urbanization and large scale urban expansion.

The new master planning, started in 2004 and issued in 2010, paid much more attention to the environment protection, as well as the harmonious relationship between nature and human. The planned urban development area was defined of 678 Km^2 (450 Km^2 built-up area) with planned population of 5.02 million in 2020. Its spatial structure is organized by the urban development core which is within the third ring road, and outside there are 6 urban development clusters and 6 ecological green wedges embedded in each other. 6 urban development clusters are determined as the main area for concentration of population and industrial activities, while 6 ecological green wedges are proposed based on the natural lakes, rivers, wetland, country parks, landscape and famous scenery and hills. Such spatial structure has been issued and will be the guideline for the development of the future Wuhan. In the meantime, zoning control framework is applied to manage the land use control, by dividing the land into three types: exclusion area for construction, construction restricted area and the area suitable for construction. Natural space, such as lakes, rivers and hills ect., is defined as exclusion area for construction which is becoming more and more significant for the protection.

4.3 Cooperation of spatial planning and water management

In fact many efforts and funds have been invested in lake protection since 2000. In the 'Wuhan Lake Protection Planning in the Urban Core' in 2004 and the 'Wuhan Lake Protection Implementation Regulation in Detail' in 2005, the boundaries of 38 lakes (later increased to 40) within the urban core were delineated and staked out and the key targets and functions of these lakes were identified, which to a large extent ensures that the lake protection has gained official recognition and practical control. The regulation is playing a necessary role in the protection of lakes in the Wuhan urban core.

Actually, from the results mentioned above, since 2008, the reclamation of the lakes inside the urban core has been effectively stopped. Subsequently, the Wuhan Lake Protection planning in the Urban Core was published in 2012, which is the outcome of the cooperation of Wuhan water board, Wuhan Land Resources and Planning Bureau, and Wuhan Landscape and Gardening Bureau. This planning aims to strictly delineate the protection area by demarcating three lines, i.e. 'blue line', 'green line' and 'grey line' in details, and moreover, in order to ensure the implementation effect, the road around each lake is demarcated. This instrument is called "Three lines and one road for lake protection". For

each different area divided by the three lines and the road around different lake, the construction requirements and technical assessment of the protection have put forward. In the meantime, for each lake, the detailed planning has been made and published so as to make it easier for the public participation in the lake protection. Until now such lake protection measure has spread to the whole municipality. At present there are 166 lakes listed and the strict regulation is under formulation. Good results can be expected in the future.

5. Lessons learnt and Integrated spatial planning framework for surface water protection

The spatial issues of surface water systems are impossible to be tackled in a small scale area in a short period of time. Consideration of medium- and long-term developments in a large-scale region needs integrated planning attention from the strategic level to the local action level. An integrated spatial plan-making model that seeks to create a framework is proposed based on a multi-sector/multi-disciplinary approach to spatial planning and surface water management (Figure 5), which entails a comprehensive plan-making system which covers the key issues from the strategic to the local level.

At the strategic level, it is important to achieve awareness and agreement about the problem definition and goals. Strategic development planning, master planning and related land use planning should involve the spatial expression of the water system (e.g. water bodies, appropriate riparian buffers, retention of watershed) in the planning content and in the plan-making process. A conventional way of regarding water just as an unlimited resource for human needs should be replaced by an ecological conceptualization of water systems. This new concept and its spatial considerations should be part of the planning process and documents. For the case of Wuhan, when the lake protection has become a common, space-related concept, such as the main element of the ecological green wedges, the problems of water deterioration and reclamation have been alleviated relatively.

At the local level, based on the guiding principles and the objectives decided on at the strategic level, specific land use control measures and instruments concerning surface water systems should be implemented by regulations or legislation. In the Wuhan case, even though some instruments, such as three control lines and lake road is used to protect the shape of lake, water sensitive planning and design is still quite a new approach for many urban planners and water managers, and plays no role in the process of issuing land use permits. The concepts of Low Impact Development should be advocated, as a supplement to the present ‘blue line’ and ‘green line’ regulations.

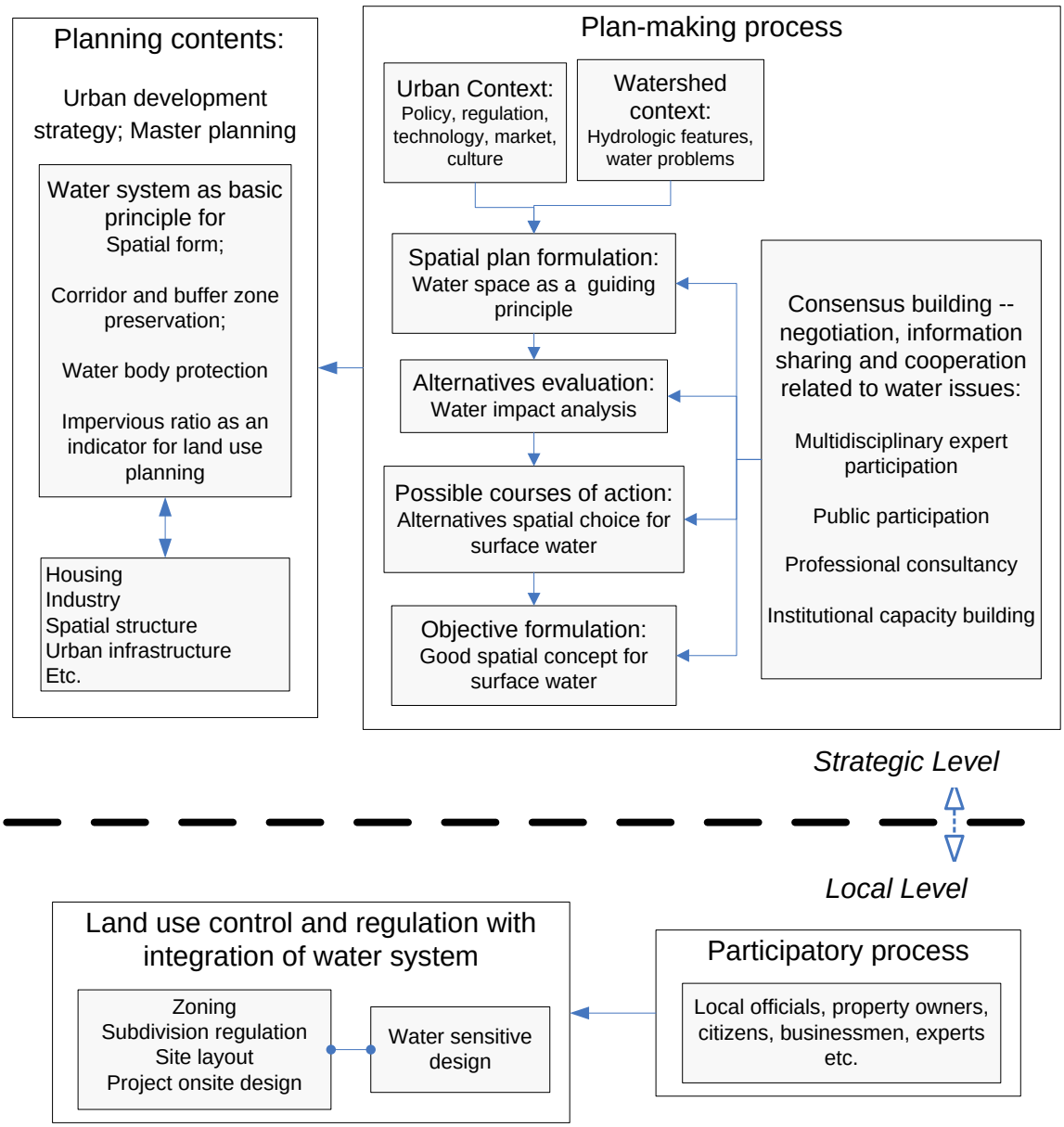


Figure 5: Proposed integrated spatial plan-making model incorporating the surface water

6. Conclusion

To some extent, Wuhan's experience shows that it is not easier to protect the water bodies inside the fast urbanized area. Water-resilient city requires some fundamental changes in planning concepts and practices with the compromise between the aims and needs of economic and urban development. On the whole, the measures for surface water management must integrate into spatial strategies, with guidelines both for the urban region as a whole and for local actions as small-scale solutions. 'Green corridor' or 'green belt' planning tools which have been used in the present master planning, can be integrated with water system so that combined green/blue systems can be created that will contribute to good quality of space. Moreover, in order to retain open spaces and natural vegetation areas of the upland regions of watersheds, land use regulations and new design approaches that regulate imperviousness and surface water runoff should be promoted for new construction. The indicator of imperviousness may be used to assess the layout and site design in order to

encourage better practice with respect to water-sensitive planning and design. The planning system will ensure that new development is designed to be integrated with the water space, to ensure the harmonious cohesion to meet the needs of people at all stages of life.

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WATER IN MEDIEVAL CULTURE AND ARCHITECTURE OF TURKIC PEOPLE OF CENTRAL ASIA

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The stats created by Turkic peoples in the period of the early Middle Ages, distinguishes military mobility which assumes strong public hierarchy. The last was caused, actually, by a way of Nomad' life in which there was a steady dependence on variability of results of natural sources' reproduction. It demanded a systematic, expedient regulation and careful approach in use of pasturable grounds and water resources, installation of strictly certain routes of the removement, existing during the centuries [Abayev V.N. 2005]. The Turkic legend and the Chinese chronicles connect an origin of Turkic peoples with East Turkestan and with *Otyuken* black (cave). However, in the light of a considered problem it should be noted that in the Chinese sources *Otyuken* is mentioned together with other sacred place of Turkic peoples - the *river T'a-jen* which name is translated as "the worship/honouring river". [Zaytsev I.V. 2005].

1. Water in medieval cults and religions of Turkic peoples.

In ideology of Turkic tribes which started being settled widely in the territory of Central Asia from the early Middle Ages, water was closely connected with the earth, as in value of a place where are engaged in agriculture, and with space for pastures. Along with the main Turkic gods — *Tengri* and *Umai*, existed a deity *Ydyk Yer-Sub* "sacred Earth-Water of Turkic peoples" in which image this interrelation of the earth and water is reflected. The mention of this deity meets in the Big inscription to Kul-tegin (732 c. AD). According to cosmogonic hierarchy, a deity of Yer-Sub belonged to an average – terrestrial level [Bezertinov R. 2000]. The deity of Earth-Water was object of a special cult: most likely, the main functions of this deity were that it patronized Turkic peoples and punished the sinned. In the Chinese sources the sacred mountain esteemed by Turkic peoples (VI century) it is called by them "God of Earth". The cult of sacred tops was part of the general cult of Earth-Water at the ancient Turkic tribes [Klyashtorny S.G., Savinov D. G., 2005]. At the same time, any hollow and an opening could appear an entrance to the bottom level - an underground kingdom, and all live, living in the earth, underground and in water, was considered as accessory of the bottom world. Thus, water in representation of ancient Turkic peoples was accessory of two levels, and then there is clear a presence of reservoirs in the cult complexes which had mainly funeral character. Possibly, internal wells quite often found in cult constructions are devoted to the goddess Yer-Sub.

The arrangement of reservoirs at an entrance to funeral complexes of the ancient Turkic Kagans – *Kuruks* is remarkable. *Kuruks* represented the whole complex of constructions to which the chain of stone sculptures conducted with the East, *Balbals* and the columns which height increases as approaching a complex. According to V.E. Voytov, they symbolize a course of life of the person from the birth (the smallest column at the end of a chain) to a death threshold (Balbal or a sculpture) which begins at "the bridge over a chasm" which function carry out an aperture of gate and a ditch [Voytov V. E. 1996]. Here, on border of the alive and dead world the reservoir also is arranged, preceding an entrance to Erklik's

kingdom. Behind shaft on the main longitudinal axis of composition the pass flanked by pair statues of rams, lions and people, conducts to the temple behind which the sacred tree and the stone cube serving, most likely, as an altar of fire settle down. Thus, the composition of a funeral Earth-Water complex represents a horizontal projection of vertical hierarchical division of the world. It is spatial cosmological structure in which the place of water object as intermediate, marking transition from terrestrial level in the other world, reflecting guarding function of the goddess Yer-Sub is accurately designated.

It should be noted that in the environment the Earth-Water states which main part professed a *Tengrianism* – the religion tending to monotheism, - various religions and cults, such as Zoroastrism and the Indo-Iranian cults of fire, the Buddhism, Christianity, a Manichaeism, and later, Islam and its esoteric ethic-and-philosophical system – Sufism were widely adopted. The assumption of proximity of ideas of various religious systems is remarkable: so, some positions of a *Tengrianism* and the Buddhism are represented by different stadial layers of variations of the same central Euroasian religion having the general ethnogenetic roots [Abayev N. V., Ayupov N. G. 2009]. Thus, constructions of various religious directions in which symbolical structure Water (reservoirs) played one of key roles were built at territories of Central Asia in the period of the early and developed Middle Ages.

In general, the tradition of the device of a sacral reservoir is traced in Central Asia from an extreme antiquity: so, in the yard of the Zoroastric temple on Dzharkutan, constructed in the II millennium B.C., along with an altar, under a special canopy the sacred well settled down. Possibly, it is connected with a cosmological component of Zoroastric sacred books, in one of which, Bundakhishne, it was told about creation and structure of the Zoroastric world where water was the first created element from which there was all the rest. Water took the certain place in structure of the Iranian universe: it "covered everything that was lower than this earth". According to mythical Zoroastric geography, in the center of the terrestrial plane near Hara's world mountain is located the Vorukasha lake — a source of all terrestrial waters [Lelekov L.A. 1991]. In Zoroastrism honoring of fire and the water, used in rituals, indicate its archaic underlying cause. The union of these elements which in the Indo-Iranian time was thought as marriage, is marked by ablution of basis of an altar of fire by the consecrated water. On a course of Yasna reading clear water prevails on the first, and fire – at the last stages of a liturgy, at the end eat ritual bread. It pulls together Zoroastric ritual with the latest Christian [Meytarchiyan M. B. 2001].

The role and water function in a Christian cult is well-known. I will note only that in the cult constructions of Central Asia identified with Christian churches and monasteries, the remains of fonts also were found. So, in the Nestorian the complexes located in the Talas valley, Semirechye, the Turfan oasis reservoirs settled down in a courtyard or the certain room at an entrance.

In cult constructions of Islam a water – the integral component of an image and Paradise' embodiment in structure of the Muslim temple, necessary element for daily departure of ritual. Therefore a reservoir – obligatory part of a mosque, madrasah, a funeral complex, khanakah.

It is remarkable that the relation to water as to a sacral element, a basic element and, respectively water presence directly in a sanctuary (in the form of a well), is noted in the Sufism which has widely extended in the Turkic environment. So, the well was available in the central hall of khanakah in Sauran ancient settlements. This tradition is carried on also in H.A. Yassaui's mausoleum- khanakah in Turkestan – there was a special room with a well – the *kuduk-khana* which was located in right side from the main portal of the building, i.e. for an entrance in jamaatkhana – the main room for the Sufi rituals [Nurmukhamedov N. B.

1980]. Position of the well room at an entrance is pointed, in our opinion, to continuation of symbolical and ritual tradition by the ancient Turkic of funeral complexes (Fig. 1).

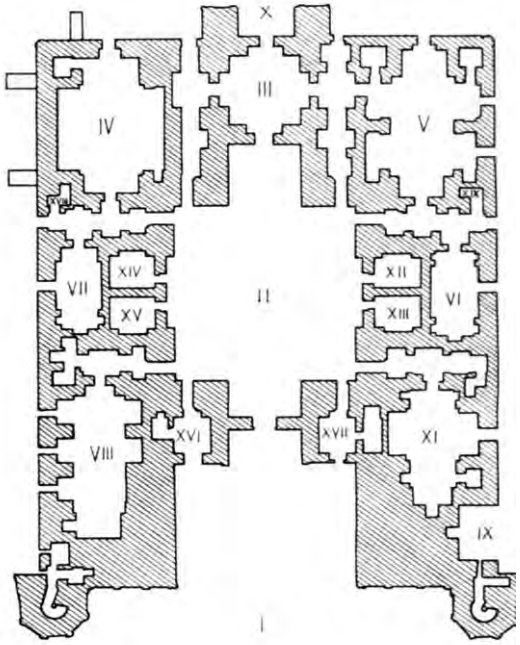


Figure 1. Plan of a complex of the H.A. Yassaui's mausoleum-khanakah. The room No. XI – kuduk-khana (source: [Nurmukhamedov N. B. 1980])

2. Cities of Turkic peoples: on and under water.

The surface of the water could be used as the location of the residence or cult ensemble, as, for example, in a case with the ancient settlement Por-Bazhin on the lake of Tere-Kol (VIII century, Tyva). This architectural monument under a name Kasar-Kordan is mentioned in written sources – three stone steles with inscriptions. There are some versions of a functional purpose of a construction. On one of them Por-Bazhin is considered by the summer residence of Uighur khagan Bayan-chur which was constructed in 753-755 in the territory of the Uighur Khaganate (Fig. 2). According to other version this is the Manichaean monastery built in 770x years by the Bayan-Chur's son Byogyu tekin. Complex researches showed that the construction was built on the island existing already then, and as a construction material served coastal clay [Panin A., Arzhantseva I. 2010]. The ancient settlement presents in the plan the correct rectangle with sizes of 211x158 m. In the middle of east wall there are gate from which the main composite axis conducting to the palace on a platform begins. Clay was the main construction material for construction of walls. It kept within layers 10-12 cm thick a timbering. This construction equipment is well-known among Uyghurs under the name "*Sokma tam*". Characteristic of a complex – a rigid regularity of planning, strict axial symmetry, gradual development on the central axis of domestic spaces, domination of the central palace (temple) built on a platform from the inside of which auxiliary rooms were provided. In our opinion, the ancient settlement Por-Bazhin - very bright embodiment of cosmogonic representations of Turkic peoples about the universe having a square form and "Earth, surrounded with the World Ocean", and also Earth and Water union, i.e. a form of the goddess *Yer-Sub*.



Figure 2. The ancient settlement Por-Bazhin (source – www.por-bajin.ru)

The guarding role of the goddess is sometimes shown unexpectedly: so, under thickness of water of the closed Aral Sea in 2001 was found the remains of the ancient settlement called Aral-Asar (Kyzylorda area of Kazakhstan, Fig. 3). The shallowing of the sea bared the city remains with the memorial and cult complex of XIV c. AD which has kept he decorative furniture elements. The city was provided with water by means of the developed irrigational network: remained main and taking-away channels. Researches of soils showed that here grew up rice [Voyakin of 2008].

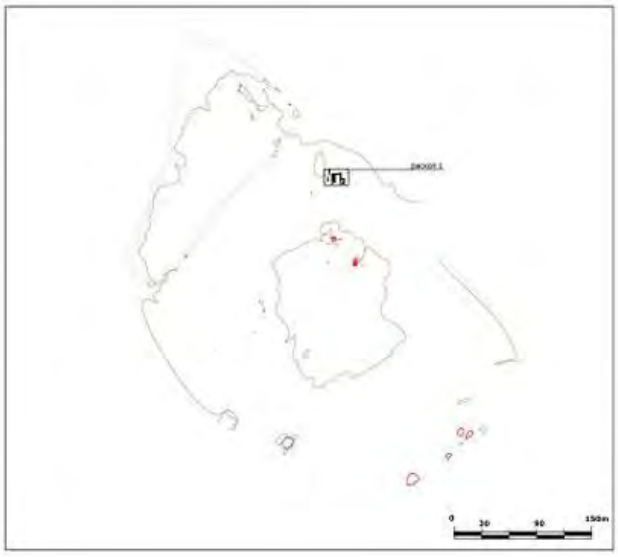


Figure 3. Plan of the Aral-Asar ancient settlement (source: [Voyakin D. A. 2008])

If the architecture of Kasar-Kordan city shows a celebration of geometry and technologies of that time, structure of the city of Yargol (Yarkhoto, the Turfan oasis of East Turkestan) – a bright model of use of the natural island formed owing to an erosion. Along with Kocho, the capital of the Uigur Idikut state, Yargol played a role of the main Buddhist center of the Turkic-speaking world. Yargol is located on the natural "peninsula" formed by washout of two sleeves of the river of the same name, thus, the city received natural protection (breaks reach in height 20-30 m, Fig. 4). City map has an outline of the extended leaf which length from the North to the South reaches 1700 m, and width from the West to the East – 300 m. The central part occupying the space about 360 sq.m, is displaced to the south, the main constructions are concentrated here. In southeast and western parts entries into the city the wide highway are located which divide it into two parts [Turan A.M.. 2006].



Figure 4. Ancient settlement Yargol (source - www.muhraeff.ru)

3. Water supply and irrigation of the Turkic cities.

Historical and archaeological data testify that the cities in the medieval states of Turkic peoples had rather high level of improvement including the developed system of water supply and an irrigation. Water brought to agricultural suburbs and directly to dwellings of citizens in several ways. By means of a construction the channels - *aryks* from dams

grounds were irrigated agricultural. The structure of water system from springs by means of clay pipes provided with water urban population.

One of the most interesting monuments of the architecture, being a striking example of the organization of water supply in the region, is the construction (allegedly country residence of Karluk jabgu), remained in 40 km to the east of Taraz – Akyrtas (Akyrtash) and is dated VIII-IX centuries. It is one of the few examples of the monumental construction, the difficult and thought-over planning of which testifies about previous construction big preparatory, including design, work (Fig. 5). The grandiose construction which has remained incomplete (walls were put up on 1-1,5 m), is a model of monumental construction of the early Middle Ages in the territory of Kazakhstan. The construction is built by the sizes of 180 x 205 m from massive stone blocks of red sandstone (60-115 x 50-60 x 50-60 cm) which had dredging in internal part so blocks assumed an air of a stone trough (from here the late name of a monument). Inside blocks were filled with rubble and clay mix. Planning of a complex of rooms is formed round the huge open yard which is crossed by two mutually perpendicular streets dividing construction into 4 blocks. Three of them have the open yards in the center surrounding by the rooms; the fourth block – of free planning. The general yard from three parties had to be framed by iwans, were here too found ditches of two khauz [Baypakov K.M. Northhege A. 1997].

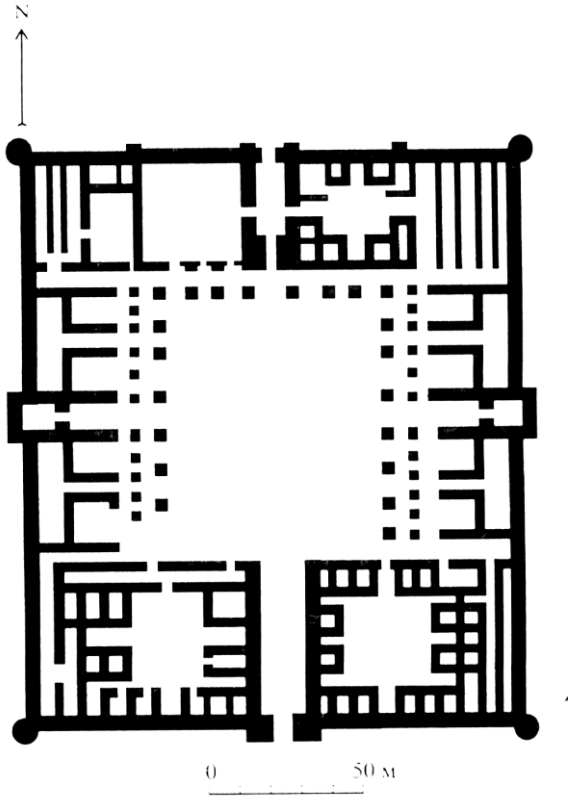


Figure 5. Plan of the Akyrtas complex (source: [Baypakov K.M. 2008])

The organization of Akyrtas' construction technology is remarkable. So, the residence of the governor of edge from which he could watch a course of works, was found in 1 km South to the west of Akyrtas. It consisted of the strengthened military garrison and the temple. The garrison represented the fortress (40 x 40 m) with the stone walls strengthened by towers on corners and a ditch. The temple of the governor also was the strengthened

construction (25 x 30 m) with gala, inhabited, economic rooms inside. Besides, on one of tops of the nearby mountain Kyzyltash the viewing tower and the platform laid out by a stone for alarm fires was arranged.

For architects and masters was created the residential quarter located to the north of the palace. It is remarkable that it was the complex of estates (about 12), consisting of houses and the yards with the reservoirs-khauzs, surrounded with walls, the big area (up to 1000 sq.m). Also there were houses of the standard sizes (10 x 10 m) for workers-builders. On a northern slope of the mountain Kyzyltash on the area about 1,5 hectares there are remains the brick furnaces, on east – the stone quarries lasting on 400 m with dugouts of workers were found.

Reconstruction of system of water supply in Akyrtas complex is interesting: it had to be provided with water from springs by means of the device of a water supply system which originated from a reservoir in the gorge (3-4 km from construction). The water supply system consisted of the clay pipes 50-60 cm long which had different diameter on the ends (20 and 18 cm), the narrow end of one link was inserted into the wide end of another. From a khauz-reservoir on pipes of smaller diameter water was brought in houses and estates. Besides, to the north of a palace complex two reservoirs which probably were supposed to be used for an irrigation are revealed. Also the fenced site (250 x 250 m) was to the east arranged where the water supply also was organized, – most likely it had to be the park garden [Baypakov K.M. 1998]. In the cities of Central Asia along with channels the system of water supply systems in the form of system of ceramic pipes – *kuburs* was widely used. Kuburs were 50-60 cm long, from the ends of different diameter that allowed to insert them each other and to make extended water supply systems (Fig. 6).



Figure 6. Kuburs of Taraz ancient settlement (source: [Baypakov K.M. Northege A. 1997])

Many cities of the region were arranged well at the expense of this system. Some of them were very considerable as, for example, in medieval Hadzhistan (IX-XII c. AD) almost twenty-kilometer water supply system from pipes *kuburs* functioned. Legendary certificates report to us about existence in Central Asia of water supply systems from lead pipes, in particular, for water supply on Afrasiab's citadel. Unfortunately, archaeological confirmations of these messages while are absent, but the general character and a level of development of an irrigation do them very probable.

Along with ceramic pipes in the Central Asian irrigation ceramic trenches, rectangular in cross section are known. Length of such trench usually 60-80 cm, thus surely one end of a trench is thinner (10-15 cm), another is wider (20-23 cm). It allows to insert their one into another. The land water supply system in the form of small covered gallery with use of similar trenches supplied with water the medieval city of Tak-Yazyr. On supervision of researchers, this water supply system was traced throughout 17 km.

3.1 Types of irrigation systems

In Central Asia some types of irrigational constructions were used, but the main two: these are the opened and closed irrigation canals in which water went spontaneously, and it means that their builders had to possess engineering knowledge at very high level. Construction of channels of both types demands huge labor expenses that can testify to the corresponding social organization of society. Thus data of archeology testify that emergence of the first channels in Central Asia happened during the period preceding the first state educations that probably was a consequence of the combined efforts of tribes for an irrigation of neighboring lands suitable for agriculture. In the western, more flooded part of the region, the system of open channels was mainly used. The source of water had a beginning of the main channel from which the network of small channels – aryks departed.

Universal irrigational system is *karez*, allowing in the absence of land-based water sources to use waters underground. *Karez* or *Qanats* are a relic form of underground irrigation important for dryland agriculture, and have been introduced in many parts of the world. In Central Asia the greatest number of them – 1200 - are in East Turkestan (The Xinjiang-Uighur autonomous region of China), total length makes, on different sources, from 5000 to 6000 km. *Karez* were also widespread in Azerbaijan (812 constructions), Turkmenistan, Uzbekistan. In Kazakhstan they were found near the ancient settlement Sauran which were built by known Muslim sacred Mir-Arab in the XVI century. Today discovered 232 *karez* [Deom J.M., Sala R. 2005]. Vasifi reports that the source of *karez* was at distance of the farsakh (7,5 km) from Sauran; over it fortress was built, in fortress the well of 200 *gyaz* in depth, and 50 *gyaz* from an earth surface to a water level is dug, 150 *gyaz* is water depth in a well; water lifted by means of *chigir*, and it was set in motion by a bull. Detection in Sauran about 350 estates with agricultural sites (the average area of 1 hectare) is remarkable. Estates represented rectangular in the plan the landscape gardening complexes broken into squares with reservoirs in the center [Baypakov K.M. 1998].

Other hydraulic engineering constructions which have played a role in the history of an irrigation of Central Asia, which is necessary to mention are aqueducts, hydroelevators, water distributors and wells — *sardobas* – a dome construction in which khauz (pool) settles down, working by the principle of accumulation of a precipitation. The head of the Spanish Embassy in Samarkand to Timur Rui' Gonsalez de Clavikho (1403-1406) [Clavikho R. G. 1990] gave the description of *sardoba* in the memoirs. Often *sardoba* took place on places of natural sources. The name "*sardoba*" has two roots: "*sard*" – cold, crude, wet, and "*oba*" -

water. The word "*sardoba*" in value of a receptacle of a cool call "grotto", "the ice house", "ice keeper", "cellar" etc. *Sardoba* represent the big tanks dug in the earth laid out by the burned brick and blocked by a dome, intended for storage the waters. They were widespread both along main trade roads, and in settlements and the large cities where the lack of drinking water was felt. Water was brought to them on a special waterway or the channel. On the power supply they share on some groups - some are calculated on thawed and rain snow, others refuel flowing water from the rivers or channels, the third are calculated on ground and *karez*' waters.

Thanks to the developed system of water supply in the Turkic cities to Central Asia the public baths found in Bukhara, Samarkand, Balasagun (identified with the Burana ancient settlement), Taraz, Kayalyk, Otrar, Akhsiket and many other cities of the region were widely adopted. Feature of Central Asian baths is use of a big copper from which pipes of different section for achievement of different temperatures in different rooms of a bath departed. Usually they were multidome constructions with the main big vault over the central distributive hall. Besides such types for water procedures were used, as *obzan* – a bathroom with the medicative herbs, close to in a form to modern bathrooms, but having a wooden cover with a cut for the head. Also so-called "dry baths" were used - the cylindrical troughs surrounded with a small ditch in which fire was kindled– thus dry steam turned out [Uralov A.S. 2005].

Summarizing the aforesaid, it is possible to note the highest level of knowledge, arts and abilities of builders and inhabitants of the Turkic cities in the water supply sphere. It was promoted by some moments: landscape climatic conditions, transit character of the territory that had a consequence an unique multiethnic situation, both eventful history, and many-sided culture, and typological variety of architecture. Already then in Turkestan the western part was flooded substantially more, than east that caused here wide use of underground waters. And in those far times, and today the problem of shortage of water in Central Asia is particularly acute very much, especially in a case with an overpopulation of oases of East Turkestan with extremely limited water stock. Catastrophically Aral shoaled (though now it is known of frequency of this phenomenon), the lake Lop Nor disappeared, shallow and change the bed of the rivers … Research and comparison of data on an irrigation, water supply, water use in sanctuaries and cult complexes, images of water in mythology, religion, art of Turkic peoples gives the chance to create multilateral and, whenever possible, a comprehensive picture of development of the Turkic culture which many components demand further deep studying.

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Analysis of Urbanization of Water in India: Implications for Policy and Practice

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1. Introduction:

Worldwide, water issues are becoming increasingly critical due to population growth and rapid urbanization. The growing water demand associated with urban domestic, commercial and industrial activities in developing countries is often met by transferring water from distant rural places where water's primary use is irrigation. There have been numerous 'for' and 'against' arguments regarding rural-urban water transfers. Water transfers are justified on the basis of the more efficient use of water achieved by such diversions. Farmers are often perceived as getting a disproportionate share of water, then using it wastefully. On the contrary, opponents of water transfers argue that they are motivated primarily by short term economic gain, ignoring the broader political economic and environmental consequences. Irrespective of these arguments, water transfers from rural agricultural use to urban use are taking place, with uncertain long-term effect.

Water transfer by administrative decision is the predominant method of water transfer in many developing countries, particularly in India. In this method of water transfer, transference is generally achieved through the exertion of 'authority' by the more powerful urban interests, often overriding rural concerns (Celio et al., 2010). In a holistic perspective, the water-supplying rural region becomes enmeshed in the regional urban-dominated water system. Such 'capturing of water' through the exercise of power has been termed the 'urbanization of water' (Swyngedouw, 2004). When water is in short supply relative to demand in water supplying regions, such water transfers create conflict among various water uses and impinge upon water's environmental effects. Most of these externalities are linked to each other through complex feedback loops that are difficult to anticipate, and thus to factor into planning and policy decision-making.

Water transfer's impacts on the water supplying region ultimately engender a vicious cycle as consequences ripple across the landscape. Moreover, these transfers create problems that go beyond the scope of what water supply alone can address. While the urbanization process has been studied in great depth, the processes and critical impacts of urban water capture and appropriation are not well researched or understood (Celio et al., 2010). To fill this gap, a detailed analysis of a selected case of rural-urban water transfer in India was carried out. Water appropriation by the City of Chennai from the Veeranam Tank through the Chennai Water Supply Augmentation Project - I has been chosen for detailed analysis.

This paper is organized as follows. Background, problem statement and objectives of the study are presented first. This is followed by a description of the selected case and methods adopted. Then the results of the study are presented. The next two sections offers discussion and recommendations.

2. Background and Problem Statement

Rural-urban Water transfers are often controversial and create competition and conflicts among various water uses. In addition, they result in many unintended societal and environmental consequences. Concerns with such water transfers involve possible externalities associated with reallocations, particularly for the water supplying region. Among these are the distortion of land use patterns, and impacts upon regional socio-economic structures. Further, vital ecosystem functions are placed at risk. Most of these externalities are linked to each other through feedback loops. An underlying problem is that the costs and

benefits associated with water transfers are usually not readily observable, and mostly, they are distributed unevenly across society (Butterworth et al., 2007; Meinzein-Dick et al., 2002). Water transfers generally will yield consequences not unlike those associated with natural hazards. These hazards of human origin frequently yield negative effects inordinately borne by disadvantaged social groups. But, unlike most "natural" hazards, this "human" hazard frequently unfolds slowly, disturbing the human-environment systems gradually, and sometimes imperceptibly, until countering actions become difficult if not impossible to mount.

Past empirical inquiries regarding the impact of water transfers on preexisting uses in water supplying regions focus on just a few variables. Most studies employ simplified models and attempt to study the relationship between these few variables. Examples of such studies include those examining the impact of changes in water inputs upon agricultural productivity, community income or water usage efficiency. Intervening or modifying mechanisms are generally ignored in these models. They fail to consider the variable characteristics of water supplying regions and the diverse response capacities of water user communities (Celio et al., 2010).

Individual and community responses to water transfers are complex phenomena that occur within particular contexts and settings. Therefore, water transfer analysis needs to take a holistic approach that considers the complex and interdependent ecological and socio-economic processes in the system that are governed by numerous feedbacks and interactions. Thus, the analysis needs to go beyond the quantitative analysis of imbalances in supply and demand, and discuss the societal responses such imbalances induce. However, review of the literature indicates that urban-agricultural water transfers, particularly in developing countries, are not researched from this perspective (Molle & Berkoff, 2009).

Thus, this study analyzes a prototypical rural-urban water transfer process and determines the ensuing trajectories of social, economic and environmental change brought about by a water transfer project in the supplying region in a selected case. The effects of external influences emerge as a result of the relationships and linkages between people and their environment. A critical system property is its adaptive capacity. When such capacity is in short supply, many otherwise possible outcomes become foreclosed. The solution space that any negotiated settlement might pursue becomes more severely constrained, and mitigative capacities are placed in jeopardy. The concept of Social-Ecological Systems (SES), consequently, is here deployed to provide a suitable vantage point from which to conceptualize the broader expanse of historical accommodative behaviors and of future policy options. Doing so is found also to provide a suitable context within which to situate the associated literature on adaptation, resilience and transformation.

3. Objectives

Adopting a case study approach, this study comprehends the responses of water users, primarily farmers, to water transfers and seeks to analyze the system wide changes in the rural supplying region. The objectives of this study are:

1. To examine the changes in social and ecological system characteristics after water transfer, specifically changes in socio-economic characteristics, agricultural production and water availability,
2. To identify and categorize diverse individual and community responses to water transfer,
3. To investigate the social and ecological factors that influence responses to water transfer and in turn get influenced by the responses, and
4. To formulate recommendations to improve the process for planning and implementing water transfers.

Knowledge about the short and long term impacts of water transfers on the supplying region and incorporation of the needs of the supplying regions in the water transfer planning process could significantly improve the environmental and social outcomes of these projects.

4. Case Description:

The selected case for this study, Chennai Water Supply Augmentation Project - I, is located in the state of Tamil Nadu, India. This project, commonly known as New Veeranam Project, was commissioned to supply water to Chennai city from the Veeranam Tank and was implemented in the year 2004. The details of the receiving regions, water transfer project, and supplying region are briefly discussed below.

Water receiving region: Chennai, the capital of the state of Tamil Nadu, is one of the most water stressed cities of India. Chennai City does not have access to a perennial source of water and depends primarily on three reservoirs. Availability of water in these sources depends on the rainfall. There is a huge gap between supply and demand which widens in drought years. Per capita water supply in Chennai was 76 liters/day in the year 2001 (Sridharan, 2008). Available water is limited, but the population continues to increase. So, to meet the growing demand, the city has been augmenting water from distant sources. New Veeranam Project is one such effort. Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) is responsible for supplying water to the city needs.

Water supplying region: Veeranam Tank is located at a distance of 230 km from Chennai. Veeranam Tank was constructed in the 11th century and renovated in the 19th century. It is a shallow tank formed by an earthen embankment. The length of its bund is 16.00 km. It has a water spread of 25.9 sq. km. The maximum capacity of the lake is 1465 Mcft. However, it has silted up over the years and the storage capacity is considerably reduced. It is part of the Cauvery river system[2] and located at the tail end of the system. It receives water from both the Cauvery River and from its own catchment area. The annual rainfall in the region ranges between 1050 to 1400 mm. It receives 72% of the total rainfall between October and December from the northeast monsoon. The nearest town is Chidambaram.

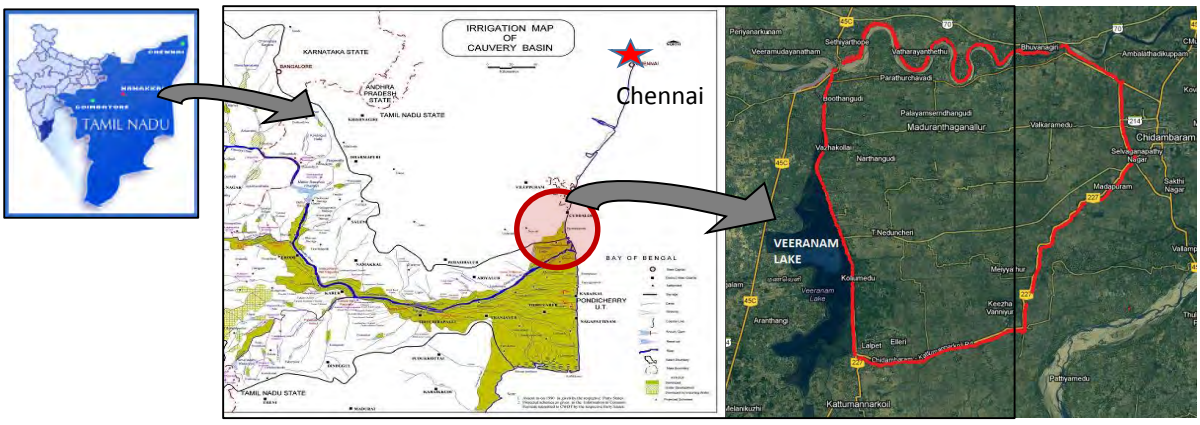


Figure 1: Location map
(Source: indiawaterportal.org; http://topnews.in)

Surface water from Veeranam tank was primarily used for irrigation for many centuries. As an irrigation tank it irrigates an area of 18,152 ha or 44, 856 acres. The total number of villages that benefit from the irrigation system of Veeranam Tank is 128. The water is distributed to the fields through canals from 28 sluices located along the eastern bund. Open unlined canals are the chief feature of the irrigation system. These canals vary in their length.

Agricultural census of India (2005-06) provides land holdings by size in the region. The region has a majority of marginal and small farmers. Marginal farmers are those who own less than 2 acres of land and large farmers own more than 10 acres of land. The region has 82% of marginal farmers who cultivate in 43% of the land area. There are very few large farmers.

Paddy is the major crop in the study area. When there is an assured supply of water, paddy is grown during two seasons: Kuruvai (May-June to Aug-Sep) and Samba (Sept-Oct to Jan-Feb). Otherwise, the crop is grown only in Samba season. Rice fallow pulses are cultivated in the paddy fields. Thus, the cropping system is paddy-paddy- pulse or paddy-pulse.

New Veeranam Project: The New Veeranam Project was built in 2004 to convey 180 MLD (Millions Liters per Day) of water to Chennai from the Veeranam tank, through a 230 km pipeline (CMWSSB, 2011). Amidst protests from the farmers in the supplying region, it was implemented in the year 2004, 36 years after it was first conceived.

To enable withdrawal of 180 MLD of water from Veeranam tank for the city of Chennai, bunds of the tank were raised by 0.61m thereby increasing the storage capacity of the tank. The Environmental Impact Assessment report prepared in 1994 by the National Environmental Engineering Research Institute (NEERI) states that the project would not have an adverse impact on the first user irrigation rights. However, an addendum to the report mentions that the farmers' interests need to be safeguarded as they would be adversely affected in dry years.

5. Data and Methods

Water transfer and community responses occurring within particular contexts and settings are complex phenomena. To examine and unravel such complexities, a single embedded case study design is selected. Embedded subunits help the understanding of the whole and enhance the insights into the single case (Yin, 2013). The water supplying region, i.e., the water source Veeranam tank and the area irrigated by it, as a Social-Ecological System, is considered as the main unit of analysis. Within the main unit of analysis, many subunits are incorporated. The two key embedded units included in this single case study are farmers types based on the size of land holdings, and villages based on the geographical location i.e., head and tail end villages. Each of the sources of evidence and the data collection methods used in this study are briefly reviewed in this section.

***Sources of evidence*:** Data sources for this embedded single case study design are archival records, documentation, semi-structured interviews and surveys. To analyze system changes i.e., to achieve objective one, secondary data from archival records, such as census data, data from agricultural department and public works department, are used. Survey data is used to understand one of the subunits, namely farmers, and to achieve objective two and three. The data collected through semi-structured interviews is used to explain and interpret the quantitative survey results.

Selection of subunits - Villages: To identify villages that are deemed representative of the command area's characteristics and observe the entire range of impacts and responses within the command area[1], a "diverse case selection" method was employed in the selection of villages. Thus two major canals, one on the northern part of the command area and the other on the southern part, were identified. Head and tail end villages irrigated by these canals were selected for detailed study. Village level census data for the years 1981, 1991, 2001 and 2011 were analyzed to understand the changes in the socio-economic characteristics.

Selection of subunits - Farmers: For understanding the complex and multifaceted nature of water user groups in different locations within the Veeranam command area, a survey of water

users in the selected head and tail end villages was carried out. The main purpose of this survey is to determine the responses by different categories of farmers and examine the relationship between their socio-economic characteristics and attitudes, and the responses. Disproportionate stratified random sampling frame was adapted in this study. Marginal farmers constitute 83% of the population in the study area, but hold only 43% of the land. This sampling method insures that important segments that are a small percentage of the population have a sufficient number of respondents in the sample, without oversampling segments that are a high percentage of the population.

There are four categories of farmers in the study area based on the size of the land holding: Marginal, small, medium, and large Farmers. In addition to this, a fifth category of cultivators is increasingly found in the region. They are the landless agriculture laborers leasing land from the land owners to cultivate. Thus, the survey respondents included five strata of farmers in head and tail end villages irrigated by the two selected canals. 40 farmers in each strata were included, except large farmers. The region has very few large land owning cultivators. Therefore, only six large farmers were included in the survey. Thus a total of 166 farmers were surveyed. The farmers were equally distributed in head and tail end villages.

Survey design: Survey questions were developed to quantify farmer's socio-economic characteristics, resource dependency, and perception of their community, leadership, and water transfer. The survey also included questions on their immediate reaction, short-term and long-term responses to water transfer, perception of changes and responses to future scenarios.

6. Results

The results of analysis of both primary and secondary quantitative and qualitative data are discussed below. The primary data collected through interviews and surveys focused on many wider issues pertaining to the supply region. However, this paper focuses only on the responses to water transfer and its relationship to the farmer characteristics. In this section, first, changes in the system characteristics are discussed. Then the descriptive characteristics of the farmers, different responses of farmers and their perception of the water transfer are presented, before exploring the relation between the responses and farmers' characteristics.

6.1 System Changes

Changes in water availability, agricultural production, land use, and workers composition in the study area, after water transfer, are discussed below. The first two variables are analyzed at the entire command area and at the regional level respectively. The third and fourth variables, namely land use, and workers composition, are analyzed at the village level.

Water availability: Farming system in the study area is dependent on three sources of water: Rainfall which occurs mainly in October to December, Veeranam tank, and Groundwater. The studies indicate that rainfall patterns have been changing in the region. Though the total volume of rainfall remains constant, number of days of rainfall has decreased. This affects farming activities. Distribution of rainfall water for more number of days would minimize the requirement for surface irrigation. Due to this high rainfall intensity, there is more run-off water and flooding.

Changes in the surface water availability i.e., water available from Veeranam tank for irrigation use, is illustrated in Figure 2. It shows that water flow into the irrigation channels are considerably reduced since the implementation of the water transfer project. There is a wide variation in the availability of surface water between head and tail end villages within the study area.

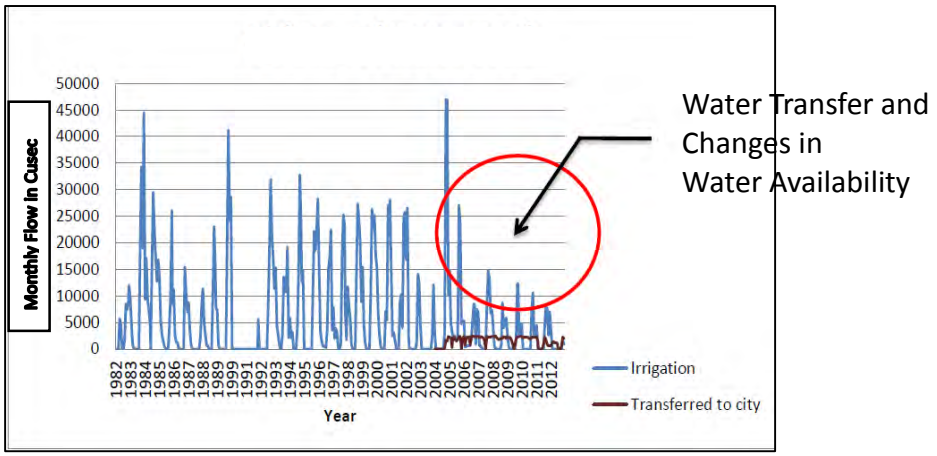


Figure 2: Water Flow in Canals
(Data Source: PWD, Lalpet, Tamil Nadu, India)

Groundwater level and quality varies within the command area. Thus, groundwater, as an alternate source of water is available only in few villages. Due to the high cost of borewell construction, wealthier farmers have better access to groundwater. Thus groundwater access has implications for equity.

Land use: Census data on the irrigated land in selected villages show no noticeable change in the land use, except in the villages located along the periphery of the Chidambaram town. However, there is a reduction in the gross irrigated area over the years, since the cropping season is reduced to one season from two.

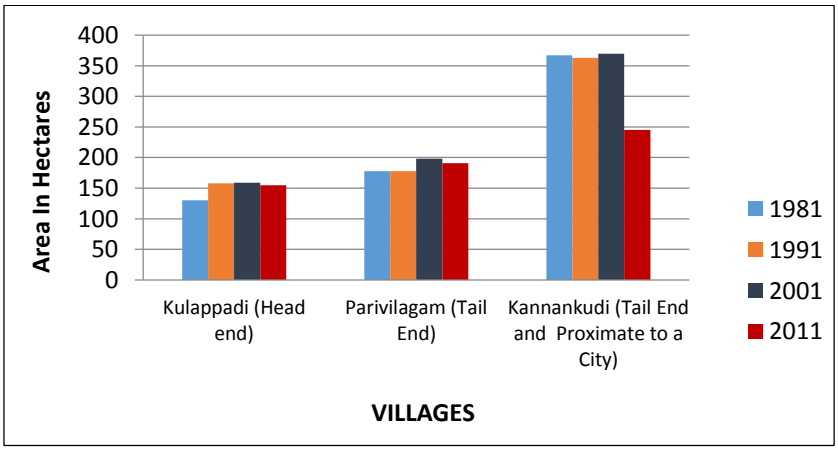


Figure 3: Land Use Changes
(Data Source: Census of India)

***Agricultural production*:** The irrigated area falls under three different local administrative divisions that include other villages and towns outside the Veeranam command area. Therefore, aggregate agricultural production data for the Veeranam command area could not be calculated. The regional production over the last 15 years shows a fluctuating trend, but there is no obvious declining trend in the production itself. Despite the reduction in gross irrigated area, the agricultural production is maintained in the region. This is attributed to the higher yielding paddy varieties However, to what extent in future higher yielding varieties can continue to bridge the gap in production created by reduction in the gross irrigated area, remains to be seen.

***Socio-economic characteristics**:* Census data of the selected villages were analyzed to determine the workers composition. As shown in Figure 4, there is a marked increase in number of marginal workers in the last decade, particularly in the tail end villages. Marginal workers are those who did not work for at least 183 days in the preceding 12 months to the census taking.

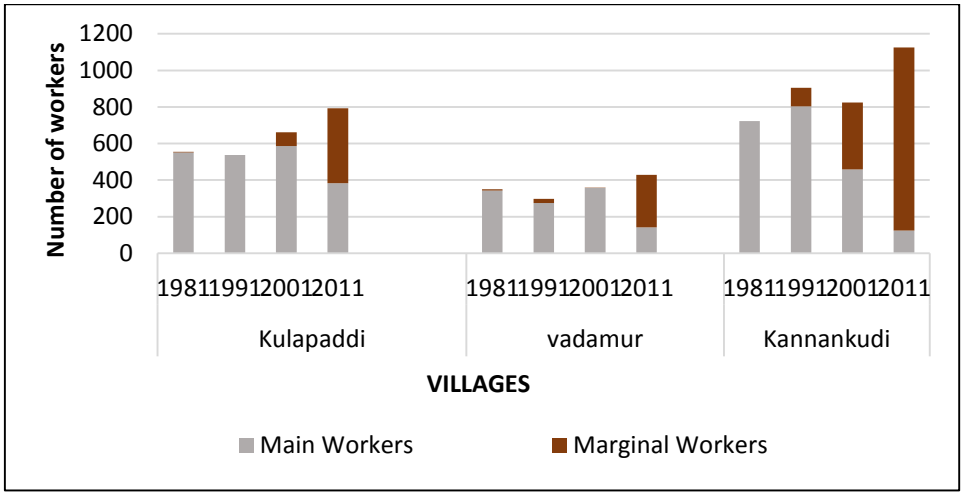


Figure 4: Workers Composition – Main and Marginal Workers
(Data Source: Census of India)

6.2 Farmers' Responses:

The results of the survey responses are presented below. As explained in section 5, a total of 166 farmers under five categories of were surveyed.

Farmers' characteristics: Descriptive statistics on age, education level and primary economic activities are presented in Table 1.

Farmer type	No. of Respo-ndents	Years of Education	Economic Activities		Primary Economic Activity					
			Farming only	Farming and others	Agri. Laborer	Const. & Agri. Laborer	Semi-skilled Const. Workers	Self-Empl-oyed	Empl-oyed	Farm-ing
Leasing	40	5.7	1	39	17	16	4	1	1	1
Marginal	40	7.1	6	34	11	4	8	3	3	11
Small	40	8.4	15	25	6	1	7	7	1	18
Medium	40	10.4	16	24	0	0	0	4	2	34
Large	6	14.0	3	3	0	0	0	0	1	5

Table 1: Farmers' characteristics

***Perception of the project and impact*:** Of the 166 respondents, 75% strongly believe that they have the first right to water in Veeranam tank. 22% of them think that both the city and farmers need to share the water. Around 70% of the respondents observed that the water available for farming has reduced since the implementation of the project and it has negatively impacted them. Many of them feel that though the tank is physically located near the village, in reality the tank has been taken to Chennai city as the release of water for irrigation is not under the control of local Public Works Department anymore. This has increased the uncertainty in availability of water for irrigation. Such perceptions show that the farmers' relationship with the tank has been redefined by water transfer.

Nearly half of the respondents do not want their children to be farmers. They wish to educate them and make them find jobs with regular working hours and better monthly income.

Responses: Farmers' responses to changing conditions were collected through the semi-structured interviews and surveys. They ranged from no response to changing conditions and bearing loss, to responses related to crop, water and land, and non-farm diversification. The responses were categorized into 3 broad types: No response, Agriculture related response, Non-agriculture response.

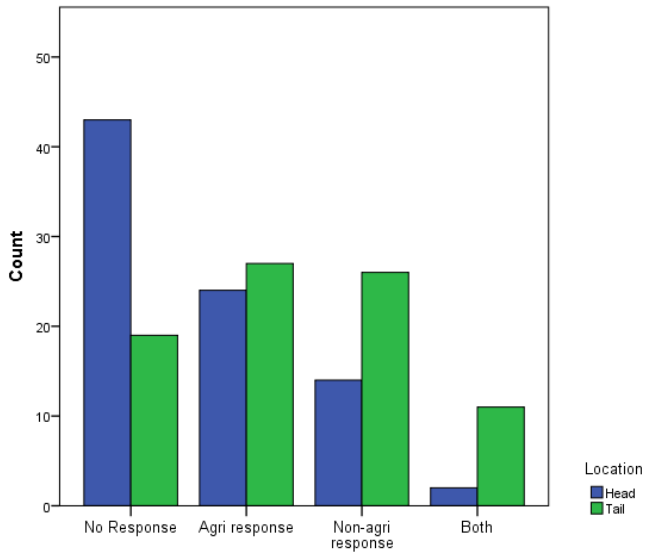


Figure 5: Frequency of responses in head and tail end villages
(Source: Fieldwork by the author in 2013)

As Figure 5 shows, many farmers in head end villages have not changed their activities. The tail end villages face the consequences of reduced water availability. This has resulted in not only individual actions in tail end villages as shown above, but emergence of collective actions as well. For instance, in one of the tail end villages, the villagers have pooled in money and labor to clear the main canal before the cropping season, so that the water reaches their land in the tail end of the system without delay. In another village, the temple tank has been deepened to collect rain water.

The frequencies with which different responses are employed are shown in Table 2. Thirteen farmers took both agriculture and non-agriculture responses. They are counted under both categories. One third of the respondents have not changed their actions related to farming and livelihood. Most of the farmers in tail end villages in this category mentioned that they have adjusted their living conditions to live with the available resources and lowered income.

Agricultural responses were taken by 60 farmers. The majority of them are medium size farmers. Different types of responses, land, water and crop related, are included under agricultural responses. Crop related responses comprise actions such as changing of planting dates, direct sowing and changing crop varieties. One of the land related responses is leveling land that allows uniform flood depth in the field and reduces the amount of water needed for irrigation. Water related responses include adopting water conservation measures, investing in rain water harvesting, investing in obtaining ground water, and recycling water from drainage canals. Non-agriculture responses include actions such as income

diversification, investing in education and training to increase employability. A total of 57 farmers have taken non-agricultural responses. Some of the responses show the presence of short term unsustainable practices, such as recycling water from the drainage canals.

	No Response	Agri response	Non-agri response
Leasing Farmers	19	8	16
Marginal Farmers	15	10	16
Small Farmers	17	12	15
Medium Farmers	9	26	10
Large Farmers	2	4	0
Total	62	60	57

Table 2. Frequency of Responses by Farmer types
(Source: Fieldwork by the author in 2013)

Relationship between actors and responses: The disaggregated data of responses by farmer types shows that agricultural responses are taken by a large number of medium farmers. As shown in Table1 farming is the primary economic activity of medium farmers. Thus maintaining the income level from agriculture is essential to maintain their livelihood. Non-agriculture responses are adopted predominantly by leasing, marginal and small farmers. It mainly consists of non-farm income diversification. The characteristics of the farmers in Table 1 show that the educational level is directly proportional to the farm size. Thus, farmers with a lower educational level take up low paying jobs as unskilled workers in nearby towns and cities.

7. Discussion

Analysis of the system changes indicate that the regional agricultural production has not declined in the last decade. If we consider agricultural production as the primary function of the system, the system has maintained the status quo despite water transfer. However, concluding that the system is resilient or farmers have adapted to the changing condition may not be accurate. Changes in workers composition show that there is an increase in vulnerable population. Association between the size of the land ownership and response types to the changing conditions has consequences as well. The main trends triggered or accelerated by water transfers are discussed below.

Before proceeding to the discussion, it is necessary to consider an important point. This study was set out to understand the system-wide impact of water transfer, as opposed to the changes in the selected few variables. The underlying notion is that socio-economic and ecological processes are interlinked and they mutually influence each other. Similarly, so many factors are operating in the supplying region and on the agricultural sector that it is difficult to segregate the impact of water transfer on the system. Farming and rural livelihood are influenced by a myriad of actions and government policy. One such example is the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) that guarantees 100 days of unskilled manual work and wages. Thus, it is problematic to precisely pinpoint and measure the impacts of water transfer and system change. In the region where the study area is situated, agriculture is declining due to diverse reasons and it cannot be attributed to a single cause. But, it could be stated that water transfer is accelerating this trend.

Implications of changing characteristics of farmers and their responses: Tamil Nadu state is a rapidly urbanizing state in India. With the urban based economic development,

migration of the work force from rural to urban areas has taken place in the last few decades. The land transfer that accompanied migration was from the wealthy large farmers to other farmers or laborers. In the study area, with the increasing uncertainty in water availability after the New Veeranam Project, farmers who do not want to take the risk, instead of selling the land, lease the land to other farmers or agricultural laborers. In this contract, the land owning farmers are assured of a sum of money and the entire risk falls on the leasing farmers.

This has both positive and negative implications. In the rapidly urbanizing state, any fallow land attracts real estate development leading to land use change. This has been put on hold by the leasing farmers. Conversely, education and skills are considered important for improving farming practices, investment and productivity. As table 1 shows the educational attainment of the farmers are directly related to the size of the land owned. It shows that literacy and mean years of education are lower for leasing and small farmers compared to medium and large farmers. Mostly, leasing and marginal farmers focus on day to day survival needs and do not pay attention to improving farming practices. In general, no proactive approach is taken by farmers. The key informant interviews highlights this point. This trend does not support improving the agricultural productivity and earnings, which in turn threatens the continuation of farming into the future. .

Implications to resilience at different scales: Water transfer has increased the uncertainty of water availability making the farming more vulnerable. Therefore, to meet their livelihood needs at the individual level, farmers attempt to diversify their income. This mainly includes permanent or temporary migration to nearby towns and cities.

The data on primary economic activities of farmers in Table 1 illustrate clearly that agriculture is not the primary economic activity, and more people are moving out of agriculture. This transition has been taking place throughout India in the last few decades. These economic transitions are justified because in a mature or developing economy the contribution of primary sector tends to decrease. However, in this scenario, transfer of water has resulted in accelerating the migration of marginal and small farmers with minimum education to urban areas in search of unskilled works to diversify their income. As a result, there is a transfer of rural poverty to urban poverty.

Though this reflects farmers' resilience in a short-term time scale, at the village level this results in the removal of local knowledge, and human and social capital. Declining agricultural activity threatens future food security of the region as well.

Contrasting developments: The survey result shows that at present the farmers, who take up other work to meet their livelihood needs, continue to farm at least in one season. The traditional pride in a being a farmer and growing food motivates them, in spite of multiple challenges posed. More than 50% of the respondents strongly believe that they will continue to farm, even if less water is available. At the same time, most of the farmers do not want their children to continue with agriculture. This indicates that agriculture's importance in the region will decline tremendously in the near future.

On the contrary, at the community scale, there is evidence of the emergence of collective action in conserving water and building resilience. Such activities indicate possibilities that agriculture will not be abandoned in the study area in the near future. Whether such collective actions will spread throughout the command area and water conservation measures will be adopted by every farmer remains to be seen.

Regardless of such contrary developments, if the water supplies continue to diminish, reinforcing the current trend, only an ageing, mostly less affluent farming community will remain with limited water availability and decreased productivity.

8. Recommendations

The following brief recommendations, drawn primarily from the findings of the study, are proposed to improve the environmental, social and economic outcomes of rural-urban water transfers.

Planning Process: In general, urban development and water transfer planning processes must incorporate the following criteria highlighted in the planning and water management literature: Transparency, Inclusiveness, Addressing uncertainty, Inclusion of multiple values and Local knowledge, Involving stakeholders.

Specific to this study context, the city in collaboration with other government departments could invest in the following as a compensation to the supplying region: Raise awareness about water conservation highlighting how the water saved is quenching the thirst of city residents; Construct barrages and rain water harvesting structures to store water and recharge groundwater in the supplying region. Such actions would reduce the uncertainty in water availability.

Institutions: Water user associations and watershed committees could be established to create awareness and manage water with in the villages and in the watershed.

Rural Development: In addition to water related investment, catalyzing the rural development would break the vicious cycle that lead to the migration to cities, which in turn increases city water demand and water transfers.

9. Conclusion

Transferring water from rural agriculture use to urban municipal and industrial use is widely practiced in water-scarce regions, particularly in developing countries. Ideally, planning and implementation of such water transfers should be achieved in a manner that minimizes uncompensated negative side-effects and that achieves a fair overall apportionment of costs and benefits in both the short and longer term.

Taking an in depth case study approach, this study traced the trajectories of social and economic change in the supplying region, brought about by a single water transfer project. The analysis reveals that, according to the water users in the supplying region, uncertainty in availability of water has been amplified by water transfers and agricultural activities are increasingly constrained by water shortages. As a result, adaptive capacities within the farm sector are seen to be diminished and non-farm dimensions of rural adaptive capacity are ascendant. Farmers are found to be increasingly inclined toward the pursuit of non-farm income diversification and migration to cities. The results indicate that water problems constructed in a rural region by actions of an adjoining city might ultimately be returning to the city at a later stage in the form of hyper-urbanization and food deficits. Thus, if for no other reason than self-interest, cities have the responsibility to protect the systems from which their water is extracted.

Endnotes

1. "Command area" means an area irrigated or capable of being irrigated either by gravitational flow or by lift irrigation or by any other method, under an irrigation system, project or source.
2. Cauvery River originates in the neighboring state of Karnataka. There is an ongoing interstate dispute concerning the allocation of the Cauvery's water between the riparian states Karnataka and Tamil Nadu.

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Pricing the Services from New Decentralized Sanitation Systems: An Exploration for the German Context

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1. New Sanitation Technology Evolving: How to Price It?

Urban Water Management is at a crossroads, not only in the water scarce and rapidly urbanizing countries of the „South", but also in the long industrialized countries of the „North". These countries' centralized sewage systems are based on the flush toilet and an inflexible infrastructure which is increasingly costly to maintain, especially with demographic change going on. This wastewater infrastructure dilutes precious resources and carries new forms of pollution into the environment: pharmaceutical residues, some of which metabolize into unknown compounds on their way through the treatment system, entering surface water bodies, affecting aquatic organisms and likely humans, too.

Source separation of the building-related wastewater stream (in essence, separating human excreta from greywater) is a technology option that offers the chance to recover precious nutrients, to utilize the chemical energy contained in wastewater, to better manage unknown pollutants, and, last but not least, to conserve freshwater resources. These systems, explored in pilot projects for several decades, are beginning to be built in Germany and other countries of the North. Within a few decades, we will likely have a mixed technology landscape – the old centralized systems next to new smaller source-separating systems.

How should services from these new systems be priced? The wastewater sector is regulated in many ways. In Germany, wastewater management is under the legal authority of municipalities, and the fees for wastewater services have to suffice legal norms intended to serve a variety of goals, including the equitable treatment of customers and the confinement of municipal economic activity. At the same time, the Water Framework Directive of the European Community (2000/60/EC) stipulates that EU member countries should build incentive-based elements into their pricing of water resources and services, reflecting their true cost.

This paper presents a proposal for how to price the services of decentralized source-separating sanitation systems, a proposal that suffices the goals of the regulations sketched above and that constitutes a viable business model.[1] It is based on data of five German pilot projects. The first task in designing a pricing scheme is to identify key data on system costs and technical performance (e.g., nutrient and energy yields). This proved a complex task, for reasons explained later. Yet the projects that were chosen for obtaining this data display similarities that allow – we think – for a certain cautious generalization. Our focus is on German projects and legal norms, yet we think that the insights these yield are applicable to countries with a similar geographical and technological makeup.

The paper is organized as follows: Section 2 deals with the challenges facing urban water management in Northern industrialized countries. Section 3 presents basic principles of new decentralized source-separating systems and reports on the paradigm change occurring in the wastewater sector. Section 4 presents cost and technical data of five German pilot projects. Section 5 describes a pricing scheme for a hypothetical decentralized source-separating sanitation system whose cost and technical parameters broadly reflect the data of the five pilot projects. Section 6 offers an outlook, in terms of what is needed to bring such systems and pricing schemes closer to implementation.

2. Conventional Wastewater Technology Fails to Meet Current Challenges

Today's major challenges for urban water management (and opportunities for new technologies) are:

1) Changes in precipitation regimes due to climate change.

[1] The material presented here draws on the Ph.D. thesis by Christoph Magazowski under the supervision of Irene Peters.

2) The need to conserve fossil fuels, reduce CO_2 emissions, utilize new energy sources
3) The need to conserve water resources
4) Nutrient loss and phosphorus scarcity
5) Demographic change
6) Micropollutants

This list is not exhaustive but, in the eyes of the authors and much of the literature (Deutsche Vereinigung für Wasserwirtschaft 2008), captures the major challenges for urban water management. In the following, we sketch these interrelated issues, devoting most space to 5) and 6) as these may be least known, esp. for overseas audiences.

2.1 Changes in precipitation regimes. In the course of climate change, Germany will, on the whole, experience an increase in precipitation. However, precipitation will be more concentrated in space and time. Some regions will become wetter, others drier. There will be longer periods of drought and more extreme rain events. (Deutsche IPCC Koordinierungsstelle and Umweltbundesamt 2013; Landesamt für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen (Hrsg.) 2010). An increase in extreme rain events implies an increase in combined sewer overflows (discharges of untreated residential wastewater, mixed with rainwater) and thus emission of pollutants and nutrients in surface water bodies.

2.2 The energy issue: Wastewater contains chemical energy which can be utilized by the production of biogas through anaerobic digestion (ideally combined with other organic wastes). Nitrogen recovered from wastewater could replace nitrogen produced with the most common industrial process to date, the energy-intensive Haber-Bosch process which gains nitrogen from the atmosphere.

2.3 Conserving freshwater resources may not be as important in Germany as elsewhere – in fact, Germany has regions where groundwater levels are rising as freshwater withdrawals for water supply are declining, forcing water utilities to pump groundwater just to keep building basements dry – but taking a longer-term view, it would certainly make sense to reduce water consumption. Large urban agglomerations almost invariably use water resources from the hinterlands, often leading to depletion of resources there (Koenigs 1996).

2.4 Nutrient loss, esp. phosphorus scarcity. Conventional centralized wastewater treatment gives rise to nutrient loss. Part of the nutrient load entering wastewater treatment plants leaves the plants in the effluent, part is metabolized into atmospheric nitrogen (when the plant is equipped with the denitrification process step). The nutrients contained in sewage sludge which used to be deposited on agricultural fields have a reduced bioavailability, compared to nutrient availability from less altered wastewater products. For example, the metallic phosphate compound resulting from the chemical precipitation of phosphate from mixed wastewater is inferior in its bioavailability to the phosphorus in raw urine (Simons 2008; Römer 2013). – Especially phosphorus is scarce. Deposits of phosphate rock, primary material for the production of commercial fertilizer, are dwindling (Cordell and White 2011).

Sewage sludge increasingly counts as contaminiated. But this problematic is dwarfed by that of animal excreta, containing far greater amounts of pharmaceuticals, esp. antibiotics, deposited on fields as fertilizer.

2.5 Demographic change: Germany is experiencing dramatic demographic change. Figure 1 shows two scenarios of population decline by the German Federal Statistical Office. The first scenario is based on a net in-migration of 200.000 persons per year, the second on a net in-migration of 100.000 persons per year. Even with net in-migration, the German population is anticipated to shrink from around 80,5 million today to around 70 million or 65 million, respectively, in the year 2060.

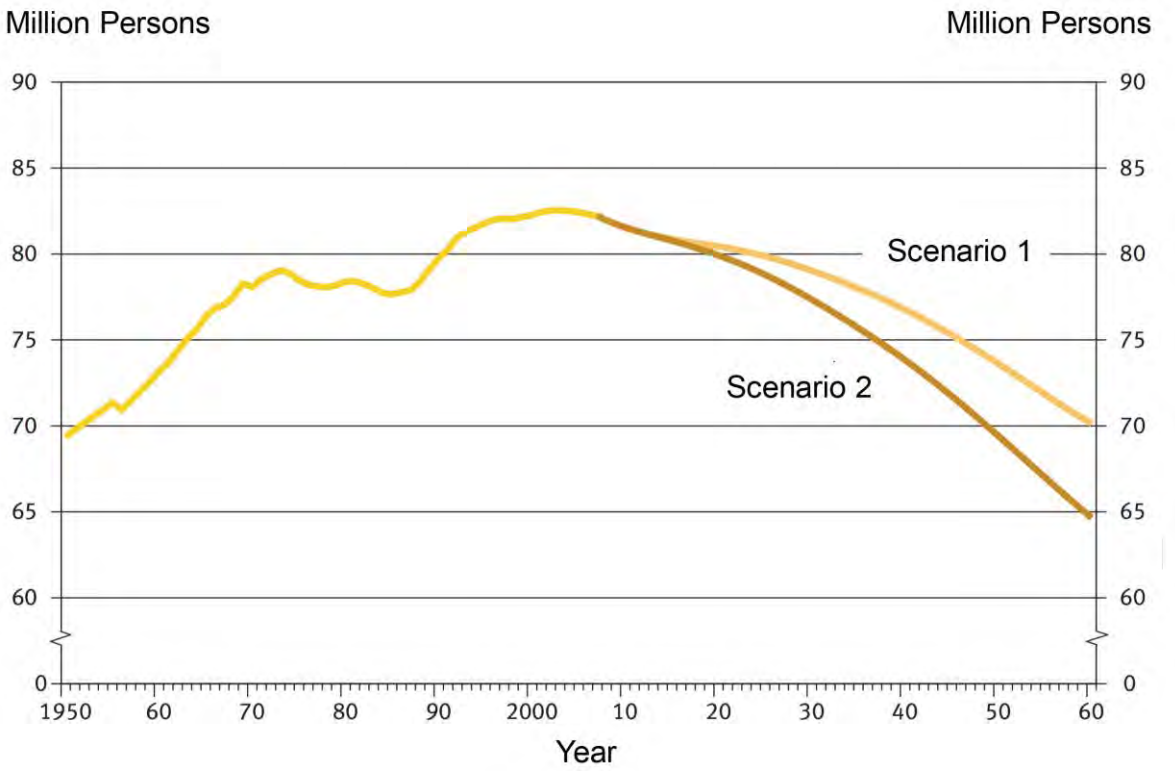


Figure 1: Population development in Germany from 1950 to 2060
Source: (Statistisches Bundesamt 2009)

Some German cities and regions are experiencing population growth (e.g., the Munich, Frankfurt/Main and Hamburg regions), others a dramatic population decline, due to net ex-migration of population. The former East Germany is more heavily affected by population decline than the West (some cities having experienced a population loss of 40 and more percent since German reunification in 1990), but there population is severely declining in some West German regions, too. Table 1 illustrates population changes for the Federal states of Germany.

Table 1: Population development of the German Federal States
Source: (Statistisches Bundesamt 2011)

Federal States	Change of population in % from 2008 to 2030
Western States	
Baden Würtemberg	-2,1
Bayern	-0,4
Bremen	-3,6
Hamburg	+4,6
Hessen	-4,4
Niedersachsen	-6,9
Nordrhein-Westfalen	-6,1
Rheinland-Pfalz	-4,7
Saarland	-13,8
Schleswig-Holstein	-4,1
Eastern States	
Berlin	-3,0
Brandenburg	-10,5

Mecklenburg-Vorpommern	-15,2
Sachsen	-13,3
Sachsen-Anhalt	-21,2
Thüringen	-18,7

At the same time, life expectancies are rising. Overall, the German population is ageing, and the share of single-person households is increasing.

Population decline is a serious problem in particular for large-scale centralized water infrastructure. Reduced water consumption implies reduced volumes of water and wastewater**.** Longer residence times of water and wastewater in the pipe and sewer networks cause hygiene problems and corrosion. (Umweltbundesamt (Hrsg.) 2010). Pipes and sewers have to be cleaned (often by flushing additional water) and repaired more often. The problem is exacerbated when per-capita consumption is decreasing at the same time (as is the case in Germany, the result of more efficient end-use appliances, possibly changes in behavior, and a reduction of losses in delivery) (Umweltbundesamt (Hrsg.) 2010).

By the way, decreasing demand not only affects the water and wastewater infrastructure. District heating systems, too, have been gravely affected by the population decline, especially in East German cities. The federal German government set up a funding programme for the adaptation to population decline in East German cities („Stadtumbau Ost“) in which the adaptation of technical infrastructure systems to population decline played a prominent role. (Deutscher Bundestag 2012)

2.6 Micropollutants. Current research indicates that an ageing population will consume more pharmaceuticals. Due to (Barmer GEK (Hrsg.) 2011) men aged 35 to 40 years consume about 300 defined daily doses (DDD), while men aged 75 to 80 years consume approximately 1500 DDD, that is five times as much.

Pharmaceutical residues excreted by human patients are not completely decomposed in wastewater treatment plants, and they enter water bodies through the plant effluent and from mixed sewer overflows. Increasingly, pharmaceutical residues are found in water bodies. They constitute micropollutants.

The Swiss Federal Office for the Environment (Bundesamt für Umwelt, BAFU) defines micropollutants as (our own translation): „Micropollutants ... are organic substances occurring in water bodies in concentrations of few nano- to microgram per litre, and which affect basic natural biochemical processes already in such low concentrations ... they include ... synthetic substances such as pharmaceuticals, substances with biocidal properties, for example for material protection... additives in foodstuffs, cosmetics and cleaning products ... but also substances of natural origin, like hormones.“ (BAFU, ed., 2012, p.8).

In 2009, BAFU looked into the retrofitting of Swiss wastewater treatment plants and concluded that an additional process step to deal with micropollutants, like ozonation or activated carbon treatment, would not be economically defensible for smaller wastewater treatment plants (serving 10.000 or less normed residential loads). Should such plants face the need to eliminate micropollutants, a connection to a larger treatment plant would be in order. Alternatively, BAFU argued, the transition to decentralized systems should be considered. Emissions could be treated with the appropriate technology where they arise, with specialized methods (BAFU, ed., 2009, p.91).

3. New Decentralized Sanitation Systems (NDSS) and the Paradigm Change in Wastewater Management

The last decades have seen research and pilot-project scale implementation of several variants of new decentralized sanitation systems (which we abbreviate with NDSS[2]), foremost in Northern Europe, including Germany. Compared to conventional wastewater transport and treatment technology, the key feature of NDSS is source separation, i.e. the separate collection of the different wastewater streams which facilitates the separate, specifically tailored treatment of different fractions and associated resource recovery, to a much greater extent than their mixing for purposes of waterborne transport allows.

One can differentiate the following building-related wastewater components: Toilet content, containing human excreta, and „grey water", which is water from personal hygiene, clothes and dishwasing, cleaning and so on. Toilet content is called „black water" when it contains a mixture of urine and feces, mixed with flushing water. If faeces and urine are collected separately, as for example in the „No Mix toilet" (T. Larsen et al. 2001), one speaks of „yellow water" (urine and flushing water) and „brown water" (feces and flushing water).

The containment of human excreta, mixing them with as little water as possible (in contrast to the conventional technology which relies on water as a medium of transport) makes for water conservation and for reducing potentially harmful emissions into the environment (pathogens, micropollutants, and building blocks for aquatic toxins – urea that can metabolize into nitrite). Typically, such systems are small-scale, treating the grey water in constructed wetlands. But high-tech solutions like membranes are common too.

Moreover, these systems, by avoiding the construction of a capital-intensive infrastructure (sewer grids and treatment plants), are more flexible and thus less expensive in the long run. Even as the current infrastructure of centralized wastewater treatment is already built, new investment requirements to address the micropollutant issue are on the horizon.

These advantages of NDSS have been recognized for a while. Authors that have been active in this field include Beck, Larsen and Gujer, Hiessl, Hillenbrand, Londong, Oldenburg and Otterpohl (Larsen 2013; Londong 2008; Hillenbrand 2009; Hiessl 2010; Otterpohl and Oldenburg 1998). Such thinking has caught on in the recent years, leading to what has been termed a „paradigm change" in wastwater treatment (Augustin 2011; Beck 2013; Koziol 2006; Larsen et al. 2009; Strang 2006; Pinkham 1999;). Table 2 gives an overview of aspects of this paradigm change.

In 2008, the German Association for Water, Wastewater and Waste (DWA) pronounced that NDSS exceed the „state of the art" in most cases keeping up with the „state of science and technology" representing high-technology solutions. (Deutsche Vereinigung für Wasserwirtschaft 2008a, S.5). And „According to current findings, it is not desirable to implement the German gravity-based sewers with a centralized wastewater treatment because it is comparatively expensive and not using resources efficiently" (Deutsche Vereinigung für Wasserwirtschaft (DWA) (Hrsg.) 2010, S.3, translation by the authors)

[2] This in style with the abbreviation NASS in German which stands for „Neue Alternative SanitärSysteme". The adjective „nass" in German means „wet". The NASS definition which was coined by the German Association for Water, Wastewater and Waste (DWA), includes decentralized and semi-centralized technologies; the „alternative" mainly drives at source separation (DWA 2008a p.12).

Table 2: Paradigm Change in Water Resources Management
Source: Own representation based on (Pinkham 1999; Strang 2006).
The words in bold, leading each table entry, are supposed to reflect the basic thinking on each of these issues, by the Centralized System vs. New Decentralized System perspectives.

		Centralized System	New Decentralized Sanitation Systems (NDSS)
Material flows	Wastewater	**Human waste is a nuisance.** It should be disposed of after minimum treatment required to reduce its harmful properties	**Human waste is a resource.** It should be captured and processed intelligently and put to use nourishing land and crops.
	Rainwater	**Rainwater is a nuisance.** Convey rainwater away from urban areas as rapidly as possible.	**Rainwater is a resource.** Harvest rainwater as a souce for water supply, and infiltrate or retain it to support suburban aquifers, waterways, and vegetation.
Infrastructure	Demand	**Build to satisfy demand.** It is necessary to build more capacity as demand increases.	**Manage demand.** Demand management opportunities are real and increasing. Take advantage of all cost-effective options before increasing infrastructure capacity.
	Dimensions of the Infrastructure	**Bigger/centralized is better.** Larger systems, especially treatment plants, attain economies of scale.	**Small/decentralized is possible, often desirable.** Small-scale systems are effective and can be economic, especially when diseconomies of scale in conventional distribution/collection networks are considered.
	System design	**Demand is a matter of quantity.** The amount of water required or produced by water end-users is the only end-use parameter relevant to infrastructure choices. Treat all supply-side water to potable standards, and collect all wastewater for treatment in one system.	**Demand is multi-faceted.** Infrastructure choices should match the varying characteristics of water types required or produced by different end-users: quantity, quality (biological, chemical, physical), level of reliability, etc.
	Flexibility	**Limit complexity:** Employ standard solutions. A small number of technologies, well known by urban water professionals, define the range of responsible infrastructure choices.	**Allow diverse solutions.** A multiplicity of site-based solutions is required in increasingly complex and resource-limited urban environments, and enabled by new management technologies and strategies.
Sustainability	Reuse	**One use (throughput).** Water follows a one-way path from supply, to a single use, to treatment and disposal to the environment.	**Reuse and reclamation.** Water can be used multiple times, by cascading it from higher to lower-quality needs (e.g. using household greywater for irrigation), and by reclamation treatment for return to the supply side of the infrastructure.
	Integration	**Integration by accident.** Water supply, stormwater, and wastewater systems may be managed by the same agency as a matter of local historic happenstance. Physically, however, the systems should be separated.	**Physical and institutional integration by design.** Important linkages can and should be made between physical infrastructures for water supply, stormwater, and wastewater management. Realizing the benefits of integration requires highly coordinated management.
User	Perception	**Grey infrastructure.** The only things we call infrastructure are made of concrete, metal and plastic.	**Green infrastructure.** Besides pipes and treatment plants, infrastructure includes the natural capacities of soil and vegetation to absorb and treat water.
	Collaboration	**Collaboration boils down to public relations.** Approach other agencies and the public when approval of pre-chosen solutions is required.	**Collaboration means engagement.** Enlist other agencies and the public in the search for effective, multibenefit solutions.

4. Cost and Technical Parameters of Five German NDSS Projects

Magazowski, in the work on his Ph.D. thesis, has found information on more than 400 decentralized sanitation system projects world-wide. (There are probably many more.) Of these, most are located in developing countries. In these countries, the pressure to improve hygienic conditions associated with sanitation is high. The projects mostly have a low-tech character. They feature, for example, dry toilets ("Sustainable Sanitation Alliance" 2014).

Of the 400 projects identified, around 20% are located in the industrialized Northern countries, and 23 in Germany. Out of these, we chose five to look more closely at cost and

technical parameters. The choice was motivated by the intention to cover a range of technology variants, and by the amount of information available on these projects. The different technologies realized in these projects are one reason why the data is not easy to compare. The other reason is less than complete accounting, esp. on financial flows. Some of these projects were initiated as pilot projects to test technical processes and received funding by, for example, German government research programmes.

These five projects are, in chronological order of their implementation:

4.1 Flintenbreite-Lübeck (Year of Construction 1999). Flintenbreite is a housing development for 350 inhabitants in the West of the City of Lübeck, an old port town on the Baltic Sea Coast. The Flintenbreite Project is a two-source-separating wastewater system, designed as follows: Black water is transported through a vacuum sewer into an anerobic blackwater digester. This provides biomethane that is used to run a CHP unit. The grey water, after removal of solids, is transported in a gravity-based sewer into a constructed wetland. (Deutsche Vereinigung für Wasserwirtschaft 2008; Peters 2002; Oldenburg 2010). The system does not run as planned originally because the housing compound has not enough inhabitants and the critical biomass production is not reached for a CHP unit to run. Instead, the sewage sludge is collected by farmers for use in agriculture (communication with the organisers).

4.2 Vauban-Freiburg (Year of Construction 1999). Vauban is the name of the French military barracks in the City of Freiburg in the Southwest of Germany. The area was redeveloped between 1995 and 2003 into a new residental neighborhood. The City of Freiburg aimed at a high ecological standard for this neighborhood in several respects. It included a small innovative sanitation project in the form of a „Null-Abwasser-Haus“ (Zero Wastewater House) for around 40 residents. Like Flintenbreite, the Vauban sanitation project consists of a two-source-separating system. In contrast to Flintenbreite, grey water is treated not in constructed wetlands, but in a membrane bioreactor. The recycled grey water is used for irrigation. Black water is mixed with organic (mainly kitchen) waste and transported by vacuum sewer into an anaerobic digester that is producing biomethane which is used in a CHP unit. (Peters 2002; Koetse 2005).

4.3 SCST-Berlin (Year of Construction 2006). The SCST project in Berlin (SCST stands for „Sanitation Concepts for Separate Treatment“) is an EU-founded project whose goal was to generate experience with different wastewater treatment technologies allowing the transferral of this experience into a cost calculation of a potential commercial project. Therefore, SCST Berlin tested different wastewater treatment technologies, all on the site of the wastewater treatment plant in Berlin-Stahnsdorf. One result was a cost calculation for a three-source-separating wastewater system. This system stores the yellow water in underground storage tanks (the yellow water being picked up for further storage and then planned use in agriculture), treats the grey water in a sequenced batch reactor and transports the black water in a vacuum sewer into a anerobic digester that produces biomethane which can be used in a CHP unit. (Deutsche Vereinigung für Wasserwirtschaft 2008; Fröhlich, Bonhomme, and Oldenburg 2007; Schmitt 2009).

4.4 DEUS21-Knittlingen (Year of Construction 2008). Knittlingen is a small town some 30 km to the East of Karlsruhe. The DEUS21 Project (DEUS stands for „Dezentrales Urbanes InfrastrukturSystem“) was realized in a new housing compound for close to 400 residents. DEUS21 is a special case within the range of NDSS projects because of the innovative technology used there for the first time. In contrast to the other projects, it is a one-source system that employs an entirely new wastewater treatment technology. The wastewater (mixed grey and blackwater) is transported in a vacuum system into a combined anerobic digester and membrane bioreactor that produces low calorific biomethane. This gas is used to run a combined heat and power (CHP) unit. The innovative aspect of this system is the

harvesting of biogas from a one-stream-system without any input of energy. The generated heat is used for heating the fermentation in the pre-separator. The electric power produced is fed into the grid. In addition, the rainwater is recycled up to the quality of service water, so that it can be used for toilet flushing, in the washing machine or the dishwasher. (Deutsche Vereinigung für Wasserwirtschaft 2008; Hillenbrand 2009; Hiessl 2010).

4.5 KOMPLETT-Kaiserslautern (Year of Construction 2009). The KOMPLETT-project had a different approach than the other projects, trying to take an integrated view of the wastewater system and laid out in three steps: A planning phase in which the technologies to be used were researched in an experimental fashion; a first implementation phase in which a technical system was installed in a housing block with 15 dwelling units, and a pilot phase which took part on the premises of one of the research institutes involved. From the technical data thus gained, various implementation scenarios were calculated, for example a water recycling system for a hotel. This planned system (with extrapolated experimental data) was designed as a two-source-separating wastewater system. The blackwater should be pre-separated and treated in a membrane bioreactor. In addition the greywater should be treated with activated carbon, ultrafiltration and chlorine. (Schmitt 2009)

These five projects are research or pilot projects. Thus, they are unique, and there are limitations to comparing their cost and technical parameters. Moreover, the data may carry greater than usual uncertainty because of the short observation periods for which data are available. Nevertheless, the findings are interesting, and the observed parameters do not vary that greatly across projects with few exceptions. Table 3 summarizes the key data.

Table 3: Key cost and technical parameters of five NDSS projects
Source: Own illustration

Parameter	Knittlingen-DEUS21	Flinten-breite	Berlin-SCST	Vauban-Freiburg	Kaiserslautern-KOMPLETT
Year of Completion	*2008*	*1999*	*2006*	*1999*	*2009*
Number of connected inhabitants (normed daily wastewater load)	*370*	*350*	*4891*	*44*	*960*
Investment Cost (€/cap)	11.215,68	2.693,18	3.264,09	5.237,80	3.062,50
Operating Cost, incl. Revenues and Savings (€/cap*a)	189,50	143,21	124,99	108,53	458,29
Revenues from Electric Power, Nutrients etc. (€/cap*a)	4,30	12,00	3,36	10,00	n.a.

Investment Cost of the five NDSS vary from around 3.000 € per capita (for Flintenbreite, SCST and KOMPLETT) over around 5.000 € per capita for Vauban to around 11.000 €/cap for DEUS21. The high cost of DEUS21 is likely due to the innovative wastewater treatment plant of the project. The cost difference between Vauban and Flintenbreite, both of whom use a two-source-separating system, may be due to scale effects, but also to the fact that Vauban uses a membrane bioreactor and Flintenbreite a constructed wetlands for grey water treatment.

The operating costs of the NDSS vary from around 100 € up to 500 € per capita and year. Here, the outstanding project ist KOMPLETT with close to 460 €, the second most expensive being DEUS21 with 190 €. One possible reason for this divergence is that the costs for the operation of a NDSS are related to the amount of treated wastewater, and KOMPLETT was designed for a hotel with a large amount of greywater.

To illustrate the competitiveness of the NDSS, the cost parameters identified for these pilot projects must be seen in relation to the cost of the conventional gravity-based system. Therefore, Magazowski carried out a survey on the investment and operating costs of conventional centralized wastewater systems. Investment costs for these systems range

from from 200 up to 1300 € per capita and year, and operating costs are around 200 € per capita and year (Günthert 2001; Sander 2003; Institut für Abwasserwirtschaft Halbach 2003; BUWAL 2003; Herlyn 2007; Deutsche Vereinigung für Wasserwirtschaft 2009).

Per capita cost of conventional wastewater systems is strongly dependent on the number of connected users. That means that centralized systems are more expensive in rural areas (where their cost cannot be spread over so many users), and hence the competitiveness of NDSS is higher there.

Overall, investment costs for the NDSS are higher compared to the conventional system. This result seems plausible, probably mainly as a scale effect (Maurer 2013). Regarding the system operation, in some cases the operating cost of NDSS can be lower than that for the conventional system. That is mainly because of resource savings (above all: freshwater) and earnings from power and nutrient production of the NDSS.

In a next step, we carry out an overall cost comparison, based on the methodology of the (*Länderarbeitsgemeinschaft Wasser*, Working Group of the Federal German States on Issues of Water Management), which in essence is a dynamic cost calculation, constructing a discounted stream of payments, for the course of an assumed useful lifetime on infrastructural facilities (different for individual system components) (Länderarbeitsgemeinschaft Wasser 2005). Figure 2 shows the results. The horizontal axis shows the useful economic life of the system and the vertical axis shows cost per normed inhabitant and year. The read area of the figure pertains to data about the conventional centralized system, the green area to NDSS systems.

This comparson shows two things. First: Taking on a conservative perspective (disregarding resource savings and potential revenues generated), NDSS are not competitive at all with the conventional system. Second: The achievable earnings do not have a major influence on the competitiveness under given market prices. That means the operational cost advantage will not make up the extra costs for the investments within a treatment plant lifetime.

However, if we include these advantages and, in addition, if we perform a sensitivity analysis, allowing for a certain amount of technological learning to take place which reduces cost by 1,6% per year (resulting in a cost savings of 50% in 30 years), we see that „sewer parity“ can be reached within a few decades. (The term „sewer parity“ has been coined by Magazowski, in analogy to the term „grid-parity“ that is used for the cost of producing electric power from renewable energy sources. „Sewer Parity“ means that the costs for the NDSS user are not higher than the costs for the conventional system user). This sewer parity can be established without accounting for the external costs that can be saved by NDSS, i.e. the positive effects it can have in terms of nutrient, pathogen and pollutant emissions associated with the centralized system!

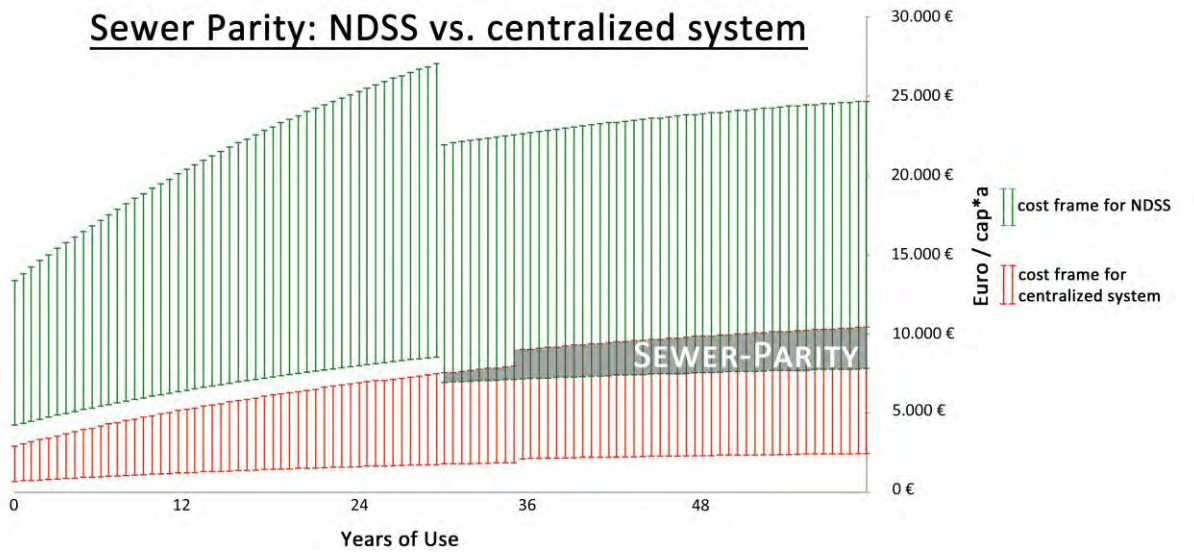


Figure 2: Sewer Parity of NDSS
Source: Own illustration

A possible conclusion from these findings is that the advantages of the NDSS have to be included into the cost comparison. Ignoring them would lead to counterproductive results.

5. A Pricing Scheme for a NDSS

Designing a pricing scheme for a technical service requires decisions on four issues. First, one needs to define the goal of the pricing scheme. Maximizing revenue? Minimizing the use of a resource? Taking into account what constraints? Secondly, one has to define different steps of the production process (here: wastewater collection and treatment) to be able to allocate incurred costs to these process steps. This is for the German context: to suffice legislation requiring a detailed cost accounting. More on this in the subsequent section. Thirdly, one needs to define criteria to which the payment of the price is tied (e.g., certain activities of the customer). Forthly and lastly, one has to decide upon the shape of the price function (linear, non linear... etc.). Below the authors will describe a possible pricing scheme for a hypothetical NDSS that is based on the project costs presented in the preceding section. By way of example, we choose an energy-focussed tariff („energy tariff“).

The hypothetical NDSS for which the tariff is constructed looks as follows. It is a two-source-separating wastewater system (black and grey water) for a new housing compound. The blackwater is mixed with organic kitchen and yard waste and transported by a vacuum sewer into a anaerobic digester. The grey water, after being sent to a pre-separator in a gravity-based sewer, is treated in a constructed wetland. If nessesary, the greywater can additionally be treated in a filtering system before it will be released into the river nearby. The rainwater is infiltrated into the ground by the user. In case of emergency it can be taken away by the operator or treated in the greywater filtration system (see Figure 3).

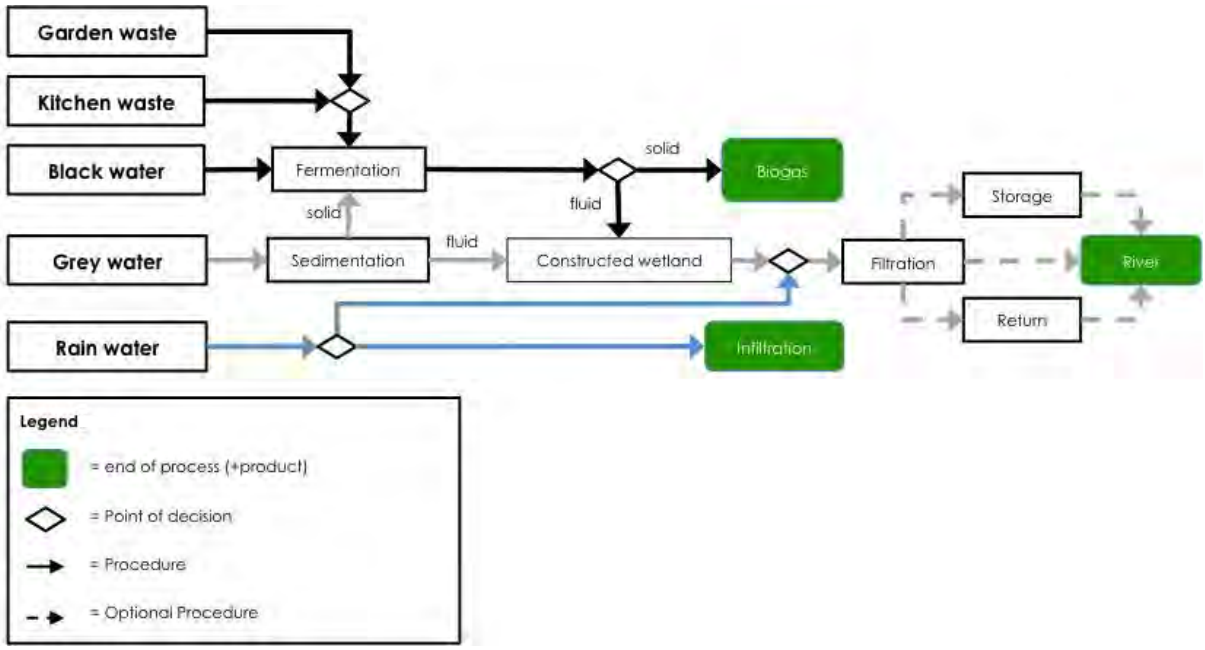


Figure 3: Structure of hypothetical NDSS which serves as illustration of a pricing scheme. Source: Own illustration

The main objective of the energy tariff is to convey the energetic value of the different wastewater sources to the user and to reduce the production of grey water. The constraint is cost recovery. The tariff consists of a separate and different charge for the individual wastewater sources. Different charges for the different sources are intended to give the user an incentive to treat wastewater sources bearing their energy resource values in mind. For example, black water is an energetically valuable resource much more so than grey water. Therefore, the charge for grey water production should be higher than the charge for black water production. Indeed, black water prodution receives a bonus, as we design the tariff. In other words, the „energy tariff" imposes a negative charge for energetically valuable sources and a positive charge for energetically inferior sources.

Such a pricing scheme asumes knowledge about the cost of the three main process steps of the hypothetic NDSS: Collection, transportation and treatment of the blackwater, of grey water and biological waste. The rainwater is not part of this consideration because of the obligation to infiltrate it into the ground. An exact cost allocation to these processes is not possible because the reviewed projects did not distinguish between the operating costs of treating the different wastewater sources. They just recorded the costs for the operation of the entire treatment system. Therefore we distribute the costs simply by weighting them – somewhat arbitrarily – due to the objectives of the tariff.

Regarding the definition of criteria to which the payment of the price is tied: That implies the NDSS-operator's knowledge about the technical water using and wastewater producing equipment. In case of the hypothetical NDSS, which will be implemented in a new housing compound, the operator may even have the possibility to decide with which technical facilities the new buildings are equipped. – Basically, a number of different criteria, or user activies, could serve the purpose. The decision if a criterion fits to the tariff is not only depending on its ojectives but also on the legal framework and technical requirements of the system components. Table 4 is showing the criteria / the activities for the energy tariff presented here.

Table 4: Criteria for the energy tariff
Source: Own illustration

Place of origin		Activity/ Event	Source	Criteria	
Bath	Shower	Open the water tap	Greywater	m^3	Flow rate
	Sink	Open the water tap		m^3	Flow rate
	Bidet	Open the water tap		m^3	Flow rate
	Toilet	Flush the toilet	Blackwater	NF	Number of flushings
Kitchen	Waste disposal unit	Waste deposit		kg	Amount of waste
	Washing machine	Machine start	Greywater	NMS	Number of machine starts
	Dishwasher	Machine start		NMS	Number of machine starts
	Sink	Open the water tap		m^3	Flow rate
Other	Yard	Rainfall	Rainwater	Obligation to infiltrate	

We designed the pricing scheme as follows:

The scheme has to just cover cost. The system operator does not make any profits. Cost includes investment cost and operating cost. For investment cost, we take the average investment cost of the five projects reported in the previous section. For operating cost, we do the same, and in addition include earnings from selling by-products: energy and nutrient products. We also include a learning curve effect of 1,6 percent per year. Operating cost is based on life spans as underlying the cost comparison we have reported on in the precedeing section.

The shown charges in table 5 are attached to different types of wastewater producing activities: toilet „flushing“, or emptying, starting the washing machine, starting the dishwasher, producing grey water through bathing and showering, and so on. The weighting of those activities to arrive a certain target operating cost (which is translated into price) is done somewhat arbitrarily; many combinations of weights and charges would reach the aggregate target number. We chose weightings that realized the intention of the energy tariff.

To concretize the activity-based criteria to which individual components of the energy tariff are connected, the authors needed to assume the frequency of these activites (number of times the toilet is emptied, the dishwasher is started, and so on). We used different studies for that purpose. (Peters 2002) report that users empty their toilets between 1800 and 3000 times a year. The amount of biological waste varies from 73 kg up to 264 kg per year and capita and is depending on the size of the yard. (Peters 2002; Friedrich 2001; Backes and Reichmann 2000; LUBW Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg 2010). The frequency of the dishwasher or washingmachine usage is around 100 times per capita and year for both (Stamminger 2006), (Stamminger and Goerdeler 2005), (Richter and Stamminger 2012).

Based on these figures, the price (or fee) for this NDSS is 327,02 € per year and capita. In the best case (taking the lowest identified cost of the five projects reported on above) the costs are 153,25 €. That means that the NDSS-cost range is roughly on par with the conventional system that charges up to 207,70 € per person and year in Germany. On average, the NDSS is around 55% more expensive than the conventional system. Given the advantages of NDSS, which we have not attempted to monetize, this additional cost could be seen as acceptable. In addtion, this 55% extra costs will be lowered by the prospective cost increase (around 30%) of the conventional system in some regions in Germany that will arise with the different challenges of wastewater management as described in section 2, e.g., demographic change (Umweltbundesamt (Hrsg.) 2010).

Table 5: Energy tariff fees
Source: Own illustration

				NDSS	Centralized	
Criteria resp. activities	**Unit**	**Assumptions**	**Weighting**	**Average**	**Mini-mum**	**Maxi-mum**
Number of water meters in the household	**Qn**	**1**	**60%**	196,21 €	8,88 €	68,41 €
Production of organic waste (kitchen, yard)	**Kg/cap*a**	**150**	**-2%**	-0,04 €		
Number of toilet flushings	**NF/cap*a**	**2400**	**-10%**	-0,01 €		
Number of washing machine starts	**NMS/p.a.**	**100**	**6%**	0,20 €		
Number of dishwasher starts	**NMS/p.a.**	**100**	**6%**	0,20 €		
Production of black water	**m^3bw/cap*a**	44,17	**-**		1,75 €	3,15 €
Production of grey water	**m^3gw/cap*a**	26,65	**40%**	2,18 €		
			Total	**327,02 €**	**85,98 €**	**207,70 €**

The main difference between the energy tariff and the conventional system pricing scheme is the ratio between the base price (tied to the number of installed water meters) and the variable price (tied to activities resp. litres of freshwater) and the charges connected to individual activities. The conventional system tariff is considering only drinking water consumption and the ratio between the base and the variable price is not reflecting the ratio of fixed and variable costs of the infrastructure grid. The conventional system is often priced via a a two part tariff, consisting of a low base price and a relativly high variable price (own research). The energy tariff, by contrast, contains different variable charges, tied to different activities, taking into account the proportion of the fixed versus the variable costs. Therefore the authors chose a two part tariff and weighted the base price with 60% of the system costs.

The NDSS tariff is considering various activities and setting incentives by charging them different amounts. To meet the goal of greywater reduction, the energy tariff levies a higher charge on greywater than the conventional tariff for the entire wastewater. On the other hand, the blackwater source is levied with a negative charge to signal the value of this source. In other words, users receive a symbolic amount of money when they flush their toilet or separate their organic waste.

6. Outlook: Could Such a Pricing Scheme Be Implemented in Germany?

Environmental resources like freswhater bodies, ecosystem services and environmental health (e.g., water quality in rivers and lakes) have long been recognized as deserving protection. In the last couple of decades, market-based environmental policy instruments have gained acceptance and are advocated as effective means to promote these environmental goals. The European Water Framework Directive of the year 2000 is a case in point. It stipulates the implementation of incentive-based tariff structures and a pricing of water resources based on their (not only market-) value. (European Council 2000)

This is – at least on the face of it – in conflict with German legal norms on the pricing of water services. In Germany, wastewater management is in the authority of municipalities, because this „business“ is seen as one that directly concerns the interest of the municipality: Its water resources. The German constitution guaranties a local autonomy to the municipalities which is concretized in various sectors, including waste and wastewater management. The German Federal states have so-called „Kommunalabgabengesetze“, that is laws on the fees that municipalities can levy, including fees on wastewater management. These fees have to obey a number of requirements, of which the three most important ones are:

a) Cost recovery: the municipality must not embark on activities that endanger its financial sustainability, and at the same time, must not make a profit from its citizens

b) A strict relation between the user's activity and the costs that these activity causes

c) Prohibition of differential treatment of same activities or like persons (*Driehaus Kommunalabgabenrecht Kommentar* 1989).

The reason for these laws is, in essence, the protection of private actors: of municipal residents (who are customers of muncipal technical services), against the might of the state, and of firms, who should not be put at a disadvantage against a mighty public player with a lot of financial resources backing him up.

Yet it is easy to see that especially (b) and (c) could stand in the way of a differentiated pricing scheme like the energy tariff. In addition these federal laws are defining what kind of expenditures might be eligible costs. As a result, one could be forced to formulate 16 different pricing schemes in 16 Federal States, for the same technical system with the same costs everywhere!

Furthermore, according to the system of these laws, every activity is causing cost. The principle of a user's activity causing benefits (by producing things of value: nutrients, energy forms ...) is not known by these laws. That means that a negative fee like in the energy tariff is out of reach, at present.

Apart from the norms governing the structure of fees for municipal services, municipalities have the right (and exert it) to connect each building to the centralized wastewater infrastructure. One can be exempted from this obligation but in such a case an alternative wastewater treatment must be guaranteed, often by an operator which is – so many municipal legal norms stipulate – the municipality itself.

In other words: Instalment and operation of an NDSS requires the municipality's consent. But the municipality is in a conflict of interest because every installed NDSS stands for users lost for the conventional system, making that conventional system even halawarder to operate. Thus, many municipalities are not interested in the implementation of NDSS.

Still, the challenges to conventional systems are obvious, and recognized by the German Water Association which also represents municipal operators as well as the water and wastewater industry. Modern forward-oriented municipal entreprises are beginning to embark on NDSS (Londong 2013). Viable pricing schemes – as the authors have tried to illustrate – will be part of the spread of such systems. The legal framework for pricing municipal services will have to follow suit.

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Effectiveness of Constructed Wetland Systems for Mitigating Water Contamination: A Review in a Tropical Climate

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Abstract

The ongoing urbanisation associated with increases in impervious surfaces in Bangkok has led to a high degree of contamination, increased water runoff, decreased water quality, and ecological degradation. As ecological and environmental issues have become more complex, sustainable solutions need to be incorporated to deal with the inherent complexity of urban issues. Constructed wetlands (CWs) provide a significant ecological service to mitigate contaminants from water discharge or other impacts and disturbance caused by urban development. These techniques use natural processes of plants and microorganisms to purify the water. This paper reviews recent research on constructed wetlands of tropical regions by drawing from peer-reviewed articles on the various practices. Also examined were existing urban issues, low impact approach practices, the potential of CWs for contaminant removal, and possible strategies for CWs implementation in Bangkok.

1. Introduction

Constructed Wetlands (CWs) are a crucial part of urban environments and play significant ecological roles in river catchments. They are recognised as a sustainable solution practice for water treatment before discharge to receiving rivers. The artificial complexes of CWs generally include water, medium, plants and the associated microbial communities designed to mimic the ability of natural wetlands to remove contaminants from water (Brix, 1997).

There has been concern that stormwater runoff from urbanised areas causes negative impacts on the aquatic ecosystem of receiving waters. In Bangkok, Thailand, runoff from impervious surfaces is one of the major causes of the impurity of urban receiving water and environments. Conventional stormwater drainage systems often direct runoff to impair streams and rivers, resulting in the degradation of ecosystem function.

Due to urbanisation along the Chao Phraya River and the intensification of industrial and agricultural development, the country currently faces the problem of river water quality degradation especially in the lower river where Bangkok is located (Greenpeace, 2011). Recent studies reported that the level of average Dissolved Oxygen (DO) and Biochemical Oxygen Demand (BOD) in the lower Chao Phraya River passing through Bangkok is unsatisfactory according to the surface water quality standard (Leerasiri, 2010; BMA, 2011).

The reduction of large retention areas and the increased level of impervious surfaces in a catchment associated with the contamination of water runoff particularly from hot spots such as residential, agricultural and industrial areas, roads, and parking lots significantly degrades urban water quality and has adverse effects upon the aesthetics of natural areas and urban environments. The rapid urbanisation during recent decades has led to the conversion of various canals and ponds to streets and roadways (BMA, 2009). The agricultural areas have been changed into housing and industrial estates in the catchment basin (Prajamwong &

Suppataratarn, 2009). The increased imperviousness and the degree of catchment development led to a high degree of contamination, an order of magnitude change in volume and rate of discharge to receiving waters particularly in the rainy season (Marome & Asan, 2011). Without appropriate stormwater management strategies, the impacts on the health and aquatic ecosystems of receiving waters can be devastating.

A decentralised approach, such as a low impact approach to stormwater management, may provide more sustainable solutions to stormwater management if applied at a catchment scale. This approach enhances the potential for runoff reduction and pollutant removal through retrofitting the hydrological regime in association with various green facilities including constructed wetlands (CWs). Restoring the natural hydrologic regime is an essential component of sustainable development in urban landscapes.

The role of CWs to provide for improved water quality has been demonstrated in several studies. A number of CW techniques are well described in the literature and a number of case studies have been published. In tropical countries, constructed wetlands are used for treatment of urban runoff (Wang et al., 2011; Lai & Lam, 2009; Sim et al., 2008; Sim, 2007), mine runoff (Kantawanichkul, 2010), and agricultural runoff (Sim et al., 2010). CWs have also been extensively used for treatment of sewage (Rai et al., 2013; Wang et al., 2011; Rivas, 2008; Brix et al., 2006; Lim et al., 2001; Juwarkar et al., 1994), polluted river (Jing & Lin, 2004; de Ceballos et al., 2001), agricultural wastewater (Wu et al., 2010; Kantawanichkul et al., 2003; Lin et al., 2002), industrial wastewater (Khan et al., 2009), and landfill (Akinbile et al., 2012; Sim et al., 2012). The incorporation of CWs into urban water management is desirable for urban sustainability.

The aim of this study is to review recent advances of CWs systems including their ability to reduce water contamination in a tropical climate by drawing on peer-reviewed articles on the various practices. The findings were drawn with areas in Bangkok to promote environmental quality improvement. As the function of wetland treatment systems is related to the environmental conditions, this study focuses on the tropical region. The primary information on existing urban issues, low impact approach practices, the potential of wetlands for contaminant removal, and possible strategies for the implementation of CWs in Bangkok were addressed.

2. Land use driven water quality issues

During the last three decades, Bangkok has experienced a rapid economic growth and extensive industrial development (Indhapanya, 2007). The development of manufacturing has resulted in a large-scale influx of new inhabitants, creating a demand for water resources and subsequently generating a large amount of wastewater. The water quality of the lower Chao Phraya River has continued to decline. The main sources of water pollution in the river are mostly generated from domestic waste flowing through high-density urban areas (Tonmanee & Kuneepong, 2004).

Economic development and uncontrolled land use change are likely to impact loss of natural areas. The pattern of urban growth in Bangkok has been shifted from agricultural to residential land use (Swangjang & Iamaram, 2011). During the last decades, urban population has increased steadily on the eastern and northern part of Bangkok, while the sprawl on the western part has primarily caused the loss of agricultural land (Perera, 2006).

Agricultural areas have been converted mostly into industrial and residential developments (Ann Marome, 2013; Srisawalak-Nabangchang & Wonghanchao, 2000).

Intensification of economic activities has accelerated the urban sprawl in the city. In the suburbs, around 75% by area has been used for industrial and commercial activities, given the deterioration in water pollution in the outer areas. The remaining 25% of the land has been identified as residential areas (Perera, 2006; Tonmanee & Kuneepong, 2004; Srisawalak-Nabangchang & Wonghanchao, 2000). The inner area continues to be the main employment zone (Perera, 2006), while the outer areas have been generally influenced by private developers as a result of ineffective land use planning in the past (Perera, 2006).

The rapid population growth, expansions of industries and housing estates, and ineffective urban land use planning have exacerbated the water quality issues in Bangkok. Ineffective land use planning has contributed to uncontrolled horizontal expansion of the urban area. The expansion of impervious surfaces often prevents rainfall infiltration into the soil, challenges the drainage capacity of natural waterways and canals, as well as accumulating stormwater pollutants to impair water quality in the Chao Phraya River.

3. Water quality issues in Bangkok

Thailand entered a period of rapid economic growth since 1957, resulting in a large increase in the number of immigrants and commercial activities in Bangkok. Currently, the wastewater effluent discharge in Bangkok - roughly 2.9 million cubic metres per day - is generated from domestic uses up to 75% and from industrial and commercial uses around 25% (Leerasiri, 2010; BMA, 2011; ADB, 2012; Suriyachan et al., 2012). The rapid changes of urban population associated with an inadequate and inappropriate water management system have contributed to the discharge of untreated water into rivers.

Recent studies reported that average dissolved Oxygen (DO) in the lower Chao Phraya River which runs through Bangkok and in Bangkok canal water was only 1.1-2.6 mg/l (Leerasiri, 2010), while Biochemical Oxygen Demand (BOD) exceeded 6 milligrams per litre (BMA, 2011). This rate is still unsatisfactory according to the surface water quality standard class 4 which means fairly clean fresh surface water resources, but requires special treatment process before consumption. This condition points out that the water quality in the river needs to be improved.

Organic pollutants from household wastewater have become the major source of water deterioration in the lower Chao Phraya River. It was found that sewerage systems and onsite sanitation system (OSS) in Bangkok are the main sources of nitrogen flow for grey water and black water respectively (Buathong et al., 2013) as primary wastewater treatment systems or septic-seepage tanks have mostly been used in households (MPH & MNRE, 2012).

Central wastewater treatment plants are also inadequate in Bangkok and improvements in wastewater treatment facilities require very high investment. Although seven central wastewater treatment facilities have been constructed in Bangkok, they do not cover the whole area and still have limitations. ADB (2012) reported that wastewater treatment plants in Bangkok cover only 20% of the Bangkok area, serving about 54% of the residents or slightly more than 3 million people. Insufficient wastewater treatment facilities for domestic wastewater have resulted in high organic pollutant loads and lower dissolved oxygen than

the water quality standards in the lower Chao Phraya River.

In 1999, a Master Plan on Wastewater Treatment in Bangkok was introduced by Japan International Cooperation Agency (JICA) in 1999. Central wastewater treatment projects were planned to operate to cover 20 zones in Bangkok, of which five Central Wastewater Treatment Plants are planned for construction in middle and outer zones of Bangkok in the near future. These projects will cover an area of 172.03 square kilometers and have a water treatment capacity of 773,000 cubic meters per day (Leerasiri, 2010).

Currently, septic tanks or on-site treatment systems have been applied as a common pretreatment practice in urban and suburban communities in Bangkok. These systems are now required to be installed in individual or private houses, while groups of houses are required to use community wastewater treatment plants (Suriyachan et al., 2012). Currently, there are 7 central and 12 community wastewater treatment plants in Bangkok, which is still insufficient due to overall capacity of wastewater treatment representing only 1 million cubic meters or one-third of the total wastewater per day (Leerasiri, 2010; Simachaya & Yolthantham, 2010; Suriyachan, 2011; Suriyachan et al., 2012). Inadequate management of wastewater can be a threat to both the environment and human health.

The capacity of the interceptor system in Bangkok was set at 5 times of the average Dry Weather Flow (DWF) to remove discharges. However, the flow in the channel system during the rainy season can exceed 25 times of the average DWF (Leerasiri, 2010). Although the excess stormwater will be screened before discharge to the canals, the flows may exceed the capacity of the interceptors during a heavy rainfall event. In this case, the impacts on and health and aquatic ecosystems of receiving waters can be devastating.

4. Low impact approaches to stormwater management: Current practices in Bangkok

Green practices such as low impact approaches to stormwater management, which adapt the principle of restore, reduce, reuse, and recycle of water, have been promoted extensively in several regions, especially the United Stated, Canada, Australia, New Zealand, and parts of Europe. Low impact approaches emphasise the use of holistic and long-term methods to provide sustainable urban stormwater management (EPA, 2013).

Low impact approaches can be regarded as an integral part of green infrastructures. The practices of LID with various green facilities including porous pavement, infiltration trenches, detention ponds, use of vegetated swales, and constructed wetlands (CWs) have prevailed. These operations provide benefits to stormwater management in terms of minimising the surface runoff and improving water quality. Vegetation aids in flood protection as it acts as a sponge that captures and absorbs rainfall in the ground, and assists in enhancing infiltration and evapotranspiration (ARC, 2003). Vegetation maximises opportunities for stormwater infiltration at source, stores runoff contaminants in catchments, and vegetates catchments with indigenous vegetation counterweight receiving river degradation (van Roon, 2005).

In Thailand, it has also been widely recognised that water resources management has been implemented by a number of Royal Projects over the past 40 years (World Bank, 2011). The application of detention ponds for storing and treating stormwater as well as flood protection is relatively widespread. The Monkey Cheeks Project (Kaem Ling Project) was introduced by

His Majesty the King Bhumibol Adulyadej in 1995 to provide stormwater detention systems for mitigating stormwater issues of Bangkok and other cities (Suksawang, 2012).

To resolve water quality issues in Bangkok, several water treatment projects have been introduced including the Makkasan Pond Royal Project and the Rama IX Pond Royal Project. The natural mechanisms have been applied through a number of Royal Projects to clean up water in canals. The native plants particularly Water hyacinth, Umbrella grass (*Cyperus Corymbosus Rottb*), Elephant grass (*Typha angustifolia Linn*), Cogon grass (*Imperata cylindrica),* Coastal grass (*Sporobolus virginicus*) and Indonesian Vetiver grass have been used as natural water filtration for absorbing pollutants including organic materials, chemicals, lead and suspensions in canals, ponds and rivers (BMA, 2011).

The Makkasan Pond, a 36-acre pond situated in central Bangkok and known as the city's kidneys, has been used to treat polluted water from the Lat Phrao Canal and adjacent communities, with the capability of efficient collecting and treating wastewater in Bangkok around 260,000 cubic meters per day. In the past, polluted water from surrounding areas, including wastewater from more than 700 slum households adjacent the pond and used lubricants from the Makkasan railway work shop, was drained into the Makkasan Pond. His Majesty emphasised the urgent need to restore and clean up the Makkasan Pond in 1985 by using water hyacinths as a natural water filter. Later on when the expressway was built and reflected sunlight away from the pond surface, Chaipattana Aerators were installed in the pond to increase the water oxygen levels and to support the water hyacinths and microorganisms in treating wastewater. The Makkasan Pond Royal Project has been adopted by the Bangkok Metropolitan Administration to plant 20,000 clusters of Vetiver grass in 2007 in order to create a natural wall in the pond and to protect landslides, absorb nutrient and heavy metals, and catch sediment covering an area of 440 square meters (BMA, 2011).

The Rama IX Pond has been used to collect and treat dirty water from the Lat Phrao Canal. Several aerators have been set up to further increase the potential of water treatment. Rama IX Pond Royal Project is now able to treat wastewater around 28,000 cubic meters per day (BMA, 2011).

The Chaipattana Aerator, the ninth aerator patented in the world, was initiated by the King and received five honors at the Brussels Eureka 2000: 49th. World Exhibition of Innovation. An important feature of this aerator is its ability to accelerate the natural water treatment process through enhancing the proficiency of decomposition process by microorganisms. Currently, this technique has been applied extensively by BMA in canals and several ponds in public parks throughout Bangkok to increase the level of oxygen in the water (BMA, 2011).

The canal water quality has been improved during last 2 decades through several aerator systems to oxygenate the water in canals. Water from the Chao Phraya River is commonly pumped to the canals during the dry season. The water is then treated and pumped back to the river from Phra Khanong Pumping Station, located at downstream of the Chao Phraya River (Leerasiri, 2010).

However, it is apparent that the application of CWs is relatively new and not widely used in Bangkok. Thus, in order to reduce contaminants entering rivers and streams, the application of CWs may significantly reduce the load of stormwater contamination and combined sewer overflow (CSO). Treated stormwater also allows for the minimisation of demand for

water supply as it can be used for various non-potable purposes.

5. Constructed wetlands (CWs)

5.1 Definition and Functions

Constructed wetlands (CWs) are artificial wetlands consisting of saturated or unsaturated substrates; emergent, floating or submergent plant species; and a number of microbial communities for purifying effluents such as wastewater, stormwater runoff, and other ecological disturbances. CWs can be classified into two major types: Free Water Surface (FWS) systems with shallow water depths and subsurface flow (SF) systems with water flowing down through the sand or gravel. Free water surface (FWS) wetland is comparable to natural wetlands, with shallow water flowing above saturated soil substrate. Polluted water can be treated by sedimentation, filtration, oxidation, and precipitation processes (Vymazal, 2013). The systems generally contain a subsurface barrier of clay or impermeable material to avoid seepage, soil surface to support the emergent plants, and water at a relatively shallow depth of less than 6 cm deep (Saeed & Sun, 2012). Subsurface Flow (SF) systems typically comprise a channel with impervious material to avoid seepage; soil to support the growth of emergent plants; and rock, gravel or crushed stone media to purify water during the contact with surfaces of the medium and the roots of the vegetation (Polprasert, 2004). Subsurface flow CWs can be further classified as vertical flow (VF), and horizontal flow (HF) systems, which are generally more effective than the free water surface (FWS) systems in regard to mass pollutant removal (Saeed & Sun, 2012). A combination of HF and VF systems, known as hybrid systems, provides advantages in complementing processes in each system for the treatment of wastewater. This system also enhances nutrient removal through aerobic and anaerobic processes.

CWs are an effective stormwater treatment measure to achieve removal of soluble contaminants such as nutrients, suspended sediment and associated contaminants. The systems apply a combination of physical, biological and chemical processes in removing stormwater contaminants. CWs have demonstrated effectiveness in reducing runoff and pollutant loads at all site scales. Existing studies provide evidence that CWs promote a sustainable stormwater management strategy with the potential to minimise both water quantity and water quality issues. However, although several CW practices have been demonstrated, there are few cases in tropical regions of prevalent implementation at a catchment scale with the clear objective to protect and restore receiving waters.

5.2 The Performance of Constructed wetlands (CWs)

The performance of CWs on contaminant removal is significant. Primary treatment mechanisms of CWs include sedimentation, chemical precipitation, adsorption, microbial interactions, and uptake by vegetation (Polprasert, 2004). CWs are efficient for nutrient removal in treating various wastewaters, particularly sewage, urban and agricultural runoff.

Plants affect the organic removal efficiency by supporting the microbial community, and by accumulating media due to the high degree of transpiration (Brix, 1997). Plants in a CW provide the main advantages including increasing the growth of microorganism biofilm and aerobic bacteria, and up-taking pollutants (i.e. N, P, and heavy metals) from wastewater.

Plants also have a great potential for runoff removal through transpiration. Water losses to the atmosphere through evapotranspiration can be high under tropical conditions. Some wetland plant species, particularly cattail and reed provide high degrees of nutrient removal, making them suitable in treatment wetlands. In Thailand, the most commonly used of emergent plants in CWs are cattail (*Typha latifilia*), bulrush (*Scirpus lacustris*) and reed (*Phragmites australis*) (Brix, 1993).

Wastewater treatment efficiency in CWs is typically measured based on the capacity of pollutant removal in inlet and outlet. The pollutants generally include biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), nitrogen (TN) and total phosphorous (TP). Plants commonly used in tropical CWs include *Typha, Phragmites, Cyperus, and Scirpus*. Several types of CW systems have been tested for treatment of contaminated waters under various conditions in tropical countries. Several authors illustrated that there is a difference in treatment efficiency in plant species.

In the pilot scale carried out in Malaysia, Akinbile et al. (2012) found that *Cyperus haspan* with sand and gravel base substantially reduced concentrations of pollutants in leachate from Pulau Burung Sanitary Landfill (PBSL) compared with un-vegetated filters in the sub-surface CWs. During 3 weeks retention time, the highest removal efficiencies of *C. haspan* for TSS, COD, BOD5, NH3-N, TP, TN, Fe, Mg, Mn, and Zn were 98, 92, 79, 54, 99.7, 67, 59, 75, 71, and 89%, respectively.

In Vietnam, a pilot scale horizontal subsurface flow constructed wetland planted with *Phragmites* was tested on river sand based systems for purifying municipal wastewater. The overall nutrient removal efficiency of the system was 86–95% for TSS, 65–83% for $BOD_{5,}$ 57–84% for COD, 16–84% for TN, and 72–99% for TP (Trang et al., 2010).

In Sri Lanka, Jinadasa et al. (2008) reported higher pollutant removal BOD, nitrate, ammonium, phosphorus, total suspended solids, and fecal coliforms in a free water surface CWs planted with *Typha angustifolia* and *Scirpus grossus* in treating effluent from domestic wastewater. However, the performance of pollutant removal was not significantly affected by plant species.

In Brazil, a study on a subsurface horizontal flow constructed wetland for treating effluent from a natural *Typha spp* wetland to purify polluted river has been conducted under the tropical semi-arid region (de Ceballos et al., 2001). The authors described that CWs vegetated with *Typha spp* rhizomes with stone gravel based system provide a good reduction of organic load: 74-78% BOD5; 58-82% ammonia; 90% FC; 94–98% FS; and 92–96% coliphages and bacteriophages, at the best results on a retention time of 10 days.

Chua et al. (2012) compared the ability a floating wetland systems (FWS) planted with different plants: Vetiver grass*, Typha angustifolia,* and *Polygonum barbatum* to remove nutrient contaminants in the baseflow to the reservoir in Singapore. The results revealed that the removal efficiencies for *Vetiver, Typha* and *Polygonum* were 40.8, 67.5, 7.8% for TN, and 19.1, 39.2 and 46.0% for TP, respectively.

Success of on-site sewage treatment with a sub-surface flow constructed wetland planted with six macrophytes: *Typha latifolia, Phragmites australis, Colocasia esculenta, Polygonum*

hydropiper, Alternanthera sessilis and *Pistia stratoites*, has also been demonstrated in India. Removal efficiencies of 90, 65, 78, 84, 76 and 86% for BOD, TSS, TDS, NO_3–N, PO_4–P and NH_4–N, respectively, were achieved at a retention time of 3 days (Rai et al., 2013).

In Colombia, Caselles-Osorio et al. (2011) experimented with *Eriochloa aristata, Eleocharis mutate* and unplanted systems on removal of pollutants from septic tank effluent in a pilot-scale SSFW at a hydraulic retention time of approximately 3 days. The authors found that all vegetated wetlands exhibited more efficient removal of COD, ammonia, total phosphorus, and total and fecal coliforms than un-vegetated units. In planted systems, the removal efficiencies were >75% for COD, 69% for ammonia, 85% for total phosphorus, and 96% for fecal coliforms.

Attempts are also being made to combine subsurface horizontal flow bed with vertical flow bed with *Scirpus* to treat agricultural wastewater in Thailand (Kantawanichkul et al., 2003). In general, the removal efficiencies of both subsurface horizontal flow bed and vertical flow bed were comparable. With a hydraulic loading rate of 3 cm/d, a maximum of dissolved phosphorus removal was obtained at 97–99% (1.1–1.4 g/m2.d), while mass removal rates for SS and fecal coliform bacteria achieved 98–99%. With a hydraulic loading rate of 6 cm/d, BOD, TP, SS and FC achieved 90–99% removal efficiency.

Common Reed *Phragmites* and Tube Sedge *Lepironia* was tested in Putrajaya constructed wetland, Malaysia, for purification of stormwater runoff from agricultural activities from an upstream area. The performance of six wetland systems has been reported to remove 82% for total nitrogen, 71% for nitrate–nitrogen and 84% for phosphate, respectively. This wetland was designed for treating stormwater runoff before entering Putrajaya Lake, and using as flood control and for recreational activities (Sim et al., 2008).

Dan et al., (2011) compared the ability of horizontal subsurface flow systems and saturated vertical downflow systems for the treatment of high-strength wastewater from a mixture of domestic and pig farm wastewater in Vietnam. The results revealed that vertical downflow systems (VF) with *Sesbania sesban* provided higher pollutant removal than horizontal subsurface flow systems (HF). At a hydraulic loading rate of 160 mm d^{-1}, removal efficiencies for TN, NH4-N, COD, BOD and TP in the VF system were 85, 88, 68, 72, and 92%, respectively.

Sohsalam et al., (2008) demonstrated the capability of a surface flow wetland planted with the six-wetland plants in Thailand, *Cyperus involucratus, Canna siamensis, Heliconia spp., Hymenocallis littoralis, Typha augustifolia* and *Thalia deabata J. Fraser*, to remove pollutants from seafood processing. The authors reported that units vegetated with *C. involucratus, T. deabata and T. augustifolia* significantly outperformed units with other species at a hydraulic retention time of 3 days. The removal efficiencies of BOD5, SS, TN and TP were 91–99%, 52–90%, 72–92% and 72–77%, respectively.

The potential for application of CWs in the tropics is substantial. CWs enhance the potential for pollutant removal through retrofitting the hydrological regime even in highly urbanised areas. CWs have been widely used in many tropical countries, particularly in Malaysia, Thailand, Singapore, India, Taiwan, Mexico, and Brazil. The review of CWs identified several macrophyte species used in tropical regions. The three most frequently used are *Typha*

spp., *Phragmites spp.,* and *Cyperus spp*. However, there is no clear pattern in the use of particular species for treatment of a particular type of wastewater or stormwater runoff. Most CWs are typically planted with several species.

6. Potential for CWs implementation in tropics and Bangkok

CWs seem to be a promising practice as they provide high performance in reducing pollutant loads and demonstrate a good efficiency for improving water quality in several tropical countries. Results of various studies indicated that CW systems in the tropics could provide significant removal of organic matter, nutrients, and bacteria from contaminated water before discharge to rivers. The treatment ability of CWs is estimated to be greater in tropical regions due to the high temperature and the high rates of microbial activity. The tropical climate is conducive to greater biological activity and there is a diversity of plant species that can support the performance of CWs.

CWs provide a comparative benefit over conventional techniques, as they are low cost, environmentally sound, energy efficient, easy to operate and maintain, and promote the conservation of water and nutrient resources compared to end-of-pipe or traditional systems. Substantial cost savings of CWs are feasible in terms of long-term operation and the cost of maintenance.

CWs are a potential alternative or supplementary system for wastewater and stormwater treatment. As wastewater treatment facilities in Bangkok are still insufficient, wastewater can be a threat to both human health and the environment through water runoff. The application of CWs and reclaimed water may significantly reduce the load of combined sewer overflows (CSOs) in Bangkok. Moreover, well-designed and well-operated CWs may achieve high removal of nutrients such as nitrogen and phosphorus from domestic and agriculture effluents.

These systems also provide practical methods for reclamation of urban runoff through converting an urban nuisance into a valuable water resource. The reclaimed water can be used for irrigating landscapes, groundwater recharge. In addition, the avoidance and minimisation of suspended particulates and other pollutants within runoff improves water quality before the runoff reaches downstream areas. The application of CWs and reclaimed water may significantly reduce the stormwater runoff in Bangkok.

However, stormwater runoff in Bangkok may convey mixed inorganic and organic pollutants and the prevalence of contaminants from wastewater, may cause a reduction in wetland treatment efficiency. Sustainability may not be achievable when these approaches have limitations to maintain river and stream ecosystems, for instance, if pollutant loads exceed the capacity of these facilities. The tropical macrophyte species and type of contaminants to be treated should be considered in the design.

Additionally, mosquito control is one of the limitations of CWs in Bangkok. The numbers of mosquito larvae in CWs under the tropical climate could be increased over the dense mats of grass or dead plants. However, the density of mosquito larvae could be decreased through maintaining at minimum 30 % of open water, planting various macrophyte species without invasive plant species, and increasing macroinvertebrate biodiversity (Greenway &

Chapman, 2003).

Insufficient land area for CWs is also a concern. As land may be limited in Bangkok areas, it seems to be a feasible alternative in medium density areas but may not be suitable in the high-density areas where a large area is required to store and infiltrate stormwater runoff. However, CWs may be suited to communities where open space surrounding public places is still adequate.

7. Conclusion

CW techniques use natural processes of plants and microorganisms to purify the water. The systems may promote stormwater runoff reduction, restore habitat for native and migratory birds, and encourage the reuse of the treated effluent for agricultural practice in Bangkok. Existing limitations to adoption of CWs for water treatment in Bangkok may include insufficient knowledge and experience with CW systems and knowledge of tropical plant species, large land supplies, and prevalence of contaminants in wastewater and stormwater runoff. Thus, these alternative approaches need to take account of sensible investment, local based applications, and environmentally friendly techniques. Cost-effective operation of excess biomass and regular harvest should be well considered before applying the system. Mosquito control should be incorporated in the CW design and operation in order to reduce public health risks. Moreover, environmentally friendly and reliable system analysis is important to implement CWs in the region.

The practice of CWs on a catchment scale through localisation of stormwater runoff in upstream parts of the catchment will be important to downstream improvements and improve ecosystem sustainability. CWs may be an essential practice for responding to the urgent need for improving and monitoring water-quality and wastewater treatment in Bangkok. As the climate changes, extreme weather events with more heat waves, droughts, and floods are expected to be more frequent and intense in the tropical region, the practice of CWs is important to minimise these impacts and will lead to improvements in sustainability within urban environments.

8. Future considerations

Although the large numbers of CWs have been applied in Europe and North America for the treatment of water, these CW strategies might not be able to directly transfer to tropical conditions. Thus, particular research and appropriate approaches based on local considerations toward this technology are significant. Coordinated multidisciplinary practices by urban planners, scientists, and engineers are also necessary for implementing CWs in tropical countries. Further research is needed to identify tropical CWs in relation to their capability in local climatic environments and for a variety of pollutants in urban land use.

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What Makes Implementation Happen? Can We Fool Mother Nature and Atone for Our Past Sins? Lessons Learned from an Urban Revitalization Plan for a Flood Prone Office Park

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Synopsis
This paper is based on an exploratory case study that describes the process of developing an urban area revitalization and transportation improvement plan and then explores and analyzes the connection or conflict between applied planning research and its implementation over the period of six years.

1. Introduction

This paper seeks to answer questions that many planning practitioners ask all the time: What are the attributes of an urban revitalization plan that enable it to be accepted by community stakeholders and successfully implemented? What are the key barriers to plan implementation? Are community engagement and scientific research critical components for plan success? This paper is an exploratory case study that describes the planning process for an urban revitalization plan completed six years ago for a flood prone office park, then analyzes its implementation and outlines lessons learned.

Plenty of literature is available on watershed-based planning (see EPA, 2014) and sustainable land use planning principles (see Brabec, 2009; Plummer et al, 2011). A revitalization plan using these principles was completed in 2008 by Temple University's Center for Sustainable Communities (CSC) for a severely flood-prone office park complex built on a marshland with a poorly organized transportation system, located in the Philadelphia metro area, USA. The project team included urban planners, policy analysts, GIS analysts, architects, landscape architects, civil and environmental engineers, transportation engineers, and photogrammetric service and topographic survey professionals. The primary purpose of this project (2006-2008), was to examine and recommend flood hazard mitigation and transportation improvement alternatives. Using GIS and mathematical modeling, the project team evaluated hundreds of stormwater control measures, including a few large flood control projects, and various transportation options. The project team created a revitalization plan that included recommendations for constructing stormwater infrastructure and other projects, relocation of flood-prone buildings and roadways through use of sustainable land use planning tools including a Transfer of Development Rights (TDR) scheme, and the creation of a mixed-use overlay district on higher grounds.

Now, six years later, we evaluate the implementation of the plan by interviewing community and municipal officials, engineers, and stakeholders. While many recommendations have been successfully implemented, others have languished. Through a series of semi-structured interviews, electronic communications, site visits, and document reviews, we seek to explore, identify, and discuss the key reasons for the acceptance or rejection of different elements of the plan. We identify planning strategies and tools that had a positive or negative impact on implementation. Finally, we present lessons learned that may be generally applicable in other areas and relate these lessons to current planning theory and practice.

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2. Background

Many scholars have criticized the implementation gap and questioned the values of plans when not implemented (Talen, 1996; Berke et al., 2006). Implementation of plans often can be challenging. In perhaps the most famous book written about implementation, Pressman and Wildavsky (1973) wrote that it is often discussed, but poorly understood. The authors concluded that even under the best of circumstances implementation can be exceedingly difficult. Often plans go nowhere and simply collect dust on shelves. The reasons are many. Plans sometimes are completed without sufficient detail to enable implementation. They often present vague recommendations or "wish lists" of proposed actions without a viable implementation strategy. Some lack analytical rigor and do not offer sufficient technical basis to support successful implementation.

In addition to the issues or weaknesses of the plans themselves, implementation of the best conceived plans can be thwarted by various factors such as political fragmentation. In order to implement specific actions, multiple actors from federal, state, and local levels can delay and hamstring the process. Elected and appointed decision makers often change as well as local priorities. Funding opportunities come and go, and often don't sync well with the planning process. Sometimes plans fail because the timing is wrong. Cohen, March, and Olson (1972) pointed out the importance of the right decision makers, funding streams, and political support syncing at the same time. Similarly Kingdom (1995) noted the strategic importance of the simultaneous "joining together" of problem recognition, potential solutions, and politics.

Planning literature suggests two conceptions of success in plan implementation: performance-based and conformance-based (Laurian et al., 2004; Berke et al., 2006). While conformance-based approach focuses on the blueprint or direct linkages between plans and actual development, the performance-based approach considers planning as a process that guides for future decisions (Laurian et al., 2004). Comparing these two approaches Berke et al. (2006, p. 581) stated, "if implementation is defined and measured in terms of conformance, plans and planners have an important influence on implementation success. Alternatively, if implementation is defined and measured in terms of performance, plans and planners are less influential in implementation".

This case study explores the performance-based implementation approach which has not been featured in most implementation-related literature. Instead of identifying a blueprint or zoning template for the office park, the CSC offered a series of recommendations that could be adapted over time to meet desired outcomes (reduced flooding and urban revitalization). The Philadelphia region is characterized by a high level of political fragmentation and decentralization. The Sandy Run watershed also contains multiple municipal jurisdictions, requiring bargaining and negotiation among the parties. In the CSC's opinion, a blueprint type plan was too static to be a viable strategy for successful implementation in this political environment.

Duerksen et al. (2009) recommended that in order to successfully implement a plan, local governments need an effective strategy that is prioritized, politically or financially realistic, time sensitive, accountable, and understandable to citizens. The authors discussed a range of implementation tools addressing the location of development, scale, quality, and character of development, impacts of development, and equity issues. Among those, tools that are relevant to this case study are zoning and subdivision regulations, land acquisition, transfer of development rights (TDR), design and parking standards, form-based standards, natural resource protection overlays, taxing/benefit/assessment districts, and property purchase and eminent domain.

3. Study Area and Challenges in 2006

Originally built on a marshland in the late 1950s and early 1960s, the 536-acre Fort Washington Office Park (Office Park) is located in Upper Dublin Township, Montgomery County, Pennsylvania. It is a major employment center in the area, but its success has been hindered by recurrent flooding, a poorly organized transportation system, excessive impervious surfaces and stormwater runoff, and lack of identity or sense of place.

The Office Park is within the 14 square-mile Sandy Run Creek watershed that drains portions of four municipal townships. The watershed consists of Sandy Run Creek and its tributaries – Pine Run, Rapp Run, and Bodenstein Creek. A large percentage of the Office Park lies within 100-year floodplains. As a result, 16 buildings and many roads such as Virginia Drive – the Office Park's primary thoroughfare – are prone to extreme flooding. Flooding has led to loss of life, property damage, high vacancy rates, and damage to paved surfaces in the park. The watershed is almost built out. The Flood Insurance Rate Maps (FIRMs) for the watershed prior to this study were developed in the 1970s and hence, did not reflect development that occurred since that earlier watershed analysis. Research indicated that the precipitation values widely used in previous studies to develop FIRMs were no longer valid because they systematically underestimated extreme precipitation events (Meenar, 2006). The floodplain maps prior to this study were therefore outdated in most part of the watershed.

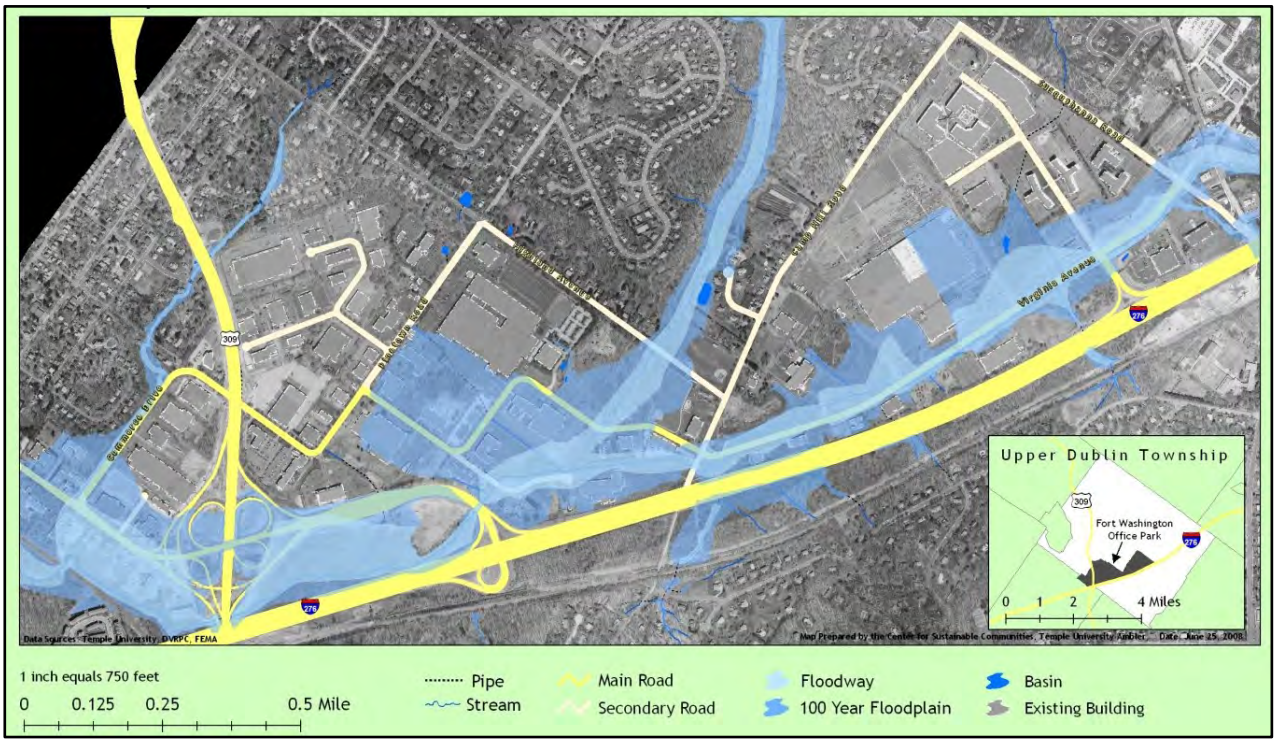


Figure 1: The Office Park and the floodplains

Streets within the Office Park have been built without regard to environmental conditions or travel efficiency. This is largely due to lack of planning. Virginia Drive is notorious for its unsafe, 90-degree turns. A slip ramp constructed to facilitate traffic exiting from the Pennsylvania Turnpike into the Office Park has adversely impacted local traffic. There is little in the park to encourage non-car travel. Pedestrian paths are seriously lacking, particularly between the park and the regional rail station. The overall design of the park discourages use of existing public transportation options.

4. Development of Visions and Plans

The CSC study and redevelopment plan (2006-2008) used an integrated analytical approach that incorporated sustainable development principles. The first component of the approach focused on watershed-wide flood mapping and stormwater improvement analysis, funded by US Federal Emergency Management Agency (FEMA) and local municipalities. The second component was focused on the Office Park redevelopment plan (plan). This study was completed after the CSC was awarded a contract through a competitive proposal process.

The plan was guided by a set of principles derived from two Charrette Workshops, conducted in 2006 and 2007. These workshops involved local stakeholders in the design process. It also drew from literature on sustainable and low impact development and a case study analysis of sustainable office park redevelopment. The principles of the plan were to reduce flooding risks to persons and properties, to improve connectivity within the office park and community, to restore the ecological functions of the natural environment while providing for public amenities, and to enrich the sense of place. Here is a brief description of five key components of the CSC study and plan, completed in 2008. More details can be found in Mandarano (2010).

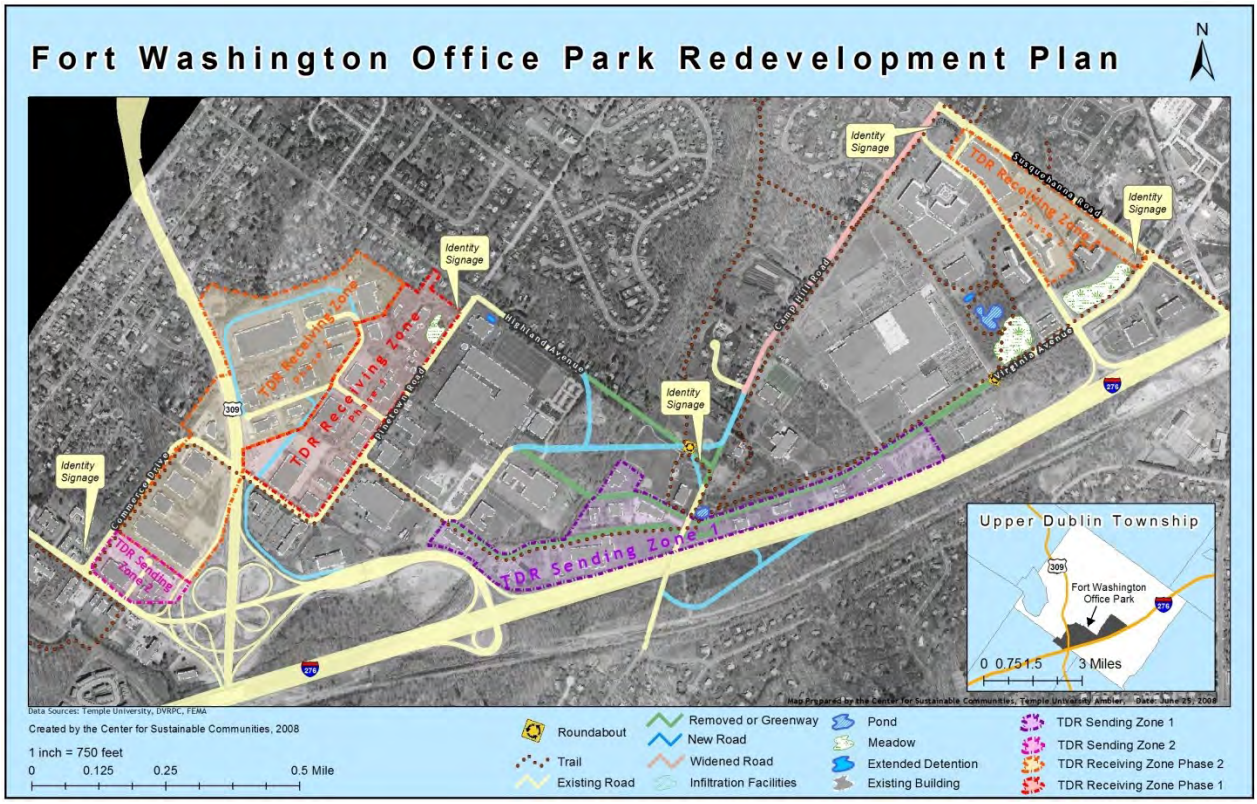


Figure 2: The redevelopment plan proposed by the CSC Team in 2008

a) Flood Management: Developing new FIRMs was a critical first step to establish up-to-date knowledge on stormwater flows and flood risks within the Office Park. The CSC Project Team developed a GIS-based data inventory including a 2' by 2' resolution Digital Elevation Model (DEM), which allowed for more detailed terrain representation and analysis. The use of newly updated precipitation values made significant difference in the inputs to the hydrologic and hydraulic models employed in the delineation of the 100- and 500-year floodplains and floodways in the watershed. The new FIRMs resulted in 28 buildings in the Office Park falling within the 100 year floodplain boundaries. This was an increase of 12 buildings from the flood

maps in place. The new floodplains demonstrated the continuing potential for flood damage in the Office Park. These were submitted to FEMA in 2008. The plan also recommended improvements to the flood warning system such as installation of rain gages and stream level alarms, adoption of the hydrologic-hydraulic model as a flood warning tool, improved public communications, and natural hazard mitigation plans.

b) Stormwater Infrastructure: A stormwater analysis of the entire watershed was completed to understand stormwater flows and identify potential stormwater management opportunities in the Office Park and the watershed. The CSC Team conducted extensive field surveys to find the highest priority areas for new or improved stormwater management facilities. More than 300 sites were identified and inspected in the field, with 200 of these in the Pine Run and Rapp Run watersheds, where the potential is highest for reducing flooding in the Office Park, including two flood control dams. An identification code for mapping and evaluation was assigned to each of the sites, and an inventory of several hundred photographs was compiled to document other significant stream features and facilities. The field observations and documentation provided a basis for subsequent GIS mapping of the sites, preliminary estimates of potential new detention/infiltration volumes, and facility cost estimates. In order to evaluate the impact of the potential stormwater improvement projects on reducing flood levels, hydrologic and hydraulic model runs were completed for the 2-Year, 10-Year, and 100-Year storms, for both pre- and post-improvement conditions. The modeling results indicate that the combined detention and infiltration volume of the improvements would significantly reduce flood elevations for the 2-Year and 10-Year storms. The total cost of the improvement projects was estimated at $28,159,800.

c) Transportation Improvements: The approach to improving the Office Park's transportation system required an extensive evaluation of internal and external conditions (e.g., connectivity to local streets, highway and mass transit). Internal roadway improvements were based on results from the stormwater analysis. Suggestions included decommissioning portions of severely flood-prone Virginia Drive, elevating roads to avoid flooding, minimizing 90 degree turns in accident-prone areas, widening and extending a few roads, and constructing a new bridge to ensure continuity of local circulation during flood conditions. External improvements included a new slip ramp at the Turnpike's Fort Washington interchange and a new interchange from Virginia Drive to provide more convenient access to the Office Park.

d) Sustainable Development: The CSC Team conducted a market study of the Office Park which assessed its current conditions and identified recommendations for improving its position in the regional market and creating a better sense of place. Major recommendations were to develop a new vision for the development with mixed uses, to increase connection to the broader community, to encourage pedestrian-oriented and scaled development with better sidewalk systems and transit services, to minimize unused parking spaces by considering shared parking, to encourage "greening" its existing buildings, and to incorporate "green" technology and flexible design into newly constructed buildings.

The CSC Team proposed a TDR program to help remove structures and development from the areas at highest risk of flooding while compensating property owners for part of their investments. Recommendations included a description of Sending Zones (where preservation of environmentally sensitive areas is desired and development rights or credits are sold for use elsewhere) and Receiving Zones (areas that can absorb more development than is normally permitted by zoning regulations via the purchase of development rights). The goal of the incorporation of mixed use development in the Office Park was to create an aesthetically natural, walkable, public-transit oriented place to work with minimal flood risk through innovative land use and green design principals. A secondary goal was to increase the density, height and uses of

buildings while maintaining the existing character of the Office Park. The mixed use development proposals were for the areas within the Receiving Zone.

e) Open Space Improvements: The CSC plan first called for re-vegetation to restore healthy functioning of the hydrologic cycle. It also recommended the construction of wet storage ponds and meadows as places to store water and encourage evaporation. The specific open space improvements included a linear park/plaza incorporating a water feature as a focal point, a greenway/ bike path to be located in the decommissioned section of Virginia Drive, a pedestrian pathway system, separation of traffic, and conversion of a huge parking lot roof into native woodland community.

The CSC Team recommended that the redevelopment plan could be achieved through a phased implementation approach. The first phase would focus on implementing the stormwater management improvements while additional studies were conducted for the transportation improvements, TDR program and mixed-use development plan, and open space improvements, to be implemented in the second phase. The cost of the first phase was estimated at $28,159,800 and the second phase $40,540,000.

5. Plan Implementation (2008 – 2014)

In 2010, two years after the CSC plan was published, Upper Dublin Township adopted a comprehensive plan that recognized the CSC plan and incorporated many of its recommendations. As the township nears build out – a situation in which 100 percent of land is either developed or preserved as open space – infill and redevelopment will become the only means of securing future investment and increasing tax base. The goals listed in the comprehensive plan that were identified in the CSC plan included implementation of stormwater best management practices, promotion of energy and water conservation in land use regulations, encouragement of “Green” design and green building practices, and floodplain preservation and restoration. The comprehensive plan recommended developing zoning and other policy tools to encourage reinvestment in and redevelopment of underutilized and/or underperforming properties. Revitalization of the Office Park was considered a top priority for the township. The township hired a project manager to oversee revitalization of the Office Park and make progress with outreach to Office Park property owners and public sector funders.

Here we describe the current status of implementing the five key components of the CSC plan.

a) Flood Management: Based on CSC data and modeling results, FEMA released a draft of new floodplain boundaries for all of Montgomery County this year (2014), but they did not recognize the impact of the two newly completed dams in the Office Park (Wert, 2014). According to the township engineer, significant reductions should be seen up to the 25-year storm level; therefore the dams should make an impact on the boundaries. For this reason the township appealed the boundaries (Wert, 2014). Five property owners also appealed the boundaries (four commercial within the Office Park and one residential) due to disagreements about being within or out of the floodplains (Barton, 2014). Considering the time of the draft floodplains done by the CSC Team in 2008, the township manager commented that the process of creating new FIRMs has been “incredibly slow” on FEMA’s part (Leonard, 2014).

In regard to a flood warning system, cameras are present at flood retardant structures and monitored by the township police. A fitness building has a flood alert system under its parking lot as it sits on the stream (Lester, 2014). The township attempted to privatize flood warning systems for three buildings, but was unsuccessful. The township manager wanted to make flood warning as integral as smoke alarms but was also unsuccessful (Leonard, 2014). The

businesses did the bare minimum to fulfill warning requirements but are not aware of how alarm systems work or what they mean (Leonard, 2014). There have been several emergency exit improvements in businesses that have their normal exits repeatedly impacted by flooding (Leonard, 2014). There are several shared parking lot segments and cross connections between them. Connections allow drivers to get to higher ground as needed in order to exit the Office Park (Wert, 2014). Several flood gates were funded and constructed in difficult areas (Wert, 2014).

Next Steps: Upper Dublin Township is still in conversation with FEMA about the new FIRMs. The final maps are scheduled to be released in late 2014. The township is in the process of collecting data in regard to the dams and amending the maps with recognition of the dams. A consultant has been engaged on model improvements. The township engineer expects a timeline of 6-9 months to form a revised floodplain model (Wert, 2014).

b) Stormwater Infrastructure: The construction of two dams on Pine and Rapp Run entering the Office Park was completed in January 2014. The township contributed its own funds for the detailed engineering studies for the projects and received a $11.9 million H2O grant from the state of Pennsylvania (Barton, 2014). The total construction cost of the two dams was $9 million (Lester, 2014). Other costs included the design, the grant application, construction management/inspection and land acquisition and easements. The projects were completed ahead of schedule and under budget. The consultants/contractors also were very informative and cooperative with the community, informing them of project timelines and purchasing low noise pumps (Lester, 2014). Favorable outcomes have already been observed from these dams. The intersection of Pennsylvania Avenue and Commerce Drive experienced no flooding from a recent large storm but there is still flooding in the central area of the Office Park (Barton, 2014). It should be noted that the dams were initially recommended in previous studies, some over 50 years ago, but never built. The CSC study documented their importance for flood control as the two dams contained over three quarters of the total projected storage from its inventory of over 50 potential stormwater improvements.

A part time hydrologic engineer was hired to look into retrofitting existing detention basins identified in the CSC study and converting them into extended detention facilities. Many of these existing basins are performing poorly (Lester, 2014). The process of retrofitting the basins has been started (Wert, 2014). Many detention basins were owned by homeowners associations and neglected. The township has taken over ownership and maintenance for many of these basins (Lester, 2014).

Next Steps: Addressing water quality issues, the township is looking into making existing detention basins perform better and on an integrated basis (Leonard, 2014). The township manager referred to a study conducted by nearby Bucks County that looked into the efficiency of detention basins in the region and found approximately 70% of them are “non-functioning” in design (Leonard, 2014). Instead of constructing new basins, the township is looking into coordinating basins and making them “smarter” and incorporating Doppler radar (Leonard, 2014). The manager feels that stormwater management and basins in particular should be treated like a system, as they are a part of a larger system of watersheds. He expressed frustration at the incremental nature of stormwater management as it ignores the systematic problems of water quality and flooding. He stated, “I got tired of bumper sticker solutions to a systematic problem” (Leonard, 2014). The township engineer referenced the importance of fixing current older stormwater infrastructure in order to move forward with new infrastructure. This process has been initiated in replacement repair plans for metal pipes and under road piping (Wert, 2014).

c) Transportation Improvements: The concept of decommissioning of Virginia Drive and making new road connections, as suggested in the CSC plan, was considered too difficult to gain community and political support (Wert, 2014). Although this concept was considered, the township required a more timely solution to flooding issues on the road while not impacting traffic patterns (Lester, 2014). There have not been radical changes to the road network but there have been small improvements (Barton, 2014). A consultant was hired to design a road diet plan along Virginia Drive and Commerce Drive (Lester, 2014). Design features include elevating the road in low areas (18 inches to 2 ft), reorganizing lanes, adding drainage, and including a multi-use trail (Smith, 2014). Following the CSC plan, the reduction of 90-degree turns was also included. Virginia Drive would be changed to three lanes with a constant center turning lane (Lester, 2014). The road diet would also prevent "surprises" along turns due to improved visibility and would allow more traffic to filter through the Office Park (Leonard, 2014). There are several case studies supporting this claim (Leonard, 2014). The consultant has also designed a slip ramp and zip ramp near the Fort Washington Turnpike interchange. The slip ramp would include both east and westbound construction (Lester, 2014). These concepts were consistent with the CSC plan. The township has applied for a grant from the Delaware Valley Regional Planning Commission (DVRPC) for the construction projects.

Next Steps: If the township receives the DVRPC grant, Virginia Drive would be reconstructed as discussed above. The timeline for the slip and zip ramp projects are unknown (Lester, 2014). Along with these projects the township is also encouraging the construction of a natural gas station near the Turnpike entrance to assist in paying for the projects (Lester, 2014). The township has been looking into the prospect of creating a transportation development area (Lester, 2014), providing better access into/from the Office Park with the Turnpike, and providing a multimodal, effective internal transportation network (Smith, 2014). The manager discussed the importance of taking care of several necessary transportation improvements before road reconstruction can take place. This includes bridge reconstruction in several areas (Leonard, 2014).

d) Sustainable Development: Following the plan recommendations and further detailed studies, a TDR ordinance was crafted by a consultant and was passed in November of 2013 (Barton, 2014). The manager cited the TDR ordinance as "the most expensive I had ever come across" (Leonard, 2014). Some property owners are enthusiastic about moving their businesses, but some are content to stay in their current location within the floodplain (Lester, 2014). While many property owners have showed strong interest in TDR, no one has done the preparations necessary for the transfer of their businesses (Barton, 2014). It was noted that this TDR program is the first of its kind to encourage economic development over land preservation (Barton, 2014). Better communication between the Fort Washington Business Alliance (FWBA) and the township is needed in order to keep businesses informed on the progress and details of TDR (Disque, 2014). In regard to mixed-use development, changes were made to the zoning code to allow for taller building heights and zoning for residential uses (apartments and condominiums) (Barton, 2014). Building heights include 70, 60, 50 and 35 ft. and are considered a long term plan by the township (Barton, 2014). In terms of sustainable development practices, two "green" buildings are currently present in the Office Park. Much of the current paving is 15-25% reclaimed asphalt (Wert, 2014).

Next Steps: The township strongly wants to encourage businesses to move out of the floodplain and retain them in the Office Park. Once businesses will move into the potential mixed-use area, other businesses will see how it could benefit them and move as well (Lester, 2014). There are prospective plans for the addition of an exposition center within the footprint of an existing office building's available warehouse space. TDR is a long term process that the township and

businesses need to stick with in order for it to work (Leonard, 2014). Once there is a bellwether project to serve as an example, the township feels that it will encourage businesses to participate and show the potential success that can be achieved by TDR (Leonard, 2014; Wert, 2014). In the far future, there is a possibility of converting the Sending Zone into a large green-space and drainage area (Wert, 2014).

In regard to sustainable development guidelines, the township has adopted a new energy ordinance as a part of the zoning code that would allow geothermal, wind, and solar power anywhere in the township, including the Office Park (Barton, 2014). One building on Virginia Drive has extensive solar panels on its roof (Barton, 2014). Many buildings in the Office Park are steel framed, meaning they are very capable of being stripped down and reconstructed for green building certification (Wert, 2014).

e) Open Space Improvements: Plans have been made for bike and pedestrian pathways throughout the Office Park (Barton, 2014). Trail improvements and a crossing area have been planned for Camp Hill Road. The recommendation for a native woodland community or green-space on the huge parking lot has not and will not been implemented (Barton, 2014). We assume that these ideas were considered as too conceptual, unrealistic, or radical. Generally, open space improvement ideas have public support. A debt question was placed on the ballot in the last election asking voters if they would approve a $30 million debt for open space acquisition. This was approved and strongly supported by the community, with a 65% vote (Leonard, 2014). A biking and walking trail along Camp Hill Road has been extremely successful with daily use, even in inclement weather (Wert, 2014). It is utilized by those working in the Office Park as well as members of the community (Wert, 2014).

Next Steps: Only $3 million of the $30 million approved for open space acquisition has been spent so far. The remainder is available for future open space projects (Leonard, 2014). The bike trail mentioned above is being continually segmented for expansion (Wert, 2014).

6. Lessons Learned

Many of the CSC plan recommendations have been implemented and others are in process. Some have been revamped or are being reconsidered in a somewhat altered form. Overall, implementation of the plan is noteworthy. As indicated in the interviews, the plan possessed sufficient analytical rigor and its authors were well respected among funders, regulators, and the citizenry of the community. Implementation was also aided by proactive local decision makers, widespread problem identification, and fortuitous timing, factors noted as important by Cohen et al (1972) and Kingdom (1995). Major funding for the two flood control projects was secured from a state H20 fund that was augmented by federal stimulus funds made available to state and local government just after the “Great Recession” of 2008. Those funds are no longer available.

The plan was specifically referenced by township officials when seeking regulatory approvals and applying for grants. The fact that it was a university study as opposed to one by a consulting firm gave it more credibility (Lester, 2014). The timing of the study was fortuitous as it was just at the time when the township needed to take action on flooding issues and federal stimulus funds were available from the state (Lester, 2014). The study brought a broad focus as to how to approach flooding and water quality issues and raised awareness in the community as to severity of the problems and the need to address them (Wert, 2014). The watershed focus of the study also was important. Among decision makers and voters, knowledge of stormwater and flooding issues is typically very narrow (Wert, 2014).

Township officials encountered several roadblocks on the way to implementation. Politically, the township cited having issues with state and federal regulatory agencies through the dam construction process. The township made a decision to choose a non-union contractor for the project, which initially caused some conflict with officials and community members. In the end the choice of the non-union contractor resulted in a cost savings of about $1 million.

Some recommendations were easier to address. The widespread visibility and community recognition of the flooding problem, made those recommendations more amenable to implementation. The transportation improvements also addressed problems with considerable visibility and community support. Both also have funding streams and strong political support among the region's elected officials. On the other hand, the implementation of recommendations related to sustainable development and ecological restoration have been more complicated. Despite its interest in supporting sustainable development, the township and business community are more inclined to support any type of development as opposed to no development to enhance economic conditions and the local tax base.

Although the TDR program has been approved and has great potential to revitalize the Office Park and reduce flood damages, township officials are aware they still have work to do in informing and persuading business owners to participate in the program. Many business owners are not confident that the flood control dams will work as envisioned and question whether the flooding problem has been successfully addressed (Disque, 2014). They want more assurances that the dams will continue to work before investing in the Office Park and TDR program. FWBA representative Disque noted the difficulty in marketing for prospective economic development given the Office Park's reputation as a flood prone area is widely known. Once the impacts of the dam projects are better documented this perception may be easier to address.

Regarding the question posed in the title of this paper "Can We Fool Mother Nature and atone for our past sins," the answer is probably no. As noted by the Township Manager, the Office Park was ill designed and built in a vulnerable location; today the township is paying the price for those poor decisions made earlier (Leonard, 2014). But given that the Office Park is an important economic contributor to the region and the township's tax base, the plan and its implementation provide a good alternative to continued flooding and economic decline.

In the background section we noted the findings of Berke et al (2006) indicating that if implementation is defined and measured in terms of "conformance," plans and planners can be more successful. This case study indicates that implementation also can be successfully evaluated in terms of "performance" and such plans also can be influential. Planners working in a fragmented and decentralized political environment may prefer to use this approach as it may prove to be the more realistic and attainable option.

Note

Interviews and electronic communications conducted in May 2014 – Richard Barton (Township Official), Kathy Disque (Fort Washington Business Alliance), Mark Hettingdon (Township Stormwater Engineer), Paul Leonard (Township Manager), Steve Lester (Township Official), Jack Smyth Jr. (Boles, Smyth Associates, Inc.), and Jeffrey Wert (Township Engineer).

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Household water consumption in Algiers facing population growth

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Abstract

Since independence in 1962, Algiers has experienced a massive influx of people from within the country. The spatial and unrestrained population growth did not take long to induce serious socio-economic and urban issues. Household water supply was one of the problems that arose with acuity. Pressure on water resources was such that the supply could not meet the growing demand. In the mid 90s water shortages were a prevailing phenomenon and the situation worsened with cyclical droughts and continuous population growth. Since 2002, Algerian government has launched major infrastructure projects consisting of dams and desalination plants to expand the water supply system and consequently overcome this deficit. Over the past two years, Algiers household water supply reaches a satisfactory level ensuring 24 hours a day distribution. Nevertheless, such a policy focusing solely on offer may not be sustainable. The demand-side management should be an integral part of a water management policy for the purpose of optimal use of resources. In this paper, we will focus on the analysis of domestic water consumption related to population growth and the means implemented to meet the needs of households since independence to present day. We will then outline the limitations of the pursued supply-oriented policy. We address thereafter the determinants that influence domestic consumption and the levers aiming at reducing Algiers household water demand.

Keywords: Algiers household water consumption, supply system, water management.

1 Introduction

One of the main indicators of well-being and human development is incontestably adequate fresh water access. In the second edition of the World Water Development Report, "Managing Water under Uncertainty and Risk" (UNESCO, 2012), UN-Water stressed that water underpins all aspects of human development, and that a coordinated approach to managing and allocating water is critical. The major water concern in many regions is insecurity about the adequate water supply in the face of rising population demand. According to the United Nations Organization FAO (2007), by 2025, 1800 million people will be living in countries or regions with absolute water scarcity and two-thirds of the world population could be under conditions of water stress.

Algiers, political and economic capital of Algeria, has experienced the problem of acute water shortage due to rampant population growth. The capital has exercised and still exercises a power of attraction for countryside people. Consequently, water demands were constantly increasing inducing pressure on water resources. The supply from available water resources could not meet appropriate consumption. This situation has been exacerbated by cyclical droughts.

In order to overcome water shortages, Algerian government has launched major infrastructure projects consisting of new dams and desalination plants. Nevertheless, the

current water supply system shows vulnerability vis-à-vis several factors. Threats to groundwater table and climatic hazards are the main elements undermining the system. But the paradox in a reputed arid country, water is not used optimally. Algerian authorities have focused on a policy of supply. Few actions were conducted to influence the evolution of the water demand.

Any strategy aiming to improve the efficiency of water use requires, in addition to a policy of improving supply, an understanding of how the water is used and how the water saving can be achieved. Several studies have been conducted worldwide to determine the major drivers of urban water use and consumption. The objective is to reduce freshwater demand.

Household water consumption is influenced by many determinants related to economic, social and environmental factors (Alcamo et al., 2003 ; Zhang and Brown, 2005 ; Schleich and Hillenbrand, 2009 ; Corbella & Pujol, 2009 ; Suzuki et al., 2010 ; Rathnayaka et al., 2011 ; Rockaway et al., 2001 ; Ouyang et al., 2013 ; Stoker and Rothfeder, 2014). Managing the demand side of household water consumption in Algiers should be undertaken in order to achieve an efficient use of water resources.

The remainder of the paper is organized as follows. We give in section 2 an overview of the spatial expansion of Algiers and the related population growth. In section 3, we address on the one hand the successive institutional reforms undertaken by the Algerian government to promote more efficient water resources management and on the other hand the hydraulic infrastructures implemented to meet the growing demand of water. The evolution of per capita per day water consumption across the municipalities of Algiers from independence to present day is highlighted. Section is devoted to the limitations of the pursued supply oriented-policy. We outline in section 5, the determinants of household water use in Algiers. Section 6 concludes the paper.

2 Spatial expansion and demographic growth

After independence in 1962, Algiers has experienced a massive influx of population within the country looking for better living standards. This trend continues to the present day. The city has gradually spread to support the ever increasing population. Table 1 shows the number of inhabitants given by the successive general national censuses (ONS, 2009).

General Census	1966	1977	1987	1998	2008
Population	989,526	1,436,141	2,015,374	2,561,992	2,988,145

Table 1: Algiers Population Growth.

In the beginning, following the COMEDOR (1968) committee recommendations and thereafter POG plan (COMEDOR, 1975), the expansion was towards the east for reasons related to the topography of the site. These measures attracted more population: workforce and their families. The urban master plan referred to as PUD (CNERU, 1983) elaborated between 1981 and 1983, has made a sudden change of the expansion direction. The city has to extend to the southwest on the hills of Algiers Sahel. A policy of individual housing was encouraged leading to urban sprawl. With interruption of the electoral process in 1992, Algeria has entered a period of political turbulence. The urban plan referred to as PDAU initiated in 1991 was adopted in 1995 (CNERU, 1995) without any consultation. Urban development was no longer a priority. The development of the city was made in all directions

without a clear strategy. The spatial extent of Algiers has progressively expanded until 1997 to include 57 municipalities. The main changes in administrative boundaries of Algiers are shown in Figure 1. This urban growth has led to a significant pressure on available natural resources.

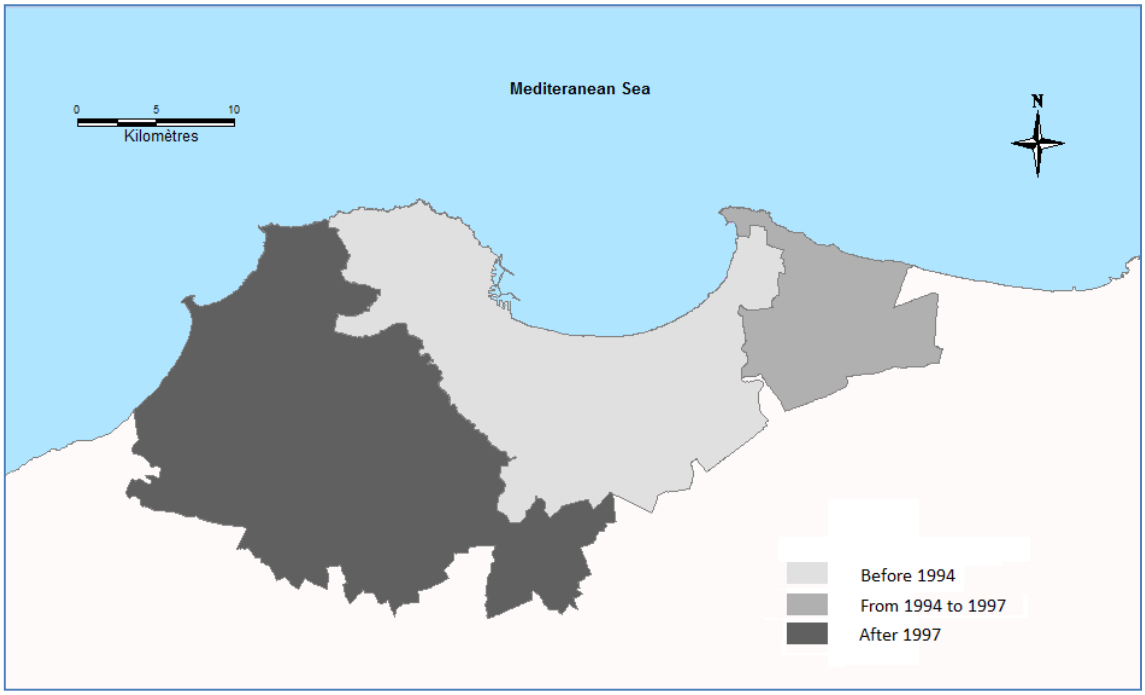


Figure 1. Changes in administrative boundaries

3 Household water issues: from independence to present day

3.1 From independence to 1976: an era of recklessness

During this period, there was no water policy. Algiers was supplied with water from Mitidja and Sahel underground aquifers (see figure 4). The millennium water resource was sufficient to meet the needs of the population. The lack of water policy induced wasteful behaviours. Use of water meters was not systematic and water was ceded at symbolic prices. This situation was not long before producing adverse effects on water resources. During this period, there was no hydraulic strategy for surface water mobilization. It should be also noted that the urban planning instruments did not take into account the water supply issues.

3.2 From 1977 to 1992: A fledgling water strategy

With the ever-growing population, the apparent effects of water policy lack began to be felt. Contribution of aquifers has become insufficient to meet the needs of residents. Increases in water consumption drained underground aquifers faster than they can be replenished. Water cuts become the daily of Algiers inhabitants. A program of water rationing was established in 1978. Policymakers have realized the importance of the rational management of water resources. A Ministry of Hydraulics was established in 1977. In the same year, a public company called SEDAL (1977) was responsible for the management of drinking water supply and sanitation in Algiers.

In order to increase the capacity of water supply, it was decided to mobilize the surface water resources located in far off places. In 1981, a hydraulic plan was adopted which provides for the realization of several dams. A law on water code was adopted in 1983 (law n° 83-17, July 16, 1983). The National Agency for Dams and Transfers ANBT was established by executive decree n° 85-163 of 16 July, 1985. The first system to transfer water from dams to the city referred to as SPIK became operational in 1987. The SPIK system involves Keddara, Hamiz, Beni-Amrane and Koudiet-Acerdoune dams (see figure 4).

In 1992, a public company referred to as EPEAL was created to manage Algiers water supply and sanitation. After a clear improvement of the water supply for the population, water shortages have re-emerged after a short period of time (Chikhr-Saidi, 1997). The water supply policy was one step behind. It should be noted that there are disparities in the allocation of water to various municipalities of the capital. Although located on the heights of the city, upscale neighbourhoods benefited a water daily supply over 100 litres per capita per day (see figure 2).

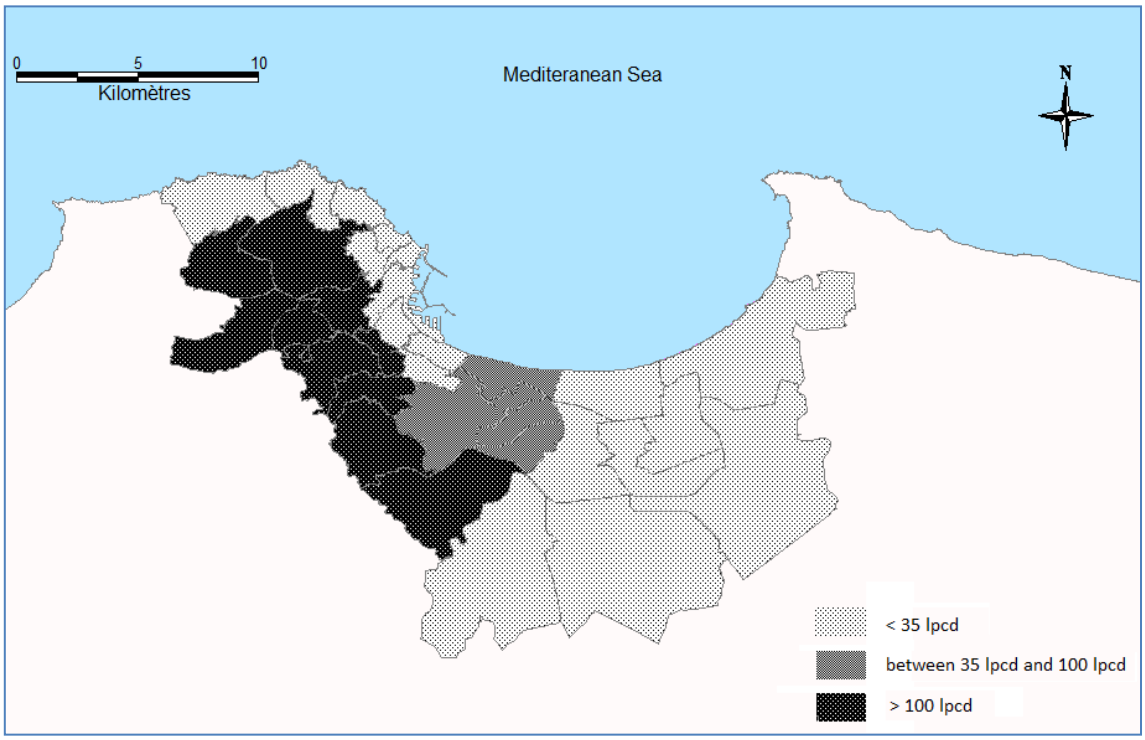


Figure 2. Household consumption in 1992

3.3 From 1993 to 1999: A downturn era

With the entry into a period of political instability, water supply of residents has worsened. The financial crisis experienced by the country during that period did not help matters. All infrastructure programs were interrupted. The use of jerry-cans and tanks took on enormous proportions. Filling jerry-cans and tanks became a national sport. A song written by Salah Ougrout, a famous humorist, whose lyrics describe the daily has become very popular: "*water flows through the taps in the middle of the night, wake up and fill …*". Water supply took a lot of time and effort to households. In 1999, many neighbourhoods of Algiers were still supplied every two days (see figure 3).

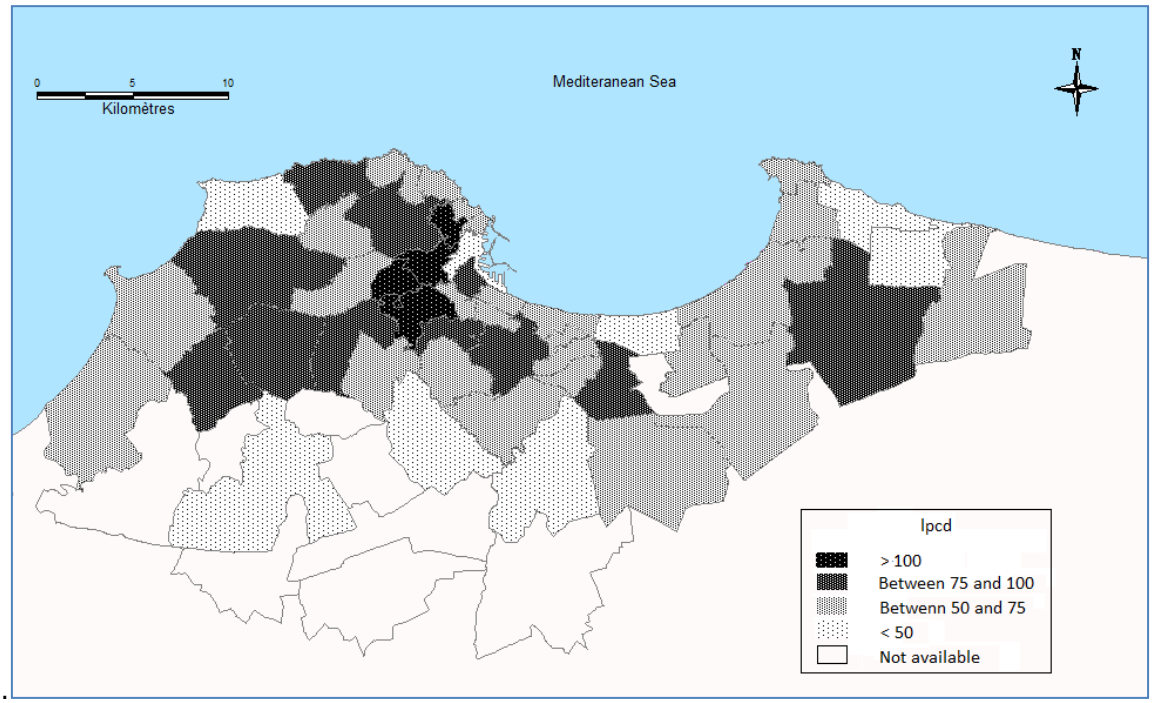


Figure 3. Household consumption in 1999.

3.4 From 2000 to present: Increasing supply at all costs

With the end of political turpitude, the water policy has become a central focus of the government. A specific ministry of water resources, that gathers all water issues, was created in 2000 (executive decree n° 2000-325, October 25, 2000). Its mission is to structure the sector in a comprehensive manner by supervising all matters relating to water: drinking water supply and wastewater elimination. Two bodies referred to as ADE and ONA, are respectively in charge of water supply and sanitation. The creation of these two structures restores some order in water management. With a newfound financial health, infrastructure projects have been revived. The SAA transfer system involving Boukedane, Bouroumi and Ghrib dams (see figure 4) had been put into service in 2002.

Despite these efforts, water supply was not keeping pace with consumption, drought exacerbating this gap. The option of desalination has emerged. The government has launched several projects of desalination plants in order to support the water supply of the agglomeration of Algiers. A new law on water was established in 2005 (law n° 05-12, August 04, 2005). The main principles of sustainable development are the guideline of that law. The opening to private management was consecrated. Since 2006, urban water supply is managed by a public company SEAAL in cooperation with a private partner SUEZ environment. In 2008, a new transfer from Taksebt dam was put into service. From 2008, desalinated water has been a non-negligible part of the water supply of the capital. Water desalination mainly comes from two plants located in Hamma (in service in 2008) and Fouka (in service in 2011). An additive supply comes from SDEM system (mono-bloc stations).

Different sources of the current water supply system are shown in figure 4. The government has succeeded to supply water to the city 24 hours a day. Since 2011, Consumption per capita per day has exceeded 130 litres in Algiers (Naimi-Ait-Aoudia & Berezowska-Azzag, 2014).

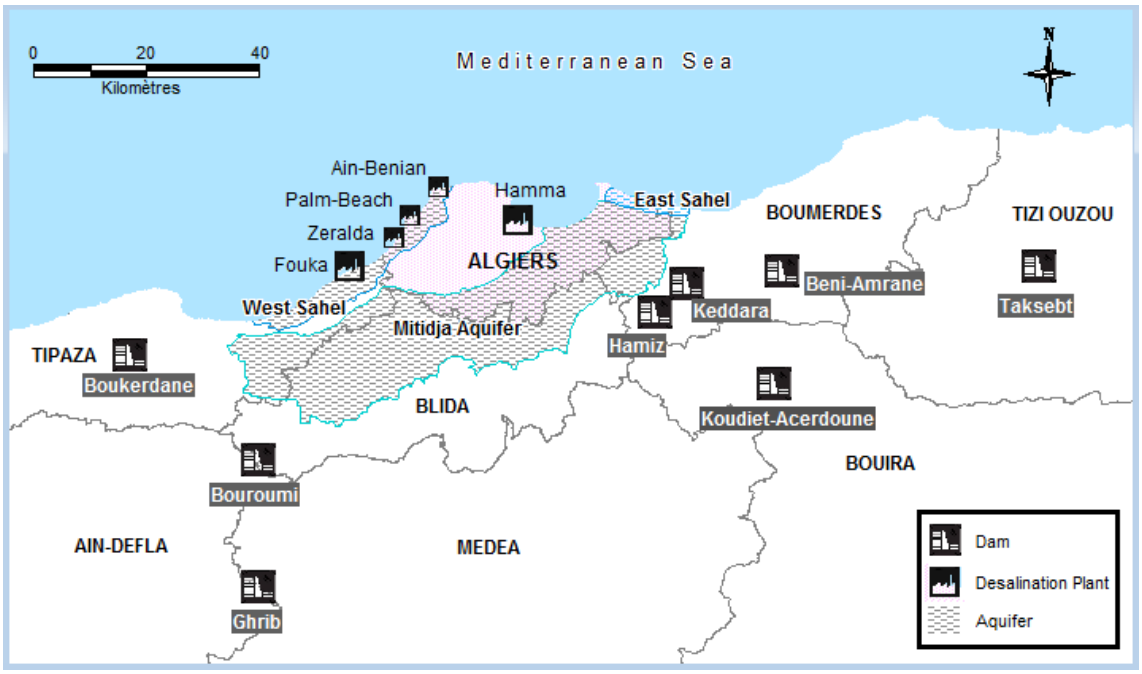


Figure 4. Water supply system

3.5 Water supply evolution related to consumption standards

Right after independence, adequate water supply for residents of the capital did not arise as the historical artesian resource was fully sufficient. With the increase of the population, water shortages have begun to be felt. Daily consumption of the inhabitants was below acceptable standards defined. Water could only be provided once every two days and even once every three days in some neighborhoods. A strategy has been implemented by the Algerian government to overcome shortages problems. However, due to the lack of sufficient financial means, the projects planned were unable to be completed. Algiers was still thirsty. With the return of stability combined with financial ease due to oil revenues, all projects were carried out. New hydraulic infrastructures were completed. This has significantly improved the level of daily water consumption of Algiers inhabitants which has now become comparable to those in cities of developed countries as shown in figure 5.

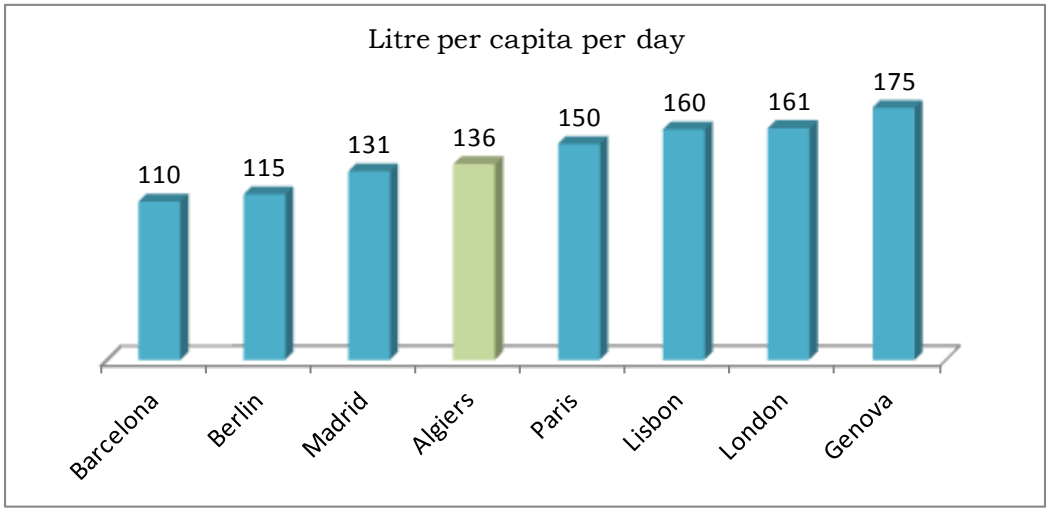


Figure 5. Household water consumption in Algiers and some European cities

4 The limitations of a supply-oriented policy

The Algerian government has exclusively focused on water supply-side management, investing largely in new infrastructure, to meet the water needs of residents. Such a policy is not exempt from several flaws.

4.1 Balance water supply and demand

According to UN demographic projections (UNDESA, 2012) shown in Table 2, Algiers population will be around 4,000,000 in 2025. This population growth will inevitably cause an important increase in water demand. Household water needs for different service levels are shown in figure 5. The choice of service levels 100, 150 and 200 lpcd (litres per capita per day) is based on the recommendations of the World Health Organization (WHO, 2011), which sets the interval from 100 to 200 litres per capita per day as an adequate consumption to minimize the risk health. It turns out that the related water needs vary considerably.

The amounts of water delivered by the supply system in place, which can be considerably reduced in times of drought, couldn't satisfy the ever-growing demand (Naimi-Ait-Aoudia et al., 2014). A policy focusing only on offer will lead to heavy investments in new water mobilization infrastructures.

Population growth combined with the threat of global warming have led water managers and planners to think critically about current and future household water needs and how best to meet them. It is therefore necessary to deeply analyze patterns of domestic consumption with a view to an overall reduction in demand through optimal use of water.

Year	2015	2020	2025
Population	3,303,000	3,608,000	3,977,000

Table 2: Algiers Population Forecast.

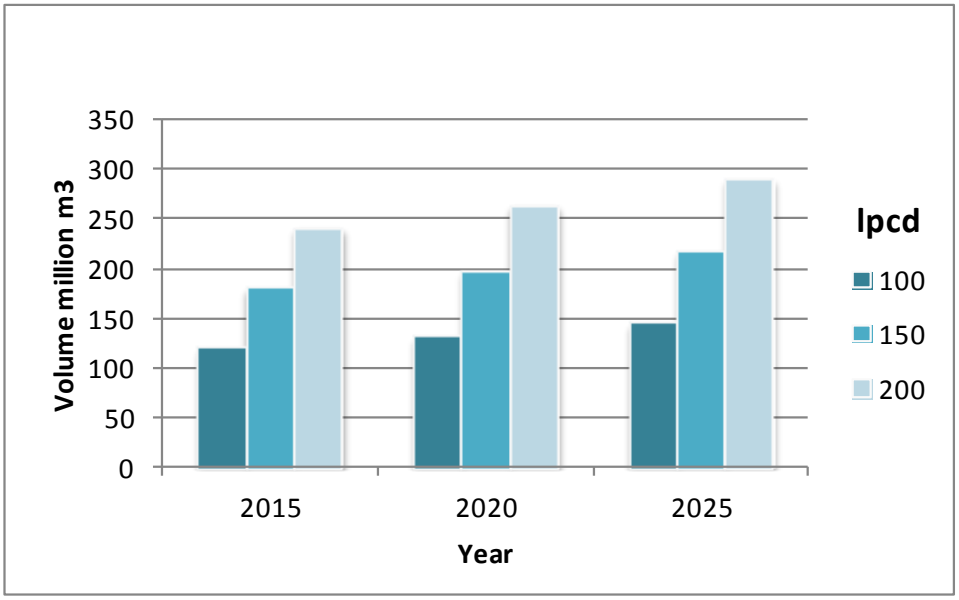


Figure 6. Domestic water needs.

4.2 The costs of water

The means used for the mobilization of water generate environmental, social and economic costs. Due to groundwater overexploitation, Mitidja and Sahel aquifers are threatened with depletion. Even worse, their proximity to the sea makes them prone to the phenomenon of seawater intrusion that will make them definitely unusable.

Surface water mobilized to meet the needs of Algiers inhabitants, come from remote areas, requiring high costs. Moreover, water availability for Algiers citizens is achieved at the expense of their neighbours.

As regards unconventional water sources, although large-scale desalination has at least 50 years of existence, there are still many knowledge gaps and uncertainties regarding environmental, socioeconomic, and human health impacts of this water product process (Cotruvo et al., 2011). In addition, costs of desalinated water remain relatively high, compared with those associated with groundwater and surface water withdrawals.

Water prices are government-subsidized. The overall cost concerning the mobilization and distribution of water is borne at 70% by the Government. The retail rates set by the Government do not allow the sector companies to cover their operating costs. Subsidized water pricing have a negative effect on efficient water use because they encourage wastefulness but the dilemma is that if the Government withdraws its subsidy, the price of water will soar and low-income citizens will no longer afford adequate consumption.

5 Demand reduction: henceforth a preoccupation in water management

Historically, water managers have focused on supply-side management and means of water resources mobilizing. However, a new orientation points to managing the demand side of household water consumption. The goal is an optimal use of water resources to meet the needs of people without recourse to new large-scale infrastructure and thus avoid adverse environmental effects that may result. Water demand reduction would henceforth be a matter of concern.

5.1 Household water use determinants

Several studies have identified many determinants that greatly affect domestic consumption. Arbuès et al. (2003), Grafton et al. (2011) and Kertous (2012) have focused on the price of water as a factor in reducing demand. Other studies have highlighted equally important determinants which are either, economic, social, climatic, policy or behavioral. Cooley & Gleick (2009) identified as the most significant determinants of domestic consumption, population growth, climate change and the type of urban development. House-Peters et al. (2010) have investigated the effects of urban spatial structure, socio-demographics, and climate on residential water consumption. Jorgensen et al. (2009) have focused on household water use behaviour. Slavíková et al. (2013) studied Impacts of climate variables on residential water consumption. De Maria André et al. (2014) focused on spatial determinants of urban residential water demand.

In sum, determinants of household use can be classified in six major categories: water supply, demographics, climate variables, policy variables, built environment and socio-economic variables as shown in figure 6. Each category involves several variables.

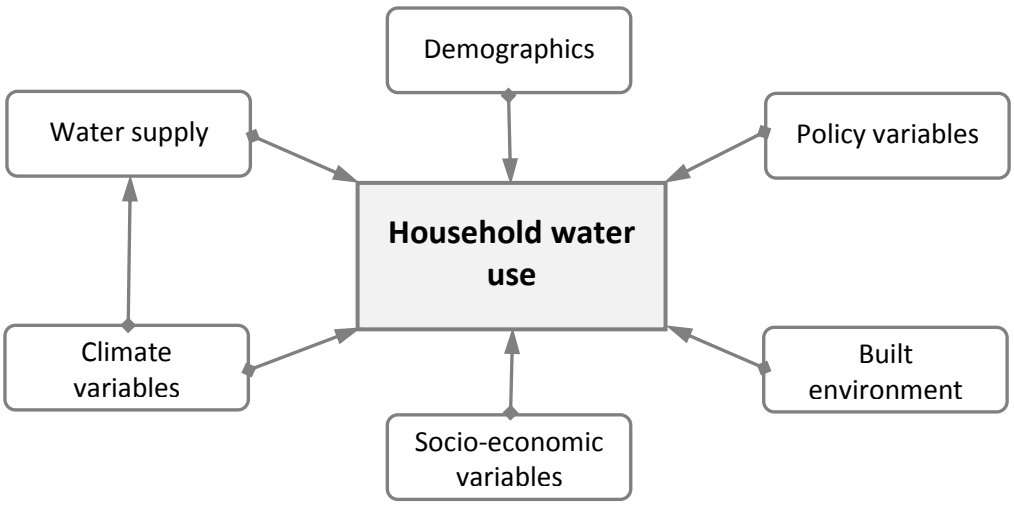


Figure 7. Determinants of household water use.

The main variables related to the determinants of domestic consumption are given below. For Water supply, these variables are summarized in natural supply potential and mobilization infrastructure. The Demographics variables are population growth and household size. Temperature and rainfall are the main climate variables affecting both supply and household consumption patterns. Policy variables such as water price and incentives are levers to regulate consumption. Dwelling characteristics and urban structure are built environment variables. Income and behaviour are socio-economic variables playing a key role in water consumption.

5.2 Levers for reducing Algiers household water demand

For an optimal management of water resources, a thorough analysis of the determinants of domestic consumption is necessary with a view to define action levers ultimately aiming at water demand reduction. This strategy is based on two major axes consisting in encouraging water conservation and combating wastage in all its forms.

The network losses, which are of the order of 30%, are fairly important in a country with limited water resources. These losses are due to poor connections, leaks, ruptures, and theft. The water distribution system in the centre of Algiers is obsolete and generates considerable loss of water. The hunt for leaks by the renovation of defective pipes is necessary. Theft, by bypassing meters, is a scourge to be strongly fought because in addition to revenue losses, it generates waster behaviour.

Usage of household water saving equipments such as low-flow toilets, shut-off valves low-water washing machines and dishwashers must be encouraged to minimize water use. Current house-cleaning habits use excessive amounts of water that can be significantly reduced. Installation of modern rainwater harvesting systems should also be encouraged through incentives. Rainwater thus collected can be used for domestic purposes like flushing toilets, laundry, gardening, and washing cars. This can significantly reduce home water demand.

In a country facing fresh water scarcity, recourse to alternative water resources turns out to be indispensable. Throughout the world, water reuse has emerged as a key element of sustainable integrated water resources management. Part of fresh water for agricultural and industrial uses could be replaced by reclaimed water with the appropriate level of treatment

and thereby increase the available volume of water for domestic use. A substantial investment in wastewater treatment plants must be undertaken so as to support this strategy.

Water pricing plays a non-negligible role in the regulation of water demand. It is from this perspective that progressive pricing was introduced in 2005 (table 3), but this measure had no impact on water consumption in Algeria (Kertous, 2013). This is partly explained by the small difference between the third and the fourth ranges of the fee schedule. An upward revaluation of the fourth range is essential to encourage consumers to show restraint.

	m^3 / trimester	Tariff per m^3
Range 1	[0-25 m^3]	6.30 DA (0.06 EUR)
Range 2	[25-55 m^3]	20.48 DA (0.19 EUR)
Range 3	[55-82 m^3]	34.65 DA (0.32 EUR)
Range 4	> 82 m^3	40.95 DA (0.38 EUR)

Table 3: Tiered pricing structure applicable in Algeria

In general, residents adopt saving behaviours if they are motivated to do so. Education, public awareness and government incentives are the main motivations that play a key role in long-term change in water consumption patterns.

6 Conclusion

It is undeniable that huge efforts have been made to secure the water supply of Algiers. During the last two years, water flowed 24 hours a day into taps. The level of household consumption has become comparable to that of countries of the northern shore of the Mediterranean. Nevertheless, focusing solely on a supply-oriented policy can be costly in economic and environmental terms. Water recycling, which is at an embryonic stage in Algeria, should be privileged in order to reduce consumption of fresh water. The efficient and effective integrated management of water resources must be a priority.

The management of water demand as much as on supply is of critical importance in a country with limited fresh water resources. Reducing water demand must be a major long-term challenge for the management of water resources that integrates sustainability issues in terms of environmental and economic dimensions. The ultimate aim is to consume less by consuming better.

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Title: Urban Transformation Implications and Prospects of Commercializing Water Supply and Water Management in Asaba-Delta State, Nigeria.

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1. Introduction

Nigeria at her $1^1/_2$ decade of uninterrupted democratic governance has experienced relative economic, social, environmental changes, and urban transformation. Hence, the state achieved fast economic growth, and urban development, even as the distributive justice question remain unanswerable. Essentially, these changes are mainly attributed to the shift from centrally-planned economy to market economy which has triggered substantial reforms both in the political and economic fields. In this process, cities gained great transformation in their economic structure, physical development and social management.

According to Obinna et al., (2010: 222) urban transformation in the less developed countries has its repercussions. They agreed with UN-Habitat (1987) startling revelations and projections regarding Less Developed Country, that by 2025 about 60% of the population in Less Developed country would be living in urban areas. Urban trasformation and urbanisation, the increase in size and number of urban places and change of land use are occurring all the time in both the less developed countries and the more developed Countries however, it is far more dramatic in the former, they summarized. The significance of the issue is emphasized by the inclusion of an objective in the Millennium Development Goals to reduce the number of people living in slums by 100 million by 2025 (UN, 2000).

In Nigeria poor performance in the development and maintenance of all aspects of urban infrastructure has reached serious proportions: many studies have indicated the cost of deficient infrastructure services in terms of large amounts of loses in industrial production, inconveniences and substantial expenditure in time and effort on alternative private sources (Whittington, *et al.,* 1989; Lee et al., 1992). Urban water supply most vividly medium reflects this situation. Although many medium size and large urban areas in the country have public water works operating for several years, hardly any is performing efficiently. It has been argued in various quarters that most urban area presently lack effective public water supply

systems that could ensure regular supplies to the population. The output from this system meets only a small percentage of water need in the cities (Ayoade, 1981; Lee *et al*., 1992).

As in most countries, State Water Authorities (SWAs) that usually have the objective of providing a social service while generating revenue to offset cost undertake urban water supply. Balancing this dual mandate under an institutional and management framework in the public sector has been frequently a source of major problems that have dogged SWAs and made them incapable of achieving any of those objectives effectively (Blunt, 1990; Blunt and Merrit, 1992; Briscoe, 1992). Problems like absence of clear institutional objectives, low wages and poor equipment and supplies have been widely cited as the typical institutional characteristics of such water supply institutions in Nigeria (Ayoade, 1981; Falana, 1991; Yakubub, 1995 and other countries (World Bank, 2004; Franceys, 2004).the effect of this problems is to entrench a vicious cycle that constrains the generation and effective use of finance to improve performance (Samson and Franceys, 1997). Performance assessments of these institutions typically reveal weakness including low output performance, ineffective delivery systems and poor financial portfolio.

The usual approach towards performance improvement had been to re-design projects for urban water supply that feature a package application of more finance, often from foreign development assistance agencies for the upgrading of existing plants and establishment of new ones. Most of this has not yielded the desired result as water supply institutions remain incapable of improving performance and continue to rely on government subventions for much of their operations. Financial and technical assistance of this type without major institutional reforms has in fact been shown to create a contradictory situation of persisting water shortages despite increasing expenditure to reduce them (Swyngedouw, 1995).

The International Drinking Water Supply and Sanitation Decade (1980-1990) marked a period of accelerated effort to expand water supply and sanitation services globally in both rural and urban areas in many countries including Nigeria. Focus had been on expanding existing services to the unserved and under-served poor populations with the goal of achieving universal access to safe drinking water for the entire world populations by 2000. Subsequently, international services of funding were mobilized especially by the World Bank and other lending institutions to the water supply sector covering both urban and rural supply systems in different parts of the developing world.

It is reported that projects worldwide during the decade extended access to safe water supply to some additional 368 million people, leading to the achievement of about 82% coverage of the global urban population (Bhatia and Falkenmark, 1993; World Bank, 1994). However, when compared with urban population growth, the proportion of the urban

population served actually declined by 5% in the succeeding decade. It is evident that despite the attempts, the situation has not improved. Thus, the global estimates, there were 300 million urban dwellers without safe water in 1990 according to World Bank, despite the situation among the developing countries in these dismal Statistics.

"About 2 of every 10 in the developing World were without access to safe water in 2000; 5 of 10 lived without adequate sanitation and 9 of 10 lived without their waste water treated in any way. There have been gains, but despite the many global commitments, notably the UN. Decade for water and sanitation, access to water and sanitation lag far behind the milestones set in the 1980's, nor do aggregate trends in the 1990's give comfort. The share of people with access to these services in Africa and Asia where the world's poor are concentrated – has fallen, remain constant or increased only slowly. Innumerable city and town studies confirm the UN Habitat Reports key message that water and sanitation service are too often failing communities. Full-pressure, "24 - 7" water supply remains a pipe dream in many cities. Because a quarter to half (and more) of urban water supply remains unaccounted for many cities are turned into leaking buckets. The limited number of network access points must be widely shared, which dramatically increase waiting times and often simply overwhelms the system," (World Bank, 2004 p.159).

The pattern of access to potable urban water supplies as given by the same institution for the year 2000 on the basis of generalised statistics shows that for urban water supply, 77% of the global urban population has access to safe water supply, representing a slight improvement over the previous decades. Nigeria is depicted as having 81% coverage for urban areas and 22% for rural, up from 60% in the 1980s for the urban coverage.

Meanwhile, the average water supply system is reported to operate for more than half the "24/7" time frame, this disguises large local variations between cities and within each distribution network. In Nigeria for example the interplay of a variety of factors notably unstable power supply have contrived to produce one of the most notorious water supply intermittences in the world (Lee and Anas, 1992). When there is frequent intermittence in the water distribution system, the consumers respond by using alternative sources, which frequently are much costly, inconvenienced and unsafe. The low prevalence of disinfection in some developing countries suggests that factors such as cost, maintenance of equipment and concern about chlorination by products may be involved (Dada *et al*, 1991; World Bank, 2004).

Attempts have been made to explain the actual situation of the state of urban water supply. The indication from many studies of performance evaluation in public enterprises institutions belong) point to the poor performance being casually linked to a factors spanning

from government policies to minute details of internal organisation and management (Blunt, 1990; World Bank 2004, WHO/UNICEF, 2006). The various factors identified can be described in terms of some issues, which in various degrees constrain the performance of water supply institutions. They include a variety of interrelated problems that tend to affect the urban water supply sector, and that originate from the lack of management autonomy and strategizing for cost-effective operations.

The World Bank (1994) in a similar assessment, identified public ownership, financing an operational problem as the foundations for a series of management problems related to widespread misapplication of resources and a failure to respond to demand even where willingness to pay for the services is high. It is further shown that public sector dominance and control serves as a disincentive for accountability especially to uses of the service. It also deprives the managers of the necessary autonomy to take decisions and be responsible for failure or success. The problem of lack of autonomy, occasioned by government control has been shed in greater light in the studies by Zipf (1986), Blunt, (1992) and similar studies on state owned enterprises. According to them, lack of autonomy has left performance among the enterprises at the mercy of the initiatives of managers at any particular time, within the scope of the limited authority allowed by the government. Thus, management may swing from a business to political orientation with the attendant consequences reflected on the performance of the institutions.

Generally, urban water supply has therefore been seen by many as contradictory and paradoxical in many respects. It is seen as paradoxical in the scene that it negates primary economic principles of demand and supply by alienating a vast majority of the urban population who for lack of direct access, spend much more on alternative sources of water (Sani, 2006). With these developments, we are in effect witnessing strong signals for major reforms that are likely to sweep the urban water supply sector in time with similar developments in some parts of the world. However adequate evaluation of the outcome and ramifications of the reforms is lacking in the Nigerian context, and by extension Delta state.

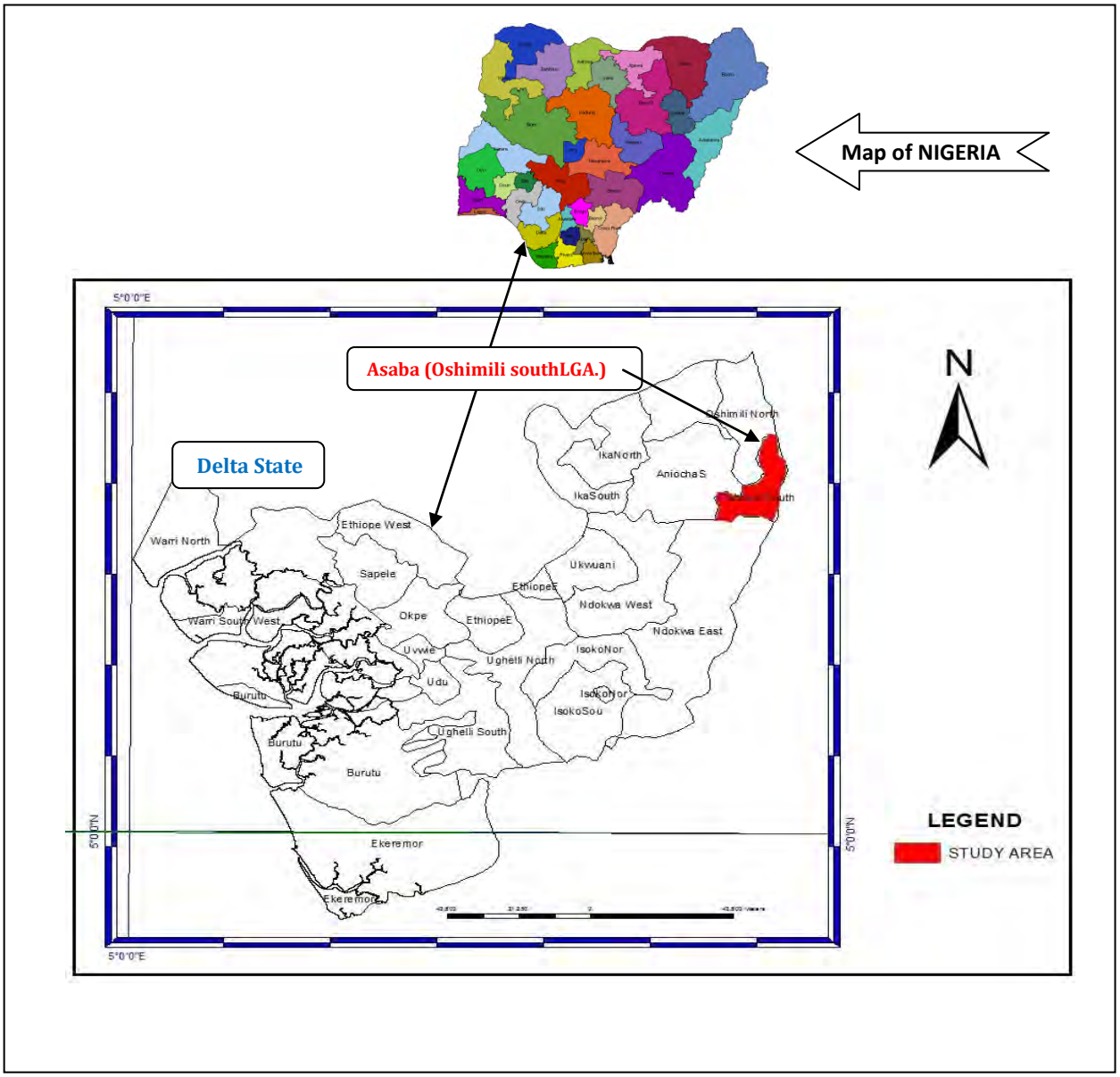
It is imperative to note that there are a number of recent experiences with water sector reforms towards commercialisation and privatisation including some in Africa, the evidence of its outcome is not conclusive and does not therefore form a basis for generalisation. Therefore, questions arise as to the application and consequences of the policy paradigms especially because this is new and distinct in the Nigerian situation. This study attempts to explore the issue further by investigating the bases of the assumption and highlighting the implications for household access to water supply should the policy be implemented to the fullest. The following constitute the research issues to be investigated:

i) The economic feasibility of the application of a fully commercialised water supply system in a Nigerian urban setting using a case study of Asaba metropolis (Delta State Capital).
ii) Urban transformation implications of commercialising water supply as it pertains to the availability of the service and access to it by a cross-section of the population in different parts of the study area. iii) Strategic options for achieving sustainability in the water supply system while safeguarding access to low-income group. iv) Implication of commercialising urban water supply for the provision of related to urban infrastructure services.

1.1 Study Area

Asaba is in Oshimili south local government area and it is the adminisrative head quarters of Delta State of Nigeria. The city is located on the west side of the River Niger. The general relief of the study area is 125m above sea level. It lies quite close to the equator, its geographical coordinates are 6°13'34.94"N and 6° 14'37.58"N Latitude and 6° 37'41 49"E and 6°43'08.79"E Longitude, with an estimated area of 200 square kilometres, and a population of about 193,804, the density of settled population per square kilometre ranges between 500 and 1000 persons, although the actual spread on ground is generally uneven being higher or lower in places according to the distribution of farmlands, open-spaces and unproductive waste lands. The town stands on an old river terrace and consists largely of sand loan so that when the Niger goes into full flood, usually during the rains; considerable areas of land are inundated, leaving much of the riverbank in swamps. But rich deposits of alluvial soil remain after the floods have quickly subsided, and these lie fallow for the next round of cultivation. The entire Delta state has a projected population for 2014 is about 5,227,942 from a population of 4,112,445 of 2006 national census.

Figure1. Location map Delta state and Asaba capital city (study area)



Source: Delta State Ministry of Lands and Survey (2014)

2. METHODOLOGY

The central team of the research consists of generating empirical backing for the evaluation of the principle of commercializing water supply as a basis for achieving sustainability in the service of the particular context of a Nigerian urban tranformation and to understand the consequences it may portend. This is aimed at providing an early warning message on the possible pros and cons of the policy, which is gaining ground as the basis for providing the services. The research involved field survey of households, the general population, in addition to secondary data from the water Board, the public water supply agency in Delta state. The field survey addressed households as users of the service with respect to access to the public water supply system presently and to envision how the

situation might be under a commercialized regime. The survey also addressed the performance of the water board from the perspective of the households and identified their aspirations on the public supply system.

The study includes those derived from the review of the activities of the water board and a household survey of the urban area using questionnaires. Both surveys were aimed primarily at providing data on the existing water supply in the study area in line with the aim of the research. The study variables are described as thus: i) Description of the Existing Public Water Supply System; ii) Description of Household Water Supply Situation: iii) Technical Criteria Used in Assessing the Prospects for Commercializing Water Supply.

The data required for this study was derived from two major sources. These sources includes; primary and secondary sources. The primary source of data includes personal interviews, questionnaires, journals, handbooks and personal observations. The secondary data includes materials from textbooks, electronic media, published and unpublished papers. The Asaba urban population is estimated as 193,804 distributed in about 10 neighbourhoods situated in the five main administrative units; Umuagu, Umuezei, Umuonaje, Ogbomanta and Umuaji Quarters. Spatially, this consist the Asaba Urban area as defined in the Asaba master plan (Delta 2002).

The key reference point in defining the sample is its spatial speed. This is to as much as possible enable an even spread in the selection of households sampled. Therefore, on the basis of this spatial structure, a two-stage cluster sampling was adopted. Therefore, each of the quarters is divided into another set of three clusters, roughly coinciding with the existing neighbourhood structure of the urban area, giving rise to a lattice of 10 sampling areas from which street blocks would be identified. Meanwhile, the likelihood of variability among the ten (10) Neighbourhoods identified in view of the social differences and the proximity to the Public Water Supply System was more readily brought to bear in evaluating the data using this sampling design. Thus, this technique made it possible to draw samples from across socio-spatial areas. Sample Size and Sampling Technique: One block from the neighbourhood was selected on the basis of centrality. After selecting the blocks, 14 compounds, reflecting the average number of compounds in street blocks was selected. However, a sample size of total of 140 households (10×14) for the whole study area was selected. This is considered adequate in view of the fair spatial representation that cluster sampling afforded.

Using data from the household survey and study of the operations of the Water Board, analyses was conducted to achieve the following objectives: i) Description of present

water supply from the public system and establishing spatial patterns and characteristics of the water supply system and access to it; ii) Assessing the feasibility of commercialization on the basis of responses to the willingness to pay survey as reflected across the different neighbourhoods and in aggregate terms for the whole urban area. This analysis sought to establish the economic feasibility of commercialization and its likely effects on access of water supply in the area. Description of the Present Water Supply Situation - The analyses were conducted to provide a description of the existing situation in the water supply system to reflect the following:

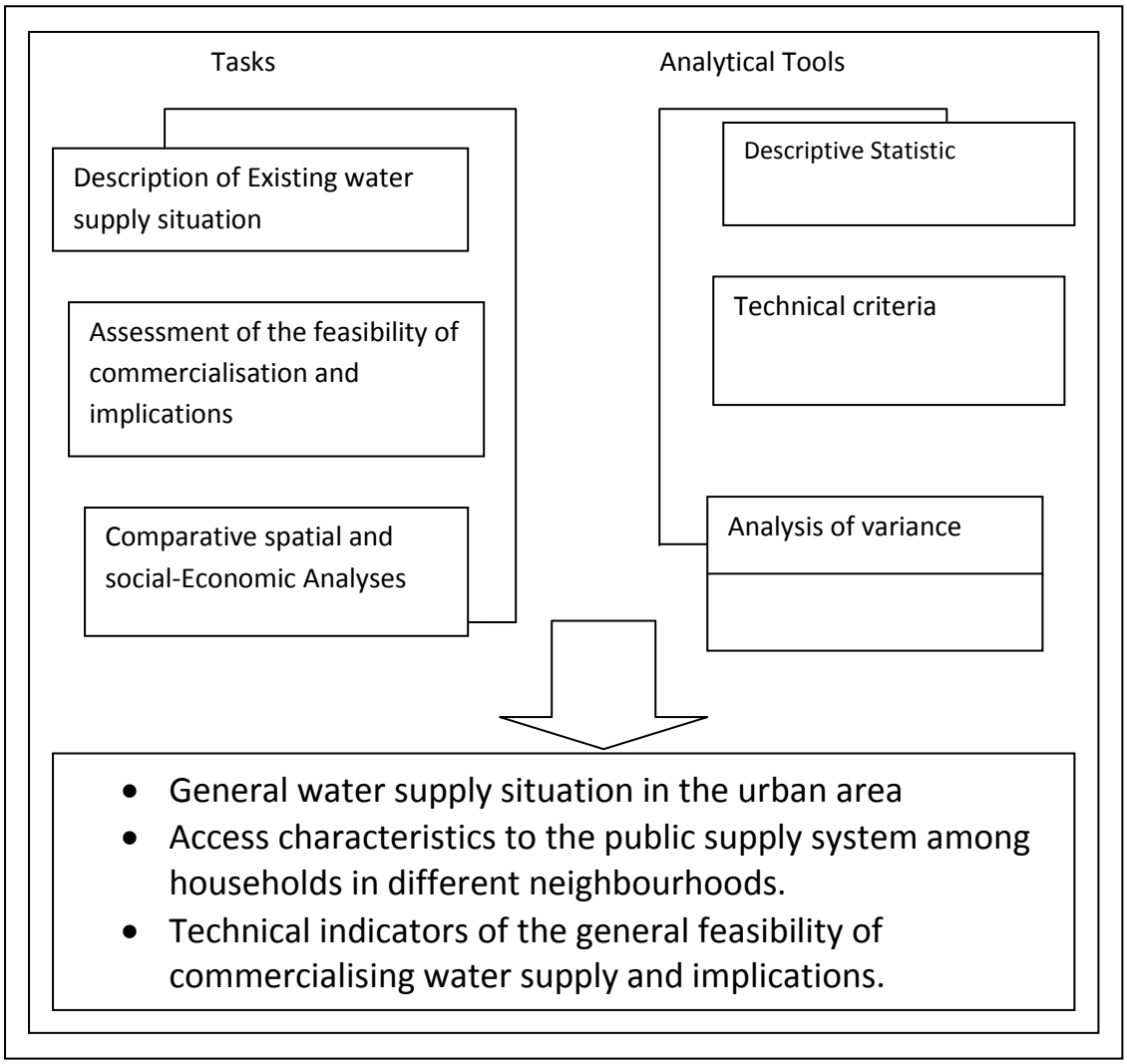
Operations of the Water Board in terms of the services provided, and the contribution of the other sources of water to households water needs. This data was derived from the records of the water Board and from responses in the household survey; Current status of the access to water supplies in both the public system and Alternative source and expenditure by households, which involved the analyses of the data from the household survey to reveal the pattern in terms of the key variables that relate to access and expenditure on water supply, alternative sources and willingness to pay commercial tariffs.

Assessment of Commercialization and its Implications - As indicated earlier, feasibility of the commercialization policy was assessed using a comparison between observed willingness to pay and the cut-off the cost of production. The cost was a bench mark against which WTP levels were assessed. This was based on separate data from the neighbourhoods and from the aggregate data from the whole of Asaba urban area. It was also supplemented by data on current expenditure on alternative sources of water. Comparative Analyses - A common thread in the analyses is the depiction of patterns of the observed characteristics descriptively and inferentially along spatial lines, that are between the neighbourhoods and relative to various social and economic variables. *Spatial pattern***:** This involved analyzing the data to reveal the pattern among the neighbourhoods in terms of access and expenditure on water supply, alternative sources and willingness to pay commercial tariffs. The data will be therefore treated to analysis conducted on the basis of the 10-samples. Differences between the samples would be assessed using the Analysis of Variance (ANOVA).

Socio-economic pattern: The differences arising from the indices of the key parameters such as income, expenditure on water and willingness to pay would be assessed using Multiple Correlation Analysis. The analysis would be employed to establish the strength of the relationships between the variables. Figure 4.0 summarizes the frame for the

data analyses and the linkage between its different components. These are identified in terms of task and corresponding analytical tool employed by way of statistical measures.

Figure 2. Frameworks for the Data Analyses



3. Results and Discussion

The study focuses on residential water supply - in the face urban transformation, which constitutes the bulk of water use in the area. Data on the aggregate demand for water by the population and the supply from the public piped supply system and other sources used by households including investigations on the expenditure on water by households are also presented.

3.1 Operations of the public water supply system

3.1.1 Evaluation and Management of the Public Water Supply System

The public supply system was first established in 1942, with a water treatment and distribution system from plant at Ogbeogonogo area. With a capacity of 8,000 cubic meters of water per day, this served the needs of other neighbourhoods of the urban area until 1975 when it was expanded to cater for newly developed areas, like Umuda, west-end area (Inalu) etc. the plant has a capacity of 25,000 cubic meters. This system is presently inadequate in meeting the need of the urban area and it is not producing at full capacity.

Overall management of urban water supply in Delta State is under the Delta State Water Board (DSWB), which operates as a region-based agency. It manages water supply to all major settlements across the state through different plants and distribution systems. The system in Asaba ranks second, in capacity to that of Warri, the state commercial capital. The DSWB manages eight operating systems under direct control of the state Government.

3.1.2 Production and Service Coverage

The daily production capacity is about 25,000 cubic meters (25 million litres), including distribution losses arising from old and damaged pipes and illegal connections. The losses have led to high rates (about 20%) of unaccounted- for water (Delta State Water Board, 1993).

Service Coverage

The system consists of a plant with a network of about 225 km of supply main, a booster status and a set of reservoirs with a combined storage capacity 4 million liters. The system is meant to serve the entire Asaba urban area in addition to major extensions to some settlements in Asaba sub-region like Okwei and Oko.

The public water supply distribution network has a spatial coverage of only 55% of the entire urban area. The coverage is inadequate and unplanned. Many areas, even within zone covered by distribution mains remain without easy access to services and lines.

There is also no coverage in newly developed areas. As revealed by the water Board, the main pumping, storage and distribution network has not significantly changed since the mid 1990's when the last major expansion on the system was undertaken. This has imposed a major limitation on the ability of households to connect because of the very high cost in areas not sufficiently covered. Many households are unable to connect or maintain connections for the same reason.

3.1.3 The Demand for Water

Based on the estimated population of 193,804, the average daily water supply from the public water supply system in Asaba can meet only about a quarter of the demand for

domestic consumption, based on an average of 100 litres per capita per day. The assumption is in line with those made under the first multi-stage water supply projected financed by World Bank in Delta State in the 1990s (Delta State 2003). The projected estimation of water demand is based on a classification of urban area in terms of large, medium and small towns. Asaba was classified as a medium town in which it is assumed, based on the existing trends and future projections, that households would access water supply from the public system through private house connections (55%) and through public stand pipes (45%). The consumption rate associated with these is 100 litres /capita /day and 20 litres/capita/day respectively for domestic consumption. For the purpose of this study a flat 100 litres/capita/day for the whole population that includes domestic, industrial and institutional consumption is used.

The overall population capacity of the Asaba public water supply system can meet only the small proportion of the demand. Only 47% of all water produced is actually available for domestic consumption in the Asaba Urban Area after providing for system losses (35%). Institutional, commercial and industrial uses (8%), based on estimates of the Water Board (DSWB 2013). With about 2,173 cubic going into industrial, institutional and commercial uses (DSWB,2013). The amount of water available for residential use is evens less.

3.1.4 Tariff Structure and Billing System

In the public water supply system, the tariff is based on a flat monthly rate billing system for domestic consumers, which varies from ₦400 for single tap corrections to ₦700 for 2-3 bedroom houses in high-density areas. This is irrespective of the level of service offered. This structure applies in most parts of the urban area as only about 10% of the connections are metered. Metered domestic connections are billed at the industrial and commercial consumers, with the domestic consumers being subsidized by the others.

3.2 Access to the public Water Supply System

3.2.1 Pattern of access to the public piped water supply system

As shown earlier, the water supply infrastructure is clearly inadequate for the needs of the population, a situation made worse by the low performance in the production and distribution system. A substantial number of households do not therefore have direct access to water from the system. Ineffective service delivery has also meant that those that are connected cannot rely on it due to the inefficiency.

Among those Household, connected; only 51% are maintaining the connections to data and there are wide variations between the neighbourhoods. An extreme case is that of Ogbeilo, where there is no active connection. It was understood during the survey that the

situations there arose as a result of complete cessation of supplies to the entire neighbourhood as a result of major faults in the distribution main serving it.

Reasons for not connecting to the Public Piped Water Supply System

Households not presently connected were asked the reason why they were not. The question was asked specially to household heads who are owner-occupiers in view of the fact that tenants and other occupants are usually not involved in the decision to connect or not to. The responses show a variety of reasons advanced including the present poor supply a feeling of satisfaction with commercial Borehole in their area and remarkably, the cost of connecting to the system varies, depending on the location of a residence in relation to the network.

3.2.2 Alternative Water Sources

Household heads were asked to indicate the source of water they use during wet and dry seasons. The separation between the seasons was considered necessary in order to effectively capture the contribution of water sources like well, rainfall harvesting and commercial Borehole to household water supply. It was observed in the survey that households utilise different sources during the two seasons. Expectedly, purchase of water from commercial Borehole was among the most frequently cited sources especially in the dry season. It is also significant that most household have access to private borehole and private well that supply water for most of the wet season in all the neighbourhoods. Other sources include rain harvesting. By far, the most dominant alternative source is private borehole and commercial Borehole.

3.3 The Prospects for Commercialization

A number of factors are brought to bear on the assessment of feasibility of commercialization of water supply in the study area. The factors are used as indices to gauge the readiness to implement the user pay system that recovers full cost. They include the present cost recovery portfolio of the water Board, expenditure by households for securing alternative source of water willingness to pay commercial charges. The assessment also includes an examination of the influence of social and economic factors including income and household size on access to water in a correlation analysis. It also includes the presentation of an opinion survey on tariff and related matters in the water supply system.

3.3.1 Cost Recovery by the Water Board Cost Estimates

One of the most difficult tasks in assessing the operations of water supply system is to arrive at a figure that represents the cost of producing a unit of water. Generally,

production cost is determined on the basis of operational and capital costs. The former represents costs of all inputs and includes labour and management, supplies (power, chemicals etc.) and all other cost components ancillary to the operation of the utility in undertaking its functions on a recurrent basis. The later represents the cost of major facilities and equipment (civil works for raw water catchments, distribution system, treatment plants etc.) whose value in the cost function is usually shown in terms of depreciation.

It is clear that arriving at a cost that is truly representative of the cost of production would be a complex task under situations of centralised management and insufficient record of operations as we have in the case study. This is more so where an inventory of existing assets, their condition and worth is not available. It is in view of this that available estimates at the Board such as statement of account have to be taken with considerable worriedness. Research has shown that variations in cost of producing water may arise due to local cost differences in abstracting raw water-for example, availability of rich aquifers as source may lower down cost of treatment as compared to abstraction from dams.

Cost Recovery Performance

A full account of cost recovery is not available at the water Board. However, the Board has been able to work out aggregated data that reflects the situation in all the twelve operational units state-wide. There are some indications from the key financial indicators of bill collection efficiency and cash flow from available information that the Board is able to sustain the current (albeit poor) services from internally generated revenue. A bill collection index of 73% ranks high among reported cases in developing countries although much of this is accounted for by bills recovery from commercial and industrial consumers. Bill collection efficiency in these categories is 90%. The cash flow and state of accounts show an apparent excess of revenue of our expenditure in some instances. However, it is only indicative of the achievement of cost recovery in respect of operational cost at the present level of services. These becloud the real picture if all cost is taken into the account.

3.4.2 Household Expenditure on Water

It has been shown that many households supplement their water needs with purchases from vendors especially during dry season. The aggregate data reveals that 38% of household across the urban area by water especially during the dry season and spend an average of ₦51 daily. However, these are large differences in the level of this expenditure between the neighbourhoods that reflect local differences in the availability of commercial Borehole over the cause of the year.

However, the daily expenditure on water supply indicates wide variations in the proportion of household purchasing water and the mean value for the purchase are indicative of the

different in local ground water conditions that favor the availability of or non-availability of water through out the year.

Comparison of water purchase with present tariff, when the daily expenditure is compared with the present tariff regime of the water, it is discovered that the expenditure is substantially higher. Thus, while the flat monthly single tap is ₦400/month (about ₦13/day) households spend as much as ₦1530 (₦51/day) on water purchases. This amounts four times the expenditure that would accrue to the board. Similarly, in comparison to income, the expenditure comes up to as much as 15% or the minimum wage of ₦10,000 which is well over the estimate of the 3% of income that households are expected to spend on water supply (World Bank, 2004). The implication is that these are scope for increasing the tariff towards cost recovery levels.

3.4.3 Willingness to Pay Commercial Tariffs

Structure of the Willingness to Pay Survey

A willingness survey for different aspects of water supply to households was also carried out. The research questionnaire presented a hypothetical scenario of an improved system with water constantly available to the respondents as described in chapter three. Based on this, questions were asked on whether they would connect to the system and secure direct access and the maximum amounts they would pay.

Indicators and Benchmarks

To evaluate the result of the willingness to pay surveys, a comparison was made with estimates of actual cost in respect of connections to the system and the cost of production. The water board has no date on the actual production cost through; it has issued an official estimate of ₦86/m^3 for the whole state. It is rescannable to that Asaba ware system operates at a similar level considering that it is able to sustain current services without regular subventions for recent expenditure from the government.

The proposed tariff is ₦600 for single tap and ₦1000 for full connections. This reflects a 50% increase over current rates. The rationale is that the water Board is able to provide services and recover its opening costs. Therefore a 50% increase on residential uses should be able to cover other costs of making for full cost recovery or commercialization.

The estimate is an attempt to harmonize different accounts of existing official costs given by the Board for the whole state. A similar estimate was also made for the cost of connection using least cost materials. It came to a minimum of about ₦6,000 including ₦2,500 administrative charges. The cost of connection assumes that services lines are available in the vicinity of each residence.

Willingness to Connect to Proposal System

Households that are not presently connected were asked whether they were willing to connect to the public water supply system given the hypothetical ides of improved services where water is available constantly and on commercial basis. A majority of the respondent (66%) in all the neighborhood expressed as willingness to connected, preferring in most cases single Tap connections as against full connections. However, a large proportion (44%) of households indicated unwillingness to connect and pay above the present Tariffs or anything at all. The principal reason given is the need for government to provide the subsidized rates.

Amount willing to pay for connection

Given that some households not presently connected would want to connect if the system improves, the actual amounts they pledged as maximum they would pay was determined. The individual amount indicated among the households varies widely from ₦1, 000 to ₦20, 000.

Between the neighbourhoods, the mean values for willingness to pay for connection ranged between ₦2,000 and ₦7,000. The variation is accounted for within rather than between the samples. Thus ANOVA shows, there are wide variations within and not between the samples, significant at 95% confidence level while the former indicates uniformly in the data across the urban area, the latex indicates variations in individual household circumstances probably in income and access to alternative sources of water.

Comparing the maximum amount pledged for connection with the estimated benchmark cost ₦6,000, the data shows that only 23% of the cases are at above the cut off in the overall situation. This suggests that only a small proportion of households that are not presently connected may be able or have the desire to connect to a commercialized system as portrayed in the contingent variation scenario.

Willingness to Pay High Tariff

Respondents were asked whether they would pay more than the existing tariff under the above discussed circumstances. The findings reveal that a majority (76%) have indicated a willingness to pay more, 18% indicated otherwise, while 3% were undecided.

Amount Respondents are willing to Pay as Tariff

A one–time willingness to pay enquiry was made, using open-ended question format. Household head was requested to indicate the maximum amount they would pay as monthly bill under the proposal. The data is presented separately for single tap corrections, which is the dominant form of access to the delivery system and for full correction. For single tap

correction tariff, a wide range of pledges were made (₦200 - 3000) in all the neighbourhoods, although the ANOVA reveals that the differences between the neighbourhoods are not significant. This is a relatively low willingness to pay among the households that have full connections.

However, generalisations will be difficult in view of the small number of households who have or desire to have full connection. This is the only incidence of willingness to pay being substantially less than the cut – off benchmark. In the group comparisons, the data reveals significant differences both within and between the neighbourhoods.

4.0 Conclusions and Recommendation

On the whole, the findings show that the prospects are high for instituting water supply commercialisation policy for the study area. This is subject to the limitations of the low-income households in having direct access imposed by the inability to pay connection costs and the inherent element of inconclusiveness in the willingness to pay tariff in the data. It can therefore be averred that while commercialisation may be feasible and essential for improving the adequacy of water supply in the study area, it will be necessary to apply strategies that cushion its effects on the urban poor, who ironically tend to spend more on water supply through incremental purchases.

In conclusion, it can be said that the fundamental outcome of recent findings including those from this study on the provision of urban services is the recognition that the most crucial problems to contend with are not so much to do with economic encumbrance to cosy recovery. The development s noted are indicative of the economic factors are not at the root of the problem of poor services in urban water supply in the study area and by extension other Nigerians urban areas where similar circumstances obtain. As studies in many developing countries have shown, other factors that characterise public sector management of urban services are at the core of the problems.

The evidence generally points to the fact that the incapacitation of public institutions responsible for urban services owe to a good extend to factors related to internal management structures which as presently constituted do not permit effective performance by the Board. The findings from this study correspond with the submission. This in effect places the search for strategies for addressing poor performance in urban services delivery in the ambit of management reforms. This defines one of the frontiers for future research on the subject.

Considering the situation in Nigeria presently, it seems that there is no question of abandoning the principle of cost recovery and user-pay systems to achieve the much needed

reforms in the sector. The question as far as recent developments in the water supply sector and other urban services is one of defining its specifications and delimiting its extent in relation to different social and economic groups in the urban population.

Recommendations

Recommendations are now proffered in respects of a few selected issues linked to the theme of this study and relevant to the improvement of the water supply situation in the study area and similar circumstances in National Policy on Water Supply and Sanitation. These include the question of cost recovery of the basis for urban water supply, appropriate institutional framework for the management of the system, community, participation, and access for low-income households and tariff policies. A summary of the recommendation is presented in Table 1.

4.1 The Place of Cost Recovery and Commercialisation of Urban Water Supply in the Realm of Urban Tranformation

The issue of cost recovery in urban water supply underlies the sustainability of the services and defines the direction and content of policies that address the sector. As reviewed in this study, it is necessary to define the stakes for reforms in the sector. This much is evident under current circumstances globally, and it can be advanced that this role is likely to wax stronger in future in Nigeria. Therefore, cost recovery and its heights of programmes for urban transformation.

The National Policy for water supply and sanitation contains clear allusions to cost recovery as the main pillar of water supply in Nigeria. This is apparent in the repeated reference to financial sustainability and cost recovery as well as privatisation "wherever Feasible". The findings from this study are essentially supportive if this stance in the policy and add to the mounting evidence on the potentials for financial sustainability in urban water supply systems once the necessary institutional frame is a place, subject to moderations as necessitated by local circumstances to assist people who may not afford to pay.

Table 1. Summary of Recommendations

Policy Issue	Existing Situation	Recommendations
The status of cost recovery and commercialisation in urban water supply	• Not clearly	• Economic and social objectives of cost recovery in service provision and welfare provisions for the low-income clearly separated and purchased in line with the new
Institutional framework	• State-owned semi Autonomous public sector institution	• Evaluate existing situation and determine suitable framework to meet objectives including private sector participation. • Fully Autonomous Public Private
Community Participation	• No framework for public participation. • No constitution with local commuter on policies and programmes of the water Board	• Regulate constitution with public on key policies and projects • Establish regular community participation procedure through field investigations and consultations to determine appropriate delivery policies.
Access for the low income	• Dependence on private wells in compounds and very few public faucets and Boreholes • Some areas not service	• Increase number of point access alternatives(public stand pipes, kiosks) • Supplement existing supply with non-piped community managed sources of safe quality(Boreholes to provide safer alternatives to wells and reduce pressure on piped system)
Tariff	• Cross subsidy based *Flat Tariff structure	• Maintain principle of cross subsidy *Institute metering to check consumption

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A new great project for the ancient water system of "Milano Città Metropolitana"

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Abstract

The extraordinary "water system" of Milan can be considered as a great project which was gradually delineated over the centuries. Water always played a crucial role in the organization of the city and its territory. This special role of the water has been taken into great consideration until the end of the XIXth century, when modern planning started to consider the water an obstacle instead of a vehicle for the progress. This new attitude brought to the progressive elimination of water in the most recent plans for the city. It was a great loss, both in terms of historical and cultural heritage and also because of the consequences it had on the entire hydraulic system. Today the opinion that it is necessary to reverse this process, in order to ensure to the territory a really durable development, is widely shared. Some different studies can now be assembled and improved to delineate a general and wider project which can be considered as *a new great project for the ancient system of waters of Milano Città Metropolitana*.

1. Premise

"Water, streets and buildings: the exact hierarchy too often forgotten by Moderns". These words were said by Giuseppe de Finetti, the only Italian student of the famous Austrian architect Adolf Loos, while he was studying Leonardo da Vinci for the Reconstruction Plan of Milan, after the second World War (de Finetti,1969). This oblivion continues today, and the comparison between the current map of Milan and the one from 1888 proves it.



Figure 1: Hydrography of Milan, 1888

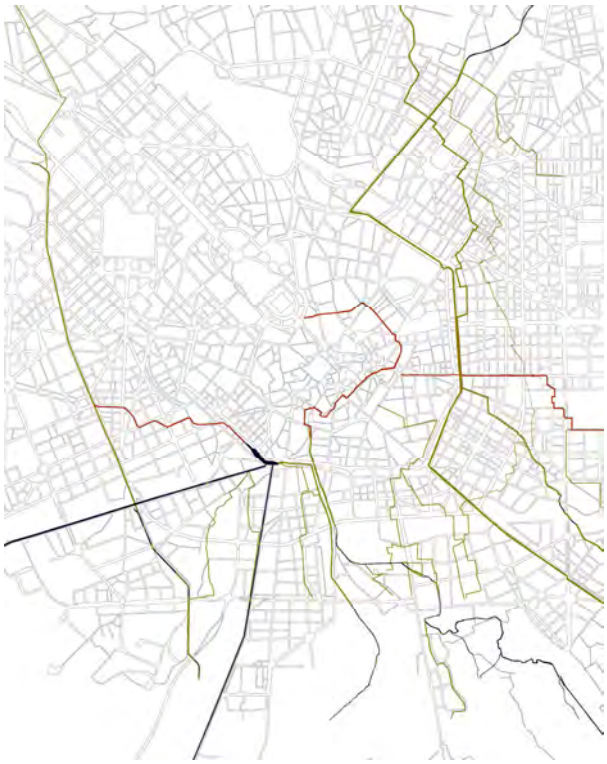


Figure 2: Hydrography of Milan, 2012

This comparison shows the almost complete disappearance of the city's extraordinary water system, which was fundamental to its organization from its origins, as well as an extraordinary source of wealth for the only European city "far from free course rivers" (Poggi, 1911).
Therefore the water system of Milan must be considered as a great project, fine tuned over the course of two thousand years of history, reuniting elements of canalization built in different amounts of times and for different reasons, but always coinciding with the most significant moments of the city's transformation (Cislaghi, Prusicki, 2014).
The late 1800's map clearly highlights its arrival point right before the decline phase began.
Specifically, you can see:
- the *Olona* river and the *Vettabbia* canal, defined under the Romans and later reshaped many times. The deviation of the Olona made by the Romans is at the origins of a town outside the city walls which is almost a bipolar structure in relation to the walled city: on one side there are the ancient roads, converging on the *Cordusio* place, on the other side the ones converging at the *Carrobbio quadrivium*; on one side the deviation of the *Seveso* river, on the other the one of the *Olona* river; on one side the cathedral, on the other the B*asilica di San Lorenzo*; on one side the Baths on the other the Market. The new riverbed of the *Olona*, that proceeds south bound, perpendicularly, then becoming the Vettabbia, was part of the process of canalization that was taking place in the South and West areas of Milan. The hypothesis of creating the first harbor along the *Vettabbia* around the area of *piazza Vetra* (named after the *Olona*), further highlights the importance of the modifications of the city's water system that had been going on since Roman times. In the case of the greatest monuments of the time that were built outside the city walls, the *Arena* and *San Lorenzo*, the water system was a necessary condition for their existence and functions (Prusicki, 2012);
- the *Naviglio Grande* and the *Fossa Interna*, defined in the Middle Ages. The Naviglio Grande was built at the end of the 12th century and served as a reorganizational element for the country side South of Milan. It initially merges with the Vettabbia, thus becoming the border of the "Cittadella", a fortified village built outside the medieval walls and surrounded by the Vettabbia, the Naviglio Grande, the waters from the moat of the city walls and from the Olona's drainage canal. When the Naviglio Grande was turned into a navigable canal (1269-71) a first *Darsena* (dock) was opened, which was at the base of later expansion projects. (Celona, Beltrame 1984).The *Fossa Interna*, made navigable in 1497 turned into an actual ring shaped harbor, developing along the medieval walls with a sequence of warehouses, the *sciostre*, which took on specific typological characterizations due to their topographic conditions (Bisi, Rizzi, Vecchio, 1987);
- the *Naviglio di Viarenna* and *Naviglio di San Marco*, with their small lakes and locks, together with the last stretch of the *Naviglio della Martesana* (Cislaghi, 2009), the "work superior to all others, among those of the same genre executed in Italy in the Fifteenth century" (Bruschetti, 1821);
- the *Darsena*, as it was in the beginning of the 1800's (Cislaghi, Prusicki, 2014) and the modifications of the *Naviglio Pavese* (Istituto per i Navigli, 2001) and of the Redefossi.

In the modern transformation of the city this great project was suddenly interrupted and, in less than a century almost completely denied through the methodical elimination of the urban landscape and its artifacts. (Lembi, 2006)
The heart of the system is what was targeted the most: the *Fossa Interna* was destroyed in a few years (Ingold, 2003), along with the *Naviglio San Marco,* and the *Naviglio Viarenna*, thus interrupting the hydraulic continuity among the *Naviglio Martesana*, *Naviglio Grande* and *Naviglio Pavia*, which guaranteed the possibility of navigation and a balanced irrigation system for the south territory of Milan (Corsani, 2010).
What followed were critical conditions for the entire system, which caused hydraulic risks, and a great shortage of water for agriculture, resulting in a loss in production value, in terms of the ecosystem and the landscape of a vast portion of the territory surrounding the city; and in the city itself, the almost total disappearance of a historic and cultural patrimony of great value, and an expression of one of the most significant hydraulic civilizations of the planet

(Cattaneo, 1841). Where the "Moderns'" destructive fury can't eliminate the waters, it hides them under the ground. Over the course of only a few decades the urban trait of the *Redefossi* disappeared, as well as the *Naviglio Martesana* (today's *Melchiorre Gioia* street), which was covered at the beginnings of the 1960's. In the same years the Olona disappeared, whose previous deviation, concluded in the 1920's along the most external ring road, had already deprived the *Darsena* of its fundamental affluent. Shortly after, with the elimination of the *Naviglio Viarenna*, waters from *Martesana* were also taken away from it, leaving the *Darsena* in a desperate situation. The *Vettabbia* was covered until the intersection with the city's railway system.
The wreckage of the unity of the system, so clearly perceived at the end of the 19th century, is accompanied by a progressive sectoralisation and fragmentation of knowledge and competence; the very memory of it is doubted, as proved by the fact that most of the available information still derives from 1800's sources (David, Lombardi, 2000).

2. A new project for the water system of Milan

Today it is universally recognized the urgent need to reverse this process, reaffirming the importance of intervening on the water system of Milan in a perspective of durable and sustainable development.
Many initiatives promoted by various organizations and institutions, at different scales and with different purposes, are nowadays in progress.
They can already be considered the cornerstones of *a new great project for the ancient water system in Milan*, developed in conjunction with a new fundamental phase of his transformation: the transition to a new dimension, the *Città Metropolitana*, established by a new law [1], which triggered a process that requires a strategic plan based on strong ideas (Consonni, 2014). The new project for the water system could be part of these ideas; however, to be fully effective, these initiatives shall be coordinated among each other overcoming the sectorial logics which partially still characterize them. Moreover they should be based on the reconstruction of a unitary process of multidisciplinary knowledge capable of recomposing the informations we have. But above all, these initiatives must be intended as an integrated architectural project, able to entirely interpret and express its potentialities within a more complex process of redefinition of the urban and rural landscape.
This process must be realized considering the role that the water system can play today, in pursuit of "the quality and beauty of the places and relationships," and of the "defense and cure of the landscapes" (Consonni, 2014). It will be therefore necessary to re-establish "the exact hierarchy fell in oblivion by the Moderns" not in a nostalgic way, but considering the new role that water can play in shaping the contemporary city (Borasio, Prusicki, 2014).

2.1 Back to the Navigli

The project for the reopening of *Navigli* in Milan, for which the Municipality has recently started an in-depth feasibility study [2], is certainly the most important and ambitious one.
This is an extraordinary chance, driven by a referendum which took place in 2011, embraced with broad participation. After more than a century the issue of the water system was brought back in the center of the city's regeneration policies.

The project foresees to rejoin the waters of the *Naviglio Martesana* (reopening it along the urban tract today provided with drains), with those of *Naviglio Grand*e along the historical layout of *Naviglio San Marco*, *Fossa Interna* and *Naviglio Viarenna*. The total length will be 8.1 km, of which 7.3 km to be built from scratch; it will reactivate the entire system of navigation locks to exceed a height of 6.2 m on the general difference in height of 10.6 m.



Figure 3: The project for the re-opening of the Navigli in Milan

Such a project provides to give new life to the great Renaissance idea of the connection of the waters of the *Ticino* river and *Adda* river, in order to reallocate them not only in their historical functions of navigation and irrigation set in a renewed and topical context of tourism and agriculture revival, but also to give new functions (such as energy, for the creation of a central ring for district heating and the reorganization of other underground services).
On a territorial scale it also means to complete the project in course of realization of the navigable waterway from lake *Maggiore* to the Adriatic See, allowing in perspective also the connection to the lake of *Como*, rediscovering Milan as a river port, once the largest in Italy.
At the urban scale it means to activate a redevelopment process of many parts of the public space that, given back to the pedestrians, regains a new role, giving also an essential contribution to one of the objectives outlined by the Sustainable Urban Mobility Plan (Spinelli, 2012).

In particular, the reopening of *Naviglio Martesana* achieve requalification of *via Melchiorre Gioia*, the main road, 40 m wide and about 3 km long: a complex urban space, where it is immediately perceivable the strong contrast between the unit given by its straight course (originated by the correction of the last section of the canal built in 1546, a century after the construction of the remaining part of the tract) and the heterogeneity of its formal and functional characters, further accentuated by the most recent transformations of the new Porta Nuova district.

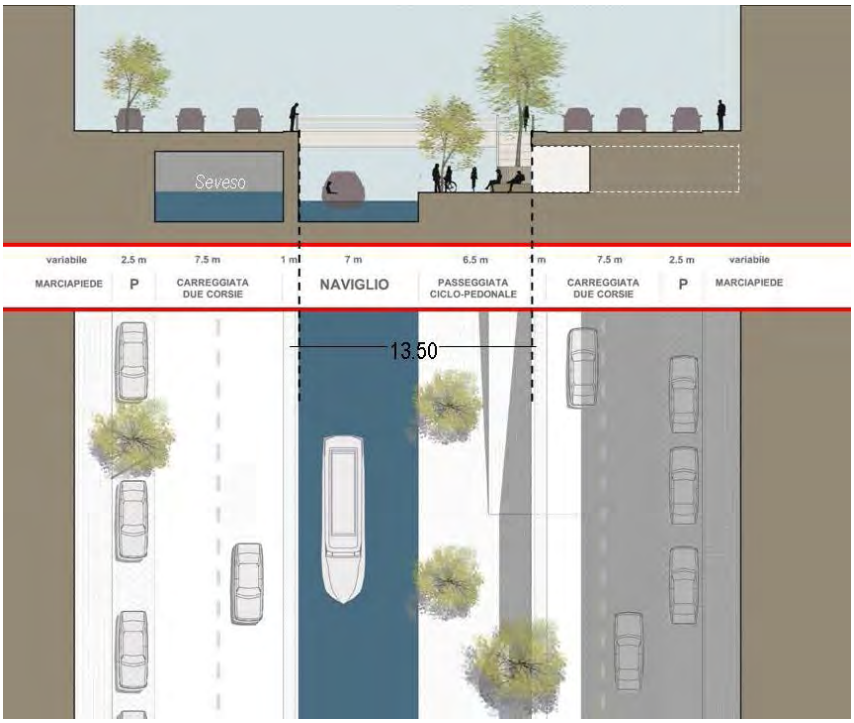


Figure 4: Section and type plan of Naviglio Martesana re-opened in the urban tract

The project [3] proposes the replacement of the actual underground hydraulic artifact with a real "street in the street", protected from traffic, 13,5 m overall wide, welded seamlessly to the existing tract of the bike path along the entire course of *Naviglio Martesana* (38 km).
It is a system composed by the canal, 7 m wide in line with the new project's measures of the *Fossa interna*, and a quay, along which there will be a continuous tree-lined promenade, located under the street level.
The size of the quay allows to foresee an equipped belt-zone, along whose linear development-line there are vertical connections, resting areas, trees, and a continuous stripe, which includes another row of trees, and paths for bikes and pedestrians. In the difference between the promenade and the street level, as well as underpasses connecting the sidewalks, can be foreseen covered and closed spaces for public places and business activities.

2.2 The project for a new Dock

A second project, carryed out as an academic research [4], proposes the construction of a new Dock on the area of the former rail yard of Porta Genova. (Cislaghi, Prusicki, 2010)
This proposal suggests further development of the waterway system of Milan. It's complementary to the idea of reopening *Navigli* and consolidates the urban role of the old *Darsena* as well. The old *Darsena* is the subject of a reorganization project, nowadays almost completed, which, however, does not solve the serious hydraulic problem due to the suppression of its two most important historical tributaries leaving standing water in large part of the basin, with negative consequences on the possibility of use.

The project for a new Dock suggests the partial diversion of the *Naviglio Grande* from the bridge of *via Valenza*, opening a new canal along *corso Colombo*. This new canal is connected with the *Olona* river, still existing below street level, so as to feed again the basin of the old *Darsena* and to ensuring the movement of the water that is currently precluded.



Figure 5: The old Darsena in 2009



Figure 6: The project for a new Dock, 2009

In the huge area of the rail yard of Porta Genova, the new canal becomes wider to form a large water square.



Figure 7: the master plan of the new Dock

The water square connects the land ways and the waterways, and unifies the surrounding part of the city and the many activities related to communication, design and fashion that have gradually replaced the industrial activities in the last forty years. The new Darsena designs a single curve with a constant section of 30 meters throughout its development, the technical reasons of the rail yard form are reinterpreted to design a new civil waterway.

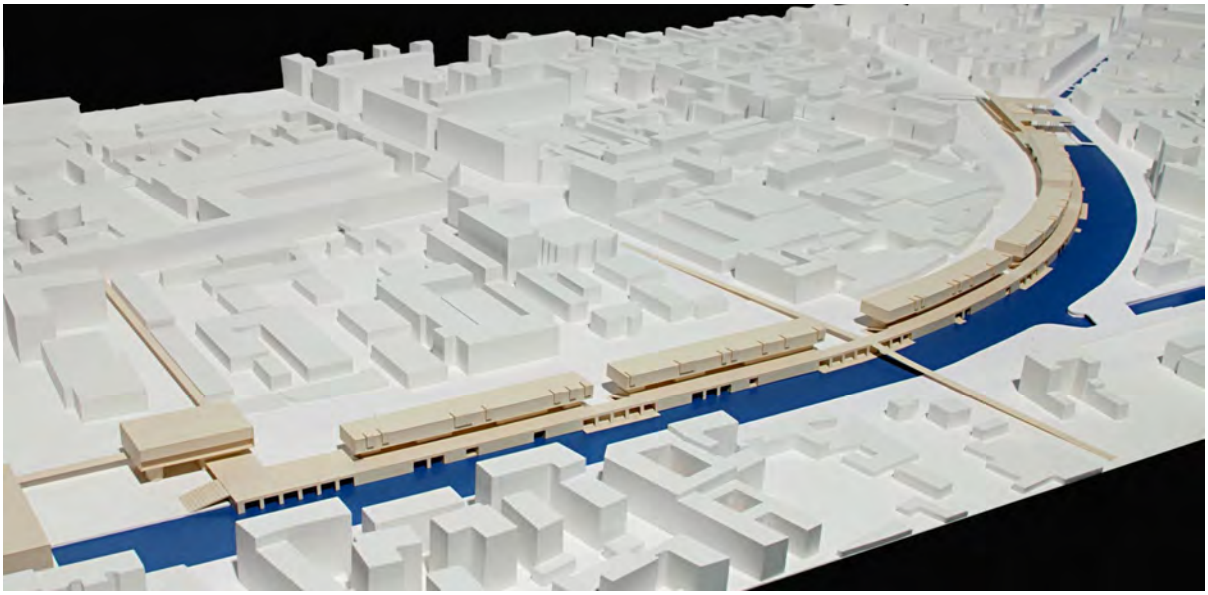


Figure 8: the architectural complex for the new Dock

The unity of the form of the new Darsena is emphasized by an architectural complex, conceived at a urban scale, which assumes the role of the northern embankment of the basin. The section of the building defines an organization of urban paths on several levels: a raised walkway that proposes the experience of public promenades designed in the neoclassical period on the Spanish city wall, now demolished, along which there were the pavillons of an important popular fair; a sequence of plazas and balconies that overlook the waterway, reminding famous projects of the highest architectural culture in Milan (Filarete, Leonardo di Vinci, Luigi Canonica, Giovanni Antolini and the same Giuseppe de Finetti, to name a few); the boulevard at street level, with a double-height portico that surrounds and protects the front of new commercial space in continuity with the axis of corso Genova and corso Colombo. The two heads of this complex are the key points of the system: towards the historical city, the train station is reused as a new port, connected to the underground station and to a shopping plaza. Towards the limit area of the rail yard area, is opened a square overlooking the water with an auditorium.
This square is also in relationship with the new museum "City of Cultures", designed by David Chipperfield, almost completed, and with a new sports complex proposed in the areas between the Church of *San Cristoforo* and the rail yard. On the new square, the sports center comes with the large building of the Baths, which aims to revive the important tradition of buildings dedicated to the water in Milan (Cislaghi, Prusicki 2014).

2.3 Projects for the rebirth of Vettabbia

Several ongoing initiatives have as their object the rebirth of the *Vettabbia* canal. It was a fundamental element in the construction of the south Milan, almost certainly navigable in ancient times, and reason of the settlement of the medieval abbeys of *Chiaravalle Milanese* and *Viboldone* (Loi, 2014).

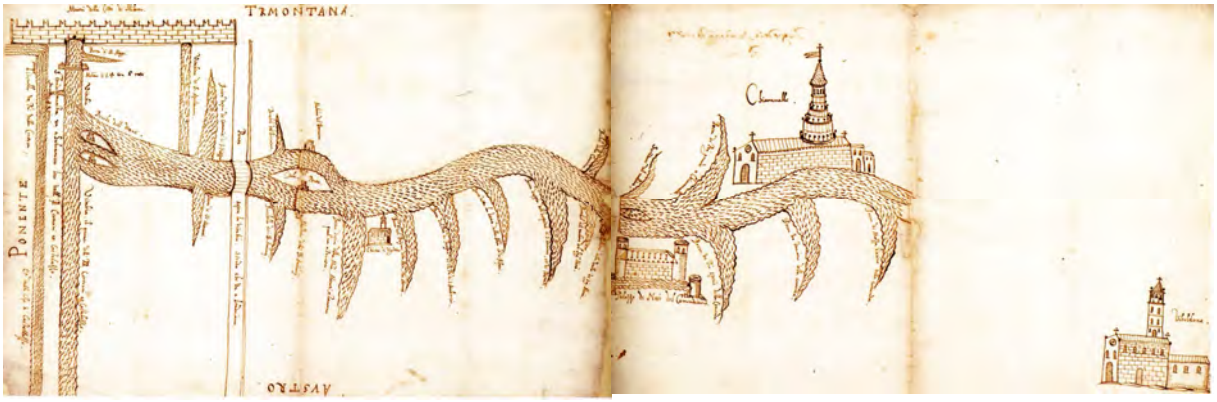


Figure 9: the Vettabbia's course in a XVI century drawing; on the right the Chiaravalle Milanese and Viboldone abbeys

After having been for more than a century the main drainage open-pit channel in Milan, with the activation of the *Nosedo* purifier, it has obtained extraordinary landscape, environmental and productivity potentialities, finding again a fundamental reference in the ancient structure of the river valley (Prusicki, 2012).
In connection to the purifying system, *Vettabbia* has been completely redesigned from the hydraulic point of view, in order to reestablish its role as the fundamental irrigator of a wide area (37 sq. km).
The new *Vettabbia* is formed of several sections: *Vettabbia Alta*, which extends from the origin to the ancient rural settlement of *Nosedo*; *Roggia Accessio*; *Vettabbia Bassa – Emissario di Nosedo*, and the *Vitabia nostra di casa*, coincident with the *Macconago* canal.

The first section, from which wastewater has been completely eliminated, is now powered exclusively by water drawn from the aquifer to take under control the ascent, an important phenomenon, determinate in the southern part of the city in its early de-industrialization period, when collections were greatly diminished.
This new condition represent an essential resource for the renewal of the urban that *Vettabbia* crosses.
Upstream, towards the city, the project elaborated by the Japanese office Sanaa for the Bocconi University provides the reopening of the *Vettabbia* for a short segment, wich is currently covered. It includes the construction of a new bike path that will be connected with the one already built further downstream, beyond the bypass and the railway. In this area the exposed length of the canal was redeveloped in conjunction with the new *Ravizza* neighborhood (recently built on the area of the former *Officine Meccaniche* factory). Here, along the townpath, was devised a long promenade called *Parco della Vettabbia*.
The second section is formed by the *Roggia Accessio*, rebuilt with a natural layout as required by the Ministry of Environment on the occasion of the approval of the project of the purifier. The *Roggia* is currently mainly fueled with treated water waiting to increase the capacity of *Vettabbia Alta* to which it is connected. This is made possible by the introduction of *Martesana*'s water coherently with *Fossa Interna* hydraulic reconnection project.



Figure 10: the roggia Accessio rebuilt



Figure 11: the pond of Acqua Resa

The *Roggia* flanks the *Emissario di Nosedo*, the canal realized in 1889. For a certain tract (up to *via Sant'Arialdo*) it has the function to overflow for the purifier and hooks into *Vettabbia Bassa* (completely supplyed with purify waters inserted under *via Sant'Arialdo*). In this way *Roggia* regains its function of irrigation canal, which is crucial for the landscape and environment and productive redevelopment of the entire Valley. Another canal, *Macconago* called *Vitabia di casa nostra* and probably the former bed of *Vettabbia* in ancient time, is given back its original functions; the fact that is supplied with treated water will allow to start up the recently restored mill of *Chiaravalle* Abbey and to flush the agricultural south lands.
These projects for the *Vettabbia* determine the *Parco agricolo-urbano della Valle della Vettabbia* [5] (Prusicki, 2007), a large public park of over one hundred acres with preminent agricultural character. The realisation is still in progress and is characterized by the regeneration and recovery of water. This is a vast agro-forestry ecosystem, crucial for the cultural and educational system of the largest regional park, the Parco Agricolo Sud, that is the widest agricultural park in Europe (47,000 has); a veritable "laboratory" for the revival of the entire valley area.
The coverage of the last stretch of *Emissario di Nosedo* allows to maintain continuity to *via S. Dionigi* bike path which comes directly from the city center. On the right bank of *Vettabbia*, between the *Cascina Vaiano Valle* and the purifier, there is a large wood with a naturalistic function, to complete the one planted inside the fence of the installations that already begins to frame the garden of the purifier building representation.



Figure 12: the Vettabbia Valley Park

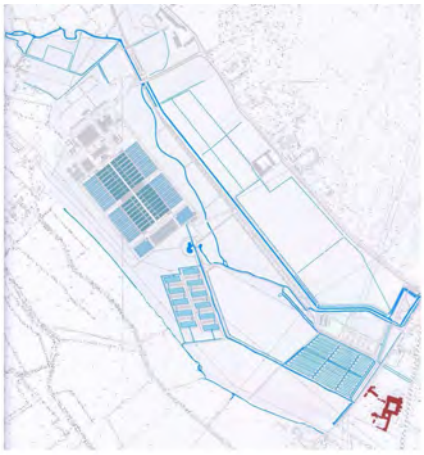


Figure 13: the water system of the Park

To the east, between it and the *Canale del Consorzio*, in parallel with the *Roggia Accessio's* new bed, open up large areas of lawn accompanied by the walk-bike path that goes beyond *Cascina San Bernardo* to the abbey of *Chiaravalle*. To the south of the quadrangle of the tanks, the event of the return of the waters is celebrated by the evocation of an ancient form, a sort of *tholos*, formed by a double row of trees in a circle enclosing a pond, the *stagno dell'acqua resa*, a typical area of the environment of the Po valley, now almost entirely disappeared.
The treated water will feed a large "humid forest" which continues and reinforces the guidelines of the ancient pattern: a multifunctional ecosystem filter that will also be strategic for the educational and naturalistic use of the park, as well as the *Marcita di Chiaravalle*, rebuilt in front of the abbey, in its original position.
In the areas for the maintenance of agricultural production, the project redefines the fundamental elements of landscape (sewers, rows, rural roads) and indicates some leanings to promote agriculture in accordance with the concepts of environmental and multi-functionality sustainability in line with current directives.

The design of the park is extended to the whole area of the valley in a vision developed as a pilot project by *Regione Lombardia* in 2005 [6] (Prusicki, 2006).

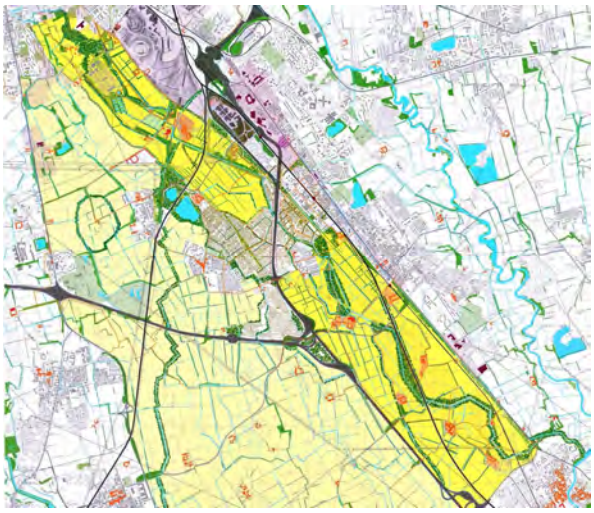


Figure 14: Vision for the regeneration of the Vettabbia's Valley

The strongest point of such a vision is the acknowledgment of the ancient unity of Valley and, at the same time, its articulation in three separate subsystems, result of its transformation process. For each of these a dominant design subject was defined.
For the subsystem of *Chiaravalle* are confirmed the central themes of the “rebirth of the water” and of the relations between *Chiaravalle* and the enviroment of the valley.
For the subsystem of *Sesto Ulteriano* (an extended crafted-manifacturing cluster, grew abnormally in the sixties of the twentieth century around the ancient rural villages without an overall plan, today characterized by a very low environmental and landscape quality) the issue identified is the “rebirth of the soil”. In addition to essential environmental regeneration initiatives, it is strategic a coherent landscaping of a long and narrow area unbuilt until today: a unique opportunity to ensure an ecological connection of the entire valley.
In the southern part of the valley, corresponding to the subsystem of *Viboldone*, the recomposition of its unity can be obtained by maintaining and encouraging agricultural activity and promoting the "rebirth of the villages".

2.4 The reconstruction of the Olona river valley

The fourth project, started by *Regione Lombardia* in 2009 as "Strategic action to enhance and upgrade the entire sub-basin of *Lambro – Olona* river," [7] proposes the reconnection of the *Olona Superiore* with the *Olona Inferiore* and the Po rivers, rediscovering the traces of their former beds diverted in ancient times, still marked by fluvial deposits of gravel, sand and silt. The artificial canalization of the *Olona* and *Seveso*’s riverbeds through Milan, started during Roman times, which was for a long time fundamental source of sustenance, became a hydraulic network of tunnels crossing the city area, absolutely unapt to sustain the hydraulic needs of an ever-growing city.
The critical situation of the hydraulic system recognized at the beginning of the last century by the Coordinating Committee of the Waters of the *Provincia di Milano*, led to the construction of large hydraulic infrastructures of protection (*Canale Scolmatore di Nord Ovest, Deviatore Olona*). Nowadays they are no longer sufficient to mitigate flood risk within acceptable limits. More recently the *Autorità di Bacino* of the Po River, with *Regione Lombardia, Provincia* and *Municipalità* of Milan, conducted new studies for the hydraulic protection of the city of Milan. They provided an innovative solution of hydraulic protection for the whole basin with a complete system of river and urban laminations and extended to the river network and integrated with the existing system of waterways and spillways.
The reconnection of the Olona river proposed by the project offers the exceptional opportunity to avert from the most critical part of Milan the flood of these rivers, bringing again, after more than a millennium, the waters in their natural beds and rebalancing the hydrologic and hydraulic asset of the whole territory. The project is important not only in relation to water safety, but also to the overall hydrological balance of the country and of the groundwater and for the consolidation of urban and peri-urban agricultural landscapes in one of the most valuable site of the Po valley.
The "new landscape of water" will be generated by a series of provisions designed to ensure high quality open spaces, with the creation of bank strips, afforestation, implementation of existing and planned bike and pedestrian paths connecting to the existing and planned parks.
Particular attention will be devoted to the enhancement, to the point of view of the landscape, of the interventions of consolidation of the surface irrigation network (fed by the waters of the secondaries of the Villoresi Canal), also to implement the development of a truly rural-urban settlement pattern and to strengthen the Regional Ecological Network.



Figure 15 : the early course of Olona, Seveso e Lambro rivers according to F.Poggi (1911)

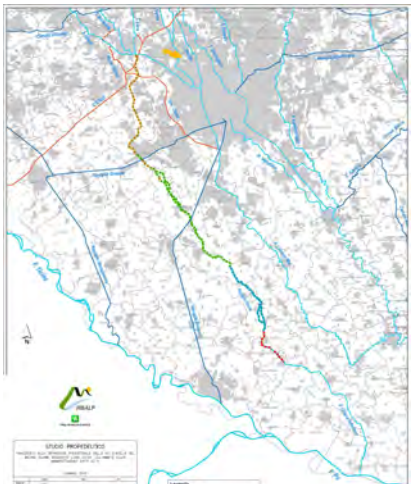


Figure 16 : the project for the reconstruction of the Olona river valley

The project of riqualification of the landscape of water of the Olona river widely exploites the opportunities offered by ongoing initiatives at the local and over-local level; it proposes an idea of transformation of the landscape of the river valley, linked with the belief that only by a shared understanding of the transformative trends may arise a will of containment of degradation and effective redevelopment.

But further research should be developed in the direction of an urban renewal strategy based on the requalification of the water system: for instance the partial reopening of the Redefossi canal, currently subject of some studies and PHD thesis at the Politecnico di Milano[8].

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[2] The feasibility study "Studio di Fattibilità della riapertura dei Navigli milanesi e per la riattivazione della navigazione lungo il complesso del sistema dei Navigli" coordinated by Antonello Boatti was commissioned by the Town of Milano to the Politecnico di Milano and involves four Universities of Lombardia. The research group incudes for the Politecnico di Milano: E. Battisti, A. Boatti, F. Boscacci, R. Camagni, G. Goggi, M. Prusicki and R. Rosso; for the Università Statale of Milano: E. Riva and P. Inghilleri; for the Università degli Studi of Pavia: S. Sibilla, for the Università Bocconi of Milano: E. Borgonovi and involves as well the experts and scholars: G. Bassi, E. Bertoni, A. Bonamore, C. Candia, G. Carucci, S. Carzaniga, A. Cassone, A. De Carli, A. Giannini, C. Lamera, G. Longhi, A. Lugarini, E. Malara, F. Malara, L. Pola, M. Proverbio, N. Rainisio, G. Rosti, M. C. Sciandra, E. Solomatin, U. Vascelli Vallara.

[3] The architectural feasibility study concerning the reopening of the canal Naviglio of Martesana was developed by M.Prusicki with C.Candia et al.

[4] The project was developed in September 2009 at the Politecnico di Milano, Facoltà di Architettura Civile, by G. Cislaghi and M. Prusicki (coordinators), with A. Lorenzi, A. Schiavo et al.

[5] The project was developed in several stages, between 2000 and 2009, by a teamwork coordinated by M. Prusicki et al.

[6] The pilot project was developed by M. Prusicki (scientific coordinator) et al.; Institutional coordinator Regione Lombardia, R. Ramozzi, A. Rossi, in the project of transnational coordination L.O.T.O. (Landscape Opportunities for Territorial Organization – 2005, supported by European Union within the Interregional Program IIIB CADSES coordinated by Regione Lombardia (Direzione Generale Territorio e Urbanistica).

7 The reconnection proposal of the water courses in the Olona - Bozzente – Lura valley was worked out by M. Borasio, A. Paoletti, M. Prusicki et al. with the institutional coordination of Irealp/Regione Lombardia within the activities for the Contratti di Fiume.

[8] About the Redefossi, see the paper presented by Claudia Candia (Politecnico di Milano) in this congress : "The regeneration of the historic Redefossi canal in Milan".

Hard versus Soft: A Comparative Study of Multi-Functional Urban Water Defence in Singapore and New York City

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Abstract

The necessity and urgency of multi-functional water defence are steadily increasing due to global competition among cities, as well as impacts of climate change. Among its many methods, water defence is generally divided into hard and soft approach. Hard approach mainly uses man-made constructions such as storm surge barriers, dikes, or groynes, while soft approach adopts a more natural approach, with an extensive use of landscape. In order to observe the applications and implications of different water defence methods, a set of parameters that consists of physical, social, ecological and city branding aspects are presented in this paper. Additionally, two case studies in Marina Barrage, Singapore and BIG U Plan, New York City are given to illustrate the use of aforementioned parameters. Both projects are chosen because of their similar urban context, with the initial hypothesis of hard approach adopted by Singapore and soft by New York City. However, a latter investigation by the parameter analysis proves the opposite. In other words, the design parameters are suitable as a preliminary analysis tool in testing the initial hypothesis and finding suitable precedents of multi-functional water defence.

1. Introduction: The Rise and Value of Multi-functional Water Defence

The shift from mono to multi-functional water defence is influenced by the changing paradigm in waterfront areas. Although the most prime real estates currently are found around the waterfront (Rybczynski, 2010), its capitalisation has just started in the middle of the 20th century. Based on an observation by Davidson (2012), waterfront in the 14th century was a platform for mercantile activities for international trade. Then, military facilities such as naval dockyard and munitions storage were built in the 16th century as the need to protect the economic activities arises. During the 19th century industrialisation, bigger docklands, railway terminals, huge storehouses and water-reliant industries like textiles, dyes, cable making or breweries laced the growing port areas. The waterfront became a domain of heavy industries that was not integrated in the citizen's life. This ignorance continued until the early 20th century, where the waterfront was seen as nothing more than an infrastructure. As Le Corbusier put it, *"The river is kind of liquid railway, a good station and a sorting house* (Rybczynski, 2010)*."* This viewpoint didn't hold for long since the advent of truck transportation and ship containers prompted the ports to move out of the city in favour of a direct connection to highways and railways, as well as a vast area for placing the containers. Finally, starting in the 1970s, the abandoned waterfront areas turned into major urban regeneration projects that called people back to the water with diverse types of programs and activities (Davidson, 2012).

In many cities, the waterfront areas are the jewel in the crown, where the most distinguished residential areas, business districts, retails, communal and cultural functions, as well as vibrant public parks or promenades are located (Rybczynski, 2010). This circumstance can be observed worldwide, from Hafencity in Hamburg, Darling Harbour in Sydney, The Bund in Shanghai, Battery Park in New York, Scheveningen Boulevard in Netherlands, to Marina Bay in Singapore. This strategic

position and complexity of uses demand a multi-disciplinary approach to satisfy the social, political, cultural, economical and environmental needs. The same attitude is also required by water defence development. As a part of waterfront areas, it holds the same significance and urgency to integrate itself to the larger urban fabric, as well as to maximise its property value by providing additional functions and services.

The emergence of multi-functional water defence is also influenced by the global competition among cities. Instead of passively waiting, cities should become proactive in constructing itself to attract business, tourism, talent or residents (Dinnie, 2011). As one of the urban highlights, the waterfront areas often become a showcase for the city appeals as well as an attribute to its branding. The contribution of waterfront as a branding attribute varies upon its physical features, events, stories and the associated city's brand. For example, Hafencity with its mixed-use programs, flood-proof system and engaging public plaza is ideal to promote Hamburg as an attractive place to live, work and play; while Marina Bay's spectacular view in addition of high-end retails, cultural and recreational functions prove to be a strong tourism attraction in Singapore. The inclusion of water defence as a branding commodity signifies that it is not merely a flood protection, but a part of the bigger stories that shapes the city image. In other words, multi-functional water defence is an important part in raising the city's level of global competitiveness.

Climate change provides a huge motivation for policy makers and urban planners to redevelop their waterfronts. As a result of global warming, the increasing sea level generates higher tides and storm surges and diminishes natural flood protection like beach, sand dunes, or barrier islands (Union of Concerned Scientists, 2011). This situation threatens the safety of waterfront areas and appeals for a better flood protection to secure its properties. The importance of waterfront area as a city branding attribute and valuable development location further heightens the urgency to incorporate water defence into its development. This is a step that has globally been taken in projects of various kinds and scales, such as Hafencity in Hamburg (mixed-use district quarter), Trinity River Vision Project in Texas (residential and recreational waterfront corridor), or Scheveningen Boulevard (leisure and tourism seaside area). The aforementioned projects stress the importance of capitalising the waterfront while taking a precautionary measure by protecting it against flood threat. All things considered, water defence becomes an integral part of waterfront development, especially on the flood-prone areas.

The variety of contexts and aims generates different methods of water defence in urban areas. These methods are generally divided into hard and soft approach. Hard approach can be described by the main use of man-made constructions such as storm surge barriers, dikes, boulevards, groynes and dikes in dune, but soft approach adopts a more natural intervention like sand nourishment or offshore wave breaker (Baptist, 2011, Deltares, 2012). This categorisation also implies different purposes and development impacts for each method. Hard approach is more likely to be integrated in a mixed-use urban waterfront development that may grow into the new city centre or tourism hotspot, and soft approach works with 'Building with Nature' concept to generate ecosystem services by creating a natural recreational area, as well as preserving and restoring the valuable existing ecology near the city for flood protection, food or water supply.

Given their essential roles in waterfront projects, applications and implications of different water defence methods need to be investigated further, especially in accordance to other relevant issues, such as city branding and climate change. For that purpose, this paper presents a set of parameters based on literature reviews, followed by two case studies in Singapore and New York City. The study results then

can be used to help decision makers in analysing, choosing and applying the most suitable method for their projects, in consideration of various aspects involved.

2. Design Parameter

The complexity of multi-functional water defence requires a comprehensive set of parameters for its investigation. The parameters are based on the aspects of urban regeneration projects and the importance of city branding. According to Sykes (2000), urban regeneration aims to bring a lasting improvement in the physical, social, economic and environmental condition of the subjected area. Since most of multi-functional water defence projects inside the urban area are regeneration projects, the aforementioned elements forms the basis of the parameter. The relevance of city branding in today's urban development projects is also taken into account. As a result, there are four main parameters in this paper, physical, social, ecological and city branding.

In order to properly work with the parameters in this paper, there are two things that a future user needs to keep in mind. Firstly, the parameters presented in this paper studies the impacts of built environment to social, ecological and city branding aspects. For that reason, the physical part provides a description or narrative regarding the project, whose impacts on other aspects are analysed in later sections. Secondly, the parameters are not and should not be used for final assessment tool because of its general characteristic. In the opposite, it is suitable for a preliminary analysis and understanding of a project, also as a starting point to develop a more customised research tool.

2.1 Physical Aspect

During the second half of the twentieth century, several writers came up with innovative views on urban planning and the physical structures of a city. Famous writers such as Jane Jacobs – *Life and Death of the American City* (Jacobs, 1963), Kevin Lynch - *Imagine the City* - (Lynch, 1960), Christopher Alexander – *A Pattern Language* – (Alexander, 1970) and Ian McHarg – *Design with Nature* – (McHarg, 1969) changed the urban planning perspective with their descriptions of a city's physical parameters. Before those publications, modern urban planning doctrines of Congrès Internationaux d'Architecture Moderne (C.I.A.M.) dictate the urban pattern in a functional way (Corbusier, 1929, LeGates, 1996) as a reaction for the past spontaneous growth of cities and the garden city movement. Because of that, it can be said that Post-Modernism gave society a new insight in integrating physical and social patterns in urban and environmental landscapes. Until now, this kind of awareness is still found in contemporary city plans because of the education and implementation of designers and planners of the last decades.

Physical aspect of a multi-functional water defence constitutes more than just its materiality. It also provides an overview of many aspects that build or influence the existence of the object. In *Port and City* (1999), Meyer points out that programs and accessibility, historical framework and urban context are important values to describe and explain the urban waterfront, in addition of form classification. For example, the historical and urban framework of Rotterdam's waterfront is considerably different than Barcelona's. Although they show some parallel characteristics in their urban patterns, they developed themselves very differently due to cultural and political behaviours, geographical positioning, architectural movements, classification of form, programs and accessibility. Based on the aforementioned theories, the physical parameters of a multi-functional water defence are described as follows.

2.1.1 Historical framework

- Historical context of the area development (e.g. neighbourhood, district, city, regional scale)
- Previous land use, structures, programs or activities on site
- Previous accessibility level to the site

2.1.2 Form classification

This point focuses on how the waterfront acts in the urban context in a physical form.

- Which part can be defined as green and blue structures
- Is it a Path or is it a significant part of an urban flow? – see chapter 2.3.2
- Can the waterfront be classified as Landmark and or is it a node in the urban system?
- Does the waterfront function as an edge, a connecting element, or a barrier?

2.1.3 Urban context

- The positioning, scale and impacts of the waterfront in larger urban context (neighbourhood, district, city, regional scale)
- Geographical context of the area development

2.1.4 Accessibility

- Accessibility level (travelling time, number of transportation mode change, waiting time) by public transport, vehicles, boats, bicycles, pedestrians or other means of transportation
- Accessibility level for people from different social, cultural and economic background, also for the disabled

2.1.5 Programs

Functions in addition of flood defence system and their spatial arrangements, e.g. a shopping mall combined with a dike in Rotterdam.

2.2 Social Aspect

After the utilisation of Environmental Impact Assessment (EIA), urban planners and decision makers feel the need to better understand the social dimension of a development project (The Interorganizational Committee on Guidelines and Principles for Social Impact Assessment, 1994). For that purpose, Social Impact Assessment (SIA) is developed to analyse, monitor and manage the social consequences and change processes invoked by the urban intervention (IAIA, 2003). During the development process, SIA is used to help developers to predict the possible implications of their projects, so that harmful effects can be avoided. Its criterions encompass diverse points, like population characteristics, culture, attitude and socio-psychological conditions. SIA variables are not a fixed set, but highly dependent on the scale and type of projects (Sairinen, 2004). Because of that, each project should develop personalised variables based on its needs and context.

The parameters in this paper are based on the multi-dimensionality and particularity of SIA. Nonetheless, they cover not only the social impacts, but also the social change. Social change refers to direct effects caused by the development project, such as change in population or number of jobs, while social impact is perceived through certain cultural or social filter, like neighbourhood satisfaction or change in lifestyle (Sairinen, 2004). As described earlier on Chapter 2 introduction, the social

aspect in this paper focuses more on the effects of physical interventions. Hence, the parameters described below are mostly socio-spatial components.

2.2.1 Demographic composition

This point provides an overview of the change and new demographic structure of the area. Current and possible social issues can also be detected from the parameters affected by the urban intervention.

- Population (age and gender ratio, percentage of temporary/ seasonal/ permanent residents, workers, visitors, and tourists, density, income, education level)
- Housings (average household size, type of dwelling)
- Working places (type of workers/business, average company size)

2.2.2 Place making and identity

Place, in opposite of non-place (Auge, 1995), is desirable because it endorses identity and social activities. The new place identity is also influential in determining a multi-functional water defence's suitability to be a part of city branding.

- The proportion of place creation, in opposite to non-place (Auge, 1995)
- Change in perceived place identity due to flood protection and other new functions
- Change in perception of waterfront area's role, quality or identity as a living, working and playing place
- Promotion of associated place and city brands

2.2.3 Social life and interaction

New urban intervention and programs bring a shift in social life and activity on site and its surroundings. In terms of urban development, provision of public space that fosters social life and interaction among its users is highly desirable (Gehl, 1936).

- Change in users, programs and activities in public space
- Change in public and social activities pattern as well as frequency
- Promotion of certain culture or knowledge
- The proportion of public places creation that encourage social interaction among their users, in opposite to anti-social public places
- Change in family and friendship networks

2.2.4 Health and safety

Health and safety is not just an absence of disease, but also a complete physical, social, mental and spiritual well-being (Vanclay, 2003), as shown on the parameters below.

- Change in health and living quality (sanitary, happiness, stress level, average life expectancy)
- Change in pattern and frequency of criminal acts, vandalism, verbal or physical abuse on public places
- Change in perception of risk, health and safety, especially on public places
- Provision of natural surveillance or eyes on the street (Jacobs, 1961)

2.3 Ecological Aspect

The presence of water is a vital part in the existence of humankind. It is an essential part to nurture our health, as well as economic development and ecosystems. It also plays an important role in socio-economic aspects such as tourism and investment by serving as a transportation medium, a physical urban element, an environmental protection and a food security. Despite its benefits, it also imposes threats to humankind by delivering diseases, fatal floods and socio-economical damages caused by the lack of it. Considering all of these aspects, proper understanding and management of the environmental cycles are urgently needed to gain benefits of the ecosystem.

In the field of urban water management, the term 'ecosystem services' is used to address the benefits that human gains from the ecosystem (Constanza et al., 1997). These services are needed to provide humans the physical and social-economic aspects mentioned before, but they can also be used to help controlling the environmental behaviour and our dependencies on it.

This physical reliance and awareness of ecosystem services in urban development is introduced as mentioned before by McHarg (McHarg, 1969). His awareness of the importance of nature and ecosystem in urban context can be directly translated to the concept of 'Building with Nature', a multi-disciplinary method that combines engineering, science, the use of ecosystem services with urban planning. By applying this concept, a city can progress from a Sewered City' – the most common state of a city nowadays – to a 'Water Sensitive City' – the preferable state of a city of tomorrow –, or from a city with only an extensive sewage system to an adaptive, multi-functional water infrastructure and urban design (Keath & Wong, 2009).

Considering its benefits, ecosystem needs to be developed and maintained by applying 'Building with Nature' concept and integrating ecological aspect in urban design. According to Van Bueren (2012), ecology can be naturally integrated into the urban development by using three different approaches as follows.

2.3.1 Urban ecology approach

This approach interprets the city as an ecological system by integrating the natural environment into the urban complexity, especially in the fields of mitigation and compensation measures for water related issues. Within this approach, ecological infrastructure such as parks and other types of green area are an important concern.

2.3.2 Flows or urban metabolism approach

The urban area is thought as an input-and-output system of materials and urban flows, like food, water, transport or energy. This approach aims to reduce the ecological and environmental burden and the dependency on natural resources of its surrounding area.

2.3.3 Bio-social approach

This approach considers the urban space as an area of human activities from an ecological perspective. It tries to understand the competition and cooperation of ecosystem and species, as well as natural components to develop an urban system based on ecosystem services (natural, socio-economic and cultural resources) regulated by a social system.

2.4. City Branding

The role of multi-functional water defence as a branding attribute is determined by its compatibility to fit and complement the existing brand. A branding attribute varies widely in form and qualities. It can be the city's unique culture, abundant natural resources, vibrant creative industries, or an environmentally sound place to live. Because multi-functional water defence focuses more on the development of built environment, it is suitable for three types of city branding's classification. The following categorisation is adapted from a study by Dinnie (2011).

2.4.1 Attractive place to live, work and play

They contribute by providing flood protection, housings, business districts, recreational spaces, community and cultural programs, natural conservation areas, parking spaces, or waterfront promenade. For example: Hafencity (Hamburg, Germany), the New Scheveningen Boulevard (The Hague, Netherlands) and Trinity River Vision Project (Fort Worth, Texas, United States).

2.4.2 Unique tourism destination

The distinctive water defence's feature serves as a landmark and tourism attraction. In order to support this function, additional facilities such as an educational centre, tourist office, or a national park can be added as well. For example: Maeslantkering storm surge barrier (Hoek van Holland, Netherlands), Oosterschelde storm surge barrier (Netherlands) and Sand engine (South Holland, Netherlands).

2.4.3 Sustainable living place through green space creation

This branding attribute can be achieved through restoration of natural wetlands, habitats for flora and fauna, or wider coast area. For example: 'Building with Nature' development concept in Netherlands, Sand engine (South Holland, Netherlands), and Sigma Plan's flood controlled areas near Antwerp and Ghent (Belgium).

3. Case Studies

According to Doxiades (1968), Singapore and New York Metropolitan Area can be classified as a metropolis with water-related issues. In other words, they are both highly dense cities near prominent water surfaces, which provide an agglomeration of economic benefits and wealth, as well as hazards and risks. Singapore and New York forms comparable case studies with their actual waterfront regeneration plans, despite their differences in cultural context, water issues and city scale. The two metropolises are comparable in their commitments in providing water resilient areas inside the urban context and their vision to be a sustainable place to live, work and play. While Singapore struggles with drinking water provision, flash floods and impacts of climate change, New York focuses on coastal protection from storm surges, hurricanes and sea level rise. For the reasons mentioned above, the juxtaposition between two cases is interesting due to their same urban development's vision and principles, as well as their differences in methods and issues to answer.

This paper presents two sample locations, Marina Barrage in Singapore and BIG U Plan in Manhattan, New York City, to illustrate the application of design parameters and as a decision-making tool for waterfront design in a complex urban situation. Both projects are chosen due to their strategic location on the seafront near a dense

Central Business District (CBD) and a recreational green area, along with their different water issues.

3.1 Singapore

Because of its limited land area, Singapore faces a challenge and an opportunity to find innovative solutions for drinking water provision and flood protection. Singapore is a small-island state with a lack of natural aquifers and lakes to collect rainwater for drinking water provision (PUB, 2012). In addition, as an island located in the tropical climate, it receives annual heavy rainfall that causes flash floods and damages in the past (PUB, 2013b). The need for sustainable water supply and flood protection is heightened with the impacts of climate change, e.g. accelerated coastal erosion and more frequent intense rain or prolonged drought (National Climate Change Secretariat, 2012). As an answer to these challenges, Singapore comes with an integrated water supply and flood protection.

Singapore supplies its water from *Four National Taps,* a sustainable water sources that include local catchment areas, imported water, recycled and treated water known as NEWater, as well as desalinated water (PUB, 2013a). The local catchment area harvest rain and stormwater, which are then transferred to the reservoirs (PUB, 2013a). The reservoirs also serve as a part of flash flood prevention system by retaining the excessive water caused by heavy rainfall from drainages, canals and rivers (PUB, 2014a). Hence, its dual function makes a reservoir an important element in Singapore's water management.

The most well-known example of this duality is Marina Barrage, a dam across Marina Channel that forms Marina Reservoir. In addition to its double functions, it also hosts many kinds of programs and activities, which make it a popular local destination. Thus, based on the previously mentioned arguments, Marina Barrage is chosen as a sample location for Singapore case study.

3.1.1 Marina Barrage

Marina Barrage is an epitome of water defence's multi-functionality in addressing city branding, as well as social, ecological and urban issues. It has 3-in-1 benefits: water supply, flood control and lifestyle attraction (PUB, 2014b), with a physical intervention that addresses its urban context and issues. It serves as both a landmark and a node due to its striking architectural form (Picture 1), programs diversity and a steady number of visitors. In addition, it also functions as a path by providing pedestrian and bicycle accessibility between Marina East and the Bayfront area, Singapore's famous recreational and commercial spot.

Marina Barrage is Singapore's first reservoir in the city centre, which contains sweet water as a source of water supply. As a flood protection, it releases excess storm water into the sea during low tide, or pumps it out during high tide (PUB, 2013b). It is a recreational destination for various water activities, as well as a host for Sustainable Singapore Gallery (SSG) that exhibits Singapore's efforts towards environmental sustainability, including its approach in water supply and flood protection. Furthermore, it also accommodates a broad range of facilities, like stores, expo's, restaurants and a solar park.



Picture 1: Marina Barrage from Above (Source: http://www.kohbrothers.com/flashxml/coverflowfx/project/marina_barrage/image_04.jpg, accessed 29 June 2014)

Despite its close proximity to the city centre, Marina Barrage has a low public transport accessibility level. The nearest MRT station is located more than one kilometre away, and a direct bus is available only from 12 locations in Singapore. In opposite, despite its location on the tip of the island that makes Marina Barrage less integrated in the urban street network, it gets a direct connection from a highway less than two kilometres away.

The barrage socially transforms the site and its surroundings in many ways. Firstly, it creates a *place* from an empty unused land and ameliorating the perception towards waterfront in Singapore. In the past, Singapore's rivers are heavily polluted with an overpowering stench to the point that nobody wants to come near them (Singapore Sustainable Gallery, 2014). However, this opinion soon changes with the river cleaning and waterfront development projects, as Singaporeans now enjoy being close to the water, as seen at Marina Barrage. Secondly, it becomes a platform for social activities and interaction, which then attracts more people and activities (Gehl, 1936) and promotes social well-being for its users and surrounding residents. The full accessibility for people from all backgrounds, including the disabled is also supportive of this role. Thirdly, it creates various permanent and temporary jobs to support its operation and occasional events, e.g. Singapore International Water Week. Thus, the barrage becomes not only a problem solver, but also an added value to the urban quality.

Marina Barrage demonstrates the approach of urban metabolism by being a part of closed water cycle and reducing Singapore's water dependency on Malaysia. The urbanised island of Singapore functions as a water catchment that encloses the input-and-output of urban hydrology system by integrating sustainable water management technology, e.g. Marina Barrage in urban redevelopment plans. Shortly, this approach reduces ecological and environmental burdens, as well as water dependency from external sources.

Marina Barrage is a suitable showcase for Singapore's 'City in a Garden' brand with its 'Mastery of Man' attribute. In opposite of creating green spaces inside the city, Singapore aims to create a garden out of the whole city. As put by Ngiam Tong Dow, former permanent secretary for national development, *"By considering the whole of Singapore as one beautiful garden, the possibilities for NParks to exercise their imagination and creativity soared. With this paradigm*

shift came ambitious plans such as linking all the major parks in Singapore with a network of cycling tracks, and developing Singapore as 'the first city garden in the world' (Song, 2011, p.49)*."* The barrage increases the green area provision inside the urban area, while promoting Singapore's advanced technology and innovation in overcoming its natural constraints. While it is not a top urban tourism destination, Marina Barrage is an internationally renowned example in integrated water management. Because of that, it certainly is an important element of Singapore's brand attributes.

In conclusion, Marina Barrage is an example of Singapore's soft approach in water management. In spite of the hard, man-made spatial intervention, it is a good implementation of the benefits of ecosystem services. While the hard spatial structure is a result of spatial constraint and demand, it does not fail to provide a comprehensive solutions and benefits to all aspects involved.

3.2 New York Metropolitan Area

As mentioned before, climate change effects like rising sea level, changes in storm surge and wave levels, will have a large impact on how we protect our coastal areas and cities. Coastal city planning will get affected not only by storm and surge propagation, but also influenced by potential freshwater resource management. Nevertheless, the application of these planning considerations is not the same for every urban area. Unlike Singapore, the demand for a resilient waterfront that can manage more frequent super storms (Fischetti, 2013) is higher than fresh water management in New York City. This focus on measurements and urban planning strategies was shifted after super storm Sandy (Regional Plan Association, 2013). As Andrew Cuomo, current New York Governor, pointed out, *"Climate change is a reality. Given the frequency of these extreme weather situations we have had, for us to sit here and say this is once in a generation and is not going to happen again, I think would be shortsighted (*Walsh, 2012, Nov, p.01*)."*

One and a half year after the storm surge, New York City and New Jersey state have made a progress in planning policies. Different plans from engineering consultants, architecture and planning agencies create awareness and urgency to integrate social, architectural and planning values with ecological and engineering context to avoid flooding. Mitigation measures in the urban zone may differ from pure hard 'engineering' solutions, all the way to urban realignment. Nowadays, the debate whether these plans generate enough urban resiliency and sustainability over a long time (Walsh, 2012, Okt.) in New York Metropolitan Area is still carried on.

Based on the climate statistics of Massachusetts Institute of Technology (MIT), Fischetti (2013) describes that the chance of flooding will exponentially increase till 2080. This prediction indicates tremendous social and economical risks for the heavily populated urban agglomeration. That is why a well-integrated urban design is needed, to protect the city over a long time and to make the implementations financially profitable.

For the reasons stated above, Regional Plan Association of New York in collaboration with Municipal Art Society, Regional Plan Association and Van Alen Institute, organise a competition of innovative design solutions to prevent future floods in the New York Metropolitan followed by selected teams of architects and engineers (Regional Plan Association, 2013). In early 2014, these plans are published at the web page of Rebuilt by Design. For this paper, the 'BIG U' plan of Bjarke Ingels Group is chosen as a comparison against Singapore's Marina Barrage. The 'Big U' plan is a waterfront development proposal in downtown Manhattan.

Among its many components, the Battery Park is comparable to Marina Barrage in scale and context. They are both an urban intervention that is highly integrated inside the urban grain, which is located close to a highly dense urban area with recreational functions.

3.2.1 BIG U

Due to its location at the tip of Manhattan Island, BIG U's primary objective is to defend Lower Manhattan and the coastline from Clinton district till Hospital Row district in Stuyvesant Town. It 'protects a low-lying geography that compromise a dense vibrant, and vulnerable urban area. The project shields not only the city against flash floods and stormwater, it provides social and environmental benefits to the community, and fosters the public realm' (BIG TEAM, 2014, p. 01). The proposed system is founded on two pillars: social resilience and ecological engineering, while the city branding is addressed in a lesser extent through high economical value and visually distinctive design.

This plan is ecologically vibrant due to the use of aforementioned 'urban ecology approach'. By using ecological infrastructure such as rain gardens, native species bio-swales and street planting, this design integrates natural environment into the urban complex. It compensates the loss of local natural ability to reduce air and noise pollution, absorb coastal waves, cool down projected city heat effects and improve urban hydrological system.

However, the focus in social infrastructure is structurally more important than in ecological aspect. The BIG U combines a large-scale infrastructural project with the social doctrines of Jane Jacobs (1961) by adapting human scale to the new infrastructure. It creates an immense storm surge barrier that does not separate the city from its edge, but serves as an integrated connecting element that is highly accessible by various users and the nearby communities. Due to the involvement of community and neighbourhood organisations in the planning process, this plan is able to change programs, as well as public and social activities patterns in a positive direction. It will create a new public space with attractive programs, which is accessible for people from different social, cultural and economic background in the Big Apple.

Even though a barrier is a hard engineering component, the BIG U still incorporates the ecological aspect in its approach. Even though the water-works are a separating hard infrastructure with flip-down barriers, concrete breakwaters and multifunctional levees, they are very well weaved into the city fabric.

In spite of its large development scale, the BIG U does not support New York City's main branding attribute as an exciting urban tourism destination. On the other hand, this plan gravitates on providing public spaces and programs for surrounding local communities, which improve the city's spatial, social and ecological qualities. Because of that, even though the BIG U does not fit into the current New York City's branding, it can be an important support for a potential branding attribute of New York City as a sustainable place to live, work and play in the future.

In conclusion, the BIG U project is using a hard approach with a touch of soft intervention. It means, the working principle behind this scheme is based on hard water defence approach, while its spatial implementation uses soft landscape elements. This project has a huge capacity to succeed, especially

considering the involvement of local communities, environment and water consultants.

4. Conclusion

In a glance, the case of Singapore and New York City looks comparable from the similarities of their position as a waterfront metropolis with high density, sustainable development vision and popularity as an urban tourism destination. However, the analysis result proves the opposite. Singapore and New York faces different challenges influenced by different cultural and ecological backgrounds, which lead to an adoption of different water defence approaches.

The initial hypothesis regarding Singapore and New York's water defence approaches is also proven differently by the analysis result. On the surface, Singapore seems to adopt the hard approach with its man-made structure, while New York prefers soft approach with an extensive use of landscape in its scheme. However, a latter examination shows that Singapore applies the soft approach, i.e. the integration of ecosystem services in hard man-made interventions, while New York's approach is more of a hard approach with its extensive seawalls along the island of Manhattan.

In conclusion, the design parameters are suitable as preliminary analysis tool to understand a project. This paper demonstrates that an initial hypothesis is not always accurate. However, fitting precedents of multi-functional water defence can later be determined using the parameter analysis.

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Water Management in the Linth Plain Expedites Cross-Border Planning

Martina Schretzenmayr, Jacques P. Feiner

Natural disasters, avalanches, floods, and landslides have a long history in Switzerland, a country that is dominated by mountain regions and rivers. During the 18th and 19th century settlement areas and farming land have been increasingly subject to flooding. Since the 1800s many flood control projects have been carried out and were accompanied by land improvement and subsequent use as settlement area. Traditionally an effective protection against urban sprawl in Switzerland is the prohibition of building on areas endangered by natural hazards.

From 1987 to 2005, a series of disastrous floods have brought flood control back to the agenda. Since then, a series of flood protection projects have been completed, others are still under way. Focusing on the case study of the Linth plain (by expert interviews and document analysis), we will demonstrate that flood protection projects (1) have to be accompanied by measures that prevent urban sprawl as the abolition of flood danger enables urban development on areas with former building ban, and that these projects (2) give the opportunity to force municipalities and cantons, to progress with cross-boarder planning, i.e., sustainable land use planning, limitation of built-up areas, and ecological compensation.

1. Introduction

When spatial planning was finally firmly established in the Swiss Federal Constitution in 1969, Art. 22quater BV transferred the responsibility for framework legislation to the Confederation, but left the practical planning implementation to the cantons. Although the Confederation coordinates and promotes the planning activities of the 26 cantons, cross-border cooperation between cantons remains a big challenge. Whereas infrastructures, particularly for transport and environmental protection, are all federal responsibilities, land use planning (zoning and building regulations, cantonal structure plans), nature and habitat conservation are cantonal responsibilities. In most Swiss cantons, local authorities have far-reaching responsibilities, e.g. mandatory regulations for land use planning. As a result, the reality of Swiss spatial planning is intricately intertwined, especially between the cantons.

To face the difficulties that especially affect metropolitan areas, in the 2000s the Swiss Federal Council established two instruments: pilot projects (*Modellvorhabe*n) and agglomeration programs *(Agglomerationsprogramme*). Both are part of the Federal Agglomeration Policy. The first is technical and financial support for communities, regions and cantons offered by the federal level since 2002 to initiate pilot projects for sustainable development. Starting in 2007, pilot projects are not limited to metropolitan regions, but also open to rural areas as well. The agglomeration instrument intends to foster coordinated planning of settlements, transport infrastructure and landscape in a close cooperation between cantons and/or bordering countries, regions, and communities. As a reward for good coordination between general traffic and settlement development, the Confederation will co-finance transport infrastructures for public, motorized and human-powered mobility. Currently, 36 agglomeration programs receive financial support from the federal level to implement measures intended to achieve the sustainable development of the agglomeration program, e.g. transport infrastructure.

In this paper, we present the case of a flood protection plan for the Linth Plain in order to analyze how water management projects that concern more than one canton can boost cross-border planning beyond the instruments of the Swiss Agglomerations Policy established in the 2000s, i.e. pilot projects and agglomeration programs.

We will demonstrate that flood protection in Switzerland has a long tradition of initiating planning issues and cross-border planning. Recently, common concerns caused by natural hazards has induced cross-border activities that are not limited to the mere protection against this specific risk, but also includes sustainable development of the living space: setting limits for built-up areas, protection of landscapes and agricultural land, ecological compensation, improvement of transport infrastructure, etc.

2. Historical Background

Switzerland is not only a small country, but due to its mountainous areas, it also has a limited area available for settlements. Many of the valley plains have been threatened by floods since prehistorical times, and are therefore neither arable nor buildable ground due to high groundwater levels. Thus, settlements have been limited to the hillsides along those plains. During the 18th and 19th centuries, the danger of floods – and with them malaria – increased due to climate change and increasing deforestation. Moreover, population growth since the 19th century has increased the demand for arable land. By 1955, more than 500 km of river regulations had been carried out in Switzerland in order to improve the living conditions and extend the area that could be used for agriculture, settlement and economic purposes.

When the federal constitution created a federal fund for public works in 1848, it also produced a series of river regulations for all of Switzerland. The first river regulation took place in 1711–14 when the Kander River was redirected into Lake Thun. A century later, in 1807, the Linth Plain was endangered by the continuous rise of Lake Walen due to sediment from the Mollis River at the lake's exit into the Linth Plain. This was the second site of a huge river regulation: (1) redirecting the Mollis River into Lake Walen via the newly built Escher Canal and (2) straightening the Linth River between Lake Walen and Lake Zurich via the newly built Linth Canal (Speich Chassé 2013).

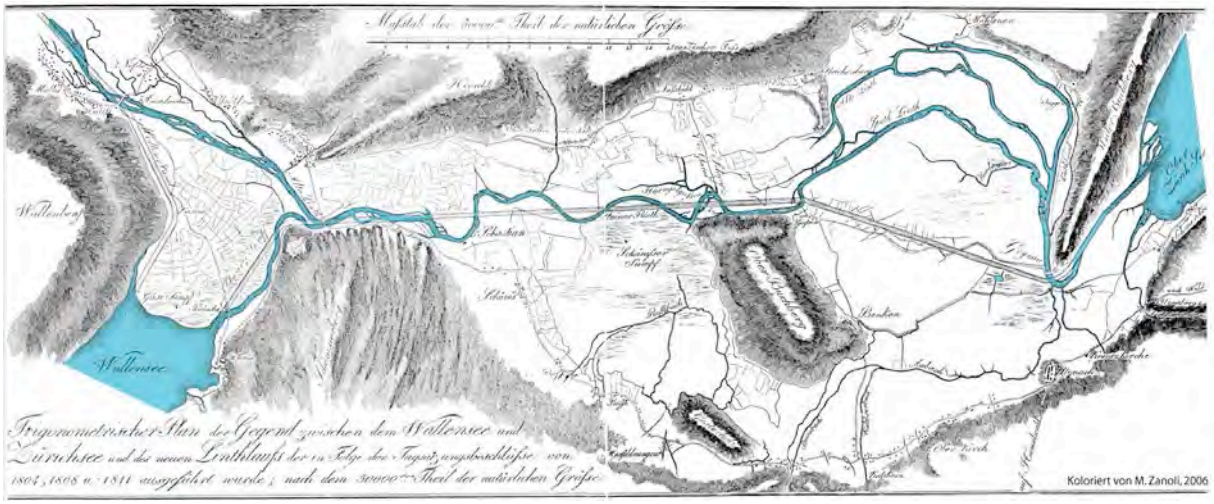


Figure 1: River regulation in the Linth Plain 1807–1816. (Source: Technische Oberleitung der Linthebene-Melioration (Ed.) (1965) Melioration der Linthebene: Schlussbericht)

This "structure of the century" was a unique engineering achievement as well as an extraordinary management achievement. Hans Conrad Escher, "Father of the Linth River

Regulation", managed to conquer the technical, political and financial challenges: He involved one of the best water engineers, the German Johann Gottfried Tulla, provided financing for the project implementation through a stock issue, and was able to coordinate a project that involved three cantons, St. Gallen, Schwyz, and Glarus, with the support of the *Tagsatzung*, i.e. the legislative and executive councils of the Swiss Confederation, from the beginning until the formation of the Swiss federal state in 1848. The Linth River regulation was a project that was shaped by trans-regional solidarity from its very beginning.

Due to the Linth Canal system, the flood danger was alleviated. The canal system also drained many of the large swamps, which led to the elimination of malaria. Moreover, the canal could be used for shipping, which significantly improved the transport infrastructure of the time. However, the drainage of the plain was not completed until the 19th century because it had to be financed by the private owners of the land. Meanwhile, only sedge grew in the plain, which was harvested by the farmers. It took another 100 years before the Linth Plain was arable and settlements could be developed. The catalyst for the final drainage of the plain was World War I and the interest in preventing food shortages during future crises. As a result, in 1918 a drainage system was established and the plain became fully cultivatable and settlements could be established as well. About that time, a project was initiated to fill in the plain in places with rubbish from the City of Zurich. Fortunately, transport of the rubbish could not be implemented and land acquisition was too difficult, so the project was dropped (Hösli 1966).

The drainage efforts in the Linth Plain were part of a nation-wide undertaking that was labeled "interior colonization" (*Innenkolonisation*) (Vital 1951). This movement was initiated in July 1918 when the Swiss Association for Industrial Agriculture *(Schweizerische Vereinigung für industrielle Landwirtschaft* (SVIL)) was founded. It changed its name in 1919 to *Swiss Association for Industrial Agriculture and Interior Colonization*. The aim of interior colonization was to increase the amount of arable land in Switzerland by bringing farmers to drained and improved plains and to resettle city dwellers in rural areas in order to curb the trend towards rapid urban development, i.e. to decentralize population and industry rather than centralizing them (Vital 1951). Therefore, SVIL initiated the first national plan on settlements in Switzerland.

In the 1930s, a huge improvement project was started in Switzerland that was also intended to create jobs during the Great Depression. This initiative for land improvement was intensified during World War II because food shortages were once more a pressing problem. In the course of the ensuing "battle for cultivation" *(Anbauschlacht*), Switzerland wanted to increase the production of food in order to be independent from having to import it. The amount of arable land was extended by all possible means, with the goal to double agricultural land nation-wide. Even the parks in the City of Zurich were used to plant potatoes. Moreover, the drainage of different plains in Switzerland was pushed forward, including the Linth Plain, which would not have been feasible due to regional conflicts and controversies between different actors, without the pressure from World War II.

Almost 28 square kilometers were drained in the Linth Plain during this period. Since then, a total of 150 km of canals drain the plain and the pumps still run continuously. The Linth Plain is a "man-made" landscape that "turns the laws of physics upside down" as the water level of the Linth River is higher than the plain itself in some areas (Schlegel 2013:87). A broad land improvement was carried out from 1941 to 1964 (Speich Cassé 2013) and about 100 new farms were scattered across the Linth Plain (Vital 1951). As a result, the formerly marshy landscape of the Linth Plain was vastly transformed (Hösli 1966).

This clearly indicates that water management measures for the Linth Plain have always been connected to the necessity of land use planning because new agriculture and settlement areas could be created and land use rules had to be established.



Figure 2: The Linth Plain with agricultural land and high-voltage power lines that transport hydroelectric energy from the mountains to the metropolitan regions. (© Author 2012)



Figure 3: Rural village in the Linth Plain. (© Author 2012)



Figure 4: Single drainage manhole protruding from the plain due to an abatement of the water level. (© Author 2012)

A freeway was built in the 1960s that connects Basel and Zurich with the Grisons mountain resorts – crossing the Linth Plain. This highway and the extension of the commuter railway system (S-Bahn) of the booming Zurich metropolitan area to this region, made the Linth Plain an attractive living and recreational area and increased the development pressure for housing and firm locations.



Figure 5: Development pressure in the Linth Plain, marked by construction profile boards that are required in order to obtain a building permit. (© Author 2012)

3. Flood Protection of the 2000s

In 1999, the Linth Plain was again endangered by flooding, but the dam held. However, having been on the brink of disaster, the three cantons involved, St. Gallen, Schwyz, and Glarus, put a new flood protection plan in 2000 into force that aimed to reinforce the Linth Canal and its dams. The measures for the improved flood protection had already been developed and a consultation process that gave all actors involved (from communities and cantons to private owners and organizations) the opportunity to state their interests and objections was already underway when another flood occurred in 2005. Once more, no dams burst, however, the urgency of the condition of the dam works was obvious and forced all actors to proceed. In 2007, a construction permit was granted for a refined flood measure project based on the initial project High Water Protection Linth (*Hochwasserschutz Linth 2000*) however, several objections were taken to court. All objections being finally rejected by the court in 2008, the construction permit was confirmed and the implementation of the flood protection project could be carried out between 2008 and 2013.

The objections that accompanied the flood protection development and permit procedure concerned the reallocation of agricultural land and disputed the areas devoted to flood protection measures and ecological compensation areas.

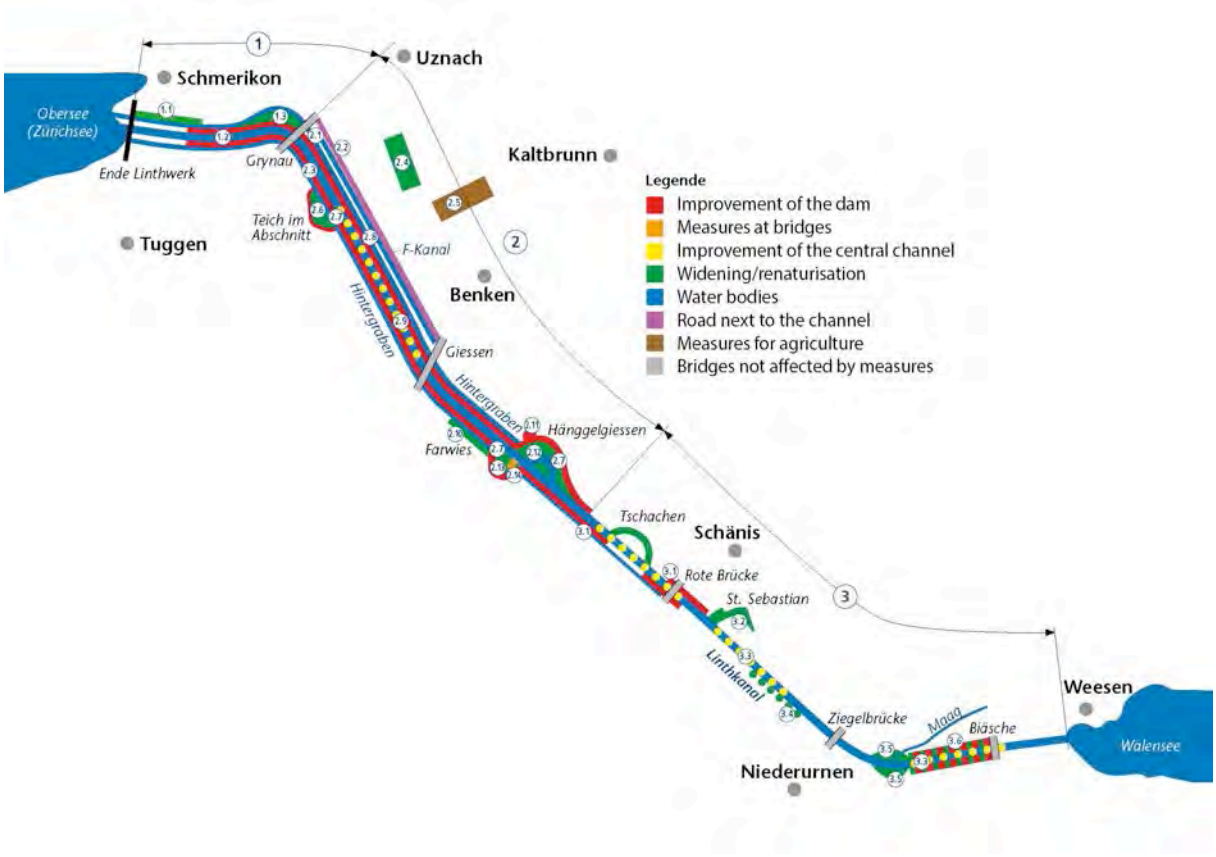


Figure 6: Flood protection measures 2008–2013. (Source: Linthwerk; http://www.linthwerk.ch/projekt-linth-2000/massnahmen)



Figure 7: The Linth Canal. (© Author 2012)



Figure 8: Improved Linth Canal. (© Author 2012)



Figure 9: Improvements in progress. (© Author 2012)

4. Development Plan for the Linth Plain

The Linth Canal that so needed improvement was basically no more than just a line in the plain indicating an infrastructure project. However, the importance of this public work was fundamental for the region. Therefore, the measures that had to be taken to protect the plain from future disasters had to reach beyond mere flood protection: it must enable the use of the plain for agriculture and settlement development. To prevent future land use conflicts, the Office for Spatial and Regional Planning of the Canton of St. Gallen intended from the very beginning to establish a development plan that would accompany the flood protection project. The overall aim was to use the flood protection project as a stimulus for the overall development of the region with the special intent to achieve sustainable development in the Linth Plain.

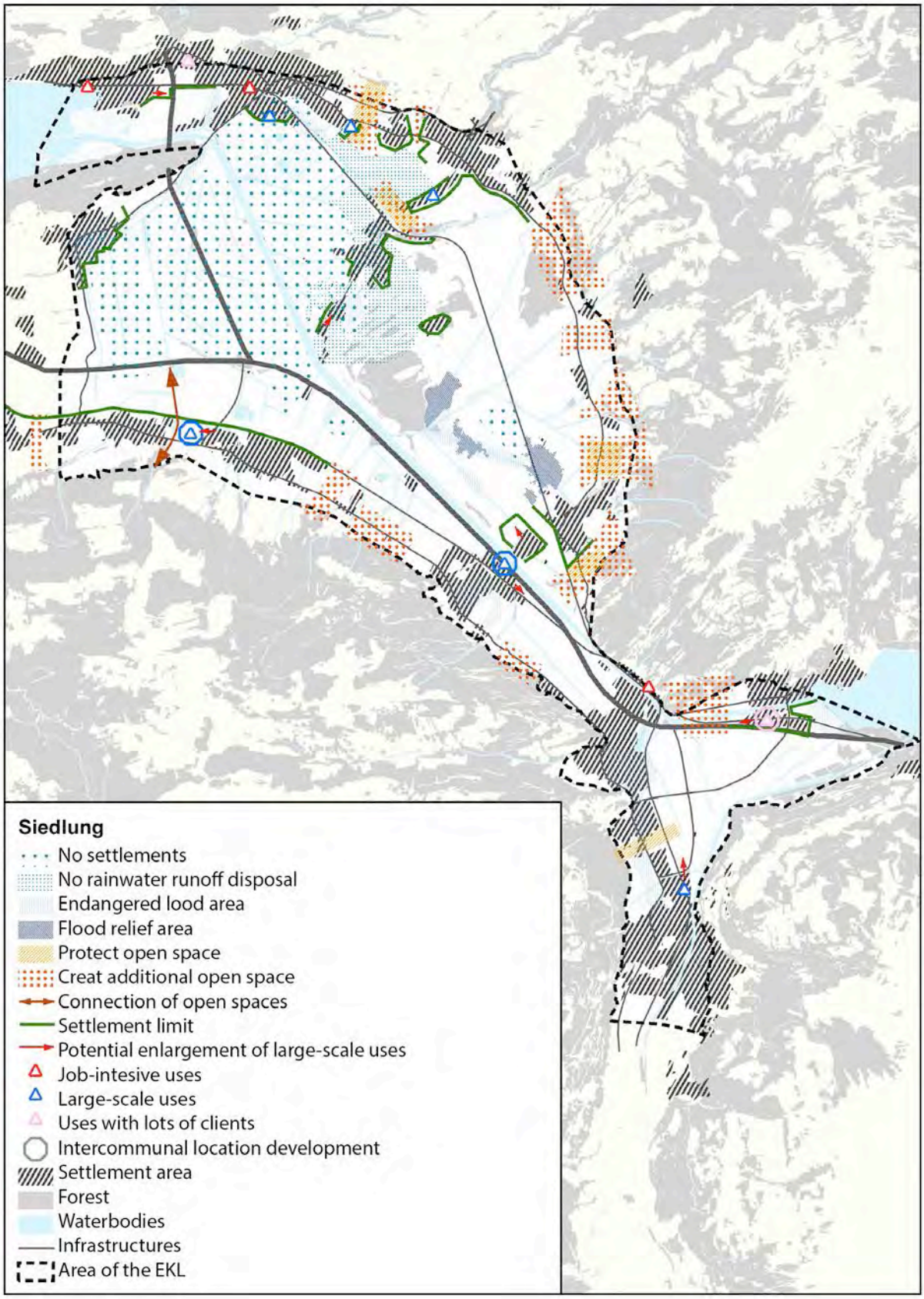


Figure 10: Development Concept for the Linth Plain, Part 'settlement'. (Source: Synthesebericht EKL 2007)

The Planning Offices of the Cantons of Schwyz and Glarus agreed with the proposal from St. Gallen concerning this goal and joined in. In June 2003, all three cantons approved the framework for a cross-border development plan for the Linth Plain (Schlegel 2013). The Development Concept for the Linth Plain (*Entwicklungskonzept für die Linthebene* (EKL) was financed by Linthwerk, the organization responsible for the Linth Canal. Work on the Development Concept for the Linth Plain (EKL 2003) was started to pave the way for a sustainable development plan, which included an ecological and aesthetic landscape plan for the improvement of the landscape and resolution of the land use conflicts in the plain. Some of these conflicts had already existed for some time, while others came up just before implementing the new flood protection measures. The main goals of the development concept process were (Schlegel 2013: 88f.):

- Keep an open landscape and save agricultural land.
- Coordinate the enlargement of building zones and base them on the overall development goals.
- Coordination of recreation areas and employment zones of transcommunal importance must take place on the regional level.
- Assume ecological responsibility on behalf of the entire region.

In 2008, the implementation of those measures of the development concept that were neither within the responsibility of the individual communities nor the three cantons or the Linthwerk as such, i.e. tasks that required cross-border cooperation, was handed over to the association NGO Forum for a Vital Linth Area (*Forum Lebendiges Linthgebiet* (FLL) founded in 2004 (Schlegel 2013). Project and funding responsibility also shifted from the Linthwerk to the cantons. The cantons and communities involved became members of the FLL. Its aim was to deal with the development of the plan, the coordination between the members and the simultaneously ongoing public participation process. It was especially aimed at involving the inhabitants of the Linth Plain in decision-making processes relevant for the living space and the landscape in this region.

5. Cross-border Planning Experiences in the Linth Plain

The Linth Plain has a long history of cross-border cooperation connected to the flood protection goal. Activities since the major flood in 1999 provide an interesting example of how water management can trigger cross-border planning and can work as a catalyst for a maturing civil society in a region. In the following sections, we report on the interviews conducted with the Director of the Office of Regional Planning of the Canton of St. Gallen and the Director of the private planning company that was responsible for the development of the EKL. Our goal is to analyze the inter-cantonal cooperation linked to water management and related planning efforts.

5.1 Inter-cantonal cooperation

The motivation for the inter-cantonal development plan for the Linth Plain was the Environmental Impact Assessment of the flood protection measures, which required a comprehensive planning project in addition to the mainly technical project for flood protection improvement.

Every canton involved in the Linth Plain project was invited to join the organization and was free to choose its representative regardless of their respective discipline. As a result, every canton delegated someone from a different discipline to represent the canton in the development plan project organization: Director of the Office for Spatial Planning (St. Gallen), Director of the Office for Agriculture (Schwyz) and Chief Civil Engineer (*Kantonsingenieur*) (Glarus). In addition, representatives from Linthwerk joined the organization. The general

secretary position of the development plan organization was mandated to a private planning firm.

Thus, different disciplines were represented in a project that, due to its nature, was already interdisciplinary. The inter-cantonal cooperation that followed has been reported as positive: “Work on the EKL has triggered a new inter-cantonal collaboration. The cooperation between the cantons involved was strongly improved over the course of the EKL development concept plan. Today’s cooperation is completely different to that of twelve years ago when work on the EKL started. This constructive cooperation, for example, enabled the responsible actors to prohibit two large-scale shopping center proposals (IKEA Schänis, Glaruspark) in the Linth Plain. Today, the collaboration of the three cantons of the Linth Plain is less intensive than it was during the crucial phase of the EKL, but we meet on a regular basis in different organizations where we can proceed in the context of these different tasks with the new quality of inter-cantonal cooperation. If a task comes up in the future that requires a cooperation as complicated and challenging as the flood protection and EKL projects were, we will be prepared to establish an inter-cantonal cooperation as successful as the EKL process” (Interviewee).

5.2 Regional identity-building and cross-border cooperation

During the interviews, it was reported that there was a second major success of the EKL: people came together who previously would never have met or worked together. Though flood protection is a very technical topic, during most of the technical debates, the borders that split the Linth Plain were discussed. It became obvious that borders are a main concern in the Linth Plain and the question of how the deficiencies can be overcome were a major point.

All in all, “work on the EKL changed the atmosphere towards cooperation in the Linth Plain ” (Interviewee). People got used to discussing problems that affected not only their own commune but others as well and together they tried to find cross-border solutions. In this context, cross-border cooperation did not always mean inter-cantonal, i.e. single cantons cooperating; single communities from different cantons also worked together beyond cantonal borders.

The whole process supported the process of regional identity-building and, with it, increased cross-border cooperation. One interviewee stated that this process was intensified because the cross-border region was commonly affected by the flood risk. This common concern was able to strongly trigger the emergence of regional cooperation and the regional identity that enabled the actors in the region to overcome the borders.

5.2 Maturing civil society in the Linth region

In order to give the people living on the Linth Plain a voice in society, the NGO Forum Lebendiges Linthgebiet (FLL) was founded in 2004. The FLL was initiated by and financially supported by Linthwerk, the organization responsible for the Linth Canal.

The aim of FLL is to offer the inhabitants of the Linth Plain the opportunity to participate in the complex processes linked to the technical flood protection project and its wide-ranging impact on the natural and socio-economic environment and to be actively involved in the development of the Linth Plain. This organization was intended to take responsibility for “soft” factors such as culture or identity. Over the course of workshops, projects and events organized for the public, people can shape the future of their living space together. The FLL focuses its work on cross-border tasks that are not within the responsibility of the communities. Moreover, it's a dialogue partner for local and cantonal organizations and public authorities. Its overall motto is: “From the people, for the people – in cooperation with the authorities.”

Starting with a “Future Conference” involving the Linth Plain inhabitants’, the FLL asked the population to discuss their visions and wishes for the future of the Linth Plain. In the events that followed, topics were prioritized, projects created and groups established.

Over the course of the project, the FLL was successful and enduring, so in 2008 the implementation of the inter-cantonal development plan EKL was handed over to the Forum and the original organization that carried out the process of development was closed. Today, the FLL is an inter-cantonal organization for the Linth Plain with regional development projects that are financed by the communities, strongly supported by civil society and based on activities in participation processes. For example, under the responsibility of the FLL, a comprehensive program for the improvement of the network quality of slow traffic, i.e. pedestrians or bicycles, was initiated.

However, the implementation of follow-up projects, e.g. slow traffic improvements, which lies within the responsibility of the FLL are suffering from a lack of an institutional, statutory and financial base and that has evoked the communities’ resistance. Meantime, all communities from the Canton of St. Gallen have left the FLL. The communities are irritated and concerned that a private association without any formal legitimate standing develops inter-cantonal and inter-communal planning proposals and the communities have to implement (and to finance) the derived measures without necessarily agreeing. Despite these difficulties the open discussion of the Forum is expected to survive.

6. Conclusion

The Linth Plain is a man-made landscape that has been shaped over the past 200 years by water management, i.e. river regulation, flood protection and drainage. The pumps that drain the plain are still running and will have to continue to do so in the future.

The motivating factor for the creation of a development plan, which among other goals, clearly limits settlement development, was on one hand, the large provision of settlement land through the implementation of flood protection and swamp drainage measures, and on the other, the continuously increasing urban development pressure exerted by the Zurich metropolitan region. The responsible actors during the early phase of the flood protection project were convinced that a 100 million CHF flood protection system could not be implemented without looking beyond the line of the water channel to the whole region and its future development.

Without the measures proposed by the development plan, the sustainable development of the region would have been at stake. Therefore, as a general rule, flood protection programs that eliminate flood danger from large areas (which would then suddenly be available for urbanization) should always be accompanied by strict settlement development plans. These plans should regulate the way future urbanization takes place. Other examples in Switzerland, neighboring Austria, the EU and developing countries show that the lack of such regulating plans can provoke urban sprawl – with strongly negative consequences for the landscape, quality of life and regional competitiveness.

However, the EKL and the cross-border cooperation that enabled the work on this development plan would not have been possible without the pressure from the flood project and the interest of the actors involved at the time. Mainly Linthwerk itself and the Canton of St. Gallen, which holds the economically most dynamic part of the plain, initiated the development plan process in order to solve problems: 1) to prevent undesirable spatial development, and 2) to overcome the resistance of the farmers to sell land for flood protection and ecological improvement measures.

Being affected by flood risk triggered a process that resulted in the development of a regional identity. It permitted addressing the, at that time, lack of cross-border cooperation and helped to overcome this deficiency. In this context, both the cooperation of cantonal authorities and the cooperation of adjacent communities belonging to different cantons were strongly

improved. This process resulted in a maturing civil society that is willing to carry responsibility for the implementation of the EKL. The EKL plan and the related the cross-border work on the future development of the Linth Plain would never have been possible without the threat from the flood risk.

The fact that people experienced participation and cooperation is a major success of the development plan process. The conflict culture in the Linth Plain changed into a culture that supports all actors in achieving sustainable development.

In addition to this “soft” part of the process, the cross-border cooperation in the Linth Plain, which was mainly triggered by the water management program linked to flood protection, resulted in a series of implementations of “hard” planning measures and planning regulations, for example, ecological improvements along the Linth Canal, settlement limits fixed in the various cantonal development plans, and the successful prevention of further shopping centers. The matured quality of the discursive culture in the Linth Plain will allow working out solutions based on this occurrence of cross-border cooperation as soon as new planning challenges in the Linth Plain might show up in the future. However, the lack of commitment or obligation concerning the formal responsibilities under the leadership of FLL needs to be resolved in the near future.

Last, but not least, experiences from the Alpine Rhine Valley, which belongs to Switzerland (Canton of St. Gallen), Austria (Vorarlberg) and Liechtenstein, confirm the lessons learned from the Linth Valley. This region also has to improve its flood protection and international cooperation already could be strengthened by the planning processes linked to the required water management in this area.

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Potentials of water usage in urban neighbourhood structures

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Abstract

This paper will treat about water influence and possibility of its usage in the urban neighborhood structures (e.g. districts, real estate properties, town parts) in the context of actual regional environmental problems and according to directories determined by European targets.

It is not rare yet in the basic stage of urban design that water is treated as a threat, not a chance. In result planned structures are often built, for example, on hills on the one hand escaping from water but in reality creating new water-related problems (e.g. “the end of the stream/ channel/ pipe” problem). Hardening of the permeable top soil, wetlands drainage, channeling streams and even rivers, building concrete reservoirs without public entrance – everything a (never ending) combat with the element. However, since the down of history, still until now, many communities around the world have been living without any conflict with surrounding water - treating it as a gift of nature.

Wetlands, rivers, lakes characterize of biodiversity, both: fauna and flora. It is one the reasons of using it as a natural resource and development direction in improving the city quality of life. But there are many more contemporary possibilities of its usage: waterside offers to surrounding residents recreation places and sport activities (even some winter sports); aquatic organisms are used for water treatment and its plants for energy produce (algae panels or biomass combustion); research reinvented aquaponics as a harvesting and breeding which could be massively use in urban food production (it helps harvesting without need of top soil what is necessary to maintain wastelands, rooftops etc.); elevation differences of the terrain helps not only in energy produce but also in its kinetic storage and trading (depending on net energy price) for local use.

The paper will scrutinize contemporary worldwide cases in modern (re)inventions of water usage in the urban neighborhood structures such as: aquaponics, micro-hydro-power plants, bio-water-treatment or algae energy produce. Above examples fit in local problems, especially in lack of drinkable water or flood risk. As a result author will show the possibilities of combining multiple cases from different points of view: neighborhood autonomy, safety and flood prevention, energy diversification.

1 Introduction

The paper treats about potentials of water usage in settlements like compact villages, small towns, neighbourhoods in the city and real estate properties development. It is based on research of interdisciplinary literature and observation of new trends in water management in the fields of: indoor and outdoor technology, spatial planning, landscape architecture, environmental protection and quality of life. Article refers to a number of historical, contemporary and conceptual examples from around the world. The result of this paper should be the output for further consideration of the water management topic. Planners and other specialists should cooperate to obtain emergent diverse solutions for the future of

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neutral neighbourhoods, towns and cities, and energy independent regions and countries for safer life of future generations. Author will scrutinize the implications of described study case research and according to them will propose continuation of technology development supporting innovative solutions for the future neighbourhoods.

2 Water use in cities

Basic spatial structures in neighbourhoods are morphologic (topography, infrastructure, buildings), socio-demographic (age, wealth, education, health, accommodation type) and functional (services, business, industry, housing). Each one determines or is determined of water: accessibility, risks or demand. The shape of the land determines access to water (both, using gravity or mechanically) but also flood risk (for example rainwater runoff from hills to lower areas or levees break in river neighbourhoods).

Infrastructure is responsible for both – water management and water related problems, for example storm and sewage systems help to get rid of planned volumes of wastewater but it provokes to develop neighbourhoods ignoring rainwater and sludge formation, moving the problem somewhere else at "the end of the pipe". Street infrastructure intensifies the problem because roadways are designed to get rid of water into the storm sewage system instead of using materials and elements that allow percolation of water, for example porous asphalt concrete (Królikowska & Królikowski 2012, p. 105), green absorbable drifts and ditches, or water collecting channels and ponds (Uhl 2010, p. 204). This solution is named Low Impact Development (LID) and is focusing at origin of the problem instead of "the end of the pipe" – runoff time after urbanization process should be the same long as before.

Neighbourhood access to water determines people quality of life, for example clean water improves community health, and natural water surroundings can stimulate recreation, sport, tourism, and therefore wealth (Brandes 2007, pp. 51–60). Location and form of buildings determines the need of infrastructure. Gravitational water supply source should be placed higher than buildings rooftops, and water pumping should include the amount of pressure loss: 0,8-1,0 m per storey, 30% of local loses and 1-2 m pressure loss within the water meter, and maximum pressure of 1-2 m at the beginning (Heidrich 2004, p. 381).

Since ancient times the city consume water in various quantities but thanks to modern techniques water can be used more effective and efficient way. According to W. James, Rome in 50 BC delivered 750 l of water per capita, in 100 AC it was 1135 l, 1830 – 946 l and 1936 – 568 l (Kowalczak 2011, p. 216). Today, according to Polish norms average water use in cities' households is 80-160 l per capita daily (2,4-3,0 m^3 per capita monthly) depending on local or central heating system (2002). Norm for home gardens and allotments is 2,5 l/m^2 (in total 30-80 l per garden or allotment) and for carwash is 175 l or 10 l/day (Kalenik 2009, p. 9). The average daily water use of one person is 150 l of drinkable water but only 3 l are used for drinking (Królikowska & Królikowski 2012, pp. 334–5). For example rainwater has not enough quality for drinking but there are still big possibilities to use non-purified rainwater up to 98% of other cases: watering plants, flushing toilets, car washing, cleaning, clothes washing or even taking shower. Typical household's water use is about: 3% for drinking and boiling, 10% for dishwashing, and the same for body washing and 26% for shower and bath, 30% for toilet flushing, 15% for washing clothes and 6% for the rest, like house cleaning (Heidrich 2004, p. 16). Toilet flush uses 6-10 l of water (it is up to 70 l per capita during the day) and washing machine uses 40-60 l per washing (about 25 l/day) (Królikowska & Królikowski 2012, pp. 334–5).

Neighbourhoods of one- to five thousands residents are known for the best social integration. People are using same shops, kids and youth are attending common schools and residents can recognize or even name neighbours who live around. Terrains allocated to different city functions have various water needs. Neighbourhood density in cities can vary between 150 and 450 of residents per hectare for whole area, including parks, infrastructure etc. Daily use of water can be calculated between 22,5 m^3 and 67,5 m^3 per hectare of housing. In addition

to housing, for such neighbourhood size, there are diverse services using water in neighbourhood: public facilities, commercial services and retail, offices and workshops. According to Polish norms average daily water use per capita in services are, for example: ground school – 15-25 l per child, office, house of culture or library – 15 l per worker/user, restaurant, pub or bar – 100-150 l per guest. Of course the biggest amounts of daily water use is in open-air and roofed swimming pools and so called "aqua-parks", respectively: 160, 200 and 400 l per user. The last but not least element is neighbourhood's fire protection which needs sufficient water supply. According to Polish law, neighbourhoods up to 5.000 residents needs water supply of 100 m^3 with fire protection performance of 10 l/sec, and neighbourhoods of 5.000-10.000 residents: 150 m^3 and 15 l/sec (2002).

3 Water related problems

Along attempts to solve the water related problems, at the same time there are created new problems. The problem with water pollution and its treatment is that dissidents focus "at the end of the pipe" instead of preventing the problem. From home to town scale it is common to get rid of the pollution to another place. For example, when concentration values of the pollutions are exceeded on the area the solution may be to build higher chimney or to lead pipe on far away. In these cases the concentration values are smaller in the same area but the pollution problem did not disappear – instead, it was spread on bigger area or moved to another place. The real solution should be preventing the possibility of pollution appearance in neighbourhood or eliminating and reducing already existing pollution next to where it was created – inside the district or even in the backyard. There are possibilities, mixed of traditional and modern techniques, that allow to combine real solution with benefits for the neighbourhood. For example in Berlin there are some places where grey water is purified already inside the urban blocks (Kowalczak 2011, p. 472). It creates nice green neighbourhoods with water implemented inside. In Poland most of the rain water is treated as a waste to get rid of and directed to the sewage system (Kowalczak 2011, p. 476). The final result are whole districts full of concrete pavement separated from retention reservoirs located far away of neighbourhoods.

Storm sewers are built to receive and dispose rainwater from paved ground and roofs. Because of this possibility more and more grounds with permeable top soil are hardened. There are two main problems with this dependence on artificial structures instead of natural retention. The first problem is insufficient capacity of the sewer system in case of heavy rains, intensified by rapid runoff on paved, impermeable surfaces. The second problem is shedding the problem to the lower sites. Lack of coherent system of retention prevents the introduction of any concept of drainage control and groundwater recharge. Cities invests huge funds for storm water drainage instead of fighting the cause, which is excessive hardening of permeable top soil (Kowalczak 2011, p. 471). Moreover, mentioned later in this paper concrete water reservoirs are not inviting for people, neither wildlife.

Worth to mention is wetland drainage which can cause damages of existing structures, like cracking and deposition of buildings. Constant drainage is expensive and any interruption in pumping water can cause groundwater level rise and local flooding. The best way is to accept water as it is normally and to forecast extreme situations. There are also many worldwide examples of channelling rivers, streams and encasing with concrete other water basins and polders. Vibrant rivers were destroyed along with urban character, green space, healthy waters, and fish and wildlife habitats. Many projects actually increased flooding downstream having sometimes catastrophic consequences. For example, New Orlean devastation during hurricane Katrina in 2005 "was caused in large part by decades of Army Corps water projects that caused the massive destruction of Louisiana's natural storm defenses – its coastal wetlands" and when dikes constructed to protect the city were broken they exactly kept water inside, enhancing the destruction (Samet 2007, pp. 144–64). Meanwhile, cities around the world, from Seul to Salt Lake City (Urban River Restoration

Initiative), are encapsulating channelized rivers and streams to restore urban aquatic ecosystems (Love 2007, pp. 86–95).

4 Water in local food production

"Waste equals food" is a citation from the book "Cradle to Cradle" whose authors invented paradigm of the same name. It means that design products, materials and ingredients must be fully recyclable and healthy so you can produce food of waste – like it was for thousands years before modern times. Cradle to Cradle approach on energy, water, top soil and materials. According to water topic, the statement says: produce a better water quality out as it gets in. (Luscuere 2010; McDonough & Braungart 2002). This cycle of matter is called "upcycle" instead of recycle. „The goal of the upcycle is a delightfully diverse, safe, healthy, and just world with clean air, water, soil, and power - economically, equitably, ecologically, and elegantly enjoyed" (McDonough & Braungart 2013, Lok. 212). There are many techniques not only to purify rainwater and waste water but also to use it for city food production instead of comfortable getting rid of runoff or sludge water to the sewage system. It is called urban farming and examples exists and appear around the world.

Already in Aztec times food was harvested straight on water. The fields were rectangular rafts of reeds floating on the canals of the island city Tenochtitlan (located on Lake Texcoco, and which is since Spaniards conquer until now Mexico City). This technique is named aquaponics from combination of two words: aquaculture and hydroponics. It does not need of watering and fertilization because water is already below and fish are producing all needed nutrients for plants (Stout 2013). This technique can be used in neighbourhoods inside of buildings or in the rooftop greenhouses or on the wasteland and floating on water surface around neighbourhood.

Another type of floating fields are platforms with soil like the traditional floating gardens on Sun Moon Lake in Taiwan or contemporary floating greenhouses in Naaldwijk, Netherlands, e.g. used to grow vegetables. Similar idea has Waterstudio, Dutch architecture office, which is proposing elongated floating platforms built up from modules measuring 10 x 100 m. "The method of harvesting is completely different from that on land. The modules are pulled to the harvesting location in an elongated chain, where the crops are then brought in off the land under efficient and controlled conditions" (Olthuis & Keuning 2010, pp. 102-103, 188–190). If examples mentioned above were popular in cities it would reduce the price of food by avoiding intermediaries and their costs. Urban farming would create new jobs, decrease transportation consequences (like traffic, costs, noise and pollutions) and would allow deliveries of super fresh food. For example New York City uses 20.000 t of vegetables per day (Kowalczak 2011, p. 329) and its deliveries produce additional congestion on city's streets which produce additional costs of transport (including staying in traffic) or food cooling.

5 Flood risk management in neighbourhoods

John R. Short described that cities average weather conditions are different comparing to the countryside. For example the annual average temperature is +0.7C higher, it is about 5-10% more cloudy, 30-100% more foggy, 5-10% more rainy and 5-20% less winds depending on buildings highs (Kowalczak 2011, p. 81). That means cities are more at risk of flooding than countryside. During the planning process it is necessary to answer the question to develop the city or not in flood risk areas. In case there is no other choice or the urban structures are already built there are many possibilities to prevent flooding and its consequences. The main reason of flooding are heavy rains whose frequency is rising because of anthropogenic reasons: systematic conversion of land use, urbanisation, cutting forests, development of agriculture land use, improper drainage. European Union law requires to treat rainwater as part of sustainable development of the cities using methods that mimic natural runoff and

retention. Developing neighbourhoods with keeping existing trees and smart planting new ones can help to get rid of huge quantities of water, for example beech stand can evaporate 68% of water, pine stand 62% and spruce – 76% (Królikowska & Królikowski 2012, pp. 41–2).To protect sewer system from the overflow can be used wide drifts and deep ditches, or ponds that keep runoff water inside the neighbourhoods. Drifts and channels can also transport water to reservoirs below neighbourhoods (Uhl 2010, p. 204).

To prevent flooding it is common to build ground reservoirs which allow reducing of water flow during heavy rains by collecting it temporary. The problem is that many times these structures are technical utilities where fauna and flora and even people are not expected – depending of its engineering design or local policy. In this case the water reservoirs in neighbourhoods add some minimal diversity of visual effects but there is lack of biodiversity or recreational possibilities.

The answer for that problem can be water gardens which allow designing professional landscape architecture inside the neighbourhoods. Rain garden design consist of litter layer, permeable soil and drainage pipes. There are many benefits of rain gardens, for example ground water balance improvement, relieving overflowed sewage system and it is easy to make. One rain garden can collect runoff from up to 1 ha of roofs, streets and parking places, and area of 10-30 m^2 is enough for one single family house (Królikowska & Królikowski 2012, pp. 326–33).

There are some regions where rural and urban structures are developed ignoring the restraints imposing by water. Examples are exotic villages on poles, cities being surrounded by water during tides or regions developed under the sea level. Nowadays some cities historically located near water are using the high-water shields which, in case of flood risk, allow to fast closure and its dismantle. It allows only temporarily visual change to the historical urban landscapes and separation of functional areas in neighbourhoods. The embankments are used mostly outside of the city in the countryside. They are wide enough to keep technical roads on top which allow transport for rescue and evacuation when polders beneath are underwater.

6 Water and buildings

The space saving example of retention in dense urban structures are buildings with green roofs. The storm water is escaping the roof only after the soil on it is full filled. In this case collected water can be also used inside the buildings or neighbourhood without additional water treatment because plants and soil are natural filters. The rest of collected water is being evaporated straight from the soil and by plants.

Some buildings are equipped with tanks on the roofs, in the basement or beside, for collecting water for further use. The example is the Nuremberg Prisma Project, Germany where all the runoff is harvested into 300 m^2 tank. Water is used for plants and pond supply in the four-storey conservatory foyer of the inside court. Because of water temperature of about 18° C it is cooling foyer during the summer and warming it during the winter (Ludwig, Karl H. C. 2009, pp. 115–6). A new Victorian Government County Council building – County House 2 (CH2) – has the 20.000 l water tanks on whole area of 1500 m^2 roof that collect 70% of buildings water needs, that is 57.000 l per month. It is used for toilet flushing, irrigation of the plants, “shower towers” and to wash down. (Zierke 2009, pp. 155–61)

7 Water and biodiversity

Natural surface water and its closest surrounding terrain is the best place to keep or locate green. Natural green located along floating water builds an ecologic corridors allowing the mobility of fauna and flora, for example spreading seeds or migrating animals. These corridors can cross urbanized areas improving the quality of citizens life. It creates aesthetic

landscape views, allows to enter fresh air to the inner neighbourhoods, and in addition cooling cities' warm islands and purifies air and water polluted by anthropogenic influence. There is also possibility of appearing unexpected negative consequences of eco-corridors. They allow to spread invasive species such an aggressive carnivorous fish (Theriot & Tzoumis 2007, pp. 75–80), algae or weeds. For example Latvian, Lithuanian and Polish ditches, streams and small riversides suffer of imported from Caucasus invasive and toxic Sosnowsky's Hogweed (*heracleum sosnowskyi*), the touch of which is dangerous for human health and even children life.

8 Water influence on quality of life

Water is the most important element of known forms of life. Presence of water in the district has a positive effect on the quality of its inhabitants life. Rules of attractive and sustainable public spaces over the water are: eliminating barriers and gaining land and water access to the water's edge and continuity of pedestrian ways along the water; safety and comfort; a high level of aesthetics, for example by creating great riverfront park systems; cultural continuity and identity of the place, and past and present relationships with water; multifunctional development (recreation, culture, education, nature, neighbourhoods) and cultural destinations of distinct character; adaptation to hydrological and environmental conditions; focusing the city centres growth on the river; planning in the neighbourhood scale (Brandes 2007, pp. 51–60; Januchta-Szostak 2011, p. 150).

The example how lack of access to the surface water can cause poverty is Washington, D.C. „Today, residential neighborhoods abut the federal lands along the river, although almost all of them lack any or easy access to the river. (…) Neighborhoods along the river are home to some of the poorest residents of the city and the region, with the average per capita income averaging less than half that of the region and with concentrations of poverty in select neighborhoods approaching one in four households." The repair plan for the river's waterfront lands is to coordinate planning process by District of Columbia Office of Planning, to establish a joint steering community comprised of few agencies, and citizens participation in planning process (Brandes 2007, pp. 51–60).

Surface water is a natural place for human recreation. The lack of recreational places in the pedestrian or bicycle distance consider people to move by cars or to stay at home – both has negative consequences on human life quality. In this case allowing easy access to the water landscapes helps reducing car traffic, noise, pollutions and costs, and helps improving social contacts of neighbours meeting over the water or walking on the way (Gehl 2009, p. 127). These recreational places helps to build stronger local community and healthier neighbourhood surrounding. Investing in runoff protecting water-gardens inside the neighbourhoods is a good example. It allows not only to prevent runoff shock wave and store rainwater for later use, or benefits natural environment, but also rises aesthetic quality of neighbourhood, and hence allows to develop recreational infrastructure. There is lack of buildings, with just few examples, that can add some additional recreational, play and fun possibilities using water. Mostly it is reserved for one-function structures like private or public baths, pools or aqua parks. But runoff water should be used at least at kindergartens, schools and public spaces moving tools and watering gardens as the fun and playful example of physics and environmental protection for children (Magnus 2010, pp. 46–57).

Depending on morphologic structure of water surrounding it allows also different sport activities from fishing over small ponds and rivers to yachting on bigger lakes. The easy investment is to allow launching kayaks in the water which does not need much place – kayaks are transported near to the water from private properties. Well designed neighbourhood over water should allow to bring sport equipment into the water without need of using vans or cars with trailers. Example of simple improvement for neighbourhoods can be secure lockers to keep equipment outside of multifamily housing. For swimming or kite surfing there is also need of some development of the shore, for example with public or

private beach or small footbridge pier. Yachting or water skiing needs larger bodies of water and more infrastructure, for example for boat mooring, charter services or even gas-station. Investing in water recreation and sport facilities is expensive because of its seasonal character, equipment cost, safety reasons and environmental protection. Depending on climate conditions water in neighbourhood can be used, for example for ice skating, fishing in the ice-hole, or for cross-country skiing along the shore.

9 Water-supported energy management in neighbourhoods

There are many possibilities of energy produce and storage in cities. Heat pumps (with air, ground and water sources) are used for building heating and cooling and for heat energy storage. Solar panels are used for tap water heating. Electricity is generated by photovoltaic panels, small and medium wind turbines, and by hydro-power plants on local rivers. Local biomass and biogas power plants produce heat and electricity in cogeneration from trash or especially harvested plant fields. In author's opinion all these techniques seams to be separated of each other and can be combined in innovative way. The idea came during the case study project in urban planning master thesis on the Faculty Architecture in Gdańsk University of Technology. The topic was *"Pruszcz 2020+ - The Study of Development and Modifications of the Town"*. The project was awarded in three competitions of chambers (POIU, IUP) and association (TUP) of Polish urban planners. The main goal of the project was to design new dense and green neighbourhood based on the idea of combining diverse water, energy and mobility management.

Proposed below the ways of water and energy management system in neighbourhoods can be an innovative way how to make neighbourhoods energy independent, CO_2 neutral and free of water related problems (floods, costs of water purification and wastewater treatment). There is a lack of use of the kinetic energy of water flow and lack of use of the potential energy of water storage in neighbourhoods. Water has also not enough used potentials of one of the biggest heat capacity in nature. To meet the needs of water and power, author propose combining separated systems into one system where drinkable water, potential energy and heat are stored together. Water should be stored in higher and lower attitude reservoirs with well thermal insulation. Reservoirs on top of the hills in water towers and over the tall buildings should be used to store potential energy. Reservoirs in the lowest places and under the buildings can be used for receiving water release during electricity production from kinetic energy of water. This system would be a local micro pumped-storage hydro-power plant. Both types of reservoirs can be used to manage energy demand by pumping it up and heating its water volume during, for example, overproduction of the solar energy or when net energy is cheap. Potential energy stored in higher reservoirs can be released during the night, for example to power the neighbourhood's streetlights, or when the net energy cost is expensive.

Heat energy stored during summer in reservoirs can be used for buildings heating in winter and for hot tap water. The origin of water in reservoirs will be a rainwater purified by green roofs on tops and by water gardens in lower areas. Green roofs and water gardens will also prevent flooding allowing similar to natural retention in neighbourhoods, and plants growing on them will be used in biomass and biogas power plant, producing heat and electricity which can be stored again in water reservoirs as the potential energy and heat energy.

The system will allow net energy diversification and neighbourhood energy independence. It will work effectively and efficiently when national or regional smart-grid system would be introduced. The biggest limitations of the proposed solutions are the costs of investments. The problem to solve is how to consider developers and investors to invest, for example, 20-30% more expensive to build structures which can bring savings in the coming decades. Strict master plans can not pass during the public participation processes until the social consciousness is focused on private property and business. One of the most famous examples of innovative neighbourhoods, connected with city core by highways, is

Amsterdam's suburban ccompletely CO2 neutral district of Heerhugowaard – The City of Sun (Boomen 2009, p. 131). But „spaces created through trans-local practices are often nearly invisible and therefore unrecognizable for outsiders who do not act in them. Thus, these spaces are not related to traditional forms of the local public space" (Bremer & Sander 2011, p. 166). This raises the problem of only fragmented implementations of solutions for global problems.

10 Summary

The reason to digest this topic is lack of emergent activities with water. Most of the urban water systems are not combined with other systems, for example water and energy storage, retention and recreation, or water treatment and energy produce. Natural surface water is mostly about landscape architecture, biodiversity or recreation and for domestic and industrial use. Storm water is being understood as an unwanted element and connected with sewage system. Groundwater is purified and delivered to the pipe system for domestic use.

The paper treats about new and innovative ways of using water in urban neighbourhoods. It is common that cities' management of water is treated separately to other resources but water can help in savings other resources. One of the examples is energy saving, storing and produce. Heat-pumps can store heat and cold in water reservoirs for buildings cooling during the summer and warming during the winter. Water reservoirs on top of the hills or tall buildings connected with micro pumped-storage hydro-power plants can store sun energy as potential energy for its later use. It can be used at night when there is no sun, for example for street lights (costs reducing), or during the time when electricity net price is higher and surplus can be sold (earning). Fast growing water plants can be used for water treatment and later harvested and combusted for energy produce. But also wastewater can be used for energy savings and produce. Separated solids from wastewater can be combusted in biomass and biogas power plants.

Local water and energy saving, storing and reusing is also important in resource independence of whole countries. Example of Singapore shows that prices are going up because it is depended on importing resources from overseas which costs also additional energy for transporting and cooling. There is lack of additional 15 km^2 of land for feeding all citizens of this high dense city (Kowalczak 2011, p. 329) so the private investors introduce local commercial vertical farming systems. It can be imagined that regions are independent from deliveries by saving, collecting and reusing water for food and electricity production. From small towns to megacities water can be easily harvested making food and energy production cost-effective.

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Small Urban Streams in Belgrade – Prospective New Urban Landscapes

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1 Introduction

In the past two decades, water became one of the most important issues in the field of sustainable development of urban areas. The pollution and destruction of water ecosystems is most prominent in the cities, and it is often associated with small urban rivers and streams that were neglected and treated inappropriately in the past. Affected by climate changes and uncontrolled expansion of settlements, problems concerning pollution and floods are becoming more severe and numerous, while these zones are regarded as eyesores of the cities. Their revitalization has, therefore, become the priority task, and it represents the final phase in the long history of human interrelation with water. (Schanze, et al., 2004)

Small urban streams in Serbia are very demoted and polluted. Their surroundings are not being maintained and they are covered by large amounts of waste. However, although neglected, these zones often occupy central areas of cities, and represent potential for the creation of new public green spaces.

On the other hand, planning and regulating urban rivers is a highly demanding and complex task in terms of use, density, population, institutional framework, degree of pollution, public involvement, etc. (Sretović Brković, 2014) Integration of river basins in the context of cities, with respect to the existing urban scenery, will therefore represent a great challenge for urban planners and designers in Serbia. Taking the example of the city of Belgrade, in which streams were for a long time considered to be disadvantages and obstacles, we can now witness the attempts and endeavors to integrate and revitalize these watercourses in order for them to become an integral part of citizens' lives.

2 Belgrade and Its Streams

Belgrade is located at the confluence of two important rivers, Danube and Sava, and it is these two rivers that are usually had in mind when saying that Belgrade is a city wealthy in water. However, these are not the only two shores in the city. Belgrade is located at the complex network of small city watercourses, concentrated in the part of the city which belongs to Šumadija district.

The number of these streams was high, and they used to play an important role in the urban city life. (Ćorović & Blagojević, 2012) During the process of founding of the city of Belgrade, some of these streams were very important for the establishment of the first settlements and rest areas. (Miljanić, 1985) In the 20th century, their role started to be considered marginal and problematic for the overall development of the city. The value for their further development decreased along with the evolution of mass production. A great many of these streams was piped and removed from the urban scenery. Nowadays, the biggest sewage collectors in the city are being named after them.

Nevertheless, some of these streams remained preserved, as surface waters. They can no longer be found in the central zone, although several streams were preserved in the mid- and the outer- city zones. The most famous among them are Topčiderka river with its confluent streams, parts of the former Mokroluški basin, Kumodraž stream, basin of Železnička river

and Mirijevo stream. Some of them are regulated, although often inadequately, and are not integrated in the urban tissue of the city. Others remain completely unregulated. Their waters are highly polluted and they are often the very cause of severe floods which occur in the city. These streams are not integrated in the urban scenery and their regulation is based solely on technical and economic aspects, with no understanding of social and aesthetic values. As a result of such an approach, these became unattractive streams in Belgrade which often represent shabby and unordered zones.



Figure 1: Small urban streams and rivers in Belgrade (Source: left - www.beobuild.rs, right – own work)

3 Basin of Topčiderka River

Basin of Topčiderka river represents a zone which has historically been very valuable and interesting for research because of its diverse and complex surroundings. Throughout the history, natural elements of this river have been connected to the cultural heritage in the surroundings, as well as with the identity of the city, and they need to be approached carefully during the process of revitalization.

Topčiderka river with its confluent streams represents one of the biggest basins of small rivers on the territory of Belgrade, occupying 147 km². (Milovanović, et al., n.d.) The river flows in the bottom of the city's hills and discharges into the Sava river, as its right-side confluent stream. It is situated in the middle zone of the city center. Bottom part of the basin is in the urban zone of the city of Belgrade, while its remaining parts are being used for agriculture, fruit growing, forestry, and rural settlements. International railway Corridor 10 passes through its valley, creating the link between Northern and Central Europe and Southern part of the Balkans and Asia. (Milovanović, et al., n.d.)



Figure 2: Distinctive areas in the urban part of the basin of Topčiderka river (Source: own work)

Today, Topčiderka river with its confluent streams runs through four distinctive areas formed throughout the rich history of this part of the city, giving a specific character to this valley. It is believed that during the middle ages roads from Belgrade to Serbia lead through the valley of Topčiderka river. At the end of the 18th and at the beginning of the 19th century, this valley had a very important strategic position and it slowly started to emerge as a zone of Belgrade's resting and hunting grounds. Its appearance was different from what it is today, as it meandered through the valley surrounded by hills. In the 18th century, small settlements and houses were positioned close to its shores. Later on, during the period of Serbia's liberation from Ottoman rule, these villages were emerging and disappearing as the result of conflicts between Serbian and Ottoman armies. (Miljanić, 1985)

Next to small settlements and isolated houses, the first significant distinctive area started to be formed. This was Topčider park, which has been preserved to date, located close to the mouth of the river. It all began with the construction of one residential house - Residence of Knyaz (Prince) Miloš, the first ruler of the independent Serbia. Throughout that period, the zone surrounding the river was a floodplain. This was so until approximately 1860 (Miljanić, 1985), when river was regulated in that area under the supervision of the engineer Jakov Slivić. (Ćorović & Blagojević, 2012) From that time onwards a crossing ferry and a custom house were located here, while the river bank was used as a beach which was connected with a steam bath built in the new park. (Ćorović & Blagojević, 2012)



Figure 3: Distinctive area 1: Topčider park and Topčiderka river (Source: first- www.mestokojevolim.rs, second- www.srbijazatebe.rs, third - L.Vuletić, (V.V., 2008)

Foundations for Topčider park were laid when the area surrounding Residence of Prince Milos started to be regulated. The park was created under the supervision of Atanasije Nikolić, a great admirer of nature. It is composed out of two different parts: the first park space surrounding the Residence of Prince Milos, and the second park between the railway and the road to Košutnjak. Topčiderka river runs through this road, it has been forested and it contains numerous meadows which makes it a pleasant place for longer dwelling of visitors. (Maksimović, 1978) It replicates the style of English gardens, with its meandering paths, lush vegetation, abundant presence of still water, several aquatic devices and, in addition to these, a few classical elements. (Ćorović & Blagojević, 2012) In 1894 the park was connected to the city by one of the first tram lines and it became the city's main recreational area. (Miljanić, 1985)

In the 20th century, with the further development of the city of Belgrade, this park started to lose its attractiveness. The park, being rich in cultural and historical landmarks is, nevertheless, a part of natural heritage, which makes it a unique complex from a natural, environmental, cultural and historical point of view. However, with the construction of road substructure close-by, it was cut off from the central city area and, with time, forgotten.

The second important distinctive area in the river's valley is the industrial complex Rakovica. For many years this valley resisted the construction of this industrial complex, but in the 20th century it eventually succumbed to the pressure. The value of the river was disregarded and new heavy-industrial complex appeared, polluting river and changing its purpose and importance for the city. Devastating effects of this development are best shown by the fact that penetration of toxic waste in the river, such as cyanide and other toxins from the industrial zone, were registered. (Cvejić, et al., 2002)



Figure 4: Distinctive area 2: Industrial complex Rakovica (Source: left - www.novsti.rs, right- www.politika.rs)

The biggest part of Topčiderka river and its confluent streams runs through residential settlements, and this represents the third distinctive area of the river. As a result of exceptional environmental characteristics of its surroundings, this zone used to be Belgrade's recreational area before industrial complex Rakovica and massive housing development composed of tower blocks started being built. (Urban Planning Institute of Belgrade, 2006) Some of the confluent streams were then piped. Next to the commercial zone in Rakovica, in the area planned for greening, a great number of housing blocks was built spontaneously. (Urban Planning Institute of Belgrade, 2006) These illegal settlements do not have regulated wastewater systems, and waste and atmospheric waters discharge to the stream without being refined.



Figure 5: Distinctive area 3: Residential area and Topčiderka river (Source: left-www.panoramio.com Dušan Railfan, right – www.blic.rs)

In addition to polluting the river, these illegal settlements were increasing quantity of water, which was the result of substitution of pervious with impervious surfaces. This problem grew more serious in every subsequent year, due to the modification of the river´s natural water flow occurring throughout the years. During the previous, and in the beginning of this century, there have been a succession of floods in the basin which caused great damage in the river's valley. (Cvejić, et al., 2002)

The fourth distinctive area is the river's mouth, close to which certain industrial areas are to be found, along with horse racing tracks. This unit is located at the former meander of the river, buried at the beginning of the 20th century, at the site of the demolished bridge Careva Ćuprija (Emperor's bridge). (Miljanić, 1985) At its very mouth, river runs through the newly built traffic junction and discharges into the river Sava, just below the bridge recently built on it. New traffic routes have completely disregarded the river's value and ruined the potential for the creation of a blue and green corridor in this area of the city.



Figure 6: Distinctive area 4: Racing tracks, new bridge and Topčiderka river (Source:left-www.beobild.com, right – www.skyscrapercity.com)

4 Planned Actions for Revitalization of Small City Streams in Belgrade

One of the main development objectives for Belgrade until 2021 is that Belgrade should be a city which is in line with nature. The whole rehabilitation of nature in the city is imagined as revitalization of the existing green zones in the city and creation of new green oases, green corridors which run through the tissue of the city. It is very important that green zones are allocated uniformly and should form a system – a network of green areas. The main feature of the concept of organization of the greenery system is forming of green protection ring surrounding the city and its linking, via green corridors, with green areas, into the territory of the city. (Urban Planning Institute of Belgrade, 2006)

One of the priorities of urban policy according to General Plan for Belgrade 2021 is preservation of natural valleys of small streams, i.e. their revitalization. New large green areas and parks are planned to be developed in their valleys. A number of small retentions and accumulative lakes on streams are also planned in order to prevent flood waves propagation, as well as the naturalistic reconstruction of their stream beds using necessary biotechnical measures in the drainage basins. (Urban Planning Institute of Belgrade, 2006). The idea is also to create numerous artificial water surfaces when developing new parks close to representative greenery. These zones are planned as multifunctional spaces for recreation, gatherings and relaxation.

From a technical point of view, when managing basins, reconstruction and upgrading of the existing systems will have the priority. Flood management on small watercourses is planned through construction of integral systems of active defense via retention and accumulation by reduction of the high waters and through passive defense via construction of linear protection systems. (Urban Planning Institute of Belgrade, 2006)

Revitalization and regulation of Topčiderka river with its confluent streams are planned in accordance with the previously mentioned principles. The complete integral development of Topčider park, close to which traffic conditions will be adjusted to cultural heritage and protection of nature, is separately planned. Integral consideration of this zone is of high importance because of the elements present in this area: railway, river, big traffic junction, corridors, as well as cultural and natural heritage. (Urban Planning Institute of Belgrade, 2006) Adjustment of railway and accompanying properties for the purpose of park functioning is the priority task. As an extension of Topčider park, it is planned to carefully integrate the complex for central entertainment activities typical for parks close to the industrial complex, with small floor area ratios.

These planned activities in regulation of small city watercourses such as retentions, natural management of watercourses and need for the creation of new water bodies should introduce a number of improvements in ecological, economic and aesthetic sense. In

accordance to this, technical solutions offering different options for problem-solving started appearing on Belgrade streams. Some of these solutions are based on traditional approach, while some are very modern and in compliance with the idea of naturalization of watercourses and the use of BMP systems used for draining and purifying atmospheric waters.

5 Examples of New Technical Solutions for Belgrade's Streams Management

The project for revitalization of Kumodraž stream represents a modern solution which proposes construction of three retention basins, preservation of the surface flow in the upper part of the stream, and the use of wetland technology for water treatment in the unregulated part of the stream's surface flow. (Sretović Brković, 2014) The construction of three dammed surface retention basins is being planned in the upper course of the Kumodraz stream, in which the storm-water runoff will be channeled, collected and accumulated, in order to manage the discharge of water downstream (Despotović, 2009).The project proposes construction of new wetlands, and revitalization of the existing riparian vegetation in floodplains. Furthermore, the newly constructed lakes and wetlands are to be part of the city-level green and blue pathways and can be used for recreational purposes (Cvejić, et al., 2002).

For Kaljavi stream, which is one of the confluent streams of Topčiderka river, it is planned to reconstruct the river coast area using concrete embankments in the first phase, and restire the natural coastal and riparian areas in subsequent phases. Preservation of the existing forest vegetation in Kaljavi stream basin is planned, as well as in adjacent basins of Banjički and Jelezovački streams in order to establish connection between "green" corridors. (Ristić, et al., 2008)



Figure 7: Reconstruction of the stream course – Kaljavi stream, one of the confluent streams of Topčiderka river (Source: Ristić, et al., 2008)

6 Guidelines for Urban Design of the Small Watercourse Zones in the City

Contemporary systems for stream regulation and draining, as well as treatment of rainwater in the basin, all represent an integral part of urban landscape. They consist of plants and water and are used to green the city spaces. Because of the possibility of flooding, they are most commonly surrounded by open spaces. As such, they need to be carefully integrated into the existing context.

The position of Topčiderka river, for example, has a potential for development of public open areas significant for the entire city. Open spaces can lead to creation of new identity of this location and its surroundings. Naturally managed river course, creation of new retention/small accumulation and systems which use aquatic plants for water treatment can attract local residents. For that reason it is necessary that technical solutions are planned and designed so that they are visually integrated in the existing scenery.

When designing a new green urban area rich in water, it is necessary that this is done in such a way that it attracts users, promotes healthy lifestyle, allows for relaxation and recreation and guides towards social interaction. (Water by Design, 2009).

Water is a very important tool in hands of urban designers and it can create interesting and diverse spaces, as well as unique mood. It can bring life to every scenery and change its character. It is one of the most desirable elements that urban designers can use in their work, since it makes space unique and recognizable. (Woodward, 2005)

In order to achieve the highest quality possible in the integration of contemporary open urban water systems, it is necessary to attain following objectives[1] when designing open spaces which surround them:

- Compatibility with the existing urban landscape;
- Adaptability and multifunctionality;
- Dynamics and attractiveness;
- Educability;
- Safety.

In line with these objectives, and actions planned for small urban streams in Belgrade recognized in the General Plan for Belgrade 2021, in the next part of this paper we will present the guidelines for urban design of the small watercourse areas. Some of the general principles and guidelines developed by Stuart Echols and Eliza Pennypacker and published in the article „From Stormwater Management to Artful Rainwater Design“ in *Landscape Journal,* 27(2), have been applied in the case of Belgrade. The guidelines are differently grouped due to the specific requirements of the Belgrade case studies.

6.1 Compatibility with the existing urban landscape

Main principle of new approach is returning to natural processes and appearances of streams. New systems have a role to improve the quality of existing landscape by simulating natural processes. It is necessary to maintain balance between natural and built environment at all times.

Water systems should be integrated in the existing urban landscape in an adequate way, according to its surroundings and the character of the place in question. Culture of the local citizens, their relationship to green areas, and visually constructed or non-constructed sceneries are very important for system designing. It should not be forgotten that these systems are being designed for the local citizens and their needs, that they have been forming their positions for years, and that only in this way these spaces will be brought to life and will start functioning.

[1] These objectives combine goals for urban design with atmospheric water, based on (Dreiseitl, 2005) (Echols & Pennypacker, 2008) (Water by Design, 2009) and urban design of public spaces (Partnership, 2007)

	Water area	Boundary zone	Surroundings
Stream course	• During urban design local residents should be consulted about desired appearance of these elements • Natural stream course should be retained as much as possible	• Needs to be handled in the most natural way in order to integrate in the surroundings	• Use local materials in treating open spaces • Combine natural and artificial elements for sitting • Improvement of local biotopes • Integrate all natural elements which can become part of the system into the design • Adjust these systems to culture of local users as much as possible • Pay attention that it is in line with the sceneries that local residents are accustomed to
Retention – small accumulation (with constructed wetlands, bioretention system, sedimentation basins etc.)	• Design in such a way that it creates unique microclimate by reducing high temperatures during summer and increasing air humidity in the close surroundings • Use old, natural processes in the innovative way • Preserve the habitat for the existing plant and animal species • Use herbs which already existed in this zone or in its the surroundings, and to which local residents got used to	• Use natural elements in order to form this zone	

Figure 8: Guidelines for urban design in accordance with the objective: Compatibility with the existing structure

6.2 Adaptability and multifunctionality

It is important that public spaces offer a possibility of choice. Users of these spaces want to relax and refresh, establish contacts and engage in communication or participate in active recreation or some manifestation. For that reason it is crucial that these spaces offer various possibilities and that they are designed in such a way that they can be readjusted.

Additionally, flood stage levels can change and throughout certain periods these systems are operating with small amounts of water. Their appearance depends on the amount of water which exists in their surroundings. Therefore, they need to be designed in such a way that they are adaptive to different weather conditions, but that they remain attractive as centers for different activities. (Stahre, 2008)

	Water area	Boundary zone	Surroundings
Stream course	• Enable users to modify the systems - transfer of rocks and different organization of sitting places for example* • Planning water area usage for rafting during the high-water period	• Adequate integration of a basin in the surroundings when flood stages are high	• Form zones for sitting and gathering next to the linear watercourse • Design trim trails • Plan for equipment for different recreation activities • Installing elements which can be used for recreation in the surroundings and integrating them with paths and bridges • Forming spaces which can serve for different manifestations • Forming central gathering points close to the zones which are always covered by water • Planning for interactive playgrounds for children • Creating spaces which call for research of natural attractions
Retention – small accumulation (with constructed wetlands, bioretention system, sedimentation basins etc.)	• Forming gathering places which can be used both during the wet and dry periods • Taking into account the appearance of the area during the low-water periods and how it will be integrated into surroundings • Create a number of zones within constructed wetland area which stimulate observation and research*	• Managing these areas in a natural way in order to integrate them in the surroundings when flood stages are low • Create clear zones for approaching the system* • Form sitting elements: benches, walls from which swamp can be observed*	

Figure 9: Guidelines for urban design in accordance with the objective: Multifunctionality

**edited and adapted from Echols, S. & Pennypacker, E., 2008. From Stormwater Management to Artful Rainwater Design. Landscape Journal, 27(2), pp. 268-290.*

6.3 Dinamic and attractivity

In order for them to be active, open public spaces have to be attractive for visitors which is accomplished through various activities they are designed to offer. It is necessary that they can provide people with various options for entertainment and relaxation, as well as that they can offer a number of ambient units which stimulate and attract different social groups.

Water affects visitors' moods and activates all senses. Visual elements are highly significant and often play a central role in a certain space. However, the presence of water in our surrounding is also registered by our sense of hearing. In addition, water is important for our dynamics and the way we use the space we are in. Depending on whether water is still or flowing, whether it murmurs or falls, its appearance is different and the feelings it creates are different. (Echols & Pennypacker, 2008)

	Water area	Boundary zone	Surroundings
Stream course	• Design frequent changes of the horizontal and vertical movement of water (still water, small waterfalls…)* • During the inflow of atmospheric water use various materials (metal, stone…) onto which water is falling, in order to produce different sounds*	• Secure an obvious path towards the stream • Within the zones of extended areas in which constructed wetlands are located create a number of theme-based units	• Integrate spaces for walking - a path network • Form a number of bridges for crossing over streams
Retention – small accumulation (with constructed wetlands, bioretention system, sedimentation basins etc.)	• Position retention in the central zone of the public space in order for it to be visible from all sides* • Use aquatic plants on the water surface • Use diverse vegetation placed in such a way that it increases dynamics of the space • Plan for a number of bridges and paths which enable users to approach the swamp* • Create a habitat for different animal species*	• Form a clear lake line, naturally treated in some areas and regulated with stones in others • Secure vegetation which grows inshore to create more attractive space and deduce coastal erosion • Boundary zone should be especially attractive with diverse vegetation	• Form an open area with a number of distinctive units • Use different materials - combination of natural and artificial* • Integrate spaces for walking, network of paths and bridges • Integrate all the elements of the system into design in an attractive way

Figure 10: Guidelines for urban design in accordance with the objective: Dynamics and attractiveness

**edited and adapted from Echols, S. & Pennypacker, E., 2008. From Stormwater Management to Artful Rainwater Design. Landscape Journal, 27(2), pp. 268-290.*

6.4 Educability

The presence of decentralized, open systems is very important since it offers the visitors of these spaces a chance to spend time close to water areas. In these places, rainwater ceases to be invisible and hidden below the ground, and citizens have an opportunity to become aware of its existence, and gain deeper understanding of the importance it has as a resource. Therefore, it is necessary to create conditions in which space users will learn about the principles of decentralized systems and understand their significance. (Echols & Pennypacker, 2008) It is important to familiarize citizens with main advantages of these systems.

	Water area	Boundary zone	Surroundings
Stream course	• Make all the systems visible and recognizable* • Through urban design draw attention to the importance of hydrological cycle protection in the city by different means of informing • Enable users to modify the scenery by moving different elements so that they can form parts of the system* • Think about different presentations of water and different topics*	• Enable direct contact with water (by touch)*	• Actively integrate all the elements of the system in the design* • Create a possibility to plan educational activities and games within the system* • Create spaces close to the systems where citizens would be able to sit
Retention – small accumulation (with constructed wetlands, bioretention system, sedimentation basins etc.)			
	• Give clear information on vegetation species and ways of water refinement • Create habitats for animals living there*	• Place clear signs which will inform users about system's position*	• Create spaces which would encourage users to investigate refinement system, or play close or within it • Within the system create zones in which different activities designed to improve knowledge about the systems

Figure 11: Guidelines for urban design in accordance with the objective: Educability

**edited and adapted from Echols, S. & Pennypacker, E., 2008. From Stormwater Management to Artful Rainwater Design. Landscape Journal, 27(2), pp. 268-290.*

6.5 Safety

One of the main requests in creation of spaces in which modern systems for regulation are placed is their safety. In a zone in which there are many water areas which appear often and which are directly approachable, it is necessary to provide paths and all other access means, both for children and adults, as well as a number of other protection elements.

	Water area	Boundary zone	Surroundings
Stream course	• Secure bridges which enable access to the system by fences, screens, canvases and glass, so that safe observation is possible* • Slow watercourses by setting up water straits, rocks and small waterfalls* • Slightly change the direction of the stream, create extensions in order to slow the course*	• Secure all the access points with walls, fences, canvases or glass so that they are easily approachable and safe	• Design surroundings in accordance with all safety characteristics of any public space
Retention – small accumulation (with constructed wetlands, bioretention system, sedimentation basins etc.)	• Carefully plan water depth. Do not plan for great depths.* • Secure wider and, in special circumstances, longer basins, instead of designing deep waters • Position systems in such a way that they are easy to find and follow • Secure access to the system from the upper side as well as safe movement by the use of various fences* • Secure the access space so that construction machines can maintain the space regularly and make it safe	• Form clear entrances in the systems* • Secure thick vegetation which does not block the view, but disables access to water*	

Figure 12: Guidelines for urban design in accordance with the objective: Safety

**edited and adapted from Echols, S. & Pennypacker, E., 2008. From Stormwater Management to Artful Rainwater Design. Landscape Journal, 27(2), pp. 268-290.*

7 Conclusion

Position of the urban streams within the city could be a huge potential for the improvement and strengthening of the city identity. Carefully planned and designed new urban landscapes in accordance with the existing urban riverfront areas can show an enormous potential for recovery and rehabilitation, combining urban regeneration with environmental, socioeconomic and aesthetic improvement. (Schanze, et al., 2004).

The results of this research are detailed guidelines for urban design that should be taken into account when designing and creating new open spaces on the banks of small urban streams. They should also be taken into consideration when integrating new principles and roles from higher level plans into the detailed planning documentation.This integration is the most important step in the planning and design practice in Serbia, and it can provide a solid base for the revitalization of numerous rivers in Serbian urban areas.

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Challenges and Strategies Towards a Livable and Water Sensitive Delta City

- the case of Guangzhou, the Pearl River Delta

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1. Introduction

The Pearl River Delta (PRD) is an economic zone in South China, which refers to an emerging large agglomeration in Guangdong Province including 9 municipalities (including Guangzhou, Shenzhen, Zhuhai, Foshan, Jiangmen, Dongguan, Zhongshan, the urban areas of Huizhou and Zhaoqing). It is currently one of the most economically dynamic and densely urbanized agglomerations in the world, covering a total area of 41698 km^2, including a built-up area of 6640 km^2. The Greater Pearl River Delta (GPRD) is a larger region including the PRD economic zone and 2 Special Administrative Regions (SARs) of Hong Kong and Macau. Urban development of the PRD was characterized by its rural industrialization and fast urbanization process over the past three decades. As the capital city of Guangdong Province, Guangzhou is the biggest megacity, as well as the socio-economic and cultural centre of the PRD with the population of over 13 million.

2. Challenges

2.1 Current spatial structure

Currently, the spatial pattern of the Pearl River Delta is polycentric, with three growth poles (Guangzhou - Foshan, Shenzhen - Hong Kong and Zhuhai - Macau), supported by a network of medium sized cities and small towns (Figure 1). Transportation and other infrastructure networks are being considered as essential components shaping the spatial structure of metropolitan areas, as well as the consolidation of the region, especially along development corridors connecting the three main growth poles.

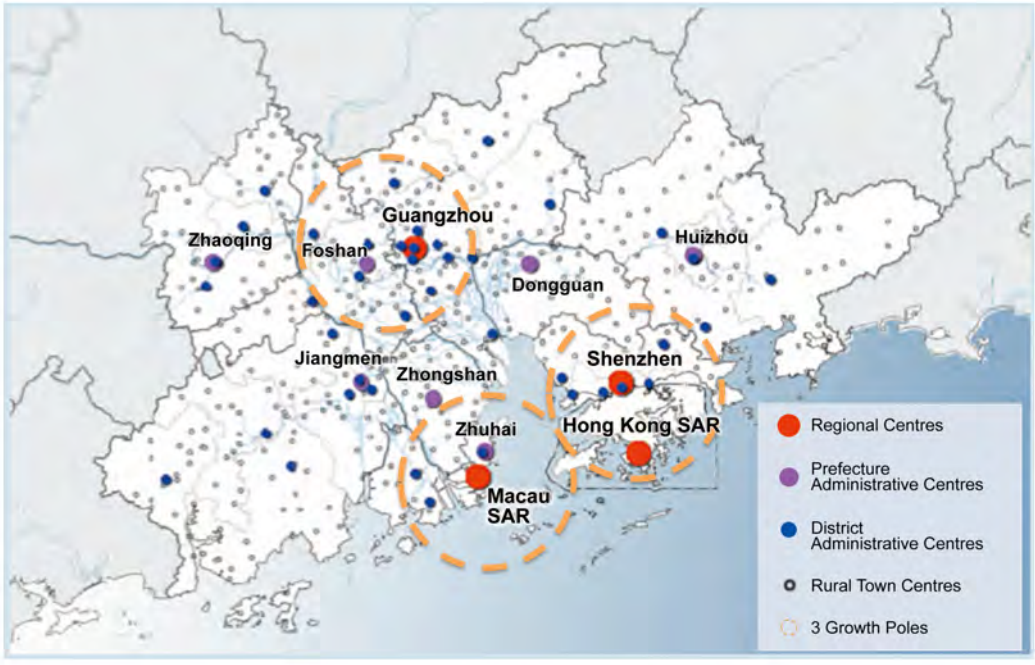


Figure 1: The Polycentric Development Pattern of the GPRD Region
Source: Planning Study on the Coordinated Development of the GPRD Townships 2006-2009, P29.

In this context, driven by the regional restructuring of the Pearl River Delta, Guangzhou has expanded its municipal boundary by including the northern and southern areas in the metropolitan region since 2000. Current spatial pattern of Guangzhou is “Mountain-City-River-Agriculture-Sea” (Figure 2).

Based on the conditions of landscape, water discharge features and urban form, current metropolitan region of Guangzhou can be divided into three morphological zones. Understanding the challenges and opportunities of these morphological areas could help to develop a more resilient, livable and water sensitive urban system. These three zones generally represent three levels of urbanization with different dominating flooding and urban problems. Zone 1: Initial Stage (urbanization rate<30%), Zone 2: Mature Stage (urbanization rate>70%) and Zone 3: Medium Stage (urbanization rate: 30%-70%).

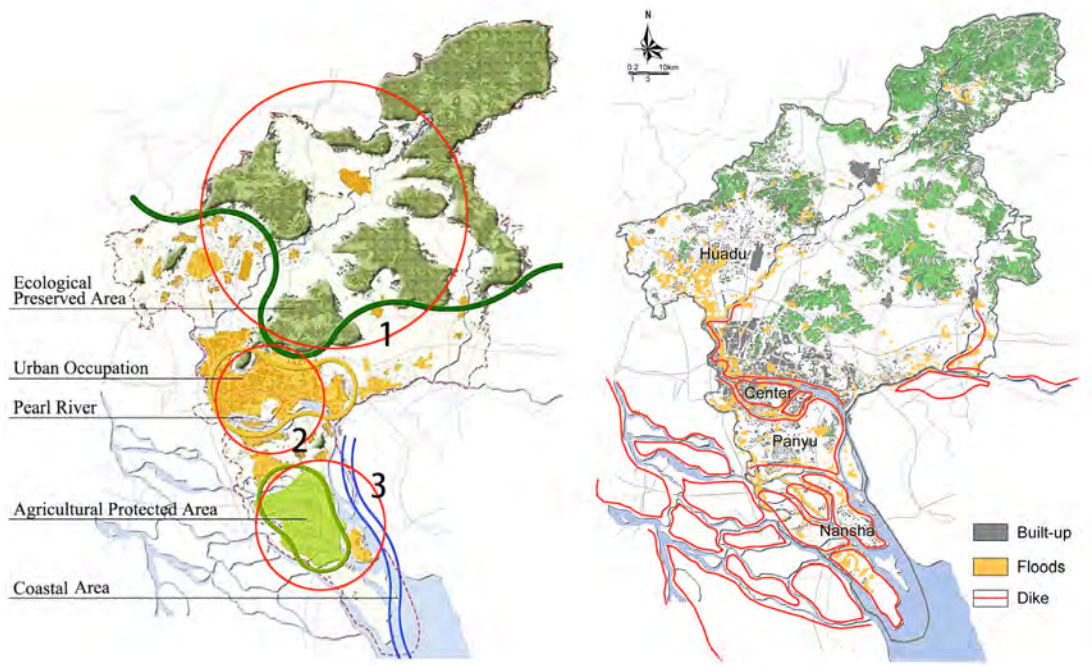


Figure 2: Left: Three Morphological Zones of Guangzhou;
Right: Past Flooding of Guangzhou (Yellow areas indicate past flooding from 1997 to 2010)
Source: Flood Area Based on MODIS FLOOD MAP, NASA

In general, there are two dominating pressures and uncertainties threatening the delta landscape: urban development and climate change.

2.2 Challenges from urban development

As one of the most fast growing delta regions in the world, the Pearl River Delta has been developing with a long-term process of land reclamation towards the sea. Driven by the national reform and opening-up policy in the late 1970s, this kind of process has been accelerated for rapid urbanization and industrialization. The Pearl River Delta has to deal with the pressures of urban and population growth on limited land. Cities have been continuously seeking new land and opportunities for expansion at the regional level. Urban growth is driven by regional traffic infrastructures like highways, high-speed railways, international ports and airports. Thus, industry and logistics-based new town development has been promoted to accommodate increasing population and urban functions. In this regard, the delta is confronting enormous challenges in terms of water safety, environmental and socio-economic transitions.

On the one hand, regional ring dikes were constructed to enhance the protection against fluvial flooding. However, inappropriate dike construction and premature reclamation activities led to severe environmental deterioration, such as deforestation, soil erosion, silting up of river channels and flooding. Dikes somehow changed the natural process of sedimentation, resulting in higher riverbeds. Therefore, dikes had to be heightened constantly to deal with higher water levels, which caused greater distance between water levels and the land, namely higher flood risk (Li, 1998).

On the other hand, the rural industrialization model and the dispersed urbanization pattern

have generated enormous environmental and ecological issues. Firstly, massive construction resulted in overly rapid changes in ecosystems and farmland loss (Mee-kam, 2006). Since the 1980s, with the coastal fishponds and seashore being transformed into built-up areas, the mangrove ecosystem in Guangdong Province has been shrinking. Damage to the mangrove ecology and resources by urban constructions occurred in areas like Futian in Shenzhen (Xu & Li, 2002). Secondly, being the "world factory", the labor-intensive industries in the Pearl River Delta also generated water pollution. Although there are abundant water resources in the PRD region, due to the water pollution and seawater intrusion, there is still a shortage of fresh water (Di et al., 2008). It has been estimated that the water supply deficit in the PRD region will increase in the near future. Finally, as new ports have been established at the Pearl River estuary, old industrial land and ports in old city centres have to face new functional transitions, determining a new agenda for sustainable urban transformation.

For the city of Guangzhou, along with the shrinking surface water and changing ecosystem, the city is becoming more vulnerable to flooding. Waterfronts that used to function as flood buffers have been fully occupied by real estate projects in recent decades. Water however, is introduced back in the city centre as a design element for city beautification, in the form of lakes and canals, with little relevance to the original water system. Most canals and streams in the old town were replaced with road infrastructure. Guangzhou has gradually lost its cultural identity as a historical water-structured city. Besides, the tradition and culture of dealing with water has been altered, from local residents' self-management to hydraulic engineers' construction work.

Besides floods, Guangzhou has also witnessed dramatic socio-economic transitions and pressures. According to the economic analysis and prediction of Guangzhou (Guangzhou Development Academy, 2013), Guangzhou accommodates the population of over 13.55 million at present, which has greatly surpassed the comprehensive bearing capacity. The city's strategic development plan even set a population target of about 18 million by 2020. Guangzhou is now facing great pressures concerning infrastructure construction, environmental protection, urban regeneration, rural development, as well as water management due to rapid population growth.

2.3 Challenges from climate change

There are two main undeniable driving forces, which have intensified the pressures on flooding. Besides the impacts of rapid urbanization and industrialization, climate change has attracted increasing attention in urbanized delta regions world-widely in recent decades due to their climate sensitivity.

The Pearl River Delta is exposed to rising flood risk induced by climate change: especially sea level rise and extreme typhoons and storms in summer. Climate related disasters are happening more frequently in the recent decade. For instance, several big floods caused by intensive storm water occurred this year, threatening public safety, especially by destroying infrastructures and blocking traffic, such as in Shenzhen airport and Hong Kong subway.

Besides, more threatening result of climate change are indicated as the uncertain consequences of the sea level rise. According to scientific statistics, the magnitude of the mean sea level rise in the Pearl River Delta between 1990 and 2030 was predicted as 30cm with an annual rising rate of 5cm (Chinese Academy of Science, 2002). Occupying vast low-lying floodplain around sea level, Guangzhou as well as the whole Pearl River Delta is greatly threatened by the estimated consequences of climate change, let alone more uncertainties in the future (Figure 3).

However, the situation could be even worse if we consider both socio-economic and climate uncertainties. As urban areas grow, both geographically and demographically, the flood hazard and risk increase for more exposure, and the process of urbanization itself alters local hydrologic characteristics (Montz, 2000). The OECD report predicted that Guangzhou ranked top of global port cities with highest flood risk due to large exposure of population and assets by 2070 (Chart 1). Limited space calls for more adaptive strategies for future urban development.

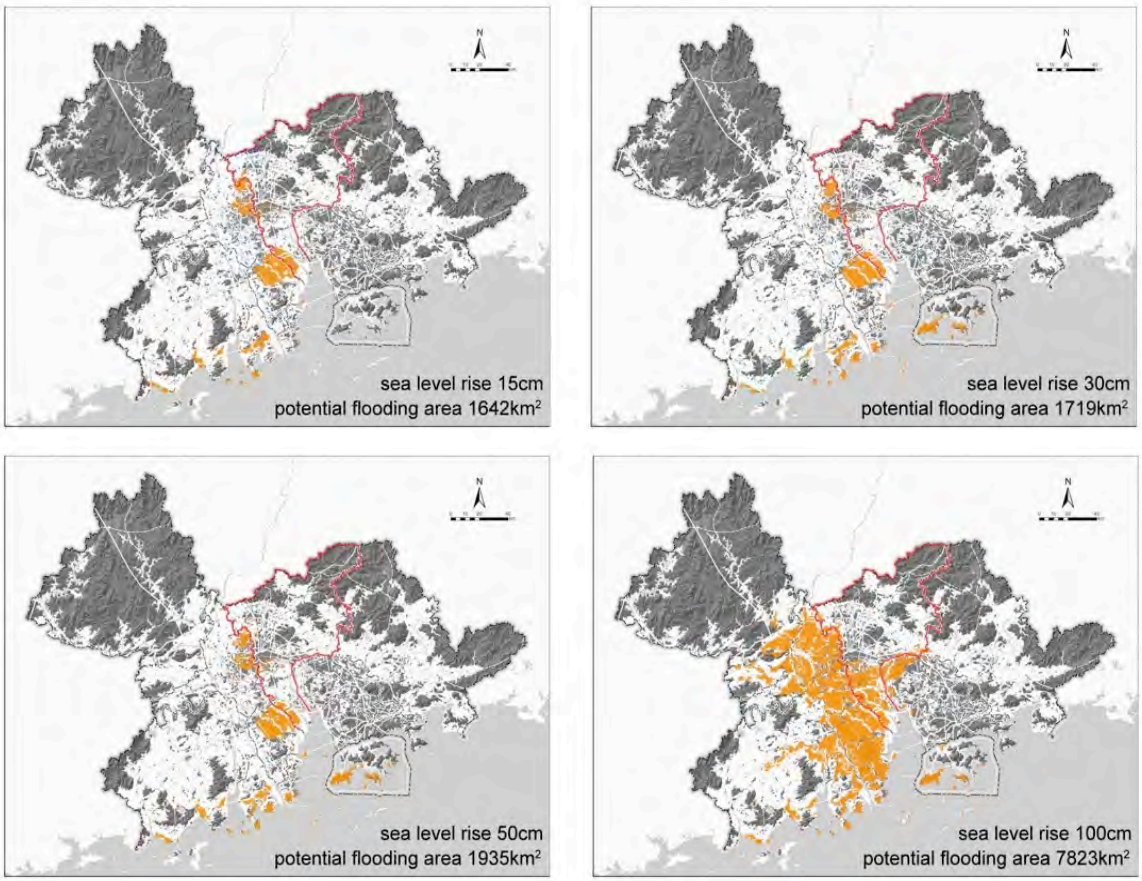
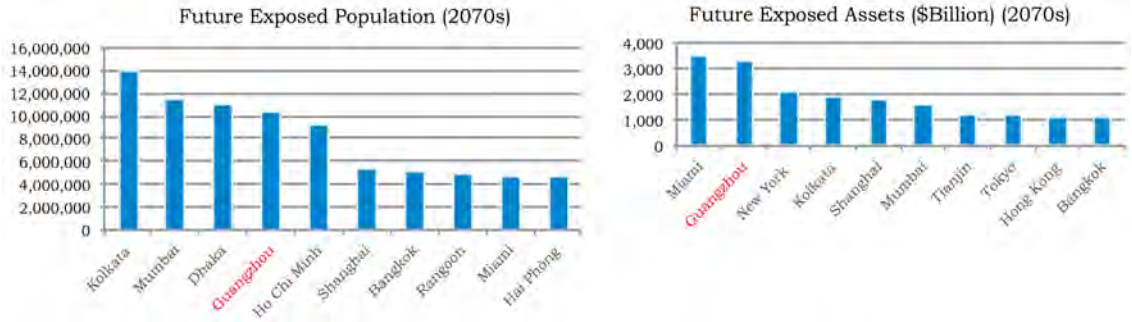


Figure 3: Potential Flooding Areas of the Pearl River Delta with Current Flood Defence (Return Period of 100 Years)
Data from China National Marine Basic Information Network Service System

Chart 1. Future Global Exposure of Population & Assets to Flood Risk (by 2070s)



Source: Hanson et al., 2011

3. Spatial Strategies

Facing the challenges of limited land resources and deteriorating natural environment, spatial strategies are in urgent need to accommodate the increasing population and new urban functions, and furthermore, to strengthen its regional competitiveness in the global economy. In general, two types of interventions are responsible for the above-mentioned urban issues: spatial planning and water management. On the one hand, interventions based on the regional spatial planning strategies have been implemented for optimizing the spatial structure to accommodate increasing population on the floodplain and to promote socio-economic development. On the other hand, water management strategies have been taken to deal with water issues like flooding.

3.1 Spatial planning initiatives

Since 2008, strategic planning initiatives have arisen on the delta level addressing the above-mentioned urban issues. By the end of 2008, an important plan "The Outline of the Plan for the Reform and Development of the Pearl River Delta (2008-2020)" was issued by the National Development and Reform Commission of China. "The Outline" explicitly regards the development of the PRD region as a national strategy for the first time. It also specifies that the PRD should perform as the pilot area to improve the regional integration of China. "The Outline" provides a comprehensive strategic framework to guide the overall coordinated and sustainable development of the PRD. With the strategic guidance, 5 integration plans of the PRD region were issued in accordance with the addressed issues in "The Outline":

- Infrastructure Development Integration Plan of the Pearl River Delta 2009-2020
- Industrial Distribution Integration Plan of the Pearl River Delta 2009-2020
- Basic Public Service Integration Plan of the Pearl River Delta 2009-2020
- Urban-Rural Integration Plan of the Pearl River Delta 2009-2020
- Environmental Protection Integration Plan of the Pearl River Delta 2009-2020

In dealing with environmental issues, as indicated in "The Outline", the PRD region will take the lead in building a resource conserving and environmentally friendly development framework. More specifically, it is targeted to reinforce the protection of farmland and ecological system, as well as to promote efficient utilization of resources (land, water, etc.). In this regard, the river mouth ecosystem, coastal swamps and mangrove forests will be effectively protected. The land obtained through filling and embanking the coasts will be utilized strictly for non-agricultural constructions.

Following the plan guidelines, greenway planning is defined as a regional spatial strategy with multiple contributions. Greenways are multifunctional corridors incorporating the quality of natural and manmade systems. Greenways conserve open space, protecting riverine systems, vegetation, soil and geomorphology that is essential to the health and vitality of the local landscape (Flink & Seans, 1993). Since 2010, many cities in the Pearl River Delta have been implementing greenway construction, aiming at regaining ecological value and facilitating slow traffic (Figure 4). Many of these green corridors are arranged along existing canals, historical heritage, and green space, for enhancing the livability and resilience of the delta within a recognized green-blue network. This strategy not only improves the regional living environment, but also contributes to flood mitigation by reducing storm water runoff in these buffer zones.

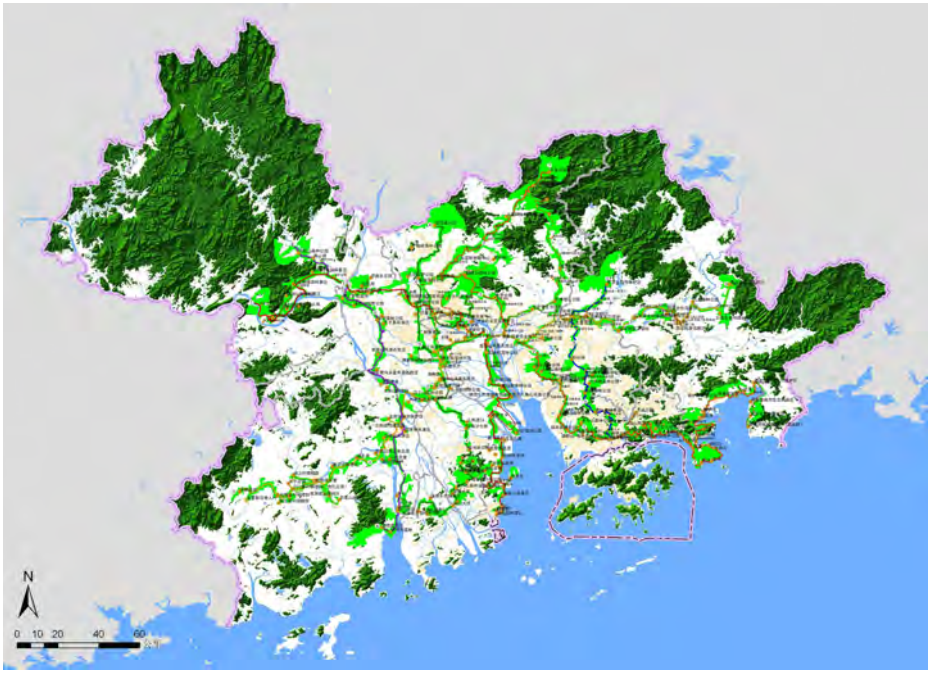


Figure 4: Greenway Planning in the Pearl River Delta
Source: Greenway Network Master Plan of the Pearl River Delta

Considering the coordination and cooperation between the Pearl River Delta and two Special Administrative Regions (Hong Kong SAR and Macau SAR), the "Planning Study on the Coordinated Development of the Greater Pearl River Delta (GPRD) Townships" ("The GPRD Study") was finished in 2009. It is the first strategic planning study undertaken with the agreement between the Hong Kong and Macau Affairs Office of the State Council and the governments of Guangdong Province, Hong Kong SAR and Macau SAR. Regarding spatial issues, "The GPRD Study" addressed 3 strategic goals concerning restructuring spatial structure of the GPRD region.

- Optimizing Spatial Structure
- Facilitating Regional Mobility
- Promoting Sustainable Environment

These strategies mainly focus on building a coordinated and sustainable world-class region that is vibrant and globally competitive, while promoting a livable and resilient living environment. The importance of preserving ecological sensitive zones is reinforced in the plan, especially the Bay Area where intensive urban development has been threatening the natural environment. To be specific, measures to be taken include: to ensure that proper planning and environmental impact assessments will be undertaken for large-scale developments before implementation; to raise the threshold for new industrial development; to implement the environmental mitigation measures before development; to exercise stringent monitoring and control on important environmental elements, such as air and water, as well as important habitats, such as wetlands ("The GPRD Study").

Following the regional strategies, urban planning and water management in Guangzhou have also experienced many transitions. The major water related transitions occurred in both old town and new town areas along with different types of urban planning models.

Canal revitalization in the old town

Along with rapid urbanisation, urban fabric in the old town of Guangzhou has experienced great transitions from canal-structured tissue to paved street network, along with rapid urbanization. Consequently, original surface drainage capacity was undermined, causing serious pluvial flooding during the monsoon season. The decreasing surface water not only brings flood issues, but also takes away the identity of Guangzhou as a historical water city. Taking the opportunity of urban regeneration for improving the spatial quality while mitigating flood risk, to reopen paved canals is one of such strategies. The project of reopening Liwan canal in the west part of the historical centre is a pilot project to recall original waterfront landscape. Traditional housing was rebuilt along the canal together with some commercial activities. Although this initiative promotes the area to be a new recreational park and tourist attraction, more research is still needed to evaluate the actual impacts and long-term effects. Whether this kind of projects can contribute to the restoration of ecosystem and living environment for local residents remains to be explored.

New town development

Under the premise of regional infrastructures (port, airport, highway and railway), the Pearl River Delta has witnessed the rise of new town development in the metropolitan region. Nansha New Town in Guangzhou is one of such cases. Nansha new town is located in the Northwestern part of the Lingdingyang Bay and includes four outlets of the Pearl River. With a very high economic growth rate during recent years, it can be considered as the most important development zone of Guangzhou metropolitan area. The coastline has changed largely through centuries due to continuous land reclamation.

Since the southern part (Panyu and Nansha Districts) was included in the metropolitan area of Guangzhou in 2000, a growing trend has emerged to make the downstream area (especially Nansha District) into an industrial and logistics based coastal new town. Ambitious urban planning was drafted to reclaim more land from the sea and make Nansha the second centre of Guangzhou as well as the transportation hub of the Pearl River Delta (Figure 5). This idea is followed by an ongoing debate, especially on the natural bearing capacity of the environment and ecosystem. A recent report "Study on the appropriate scale and density for the development of Nansha based on the environmental sustainability and the capacity of water resources" indicates that, both living environment and water resources

are two main constrains for future urban development. Nansha has dense water network and marshland. The soil is relatively soft, formed by natural sedimentation from the Pearl River through history. Therefore, it will increase the vulnerability to build high density and high-rises there due to possible land subsidence. Besides, as an important ecological corridor of the Pearl River Delta under the increasing threat of climate change, natural conditions should be well preserved for the benefit of the whole delta.

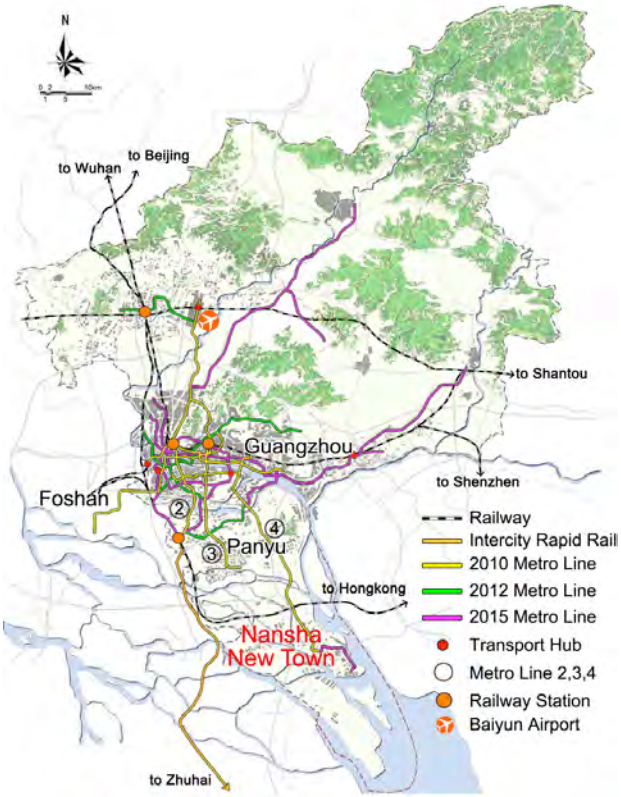


Figure 5: Nansha New Town Attached to the Development of Rail Transit Infrastructures
Source: based on the Rail Transit Plan of Guangzhou 2011-2015,
Guangzhou Municipal Development and Reform Commission.

3.2 Water management initiatives

Although water management was mentioned in the general framework of regional strategic planning, there is still a lack of integration in terms of optimizing economic, ecological and social-cultural values. At the regional level, hydraulic authorities such as the Pearl River Water Resources Commission are mainly responsible for managing water resources and water infrastructures in the Pearl River Basin. To deal with flooding, "The Pearl River Basin Flood Control Planning" was issued in 2007. However, the flood control strategies mainly focused on concreting, deepening and straightening watercourses, including river regulation and channelisation, as well as constructing embankments, which could undermine the spatial quality and ecosystem to some extent. For example, the construction of embankments could destroy the living environment for riparian vegetation and freshwater organisms.

In coping with such challenges, some integrated plans have been brought up for balancing the natural and built environments. The "Integrated River Basin Management (IRBM)" is one of such initiatives. In 2004, the China Council for International Cooperation on Environment and Development (CCICED) and the World Wide Fund for Nature (WWF) published a report entitled – "Promoting Integrated River Basin Management and Restoring China's Living Rivers". IRBM is a framework coordinating the management and development of the water, land, biological and related resources within a river basin to optimize the socio-economic benefits and environmental values in an equitable way. This is based on an ecological approach for conserving and repairing the freshwater ecosystems (CCICED Task Force, 2004). The concrete operability of this plan still needs to be reviewed comparing to "The

Outline" framework, considering an integration on goals and strategies at the diverse governance levels involved.

On the city scale, stormwater is managed by the water bureau of the municipal government. The stormwater management in the urban areas of Guangzhou is a series of projects including water infrastructure construction, pollution source control, canal dredging, sewage treatment and water diversion, incorporating the approaches of drainage, storage, control and restoration.

Drainage dependent approach - facilitating artificial drainage system

Due to the decreasing capacity of water storage above ground, current stormwater management of Guangzhou mainly depends on drainage through pipes. Since 2009, Guangzhou municipality has invested over 135 million US dollars on reconstructing drainage pipes. There are 228 low-lying areas in the city centre with serious flooding problems. The major task is to dredge and enlarge drainage pipes and establish pump stations. Many water infrastructures as sluices are used to adjust the water levels in the canals and lakes due to high and low tide of the Pearl River.

Increasing water storage capacity - building reservoirs

In 2005, the "Canal System Planning in the City Centre of Guangzhou" defined the overall guidance of building reservoirs in the north and sluices in the south of Guangzhou. Two more artificial lakes (Baiyun Lake and Haizhu Lake) are under construction with the integration of ecological parks, functioning as water storage, flood mitigation and recreation.

Improving water quality - water purification

Besides the above-mentioned strategies, water purification is involved during the whole process to improve the water quality and environment. Guangzhou has 231 canals in the city centre, while 121 of which is included in the restoration project. Guangzhou has spent around 7 billion US dollars in recent two years to improve water conditions. The water quality in 121 canals and streams with a total length of 388 kilometers has been greatly improved. A total of 30 sewage treatment plants were constructed to increase the city's sewage treatment capacity by 2.25 million tons a day.

Although some initiative plans and practice have been taken in both spatial planning and water management for tackling water related urban issues on regional and local levels, there is still a lack of integrated strategies towards a resilient, adaptive and water sensitive system. The lack of integration in terms of current urban and water strategies is somehow rooted in the lack of understanding of the water-city interrelationship over value, time and scale:

1. Lack of understanding of changing values of water

The development of technology and hydraulic engineering enabled the city to overcome the restraint of natural environment, which also led to the changing culture and values towards water. Therefore, the economic and socio-cultural values of water have been reinforced upon some certain levels of safety standard in the waterfronts. This transition directly influenced the land use and urban fabric in the waterfronts of Guangzhou along the Pearl River, which further caused some issues concerning spatial quality.

2. Lack of understanding of different dynamic systems

Considering the different dynamics of landscape, infrastructure and urban system, it is difficult to develop a comprehensive strategy without a holistic perspective. Some urban and water interventions may cause negative impacts on the natural environment in the long run. These three layers in the morphological framework are generally managed by geographers, urban planners/designer and hydraulic engineers respectively. It is inevitable to mitigate the spatial quality due to the lack of understanding of the different dynamics among these discourses.

3. Lack of cross-scale study

Spatial planning and water management strategies have been developed on both delta and city levels. However, the impacts of regional strategies on local development require more cross-scale perspective. For instance, the ring dike construction and new town development on the regional level could bring some issues related with safety, environmental vulnerability and spatial quality to some specific locations.

4. Conclusion

In conclusion, the Pearl River Delta has been experiencing increasing transitions and challenges from both urban development and environmental changes since the late 1970s. Given the fact that the PRD has been playing the leading role in propelling regional competitiveness under market driven forces since the 1990s, economic benefit is always given the priority in regional and local planning. However, it has been recognized that traditional labor-intensive industrialisation model and dispersed urbanisation pattern have caused many issues, regarding water safety, socio-economic and environmental sustainability. Moreover, the current emerging mega-region structure reflected in rapid infrastructural development and land use transformation has seriously affected the water and environmental systems at large. Considering enormous socio-economic and climate uncertainties in the future, there is an urgent need to develop the whole region in a more resilient, adaptive and water sensitive way.

Although there have been several planning and water management initiatives tackling these issues on the regional level, the cooperation and coordination among the authorities of urban planning, environmental management and hydraulic engineering are still lacking. Taking into account the different governmental systems in the PRD and two SARs (Hong Kong and Macau), there is an increasing attention on the cross-boundary issues in the GPRD framework, such as regional transportation, water resource management and ecological preservation.

"The GPRD Study" perspective on the three main strategic goals represents the effort of regional development, but its operability remains uncertain, especially the extremely fast development of the region and pressures at the municipal level, where conflicts in development interests might occur.

Therefore, there is an urgent call for integrated strategies considering the whole delta as a dynamic system with multiple spatial values on different scales and levels. Due to the competitiveness and cooperation dichotomies among cities within the PRD, strategic regional plans have to optimize values of the whole delta as a resilient and integrated system. The strategies have to deal with the challenges on both the delta and city scales. For the delta scale, the dynamics of topography and landscape determine the unique urban patterns in the PRD, which could be considered as rules of spatial transformation for regional planning. It is essential to take into account future challenges, and integrate various strategic goals at the diverse governance levels. It is crucial to adjust the functions of central mega cities in the network of different urban patterns. For instance, the development of regional infrastructures (both water and transport infrastructures) should be based on overall goals, as well as long-term impacts on regional and local scales, whilst considering socio-economic and ecological values. For the city scale, urban planning and design is associated with local conditions, such as historical and cultural values, as well as the environmental carrying capacity. New development should be based on site-specific requirements instead of merely following the upper plans. Finally, more efficient cooperation among different levels of authorities, especially between spatial planning and water management sectors, is highly required. The necessity to include a whole variety of actors to assess this challenge could constitute a way the decision making process could effectively integrate the diverse responsibilities. This would activate the overall goals, and formulate towards a more integrated and resilient system in the region, throughout the diverse scale levels and including the whole spectrum of actors, from national to regional to local ones. Considering regional coordination and cooperation, a broader concept of the Greater Pearl River Delta Region could be further promoted, so that Hong Kong SAR and Macau SAR are also included in this regional vision.

Although problems are similar, solutions are typically site-specific. It is therefore necessary to fully consider the site conditions, including topography, water system, flood risk, etc. Besides, the strategies differ according to the urban development context of the city. Under the huge pressures from population growth and socio-economic conditions, it is impossible for Guangzhou to abandon urban development and land use in the flood-prone areas. Given the fact that more space for water on the large scale is difficult in some situations, more adaptive

strategies are in urgent needs, which can optimize the overall benefits for both urban development and water management in the future.

Planning Documents

The Outline of the Plan for the Reform and Development of the Pearl River Delta 2008-2020
Planning Study on the Coordinated Development of the Greater Pearl River Delta Townships 2006-2009
Infrastructure Development Integration Plan of the Pearl River Delta 2009-2020
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Role of Water in Stabilizing Cities – Case of Delhi City

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1. Introduction

Ancient Vedas have described the role of Divine, Panacean and Emancipative Water in Vedic Religion in following manner:
"yāpo divyā uta vā sravanti khanitrimā uta vā yāḥ svayañjāḥ |
samudrārthā yāḥ śucayaḥ pāvakās tā āpo devīriha māmavantu ||"
(Waters which come from heaven, or those that wander dug from the earth, or flowing free by nature, bright, purifying, speeding to the Ocean, here let those Waters, Goddesses, protect me.)

Water has played important role in evolution of human civilization. Water, being fused with ancient Indian ethos, as we learn from the time-honoured literature, was highly revered for its unparalleled prowess and multiform presence and taken to be more than an essential need for all forms of life both in this very life and the hereafter. Beyond the horizons of our current knowledge of water which relies completely upon scientific underpinning, the honours received by water in Vedic religion solemnly fill us with owe and insist that we ponder over our mechanic wheel of life rushing towards an increasingly chaotic tomorrow.

Half of humanity is living in cities, and within two decades, nearly 60 per cent of the world's people will be living in cities. Urban growth is most rapid in the developing world, where cities gain an average of 5 million residents every month. The exploding urban population growth creates unprecedented challenges, among which provision for water for sustaining urban population is most pressing and essential.

Two main challenges related to water are affecting the sustainability of human urban settlements: the lack of access to safe water and, and increasing water-related disasters such as floods and droughts. These problems have enormous consequences on the environment, economic growth and development. Water has been most important stabilizing factor throughout the history of human civilization.

Following is an overview –

a) Ancient times

Water has been most important natural resource for flourishing of not only citied but also human civilization. Historical cities of Mohenjo-Daro and Harappa flourished on the bank of river Indus for centuries due to availability of water and fertile land. As historians/ archaeologists point out from ruins of these cities, a change in the course of river or flooding caused end of the cities and great civilization.

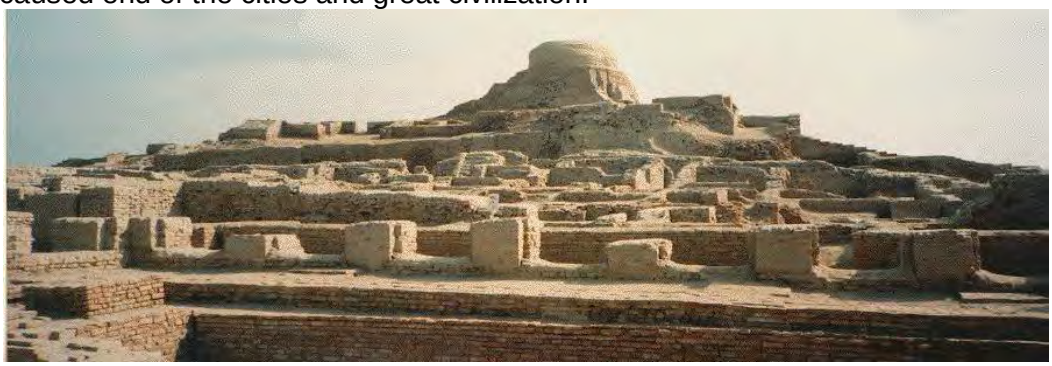


Figure 1: Ancient City of Mohenjo-Daro

b) Historical times

Fatehpur Sikri is a historic city in North India which is a mere ghost town today. Mughal emperor of India 'Akbar' had visited a saint known as Salim Chishti who then foretold that the emperor would have a second son who will survive to become a great ruler. When in 1569 a second son was indeed born to Akbar, he decided to move his capital from Agra to Sikri in honour of the saint Salim and started the construction of an architectural wonder of a town. It was then located around a natural water body lake around which evidences of civilization can be found. This place was abandoned then due to scarcity of water which could not support the growing population.



Figure 2: Historical City: Fatehpur Sikri (India)

Water is the single most essential component of the physical infrastructure for improved quality of life. Urban Water Sector is a zone of serious mismanagement. Increased urbanization, population growth and living standards have been major drivers in the increase of urban water use in the past century. The amount of urban water use depends on climate, level and efficiency of public supply services, patterns and habits of water use by the population, technological changes (for example, water saving technologies and use of alternative sources) and socioeconomic instruments.

Most urban areas have depleted, polluted or destroyed their local sources of water like rivers, lakes and tanks and in many cases even groundwater. The rainfall is generally seen as a bane rather than boon as it brings floods because the drainage systems are seriously ill designed or mismanaged. Lack of provision of adequate minimum water for vast proportions of poorer segments on the one hand and wasteful use without paying even cost prices by more prosperous segments on the other hand is typical picture of most urban areas.

2. Existing Scenario of Water Supply in Delhi

As per Master Plan of Delhi -2021, the present water demand for potable water in Delhi has been assessed as 990 Million Gallon per day (MGD) @ 60 Gallon per capita per day (GPCD) for all uses. No allowance is made for use of potable water for parks & lawns / horticulture/agriculture purposes due to water shortage. The Delhi Jal Board anticipates that by the year 2021 about 1380 MGD potable water @ 60 GPCD for a population of 230 lacs shall be required. However, the DDA has projected the 2021 water demand as 1840 MGD @ 80 GPCD.

The total city requirement is considered as 80 GPCD out of which 50 GPCD is for domestic requirement and 30 GPCD for non-domestic purposes. The domestic water requirements of 50 GPCD comprises of 30 GPCD for potable needs and 20 GPCD for non-potable water. The requirement of potable water out of total requirement of 80 GPCD has been assessed as 35 GPCD (30 GPCD for domestic and 5 GPCD for non-domestic demand) while the demand for non-potable water has been assessed as 45 GPCD i.e. 20 GPCD for domestic and 25 GPCD for non-domestic purposes.

Delhi mainly receives its water from the following 3 sources:

- Surface Water: 86% of Delhi's total water supply comes from surface water, namely the Yamuna River, which equals 4.6% of this resource through interstate agreements.

- Sub-surface water: Rainey wells and Tubewells. This source, which is met though rainfall (approx. 611.8 mm in 27 rainy days), and unutilized rainwater runoff, is 193 MCM (million cubic meters).

- Graduated Resources: It is estimated at 292 MCM, however current withdrawal equals 312 MCM.

According to various estimates, a proportion of 50% of Delhi's population lives in some kind of informal, unplanned and/or precarious settlement. Among them, more than two million people, representing more than 15% of the total population, live in illegal squatter settlements and face a permanent risk of eviction. The accountability of the municipal utility in charge of water supply and sanitation towards populations living in informal settlements is loosely defined, and most of them do not have a proper connection to the network. According to the Water and Sanitation Program (WSP), more than 40% of the urban poor in India rely only on groundwater resources through hand pumps and shallow wells for their water supply.

Around 75% of the households in Delhi are reported to have access to piped municipal supply either through a private connection or a common stand point, and around 20% of the population relies on hand pumps tapping the shallow aquifer for heir water supply. The contribution of groundwater to the municipal supply is around 11% in terms of volume, which represents around 370 Million a Day (MLD). This figure is often used as an indicator of the relative importance of groundwater for the city's water supply.

3. Problems of Water Supply in Delhi

The position of Delhi both as the centre of an urban agglomeration and as an independent state impacts significantly on its access to water resources. Water is a state subject as per the constitution of India. As a consequence, both water supply and water resources management fall under the responsibilities of state governments. In the National Capital Territory (NCT), the public utility in charge of water supply and sanitation – the Delhi Jal Board (DJB) – acts as an independent agency under the authority of the state government.

However, given the small size of the NCT, the DJB relies heavily on surface resources which are mobilized outside the NCT. Since 2005, the Delhi Jal Board received approximately 1 million m^3/day from the Bhakra dam fed by tributaries of the Indus, another million m^3/day from the Yamuna, around 0.45 million m^3/day from the Upper Ganga Canal, and around 0.38 million m3/day were obtained through exploitation of the local groundwater resources. Its right to those resources depends on several interstate agreements and their application by other states, namely Haryana and Punjab as far as waters from the Indus tributaries are concerned and Uttar Pradesh and Uttaranchal as far as Ganga river waters are concerned.

There are several problems and issues related to water supply and distribution in Delhi which are as follows:

(a) Disparity in Supply

Besides overall city level shortfall in water supply, there are wide disparities in the availability of water various parts of the city. Non-availability of even minimum supply of 135 LPCD (as per MPD 2001) to a significant proportion of city's population living in marginal settlements is the real concern. Lack of assured and timely supply of water at low pressure and quality standard not being maintained are other routine complaints of many colonies in the city.

(b) Unaccounted for Water

There are significantly high losses (nearly 30%) in the entire water supply system at different stages of raw water transmission, distribution network and other pilferage's/ unauthorized tapping.

(c) Lack of Inter-agency Co-ordination:

Although Delhi Jal Board is the nodal agency for water at the city level; the issues related to land /land use and development controls are with Delhi Development Authority, NDMC, Cantonment Board, CPWD, Railways and other local bodies, who procure bulk quantity and maintain / manage the distribution network within the areas under their jurisdiction. Absence of a synchronized annual five-year programme of each agency in line with well laid down overall city development programme set out in Master Plan for Delhi, and scientific monitoring system of executing the schemes is lacking. It results in delays and system inefficiencies besides additional expenditure due to cost and time over runs.

(d) Dependence on the sources outside Delhi

The major source to meet the raw water requirement of Delhi has been though inter-state allocations of Yamuna water and in future through prepared storage dams to be developed in Himachal Pradesh, Uttar Pradesh, etc. Most of these long – term projects are behind schedule and may take at least 10 years or more for a definite commitment about the assured quality of water to Delhi. The carrier canal and treatment plant, etc. for the same are also to be finalized both within / outside Delhi. However, there has been a lack of emphasis on recharge of ground water and of schemes to harness the source / potential of water in Delhi which are necessary for sustainable development.

(e) Local groundwater and its non-management

Although ground water abstraction is in theory regulated in Delhi. The authorities in charge of the enforcement of the regulation do not have the practical means of controlling private abstraction. In practice, abstraction is tolerated as a compensation for the failure of the public supply systems. As a consequence, waster table is falling at an increasing pace in several areas of NCT Delhi. The southern and western of Delhi, where piped supply does not match the growing residential demand are the most severely affected area. In the Chattarpur alluvial basin, were the water tables are falling at the highest rate, as well as in the western part of the state were recent urbanization is taking place in areas affected by the occurrence of saline water at shallow depths, the availability of fresh water will come to an end in a few years if abstraction continues a he current rate. In addition to this, Delhi's groundwater resources are subject to various forms of pollution.

(f) Over dependence on Planned Funds

There has been a widening gap in the balance sheets (revenue & expenditure) of the Delhi Jal Board. Low tariffs, ineffective billing and collection of dues, and operation/maintenance inefficiencies attribute to the bad financial health of DJB. Principles of water demand management; privatization and involvement of NGOs and CBOs at different stages of water system and sound management tools/techniques are relatively missing.

(g) Areas Lacking Adequate Focus

- Phased augmentation / replacement of distribution network in the congested central city / urban villages etc.

- Public awareness and media coverage for minimizing wastages of water.

- Effective implementation of legislation to curb the extraction of ground water.

4. Water Management in Delhi

Water management is the activity of planning, developing, distribution, managing and optimum use of water resources under defined water polices and regulations. In context of NCT of Delhi, it includes the following:

4.1 Management of water resources & water treatment

(a) Integrated approach for water resource management: the six drainage basins to be made self-sustainable in water requirement by integrating water-sewerage-drainage systems.

(b) Recycling of treated waste water (bod 30 mg/1) for horticulture, irrigation, industries, construction, fire etc. by

- Mandatory ecoparks with dual pipe system at all STP's

- Treated recycled water from STP's (350 mgd)

- Treated effluent from CETP'S

(c) Delhi Jal Board with the help of specialized agencies experts, NGOs, etc., should take up preparation of a detailed plan for water augmentation potential of Delhi. This may include:

- Water mapping by
  - i) Identification of traditional water structures on land-use plan and schemes to revive them e.g. baolis, historic reservoirs, ponds, etc.
  - ii) Utilization of abandoned quarry pits for water storage and augmentation of existing lakes / depressions for additional storage of rain / flood water
  - iii) On- channel storage and recharge of water in trunk storm water drains.
  - iv) Selection of areas within the river bed to be identified for water ponds and the concept of rain water harvesting for ground water re-charge are to be suitably emphasized.

- Possibility of the re-cycling of wastewater, legislation to minimize extraction of ground water within the specific limits, and measures to conserve water.

- Traditional water –harvesting model.

- Runoff is harvested through tanks, supported by his yielding wells and structures like baories, kundis and water holes.

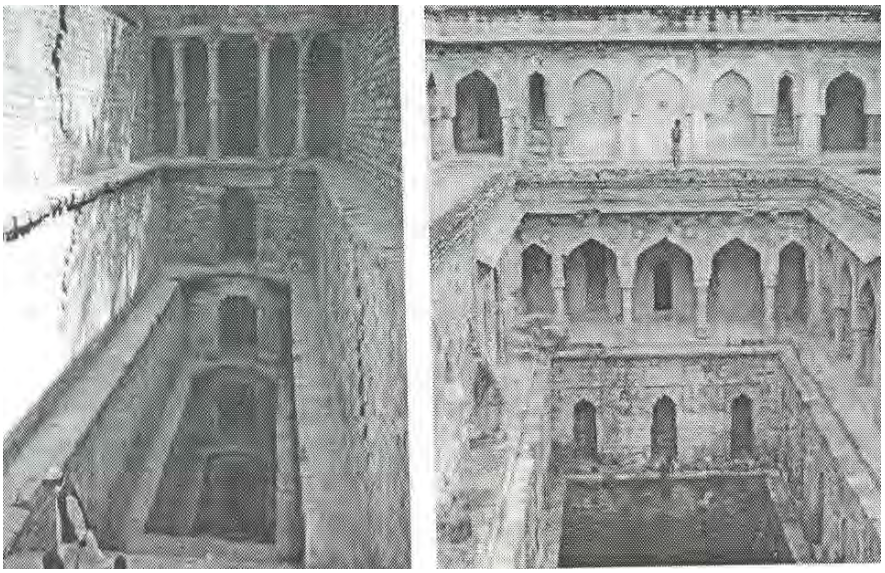


Figure 3: ***Traditional water-harvesting model:*** *Runoff is harvested through tanks, supported by high yielding wells and structures like baories, kundies and water holes*

4.2 Management of the ground water table

The ground water resources of 7 districts of NCT, Delhi are over-exploited with stage of development reaching to even 24% in south district. Moreover, the presence of saline aquifers below a depth of 30 to 40 m further limits the development of ground water resources. Thus the complex ground water regime of NCT, Delhi needs scientific planning to make the ground water resources as sustainable supplement source of water supply in NCT, Delhi. The groundwater management strategy in NCT Delhi should emphasize on the limited development of potential aquifers' of Delhi and augmentation to the groundwater resources of Delhi by rainwater harvesting and artificial recharge to the groundwater.

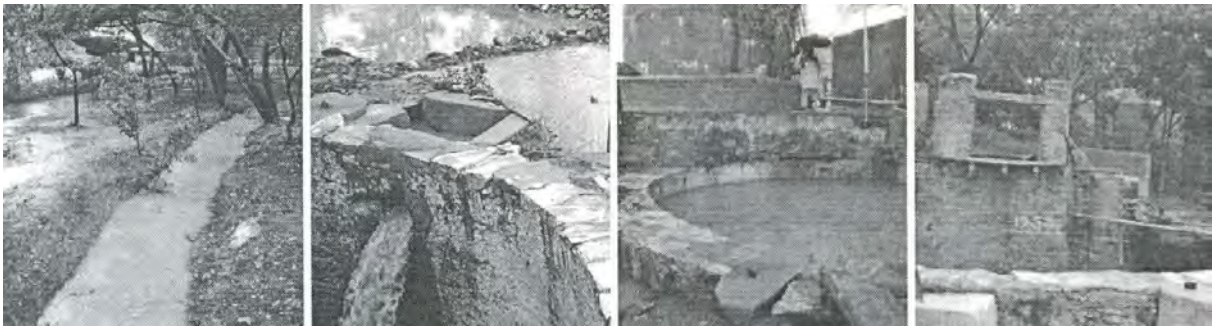


Figure 4: ***Trapping of Runoff:*** *Figures above shows Channels and gullies are created to direct excess rain water into open wells and the water collects in the well. This water then percolates into the ground and within a week 3,00,000 litres of water percolates 100 ft. below ground level to recharge the ground water bodies.*

The rapidly declining water level of Delhi is attributed mainly due to rampant urbanization and enhanced groundwater withdrawal and reduction in the available open space for recharge to groundwater. The situation can be improved by adopting rainwater harvesting and artificial recharge to ground water measures. The Master Plan for rainwater harvesting and artificial recharge of NCT Delhi estimated that nearly 440 MCM of rainwater can be harvested annually in Delhi and utilized for artificial recharge to groundwater. The artificial recharge to groundwater can be taken up by adopting different measures like rainwater harvesting at the level of individuals, at the level of colonies and by the institutions.

The Central Groundwater Board of NCT Delhi has taken up the leadership of spearheading rain water harvesting in NCT Delhi. The rainwater harvesting effort by CGWB in JNU and IIT campuses resulted in to rise in water level to the tune of about 2 to 3 metre in vicinity of the area where the project was implemented. Similar rainwater harvesting effort in President Estate resulted in the rise of water level in the range of 1 to 4 meters in the vicinity of the areas where the project was implemented.

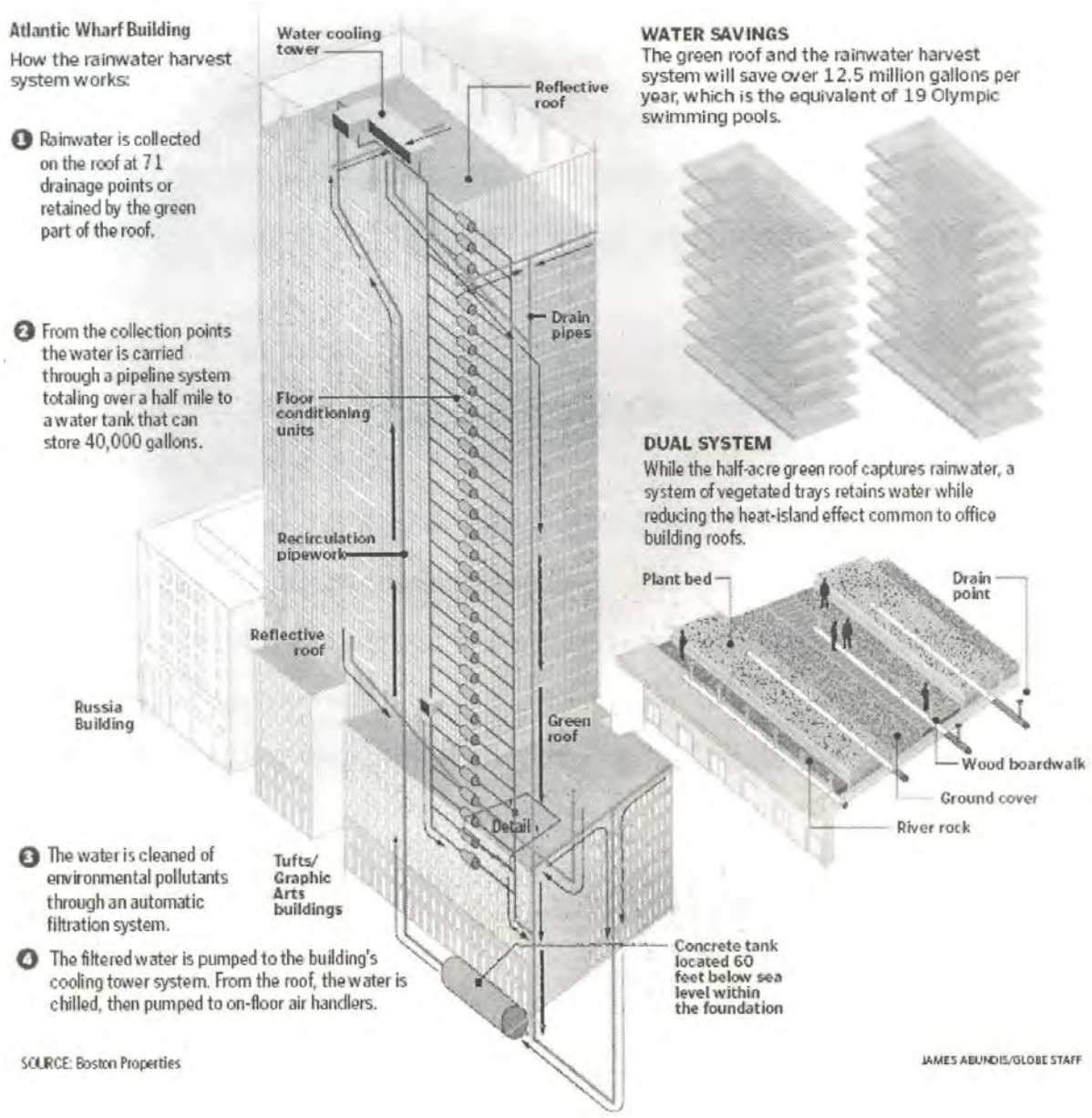


Figure 5: Roof-top rain water harvesting in a multipurpose building (containing office, residential, retail and public spaces) and various other measures adopted for water saving & reuse of waste water.

(Source: Boston Properties: James Abundis/Globe Staff)

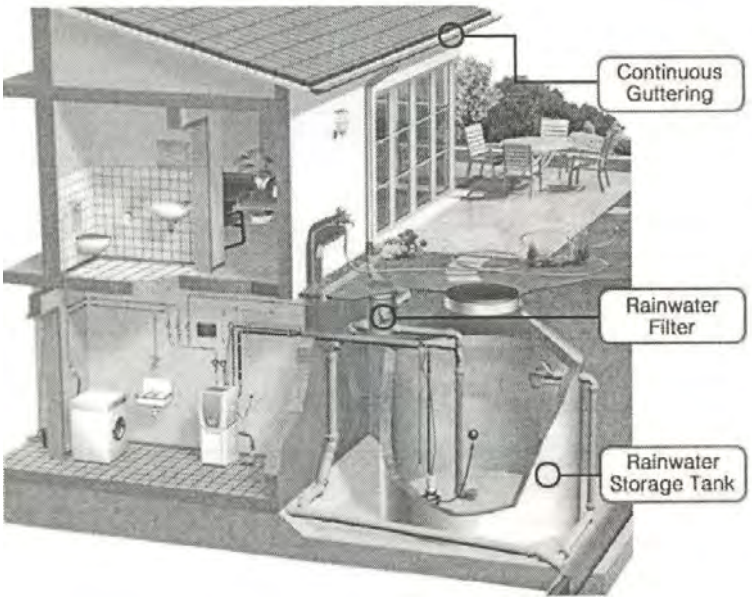


Figure 6: The details of rain water harvesting in plotted housing development and its reuse.

(Source: Boston Properties: James Abundis/Globe Staff)

5. Conclusion

In order to understand the interaction between the co-existing approaches to the problem of water supply, one has to take into account the time frame of the different dynamics at stake. Several factors will affect the evolution of the current system towards one of the scenarios described here. Among them, we can mention:

- The political process of interstate surface water allocation, which will determine the ability of Delhi to increase the volume of raw water available for its centralized system.
- The ability of the municipal utility to improve its efficiency and to manage the demand in a short period of time.
- The institutional integration between service management and local resources development.
- The evolution of technologies for aquifer recharge and recovery, and decentralized wastewater reclamation.
- The involvement of communities in the conception and the management of alternative systems.

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Watershed Urbanisation: SEA Planning Responses to Estuarine Cumulative Effects

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Abstract

The research investigated the evolving response in plans to the accumulation of copper (Cu) and zinc (Zn), related to undesirable benthic organism health responses, in benthic sediments in a New Zealand (NZ) estuary. Sources of these metals are influenced by policies and plan provisions for land use, transport, stormwater management, and the siting of boat mooring areas. During four decades of local government reform, district and regional plans responded to the scientific evidence of metal accumulation with increasingly sophisticated stormwater management. Strategic Environmental Assessment (SEA) and Cumulative Environmental Assessment (CEA) form the theoretical context of this research. The less explicit inclusion of SEA in legislation in NZ makes it difficult to assess its contribution to policy development and implementation. The extent to which a slowing in the accumulation of heavy metals over the last seven years can be attributed to SEA type policies is unclear. This research demonstrates for international audiences the concurrence of jurisdictional amalgamation; growing awareness and knowledge sharing across scientific, engineering and planning practitioners; and a steady improvement in plans to enable a marked slowing in the cumulative effects of urbanisation. This has resulted in a proposed Unitary Plan for Auckland that acknowledges and attempts to address some of the causes of estuarine cumulative effects within watersheds now no longer divided by jurisdictional boundaries.

1. Introduction

There has been progress in recent years with the uptake of Strategic Environmental Assessment (SEA) in many countries along with advances in our understanding of cumulative environmental effects (CEA). Instruments such as European Community (EC) directives, legislative reforms and non-mandatory approaches have encouraged a focus on the “bigger picture” of environmental policy-making and its contribution towards goals of sustainability. One dimension that requires attention is the degree to which the assessment of cumulative effects and its incorporation within planning and environmental assessment frameworks has been successful. Despite well-established legal systems, sometimes with requirements to address cumulative effects, systemic environmental problems still occur. While past progress has been made in building a base of theory and methodology for CEA, a transition from principles to practice has been slow. A constant theme in the CEA literature relates to the difficulties of working across jurisdictions, stakeholder groups, and different professions. CEA is now intentionally incorporated within SEA in Europe and Canada (Bragagnolo et al. 2012; Fidler & Noble 2013). In SEA and planning processes generally, methodologies do not often acknowledge the realities of political decision-making where addressing cumulative effects adequately can challenge jurisdictional agendas and sensitivities. It is the decision-making context that is problematic in addressing cumulative effects and it is often under-rated in our focus on methodologies and practice.

This paper uses an example of the incidence of two heavy metals, Zn and Cu, in Lucas Estuary in Auckland, NZ, to explore the relationship between strategic planning processes and CEA. This paper begins by reviewing relevant literature that examines the relationship between SEA, planning and CEA and outlines the planning regime in place, within which decision-making occurs. The research investigated the evolving response in plans to a growing awareness between 1974 and 2014 of the estuarine accumulation of Cu and Zn. The response within

district and regional plans was related in time to expanding scientific evidence of changing concentrations of metals in estuarine sediments and to the receptiveness of the stormwater engineering and planning professions to the science. Concentrations of Zn and Cu have been related in the scientific literature to benthic organism health responses. There has been a growing understanding of the sources of these metals from land and marine uses that are in turn influenced by plans and policies.

2. CEA, SEA and planning

2.1 CEA Departmentalisation and timing: Parkins (2011) states: "*Cumulative effects assessment is a process of scientific analysis, social choice, and public policy development, yet the linkages among these domain are often less than transparent".* There is a persistent disconnect between scientific and policy professions; spatial and infrastructural planning; transport, land use planning and water sectors; developers and statutory bodies; institutions; tiers of governance; and jurisdictions that block good intentions by nations to respond appropriately and effectively to arrest Cumulative Effects (CE) (Duinker et al. 2012; Masden et al. 2010; Weiland 2010; Kristensen et al. 2013). In western Canada spatial planning is reported as little influenced by science (Folkeson et al. 2013). CEA in Sweden is divided in separate environmental components such as plants, soil, and water (Folkeson et al. 2013). Infrastructure developers are frustrated by the need to communicate with multiple fragmented planning jurisdictions. Natural areas in spatial plans may be ignored when locating infrastructure (Folkeson et al. 2013). The need for better integration of planning for transport, landuse and the environment is still an issue. CEA could make a positive contribution to the assessment of transport projects for sustainable development (Tricker 2007; Folkeson et al. 2013). In England, CEs are frequently identified after the preferred resource use option is selected (Bragagnolo et al. 2012) leaving no opportunity for corrective action. The 'windows of opportunity' (Gunn & Noble 2009a) must be seized so that proactive changes can be made as early as possible to plans, policies and programmes (Gunn and Noble 2011; Elvin & Fraser 2012).

2.2 CEA Spatial and Temporal Scales: CEA occurs in large spatial and temporal scales. Larger scales, or combined spatial and temporal scales, increase the complexity of assessment and management. The definition of a CE typically requires trend analysis from historical to predictive future states. The predicted future states may be linked through modelling to alternative scenarios of resource use or development. Links should be made between the science and spatial planning across a continuum of aquatic and land environments. At this point, choices can be made to proactively improve the environment rather than merely preventing harm (Savan and Gore 2013). The relevant spatial scale for CEA is dependent upon the character and distribution of natural processes (e.g. hydrology) that are carriers of the agent/affect accumulating. The largest spatial scales are seldom assessed *(Kristensen et al. 2013).* CEAs that merely consist of adding the effects of numerous similar projects across a region neglect the more complex and valuable task of defining *"regional limits to development and change and the ways in which specific projects and impacts are aligned or misaligned with regional development goals and objectives"* (Parkins 2011).

2.3 Scales, CE, Systems Approaches and Watersheds: Folkeson et al. (2013) call for a socio-ecological systems approach to understanding CE and managing them through strategic regional planning. Canada already applies a socio-ecological systems approach to watershed management. A watershed is for this and other reasons a sensible spatial unit for the assessment/management of water-born cumulative effects. However, CEA for river systems in Canada are considered to be ineffective as a result of the disconnection between science, environmental monitoring and planning practice (Seitz et al. 2011; Duinker and Greig 2006; Kristensen et al. 2013). Watershed science is advancing but less is understood of the institutional capacity to manage CE (Sheelanere et al. 2013; Kristensen et al. 2013). Researchers (scientists) need to express their results in a digestible format that can be incorporated into ordinary planning processes (Folkeson et al. 2013; Duinker and Greig 2006; Duinker et al. 2013). Ontario has delegated water resource management to regional watershed agencies. (In NZ watershed management can be integrated with regional planning under a

single statute.) However, in the Grand River Watershed, Ontario, there are uncertainties about the legitimacy of the watershed authority to act as a lead agency when other agencies also have water resource responsibilities (Chilima et al. 2013). The lead agency should ideally be the provincial government (regional or unitary council in NZ) or a government consortium (Sheelanere et al. 2013) taking responsibility for land use decisions.

2.4 Scales, CEA, SEA and Sustainability: Therivel and Ross (2007) note that:…"*few strategic decision makers will voluntarily constrain their activities so as to unilaterally limit cumulative effects".* Recognition of disconnection between sectors led to the development of SEA, one of the rationales for which was to integrate environmental issues with planning and decision-making (Therivel and Partidario 1996). This type of integration occurred under the NZ Resource Management Act 1991 (RMA). Statutory requirements in the European Union (EU) (Bragagnolo et al. 2012) and Canada (Fidler and Noble 2013) have led to the incorporation of requirements for CEA into SEA and/or Sustainability Appraisals (SA) (Morrison-Saunders and Fischer 2006). SEA (that includes CEA) then becomes strengthened by its link to strategic planning typically undertaken by a regional regulatory body (Masden et al. 2010) in contrast to local project effects assessments that are the responsibility of developers. This appropriately embeds SEA within large scale planning opportunities (Elvin and Fraser 2012) in the earliest possible stages (Folkeson et al. 2013) of decision-making. To this end Canada has developed a methodology for Regional SEA (R-SEA) which places "*more emphasis on setting targets for regional environmental protection and development*" (Gunn and Noble 2009a, 2009b) than the most likely environmental outcomes for a region (Fidler and Noble 2013). R-SEA should "*establish a regional vision and bring focus to regionally significant environmental issues"* (Gunn and Noble 2009a). These issues are regionally relevant Valued Ecosystem Components (VECs) influenced by regional drivers of change (Gunn and Noble 2009b; Duinker et al. 2013). When the regional scale is employed for CEA and SEA it improves opportunities for integration across tiers of governance and spatially across jurisdictions. For example, the Municipal Comprehensive Plan for Stockholm is a positive example of inter-level spatial planning (Folkeson et al. 2013) that, like the Proposed Auckland Unitary Plan (PAUP) (Auckland Council 2013), provides these opportunities.

2.5 Dissatisfaction with CEA and SEA practice - weak implementation: The consideration of alternatives is reported (Bragagnolo et al. 2012) as a weak part of SEA. Also, in the planning profession environmental outcomes may not be linked to science but rather they are predicted from expert opinion reported in interviews (Bragagnolo et al. 2012). It is vital that environmental outcomes go beyond describing resultant physiochemical changes (that are not always of proven consequence) to demonstrating the direct links to VECs and thresholds (Gunn and Noble 2009a, 2009b) defined to protect these. Despite attempts to ensure CEs are not ignored numerous countries continue to report that CEs remain unsatisfactorily addressed (United Kingdom: Masden et al. 2010; Germany: Weiland 2010; Canada: Gunn and Noble 2011, Duinker et al. 2013; Italy and England: Bragagnolo et al. 2012; Elvin and Fraser 2012; Sweden: Folkeson et al. 2013; U.S.A: Ma et al. 2012). Despite the EU requirements there is little use of SEA in German transport planning (Weiland 2010) and it is not explicitly required in NZ transport planning (McGimpsey and Morgan 2013). The benefits of SEA – CEA integration remain a 'wish list' rather than a reality (Gunn and Noble 2011). Some integration such as the incorporation of CEA into Sustainability Assessment (SA) is considered by Morrison-Saunders and Fischer (2006) to disadvantage the environment as it can be traded off against higher priority economic and social objectives. Problems facing CEA and SEA are universal in character and might be improved by better collaboration between science and practice, the exchange of experience between countries (Folkeson et al. 2013) and intentional working across sectors, jurisdictions and tiers of governance. This paper offers some NZ experience.

3. New Zealand and Auckland planning context

The RMA, along with local government and transport statutes, largely determine the planning context of urbanisation in NZ. Prior to the RMA there was no provision for consideration of cumulative effects in statutes such as the Town and Country Planning Act 1977 (TCPA) under

which councils managed land use through regional and city/district planning schemes. Project-based Environmental Assessment (EA), termed assessment of environmental effects (AEE) is a cornerstone of the RMA, the purpose of which is "the promotion of sustainable management of physical and natural resources" (section 5 (1)). It includes reference to cumulative effects (Section 3). The effects-based land use planning system has been regarded by overseas commentators as an integrated approach to SEA and planning (Partidario, 1999; Sadler, 2001; Sheate et al. 2001). However, the mandatory AEE has had a much stronger profile than policy-based EA. At the policy level, efforts have focused on the development and analysis of policies through the implementation of section 32 of the Act which has recently been amended. The new sections do not change its overall purpose of ensuring rigour in plan decision-making through requiring a critical evaluation of the objectives, policies and methods of proposals.

The RMA establishes broad principles within which councils are free to develop their own approach to sustainable management on the basis of avoiding or mitigating adverse environmental effects. This has led to the development of the current effects-based planning system, with an emphasis on the management of environmental effects rather than on the prescription of activities. The RMA provides a hierarchy of plans where lower-level plans shall give effect to regional and national policy statements and must not be inconsistent with other higher-level plans (sections 62(3), 67(2) and 75(2)). The development of an integrated and tiered approach to plan making means that there are some gaps in what SEA advocates might argue comprises an ideal SEA system. Given the integrated nature of EA and statutory planning in NZ, it is hard to distinguish between both sets of practices. SEA has become subsumed in the planning process and much less discernable as an activity.

Since 1991 there has been an increasing trend by councils to develop non-mandatory planning instruments to assist development of greenfield and peri-urban areas. The preparation of structure plans and integrated catchment management plans (ICMPs) outside of the statutory planning process has been a direct response to the effects-based nature of the planning system (Dixon, 2005). These plans then inform statutory planning processes. Councils use structure plans to establish how an area might be developed physically in relation to land uses and infrastructure. ICMPs are used by councils to manage water resources (particularly stormwater) and to a lesser extent land use on a watershed scale. These plans identify important characteristics of a watershed in which problems may exist or occur as a consequence of development and may also evaluate the consequences of alternative futures for the watershed, particularly on the hydrological cycle (ARC, 2005).

In the Auckland Region, the Auckland Council Regional Plan: Air, Land and Water (2013) requires the development of ICMPs. In October 2010 seven city and district councils and the Auckland Regional Council (ARC) were dissolved with the establishment of the Auckland Council, now a Unitary Authority. The Auckland Council developed the Auckland Plan (Auckland Council 2012), which sets out a vision for the city for the next 30 years. In 2013 it released the PAUP that brings together all district and regional plans (land, water and coastal) but most of it is not yet operative. Plans of the previous councils remain operative at the time of writing. In the next section we examine the accumulation of Zn and Cu in one watershed in Auckland as an example of the cumulative effects of development which have occurred, in parallel with the evolution of the regional and district planning system described above.

4. The case of Lucas Creek Watershed

4.1 Cumulative Effect and Watershed Characteristics: Auckland has grown rapidly over recent decades to 1.42 million people, with the prospect of the population doubling in 50 years. The metropolitan area is located on the shores of two harbours. Over recent decades, 'State of the Environment' monitoring and 'problem' targeted research has determined the gradual accumulation of fine sediments and toxins such as heavy metals in receiving environments. Fine-grained benthic sediment in estuaries and mid-harbour areas is the primary medium within which accumulation occurs. This accumulation in sediments and food chains has been correlated with the degradation of aquatic ecosystem health and with the declining quality of

edible sea-foods. In this case study we focus on Zn and Cu as these are increasing most rapidly with urban intensification and rising traffic volumes. Zn is of particular concern in NZ as it is lost from vehicle tire wear and galvanized corrugated iron, which has been a dominant roofing material for the last century. Known Cu sources include brake lining wear and antifouling paint from marinas.

In the section that follows, we summarise zinc and copper accumulation in the Upper Lucas Creek (Fig. 1). Within Auckland some older parts of the City with mixed industrial and residential uses exhibit higher concentrations of Zn and Cu and indicate (Mills et al. 2012) along with results reported below, the likely future condition of the Lucas Creek if no corrective actions are taken within the watershed. Lucas Creek is a narrow estuary arm, six kilometres long, has fine benthic sediments and requires 11 tidal cycles to drain into the Upper Waitemata Harbour (UWH) (ARA, 1983a). This facilitates contaminant accumulation. The UWH in turn drains into the mid-section of the Waitemata Harbour, the benthic sediments of which have also been monitored for heavy metals (ARC, 2009). The watershed's 10 streams drain to Lucas Creek and are dominated (61% of the 3774 ha) by the Lucas Stream and Oteha Stream sub-watersheds that up until 1980 were mainly rural. Urban development began in the predominantly pastoral Oteha sub-watershed in the early 1980s and by 2010 land cover (Figure 1) included warehousing, a sports stadium, shopping mall, medium density housing (28% of sub-watershed), light industry (24% of sub-watershed) (Moores et al. 2012), wide bitumen roads and car parks. Impervious surfaces and traffic volumes have escalated and Auckland's northern arterial route divides the watershed. The Lucas Stream sub-watershed, which 30 years ago was covered in forest and pasture, has recently partially developed (27% urban; Moores et al. 2012) including medium density housing (13% of the watershed). Urban stormwater is detained and treated in up to 30 detention ponds with the addition of at-source control raingardens and swales in only the most recent commercial and recreational areas. The watershed is anticipated to have on-going intensification of development and traffic (Auckland Council 2013).

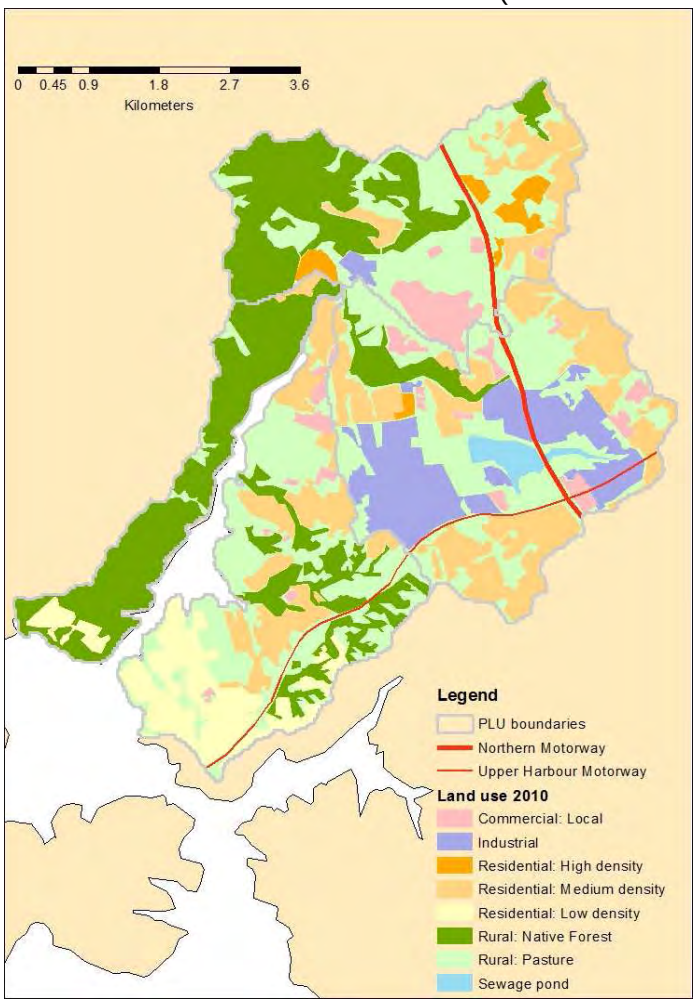


Figure 1: Lucas Creek watershed land use in 2010 (Source: Moores et al. 2012)

4.2 Evidence of cumulative effect and ecological degradation: A depth profile (averaged from nine sediment cores, not reaching pre-urban concentrations) of benthic sediments in the Upper Lucas Creek estuary provides clear evidence of heavy metal accumulation in the catchment over time, to 2003 (ARC, 2003). Declines in surface concentrations were attributed to dilution by soils low in Zn and Cu from urban earthworks.

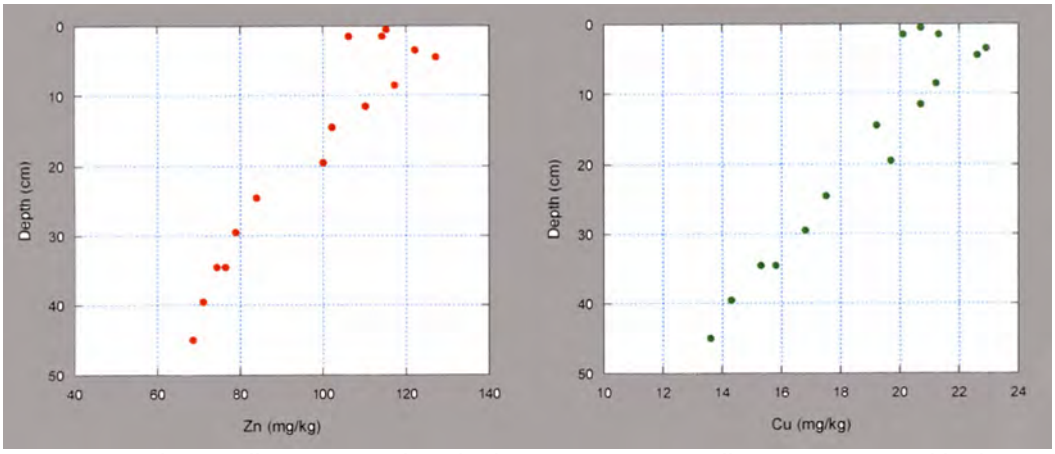


Figure 2: Concentration profiles of Zn and Cu in the top 45 cm of sediment from a mudflat in upper Lucas Creek. Adapted with permission from Fig. 4.5, pg 26 (ARC, 2003).

The ARC established the Regional Discharges Project (RDP) in the early 2000s, in response to the issue of renewing stormwater discharge consents. Sediment quality guidelines, methods of assessing marine ecological health and a monitoring programme were developed (ARC, 2003). In 2005 the UWH Ecological Monitoring Programme was established to monitor the ecological status of locations in the Harbour predicted to be affected by surrounding catchment land-use changes.

The ARC's 2004 Variation 1 to the proposed Regional Plan: Coastal aimed *"to introduce measurable Environmental Response Criteria for the urban coastal marine area into the Coastal Plan. The policy direction and support for doing this is contained within the Auckland Regional Policy Statement and the Proposed Auckland Regional Plan: Coastal."* (ARC, 2002: 16). Environmental Response Criteria (ERCs) were developed (Williamson and Mills, 2009) to assess the likelihood that contaminant concentrations of benthic sediments are negatively affecting ecological communities (ARC, 2004b). The criteria are based on widely accepted international sediment quality guidelines, and use a colour system of green, amber and red (ARC, 2003). The ERCs are applied differently to two receiving environment classifications. (1) Settling zones (SZs), including Lucas Creek: areas where most contaminants (~75%) settle out of suspension; some level of ecological degradation is expected. (2) Outer zones (OZs): wider estuarine areas downstream of settling zones or located in higher energy environments; a priority for protection, using a more protective monitoring approach. In SZs the ERCs are applied to the <500µm (total) sediment fraction; in OZs to the greater concentration from weak acid digestion of the mud fraction (<63µm), or strong acid digestion of the total fraction (<500µm) (ARC, 2004b).

Methods to rank the benthic community health of sites were also investigated, and a multivariate Benthic Health Model (BHM) (Anderson et al., 2002) was developed. In an initial analysis Lucas Creek ranked amber for both benthic community health and sediment contaminant levels (ARC, 2003). Recommended assessment procedures include prediction of future sediment quality, followed by a management response based on the predicted rate of change (ARC, 2004b). Lucas Creek Cu levels were predicted to reach red levels by 2009 (ARC, 2003), making it a high priority for remedial or avoidance action.

Large-scale modelling work on contaminant accumulation in the UWH and its individual sub-catchments examined two development scenarios: (#1) 'Existing': the then-current (2001) sub-catchment landuse did not change over the simulation period, in the Lucas sub-catchment this was rapid and substantial development. (#2) 'Realistic': modelling the sub-catchment's expected future development, bracketed by a response envelope (RE) representing no stormwater treatment (worst case), and maximum attainable treatment (best case). Both scenarios included partial sediment control (ARC, 2004c).

Predicted sedimentation rates: (#1)= 7.89 mm/yr, (#2) 2.50 mm/year, 54-yr simulation (#2)=

7.89 mm/yr and 1.97 mm/year, 108-yr simulation (ARC, 2004d).
Lucas Creek- no. of years from 2001 to reach ERC thresholds (ARC, 2004c):
Cu, Amber: Already reached by 2001.
Zn, Amber: (#1)=12.7yrs / (#2)= 7.2yrs (RE=6.8 – 9.2yrs)
Cu, Red: (#1)= Not exceeded within 108yrs / (#2)= 28.9yrs (RE= 22.7 – 35.0yrs)
Zn, Red: (#1)= Not exceeded within 108yrs / (#2)= 12.9yrs (RE= 11.4 – 14.7yrs)
In addition the lower main body of the UWH is predicted to exceed red levels for benthic sediment Zn by the year 2024, even under maximum attainable controls, up to 85% of which may be contributed by the Lucas sub-catchment (ARC, 2004d).

Mills et al. (2012) analysed sediment chemistry data from multiple programmes (now amalgamated into the Regional Sediment Chemistry Monitoring Programme) to assess temporal trends in contaminant concentrations. Information from this programme is relevant to Auckland Plan strategic directives; including: *"Directive 7.10 "Manage land to support the values of waterbodies by protecting them where they are high and reviving them where they are degraded" and Directive 7.12 "Protect coastal areas - particularly those with high values - from the impacts of use and development, and enhance degraded areas""* (Mills et al. 2012: 2).Table 1 details the currently available data from multiple sites and programmes.

Only one statistically significant trend was reported across three Lucas estuary sites excluding Lucas Te Wharau (RDP) due to insufficient data ($p<0.05$ for Mann-Kendall (MK) test p values is significant, median annual values used, 4 data points minimum required). The lower estuary Lucas Creek ('Luc' UWH) site ($p= 0.024$ (MK) test p value) showed a decrease in extractable Cu (<63µm). They caution against applying too much 'real world significance' to the results, due to data quality issues including variability and uncertain consistency over time, and the relatively short time period covered by the monitoring programmes; a wider programme review is currently underway (Mills et al., 2012).

Overall Mills et al. (2012) found that changes to spatial patterns and concentrations of contaminants have been relatively small, and generally on the scale of modelling processes, which predict varying increases over time at most sites in Cu and Zn concentrations. The scale and direction of changes do not match at all sites; however modelling involves simplifications, and a focus on larger spatial and temporal scales. They recommend continued monitoring, commenting that at least another decade of monitoring may be required in many cases to identify trends with statistical and 'real world' significance.

The BHM has been developed further (Hewitt et al., 2005, Anderson et al., 2006, Hewitt and Ellis, 2010), and now analyses macrobenthic community composition combined with information on total (500 µm) fraction sediment Cu, lead (Pb) and Zn concentrations using a canonical analysis of principal co-ordinates (CAP). Separate models have been created for two important contaminants: sediment mud content (%silt+clay, CAPmud) and sediment heavy metal concentrations (Cu, Pb and Zn; CAPmetals). A functional traits based index (TBI) was developed (van Houte-Howes and Lohrer, 2010) and refined (Lohrer and Rodil, 2011), based on macrofaunal taxa richness in seven individual functional trait groups selected for high sensitivity to mud and metals. It provides information on changes in functional redundancy, additional to the BHM (Hewitt et al., 2012).

Hewitt et al. (2012) concluded that observed decreases in Pb concentrations in benthic sediments (Mills et al 2012_041) are not currently affecting the ability of the BHM to detect change. They found the TBI is able to provide information on the interactive effects of sediment mud and metal content, suggesting that declines in macrofaunal functional redundancy may be driven initially by mud, and later by heavy metal contamination. One statistically significant trend was detected, the Lucas Te Wharau "LucU" (UWH) site showed increasing health in relation to CAPmetals (correlation coefficient >0.7, Pearson's R or Spearmans correlations). In no cases were trends in CAPmetal scores observed to be in the opposite direction to total heavy metals trends observed by Mills et al. (2012) (Hewitt et al., 2012). The differing numbers of trends



Site name/ Grid ref. (NZTM)	Original ARC Monitoring Programme	Metal	Concentration (mg/kg) by year and sediment particle size fraction (µm)																									
			1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011	
			<63	<500	<63	<500	<63	<500	<63	<500	<63	<500	<63	<500	<63	<500	<63	<500	<63	<500	<63	<500	<63	<500	<63	<500	<63	<500	<63	<500
Lucus Upper X1749681 Y5931407	SoE: Contaminants in Marine Environments	Cu	15.6	19.1	16.9	21.9			18.9	26.2			23.6	20.0			23.7	20.3			15.2	20.7							17.7	19.3
		Zn	77.5	96.9	95.0	96.6			103.8	113.1			119.3	96.0			117.3	98.8			90.9	100.0							100.7	105.1
Lucus Te Wharau "LucU" UWH X1749374 Y5930448	Upper Waitemata Harbour Ecological Monitoring	Cu															19.3	18.5	19.7	16.8	20.0	15.0	18.1	17.3	18.4	19.2			18.3	14.2
		Zn															97.0	83.0	97.7	83.4	101.7	83.7	93.3	80.7	99.7	91.7			99.0	81.4
Lucus Te Wharau X1749230 Y5930235	Regional Discharges Project	Cu													18.3	20.7			18.0	19.1			16.3	24.0						
		Zn													100.3	92.4			98.0	97.0			94.0	110.0						
Lucas Creek "Luc" UWH X1748335 Y5929477	Upper Waitemata Harbour Ecological Monitoring	Cu															20.7	12.9	19.7	14.0	21.7	12.7	17.6	11.5	16.1	13.2			19.0	13.9
		Zn															117.7	87.3	110.0	111.0	122.7	110.0	101.7	97.7	93.3	90.7			104.5	99.3

ERC Status	Green	Amber	Red	ERC Status	Green	Amber	Red
Zinc (mg/kg)	< 125	125 - 150	> 150	Copper (mg/kg)	< 19	19 - 34	> 34

Table 1; Cu and Zn concentrations (mean annual values) in Lucas Creek benthic sediments, data provided by Auckland Council, May 2014. Concentrations shown in relation to ERCs (ARC 2004b).

detected by these studies may indicate a lag between benthic community responses to changes in sediment contaminant levels; and also differing trend detection methodologies, which Hewitt et al. (2012) recommend be standardised.

Sites' continuous CAP scores can be converted into health categories (from Anderson et al., 2006) from "Group 1" (healthiest) to "Group 5" (least healthy), and combined with TBI scores (three categories) to produce an overall health ranking (Hewitt et al., 2012). Reassessment of original RDP (2002 – 2005) data used to create the BHM produced the following scores:
Lucas Upper (SoE): Metals- Group 5 | Mud- Group 4 | TBI- Group 3 | Overall- Group 5
Lucas Te Wharau (RDP): Metals- Group 4 | Mud- Group 4 | TBI- Group 2 | Overall- Group 4
Lucas Creek 'Luc' (UWH): Metals- Group 3 | Mud- Group 3 | TBI- Group 2 | Overall- Group 4
Results from recent monitoring data were as follows:
Lucas Te Wharau 'LucU' (UWH): Metals- Group 3 | Mud- Group 4 | TBI- Group 2 | Overall- Group4 (2009)
Lucas 'Luc' (UWH): Metals- Group 4 | Mud- Group 4 | TBI- Group 3 | Overall- Group5 (2011)
Recent Lucas Creek 'Luc' (UWH) TBI scores: 2010= 0.27, 2011= 0.27 in 2011. Scores <0.3 (lowest group) indicate sites with poor health and low functional redundancy. Hewitt et al. (2012) conclude that all three indices are able to produce consistent results; and that some trends are beginning to be detected, separate to factors such as cyclical patterns.

Spatial Decision Support System (sDSS) for 'Urban Planning That Sustains Waterways'
A potentially significant tool for SEA application is the development of a new support system to assess impacts of urban development on receiving environments. It is intended to enable planners to consider impacts holistically (Moores et al. 2012). The sDSS was developed in 2012 and the Lucas Creek watershed and estuary was at that time, the only pilot study used to test the model. The sDSS focuses on watershed land use scenarios in relation to the generation of fine sediment, Cu and Zn deposition in the estuary. Concentrations of contaminants are linked to VECs, particularly benthic macroinvertebrate communities. The pilot involved hindcasting to 1960, and forecasting to 2060 based on land use changes anticipated by the PAUP and increases in vehicle kilometres travelled. The scenarios also consider varying degrees of stormwater treatment in relation to costs and perceived benefits. The authors caution users of the pilot test on Lucas about the limitations of outputs. Of particular interest in the context of our research is not so much the conclusions of the pilot test but rather our recognition of this process as watershed SEA (W-SEA) and its availability to the Auckland Council in the decision-making process around development of the PAUP. The existence of the sDSS demonstrates the level of sophistication reached locally in SEA processes but doubts remain around receptiveness to outputs and implications of uptake.

Overview of ecological cumulative effects: In the case of Lucas Creek, monitoring results so far indicate that high levels of contamination by Cu and Zn, and the rates of change predicted by earlier modelling scenarios have not yet occurred. This suggests actions taken to date to

avoid or minimise degradation have been at least partially successful. However, benthic ecological health remains highly degraded, with few substantial improvements; and Hales and Hewitt (2009) comment that even at ERC green levels, contaminants may be high enough to negatively affect benthic communities.

There has been on-going development of monitoring programmes to accurately identify and track potential stressors to marine environments. The new iterations of the BHM enable the investigation of interactive effects, such as that between heavy metal concentrations and sedimentation levels; the sDSS represents a further increase in sophistication in examining multiple elements of cumulative effects. There has been a clear awareness among science practitioners that data collection and monitoring need to be able to effectively inform policy. This is seen in initiatives such as the RDP in response to stormwater management issues, or Variation 1 which aims to bring a region-wide focus to marine protection from contamination. It is not at all clear whether policy-makers have an awareness or receptiveness to scientific conclusions.

4.3 Response in plans to cumulative effect as knowledge advances: Table 2 summarises responses within plans that have provided the planning and policy framework within which land development and water management has occurred in the Lucas Creek watershed. Albany Basin urban design decisions in the 1970s were cemented into the Takapuna District Scheme. Subdivision layout facilitated car dominance of transport, maximising kilometres travelled and impervious surfaces. Table 2 indicates the growing responses within plan policies, objectives and rules to sediment and heavy metal loss to waterways. It reveals that plans prior to reforms of the late 1980s did not fully address issues of environmental quality arising from urban development. Before 1985 there was an emphasis on water quality and especially sediment loss, human health, and eutrophication. General policies recognised that there were needs for environmental safeguards. The 1983 completion of the Upper Waitemata Harbour Catchment Study (UWHCS) shaped future planning policies. It signalled an awareness of the relationship between subdivision and loss of sediment with attached contaminants, although this was poorly appreciated, beyond a small science community. Awareness of the ecological consequences was strengthening.

The early 1990s were pivotal as it was then that the evidence on the heavy metal build-up in benthic sediments of receiving water bodies developed some statistical reliability. Fortunately this coincided with the development of the North Shore City Proposed District Plan. Policies were designed to encourage the design of stormwater systems, to detain and improve the quality of stormwater, and to retain and remove contaminants to protect aquatic ecosystems and riparian margins. Stream riparian re-vegetation was typical and stormwater ponds with wetlands were standard practice. The first installation of swales at the Albany stadium followed. By 2001, knowledge of the build up of heavy metals in sediments of watershed streams and estuaries like Lucas and the relationship with land uses within the watershed was stronger, in turn informing the development of the ARC's Air, Land and Water Plan. This plan is more complex than previous plans, addressing issues of peak flow reduction, hydrological neutrality and the removal of solids. In addition, the development and interfacing of new instruments such as the ICMPs and structure plans used by the councils assisted in achieving a more integrated approach to land use and water management. From 2002 onward successive changes to the North Shore District Plan (NSDP) introduced requirements for the installation of at-source capture of contaminants via devices installed as part of a treatment train. Swales and raingardens were constructed on commercial streets and carparks. The NSDP provisions, the most advanced in Auckland by 2010, were used to inform and craft regional PAUP 2013 policies for stormwater. Over several decades, the growing awareness of, and plan provisions for, controlling cumulative estuarine contaminants at source are evident from Table 2.

However, urban form in some sub-watersheds of the Lucas Estuary was fixed before information became available on heavy metal accumulation. Considerable residential and industrial growth occurred in the Oteha sub-watershed prior to the mid-1990s, accompanied by

Reference & year >	ARA1974	TCC 1979	TCC 1980-85	ARA 1983b	TCC 1985-90	NSCC 1994	ARC 1999	ARC 2001	NSCC 2002	NSCC 2002 2003-10	ARA 2004a & changes>	AC 2012	AC 2014
Plan > Issue V	Reg Pl. Scheme	Takapuna D Scheme	Takapuna D Scheme	UWHCS Land Water	Takapuna D Scheme	Nth Shore District	RegPolicy Statement	Reg. Air Land Water	Nth Shore District	Nth Shore D, Var. 2-6	Ak Reg Pl Coastal	Auckland Plan	Proposed Unitary
Awareness of pollution in estuary caused by landuse	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Protect riparian vegetation		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Control sediment runoff to streams and estuaries				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stormwater ponds/wetlands to trap contaminants				✓		✓	✓	✓	✓	✓			✓
Recognise need to protect aquatic ecosystem				✓		✓	✓	✓	✓	✓	✓	✓	✓
Caution about runoff from roofs & roads.				✓			✓	✓	✓	✓			✓
Recognise need for watershed management				✓			✓	✓		✓	✓	✓	✓
Awareness of Cu & Zn build-up in Lucas Estuary							✓	✓	✓	✓	✓		✓
Relate sediment Cu & Zn to traffic and roofs							✓	✓					✓
Urban layout determines waterway condition							✓	✓	✓	✓	✓	✓	✓
Consent application to show how contaminants removed							✓	✓	✓	✓	✓	✓	✓
Control runoff from impervious surfaces.							✓	✓	✓	✓	✓		✓
Require treatment train not just ponds.								✓		✓			✓
Recognise need for & require **at-source** capture of contaminants										✓	✓	✓	✓
Protect intermittent streams not just permanent streams													✓
Watershed actions to avoid/ minimise Zn/Cu generation.													✓
Defines stormwater effluent concentration for Cu & Zn met by devices not ponds.													✓
Rules consider cumulative effects for Cu & Zn													✓

Table 2: Requirements or recognition in plans of issues that influence the accumulation of Cu and Zn in Lucas Estuary. UWHCS: Upper Waitemata Harbour Catchment Study; Reg. Regional; Pl. Plan; D: District; Nth: North; Var. variation; Ak: Auckland

the 1990's 'state of the art' stormwater treatment approach of predominantly stormwater ponds only. (A minor proportion of the watershed has had treatment trains recently installed.) As already noted, accumulation of Zn and Cu will continue as a consequence of existing developments approved under a much less stringent regime, despite more robust measures now in place for new developments. Thus, on-going degradation will continue to occur for many years as development intensifies and traffic volumes escalate.

4.4 Reflections on the case study: It can only be speculated that some of the levelling off of Cu and Zn accumulation in Lucas Creek sediments can be attributed to improvements in stormwater treatment and stringent plan requirements. Despite this, the time lag between science understanding of the CE and changes in plans is evident. The pilot W-SEA process for Lucas, which is not required by statute, was initiated by scientists to test land use alternatives in order to inform plan-making. This UPSW model closely parallels R-SEA (Gunn and Noble 2009a) and W-SEA (ref) models. How comprehensive should the cross-section of stressors investigated be for such W-SEA? Gunn and Noble (2009b) said: 'attention is on the fullest possible range of human-induced stress on the sustainability of those VECs" and Kristensen et al. (2013) note that the focus is on "the receiving environment and considers all of the effects on a given ecological receptor". The UPSW model focused on three priority effects generators stressing a regionally relevant VEC (benthic ecosystem). Also, it examines all four pillars of sustainable development.

5. Implications for Practice

There need to be close relationships between the scientists and planners so that problems and solutions can be identified then embedded in policies and plans for implementation. There are environmental consequences of time-lag between knowledge and responsive policies and instruments. The case highlights the unintended consequences of local government organisation. Our research suggests that the amalgamation of councils in Auckland has increased collaboration across tiers of governance but decreased collaboration between sectors. Councils need strong research cultures that are strongly aligned internally with policy and operational groups. The paper shows the significance of urban form as a driver of contamination and the need for design and development practices, which minimise adverse effects. These can range from planning considerations, such as taking a watershed-based approach or appropriately siting marinas, to micro-management practices such as regulating use or maintenance of corrugated iron on dwellings or the exclusion of copper from antifouling paint and building gutters. At a strategic level appropriate locations for urban intensification and major highways need to be chosen away from sensitive receiving waters.

Table 2 demonstrates the need for a much more nimble planning system. The new plans and policies in place represent a step forward in addressing the incidence of Zn and Cu in estuarine ecosystems. Addressing cumulative effects of heavy metals is complex, challenging and long term. Practice in CEA is slow to emerge, although this paper shows progress towards addressing it in a strategic way through comprehensive approaches to modelling, watershed management, and to unitary, regional and district planning. The need to integrate regional transport planning remains an issue. Auckland Council now stands on the precipice of integration and implementation of W-SEA/ R-SEA. It remains to be seen if the politicians and urban managers are receptive to it.

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The traditional wisdom of flood mitigation in Dujiangyan irrigation region and its contemporary relevance

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1. Introduction

Over recent years, with global climate warming and environmental changes brought by rapid urbanization, flood disaster seems to be more and more serious in cities. In July and August, big cities like Beijing, Wuhan and Chengdu have to "see the sea" after rainstorms, which seriously affects residents' living and endangers personal safety. In the midsummer of 2013, Chengdu plain, commonly known as "Kingdom of Tianfu" and where "floods and droughts depend on people", was also attacked by deluges, during which, Jintang, Pengzhou and Dujiangyan, etc. were badly stricken, thereby incurring great loss on people's property. While carrying out "disaster mitigation" actively, it is necessary for us to make deep reflection upon human settlements' construction modes and improvement directions, and it has become an urgent work to think about how to explore long-term and effective disaster reduction measures to promote harmony between human and nature. With a long history of human settlements construction, China has accumulated rich knowledge on disaster reduction since ancient times, thus studying traditional practices systematically and exploring the road of making the past serve the present and opening the present by referring to the past not only shows respect for traditional culture, but is an important way to explore future development directions by utilizing the view of history. This paper takes ancient Dujiangyan irrigation region as an example to summarize the ancients' traditional wisdom in coping with disasters.

2. Flood mitigation measures during human settlements construction process in ancient Dujiangyan irrigation region

In ancient Dujiangyan irrigation region, the process of ancient human settlements construction is also a process of continuous disaster reduction and prevention as well as adjustment and construction, which gradually forms regional human settlements with harmonious relationship between human and nature. The main flood reduction wisdom can be understood from the following aspects.

2.1 City location selection and regional flood drainage

In the early period, Chengdu plain suffered frequent floods and the human settlements were often intruded by floods. As to this, in the researches on sites like Sanxingdui and Jinsha of ancient Shu, related scholars propose the hypothesis of "disappearing due to floods"[1]. Besides, due to flood scouring, many historical relics in Chengdu urban area have to be re-built time and again, such as Shang Dynasty building ruins at Shierqiao Road, Chengdu.[2]Not until the later period of Duyu (an emperor of ancient Shu), did the ancient Shu start to build cities on the high tableland (Dujiangyan——Pi County——Chendu) of the plain to avoid floods, subsequently, Shu carried out large-scale water control (also known as "Bie Ling water control") in the enlightened period, and drained floods from Minjiang River out of the plain by making use of artificial waterways in the way of "branching into Tuojiang River in the east", thus Chengdu as the capital have relatively stable and safe disaster avoidance conditions. The mode of reasonable site selection and drainage for flood discharge provides an outlet for the safety of human settlements on the plain.

When it came to the period in which Shu County was under the administration of Qin Dynasty, Li Bing, based on the experience in water control accumulated during ancient Shu period, "gouged rock mountains at Baopingkou', and "excavated two rivers, namely Pi River and Nan River known nowadays", thus opening artificial river treatment of Dujiangyan. The process of artificial river course opening-up from Qin Dynasty to Tang Dynasty reflects the forming process of fanlike artificial river basin. In Song Dynasty, there were related historical records clearly indicating the waterway system of "3 main streams, 14 tributaries and 9

weirs"[3] of the irrigation region. After that, in Qing Dynasty, the system had been elaborated and matured gradually, and finally constituted a complete artificial river basin system. This system starts upwards from tributaries of Minjiang River at Baopingkou of Guan County and in the middle, falls into several waterways, which flow by prefectures and counties like Guan County, Chongning, Peng County, Xinfan, Xindu, Hanzhou, Jintang, Chongqing, Xinjin, Pi County, Chengdu and Huayang, and after arriving at Xinjin and Pengzhou, flow in parallel in turn before rejoining Minjiang River and flowing towards Meizhou and Leshan. [4]The artificial river course on the plain falls into two, two into four, and four into eight, finally forming thousands of tributaries covering the area, with a lot of waterways and densely distributed plains, where the city has been gestated. The formed fanlike water network can disperse floods of upstream Minjiang River quickly into various branches, from main streams to tributaries, and further to capillary ditches, thus achieving a disaster reduction way based on regional drainage. This mode leaves sufficient space for the rivers, combines flood discharge, irrigation and soil improvement together, and promotes the development of human settlements on the plain in a comprehensive way through the artificial river basins. The well-functioning artificial river basin water network system of the plain can reduce flood peaks pertinently. In history, most counties of Dujiangyan irrigation region had benefited from such fanlike river basin system, specifically, floods in these counties usually brought rising water levels but no disaster, which were often named "passing-by floods" by the local residents.



Picture1: rivers and cities in Dujiangyan irrigation region(Qing Dynasty)[5]

2.2 Embankment construction in key areas

In terms of the scope of irrigation region, embankment construction is not the leading mode for coping with local floods, but key areas shall be provided with embankment reinforcing measures, for example, in areas with insufficient plain water system drainage ability or where rivers converge, embankments are very important.With the aid of Dujiangyan fanlike water network, cities on the plain has suffered obviously less floods, however, there are still some cities facing water disaster due to floods upstream. For instance, it is recorded that Chengdu city has met with water disaster caused by upstream floods for several times, and the first documentary record that can be researched clearly was written in the period of Three Kingdoms. [6]In the third year of Zhangwu (223 AD), Chengdu was flooded by water upstream of the northwest. To protect Chengdu from being re-stricken by flood, Zhuge Liang, set up defences in the northwest of the city by "protecting the capital by building embankments called Jiulidi"[7], and issued the embankment protection decree informing related people: "any encroachment or damage is not allowed, and anyone violating the rule will be punished strictly by law, which will be followed at once". [8]Northwest Chengdu has always been the key area requiring flood prevention and has been consolidated for several times in history. Gao

Pian, a famous general in later Tang Dynasty, once constructed Mizao Weir in the northwestern area while building the city, specifically,[9] and based on this, adjusted the trend of river courses, finally, two-river surrounding a city formed since Han Dynasty turns to be two-river embracing a city, thus alleviating the flood pressure. In the Northern Song Dynasty, owing to embankment disrepair, the area again suffered major disasters, [10]afterwards, Liu Xigu re-built the embankments, which, called Liugong Embankment, provided Chengdu with safety. After disasters and embankment constructions, in Ming and Qing dynasties, strengthening embankment construction in Northwest Chengdu had become vital historical experience in Chengdu flood prevention.

Among cities bordering Chengdu plain, many require embankment construction to prevent floodwater from upstream, but on the whole, embankments for flood prevention across the whole plain only lie in several areas. For the plain area, the principle is observed that Dujiangyan irrigation region discharges flood by taking its natural course, and flood mitigation by waterway diversion and drainage is actually the main point.

2.3 Drainage of urban water systems

Chengdu city, as the core city of the irrigation region, has developed waterway systems, which play an important role of alleviating the urban floods. In history, there are detailed records on waterway system drainage, and the practices are usually associated with urban waterlogging and water environment deterioration, such as the waterlogging directly caused by ditch blocking narrated in “The Record of Ditch Dredging” written by Xi Yi: “In summer, rainstorm flooded the city and could not be drained out, together with that, places outside the city had been abandoned for long...so that (the river water) surged in great waves and torrents.”[11]Also, there is plague arising out of clogging in the drainage system recorded in “The Record of Water Drainage” of Wu Shimeng: “Though (Chengdu) has irrigation canals and ditches, blockages and swamps can be seen everywhere, resulting in that, at the end of spring and the beginning of summer, dreary atmosphere of stagnations and backups infect the residents gradually, spreading into a pestilence.”[12]

Therefore, dredging waterway systems becomes a significant adjustment method for the ancient people to cope with urban waterlogging and improve environment. The ancients thought that, similar to “arteries and veins in human body”, river courses and drainage ditches in a city constituted urban waterway systems, whose construction and maintenance is the basis of city health, just as a saying goes, “a wisp of impassability causes diseases to the groups”[13]. To adapt human settlements to cope with disasters, it is necessary to make adjustments to realize “congealed qi and blood” and “smooth and well-organized bones”[14]. “The Record of Water Drainage” by Wu Shimeng recorded the ancients’ specific methods for and working process of precise and systematic drainage of city waterways in the Northern Song Dynasty, including: (1) looking for old sites. That is, the local officials looked for and visited the elderly to ask for clues about old waterways of the city, sought for old sites of water channels in the northwest, and dispatched professionals to make a survey of the hydrologic regime; (2) looking for water sources. Specifically, by taking the sites of old courses as the starting point, going upstream for ten Li to find new water sources, and “receiving the water upstream abandoned after irrigation with gourd-like water pipes before drainage”[15]; (3) draining main streams. “Draining water from the west city gate and injecting it into channels of the city” to lead the main streams, thus realizing “two streams’ filling the channels”. [16](4) Draining city tributaries. From the west to the east, the waterways streamed into four main ditches, “distributed among small channels lying along streets and households, and converging in conduits around Mishi Bridge.” [17](5) Draining confluence east out of the city. “Converging at the east city gate and flowing into the river”,[18] finally connecting to artificial river basin system of Dujiangyan outside. (6) The residents constructed water conservancy projects by themselves to coordinate with urban public projects. Water use and drainage of various families were all connected with public water network, thus in the city, “the number of those building water conservancy projects, which increased or decreased as appropriate, could not be counted accurately”. [19]After systematic drainage on the whole, the

water systems across the city "flowed downstream swiftly with overwhelming trend with preparatory measures everywhere, thus without risk of erosion or fire"[20]. Since the water systems were distributed evenly all over the city, Chendu had an increasingly stronger ability to prevent and reduce flood disasters. "For floods in some years, the water could all be drained out through canals and ditches"[21]. Floods could also "empty and clean the gutters" [22], thus improving the urban water quality and "making the ditches clear soon"[23]. The entire drainage took its course naturally and "did not go against the terrain"[24]. Of the project, there were two gutters, three wooden sluices, two ditches traversing the streets, over 100 water wells being repaired and innumerable projects built by the residents themselves. From this, we can see the ancients' overall planning and systematic implementation in adjusting water systems. (See the site of Jiangnanguan Street for waterways[25])

Systematic drainage of urban waterways has become historical experience. For example, in the first year of Daguan in the reign of Song Huizong (1107 AD), to deal with the waterlogging caused by rainstorms, Xi Dan, during his incumbency as Chendu magistrate, had organized the residents to drain the water network, and further drained the rivers, leaving silt in the open air, which brought the situation that, "since the silt was outside ditches, the farmers competed for the silt to enrich their fields, leaving courses empty"[26]. For this, the urban environment was improved and the farmers provided with benefit. After that, Xi Yi (son of Xi Dan), a Chendu official in the Southern Song Dynasty, specially drew a urban waterway chart to record the water network in detail, which covered the situation of waterways passing by wealthy and powerful families for the convenience of deep inspection. The waterways were "drained as per the chart" without "any small blockage"[27]. During the construction of waterway systems, the emphasis was laid upon "no interference with agricultural fields and people"[28]. In the 44th year of Jia Jing, an emperor of Qing Dynasty, the Jinshui River had been obstructed day after day, for which Chendu city had to suffer waterlogging when it rained, causing the situation that "people ran in pouring rain"[29]. As to this, the government organized the people to drain the water, then dramatic change happened, and "Shu people ran about to see, surprised at the unbelievable effect"[30]. Without floodwater striking, the residents one after another started to make good use of the river water, for example, "kettle holders drew water, dirty guys washed themselves in the water, thirsty pedestrians drank the water, the weavers rinsed silk floss in the water and farmers drew water for irrigation"[31], at the same time, visitors and recreationists came in flocks, so that, along "the Zhuojin River and the Huanhuaxi River", happy laughters and cheerful voices burst into bloom, which seemed inspiring. [32] Benefiting from the river drainage, the residents acclaimed the achievement as "flying water from Tianhan "[33]. All of the above are typical practices to adjust human settlements and improve people's livelihood by water system drainage.

2.4 Drainage of rural water systems

In villages, to cope with floodwater, field water system construction takes an important position. In history, there are many examples of handling flood disasters by draining water systems in rural places, such as the disaster in somewhere of Shuzhou recorded by Lv Tao, a scholar in Song Dynasty: "Adjacent to Minshan, three rivers converged and flowed north, pouring into the Yangtze River around the eastern county. With surging torrents and rushing gushes, the confluence soon scattered into five flows. Now and then, puddles took shape after rainstorms and scattered extensively across the mountains, some of which high enough to immerse ridges, while some low flooded fields and thatched cottages, so that people worried about drowning when standing still and had to suffer muddiness if walking along. With water thereof seeping day after day, old courses along the rivers gradually became dry, and could not be used; crops, drowned in water all the time, which had been planted time and again, but were all withered every time in the end." [34]This plight of flooding made a lot of land incapable of cultivation thereon, and during the disaster, a large number of residents could only live on natural subsidies. After that, Chen Ruyu, an old man in Xinjin, reported the situation in detail to the local officials, which attached great importance and soon carried out the drainage work, specifically, "draining the water according to certain angles, arranging

giant dams, controlling and guiding streams running towards different destinations to make them return to their old tracks and flow downstream from the sources." [35]Trough drainage, droughts and floods were solved successfully, which were of benefits to the residents. Of the specific measures, the key was turned to the basic method of following old courses, tracing water sources, and conforming to nature to realize water system drainage.

2.5 Reserve for disaster prevention of settlements and landscapes

In relation to coping with disasters, the ancients attached further importance to "reserve", for example, the construction of rural human settlements was often adjusted by the method of planting various plants. In the "Brief Points of Agriculture and Silkworm", it is specified that: "Every Ding year, people shall plant 20 mulberries and jujubes respectively, or plant 20 mulberries surrounding the homesteads. If not appropriate to plant mulberries and jujubes, elms and willows can be considered with the same number as mentioned above. If growing various fruits, the number shall be limited to 10 every Ding year. Moreover, it is further required to crop alfalfas to make reserve for a year of crop failure…for villages nearby water, ponds shall be dug to keep fish, together with gooses and ducks of certain number, and people shall plant lotus roots, gorgon euryale, pampasgrass, etc. to assist in food and clothing." [36]In the intensive cultivation units of Linpan in Chendu plain, apart from grain production, bamboos and other species of trees planted acted as another consideration to prepare for flood disasters, which boosted Linpan development to multifunctional agricultural production units, every Linpan became a self-sufficient complete unit, thus forming a rural landscape in which various families "grew ten thousands of bamboos, built houses therein and thus achieved bamboo or twig fences naturally"[37].

In the fields, tens of thousands of ponds were distributed as well, while the city was provided with flood storage ponds internally, constituting a structure of "long vines bearing melons" with the ditches and channels. In "The Continuation of Xinfan Annals" written by Zhang Wenzhen, an official in Qing Dynasty, records are further made about rural water storage, embodying the agricultural water use by combining embankments and weirs with lakes and ponds, which reflects the idea of storing water to prevent disaster: "As long as being used as embankment or weir, the ditch exits must be blocked, and across one Li or a half Li of the ditch body, spring water would gather along the way, thus water from weirs and ponds might start rushing into the ditches. The spring water was abundant in autumn and winter, so farmers saved winter water most to prepare for water reduction at the beginning of spring." [38]These ponds and flood discharge ponds scattered evenly across the plain could absorb superfluous plain water, which could facilitate preventing waterloggings and floods, providing conditions for fish farming and garden planting, and at the same time, make reserve for autumn and winter when water is scarce. Diversified plants, water network and flood discharge ponds constituted an artificial ecosystem, and the landscapes reformed had achieved the basic function of disaster prevention on the whole, both of which increased the flexibility of human settlements.

3. Discussion

Rapid urbanization in contemporary times incurs dramatic changes on the surface of land, so that urban and rural human settlements are suffering even more serious challenges brought by flood disasters. As an old saying goes: "To know the general principle, one must learn from history." [39] The history of coping with local disasters contains rich information on continuous accommodation between human and nature over thousands of years. In coping with contemporary disasters, adhering to the local area, fully excavating and understanding traditional adjustment strategies, and learning about the wisdoms and ethics contained thereof, is not only a way of culture inheritance, but also an inspiration to reflecting on the present age and opening up the future.

In nowadays, wisdom from ancient times seems to be simple, but we have to admit that it is very effective. The ancients usually emphasized that long-term achievement shall be made by respecting nature, and opposed "digging for personal use, going against natural principles,

and violating physical properties"[40]. In particular disaster reduction practices, the ancients take respect for nature as the fundamental. They construct artificial river basin systems to adapt to flood, draining waterways based on respect for historical geography, and building urban water network systematically coordinating with regional watershed. And because of the long term thinking for flood mitigation, people create multi-functional landscape adapting to regional flood which can make human environment sustained for long.

These methods from ancient times fully reflect the application of comprehensive land utilization adjustment in disaster reduction. In nowadays, learning the basic spirit of respecting nature embodied in traditional disaster reduction measures, paying attention to natural system recovery and reconstruction, and make a holistic living landscape adapting to flood in a region shall become a significant way to cope with flood disasters.

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Study on Planning an Ecological Stormwater Regulation System Based on LID(Low Impact Development) Mode

----A Case Study of Chaihu Town, Zhongxiang City in Hubei Province

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Abstract

In the background of urbanization, with the increasing population and land scale, natural water cycle system is affected severely and aquatic ecosystem degrades. The traditional pipe network regards rainwater as disaster, trying to drain out the water in the shortest time. However, it does not fundamentally solve the problem, and causes many negative effects: increasing impervious city land, increasing city surface runoff, shorted convergence time, deteriorated natural water quality, weakened water storage capacity, increasing construction cost paid for rainwater pipe network. Therefore, the traditional stormwater regulation system planning has no longer met the needs of urban healthy development, which requires sustainable ecological stormwater regulation system planning.

Ecological stormwater regulation system planning based on LID mode insists on the concept that stormwater management should be suitable for the regional ecological background. Through the simulation of hydrological conditions before development, using distributed, diverse, localized technology to closure, store, percolate and evaporate rainwater from the source, protecting local hydrological conditions, reducing the negative environmental impact. This paper sets Chaihu Town, Zhongxiang city of Hubei Province as an example, analyzing the ecological and hydrological conditions of Chaihu Town, applying LID mode, putting forward the ecological stormwater regulation system planning strategy which adapts to the development of small towns. The main conclusions are as follows:

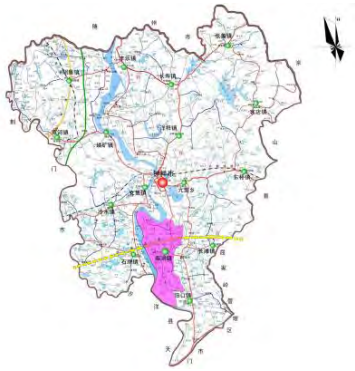
1. Putting forward the “Three-Low” development mode, which means low impact, low cost and low carbon. Using this construction mode to minimize the ecological impact, relying on natural green space and water to achieve the function of rainstorm regulation.
2. Through the analysis and calculation of the local amount of precipitation, this paper scientific calculates the required area of storage water and green space. Taking the roads as trunks, green spaces as stems, water as veins, building the green infrastructure system.
3. Repairing and integrating the original drainage ditches of planning area, replacing traditional rain drainage pipes, establishing “Two-Loop” water network system which aims at the detention and purification of rainwater, maximizing ecological benefit, economic benefit and landscape benefit.

In recent years, flooding has become a new challenge facing large cities in China. Many large cities have been trapped in a state of helplessness---- whenever there is rain in rainy season, the flood is sure to happen and creates “sea view” in inland cities, which causes the paralysis of basic city functions and great inconvenience in public life. As for the reasons of this phenomenon, on one hand it is that large areas of impervious surface has been constructed in the conventional city development mode, which results in the increased surface runoff within shortened time, and thus brings great pressure to stormwater regulation; on the other hand, the municipal drainage system in most cities are constructed following the principle of “fast and efficient engineering drainage”, which demands the rainfall be discharged to the receiving waters through the drainage pipe network in a short time, leaving the urban drainage facilities overburdened and much rain resource wasted.
The conventional stormwater regulation system planning mainly focuses on end treatment, the negative effects of which (such as natural water deterioration, reduced regulation and storage capacity, increased cost in construction and development because of large number of rainwater drainage pipe laid) are gradually revealed in the process of urbanization. Many experts and scholars began to put forward the concepts and methods for an ecologically sustainable storm water regulation, the Low Impact Development (LID) being one of them.
The planning for ecological stormwater regulation based on LID mode can achieve the interception, storage, infiltration and evaporation of rainwater with distributed, diverse, small-scaled and localized technology by simulating the hydrology situation before the site is developed. By maximizing protection for the hydrological regime of the site being developed, the ecological planning can reduce human impact on natural surroundings, restrict the flood within the precipitation area as far as possible, make better use of rainwater, and reduce cost for rainwater treatment. The LID mode, which combines macro strategy with micro engineering management, is in the nature a small-scaled and gradual development and construction mode which is especially suitable for small towns with good ecological environment.
Therefore, in the upsurge of a new round of construction of small towns, we must reflect on the past city construction mode of major destruction and major construction. Anecologically sustainable stormwater regulation systemshall be constructed alongside the preservation of existing farmland, grassland, forests, rivers and other natural elements. Chaihu town in Zhongxiang City of Hubei province is a physical example for small town construction in the LID mode.

1. Characteristics: crisscross ditches and dense water network

1.1 General description

Chaihu Town of Zhongxiang City lies on the Jianghan Plain and is located by the side of Hanjiang River in the south of Zhongxiang. In 1960s, due to the construction of the Danjiangkou reservoir, 49,000 people from Zhechuan, Henan were moved to Zhongxiang City, making Chaihu Town the largest centralized resettlement for reservoir immigrants. Located by the Hanjiang River and scattered with a large number of tributaries and lakes, Chaihu Town is known as the “water pocket”, which is afflicted by a severe problem of flood drainage in every rainy season. Since the establishment of the town in 1968, a total number of 4 major floods was recorded, which caused huge loss to people lives and properties. Therefore, a scientific and effective planning of stormwater regulation system is the top priority of Chaihu town construction .



Picture 1: area chart of Chaihu Town

1.2 Ecological background

The current ecological environment of Chaihu Town is in good condition (see Fig.3). Covering an area of 4.96 square kilometers, most of Chaihu land is farmland, forests, wetland and water system. As can be seen from the elevation analysis chart and the slope analysis chart (Fig. 2), the overall terrain in Chaihu Town is flat with an elevation range of

48.5m---37.5m, where the north is higher than the south and the east is higher than the west. In most cases, the slope is below 3% , suitable for development and construction. However, this kind of flat terrain is prone to problems of water logging and difficult drainage.

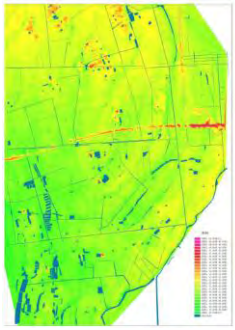
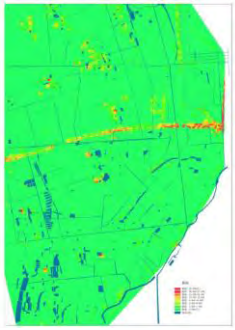


Fig. 2 elevation analysis and slope analysis charts





Fig.3 Desirable ecological environment

1.3 Current situation of water system and ditches


Picture 4 current water system

In order to solve the problems of flood control in Chaihu Town, many drainage ditches were built in the past. Currently, in the transverse direction, there are 3rd branch ditch, 4th branch ditch, 5th branch ditch and 1/6 ditch; in the longitudinal direction, there are Dongyigan branch ditch, Donghu'er branch ditch, 11th branch ditch, Sujiahe River and Wanjiahe River. In addition, the east main ditch runs through in the southeast (see Fig. 4). A portion of 5th branch ditch lies under the Jianghan Avenue as a culvert. At present, all the sanitary sewage and rainwater of Chaihu Town area are discharged along the plate-covered ditches into the main ditches in the east and west, before merging into Hanjiang River. In addition, the water network in the town area is dense. Other than the ditches for irrigation, there are also many lakes and ponds. Therefore, the overall hydrological situation of the town is characterized by "crisscross ditches and dense water network".

However, most of the ditches are in a deserted condition (see picture 5) due to lack of repair and maintenance. With the development and construction of Chaihu Town, the existing network of channels and ditches has been unable to meet the needs of future development. The core issue of this planning is to establish the drainage system which can meet the demands of Chaihu Town's development and construction alongside the protection and utilization of the existing ecological environment of "canals, ponds, farmlands and forests".


Picture 5 Deserted ditches covered by grass

2. Capacity analysis of ecological stormwater regulation system

2.1 Runoff coefficient

Rainwater runoff is mainly affected by the change of rainfall and underlying surfaces. The underlying surfaces in Chaihu Town mainly include building roofs, greenbelts, roads, water surface and squares. Green roofs, sunken lawn, permeable pavement can be used in the LID mode to reduce rainwater runoff. By using permeable pavement in areas such as sidewalks, bicycle lanes, public squares, parking lots, park roads, roadsides, and central

isolation belts, the surface runoff coefficient can be reduced to 0.4. By laying sunken lawn in each catchment area, the runoff flows into rivers via the sunken lawn, reducing 90% of the rainwater runoff. By planting vegetation on the roofs as runoff damper and purification, 60% of the rainwater runoff can be reduced (see Table 1).

Table 1 Application of LID mode

Category	Low impact development	Effect
Building	Green roof	Reduce rainwater runoff by 60%
greenspace	Sunken lawn	Reduce rainwater runoff by 90%
road	Permeable pavement for Non-motor vehicle lanes and greenbelts	Runoff coefficient reduced to 0.4
square	Permeable bricks	Runoff coefficient reduced to 0.3

After obtaining the single runoff coefficient for each underlying surface, the comprehensive runoff coefficient can be calculated by the formula $\psi = \sum \psi i \times (Si / S)$, where, ψi is the single runoff coefficient of i category surface; Si / S is the ratio of i category surface against the total area. By using LID mode in Chaihu Town area, the rainwater runoff can be reduced effectively through measures of interception and infiltration, and the comprehensive runoff coefficient can be reduced to 0.473 (see Table 2).

Table 2 Rainwater runoff coefficient under LID mode

Category	Building roof	Greenspace	road	Water surface	square
Construction ratio	56.7%	19.6%	12%	6.7%	5%
Runoff coefficient	0.65	0.15	0.5	0	0.3
Comprehensive runoff coefficient	0.473				

Note: use 0.48 as runoff coefficient Φ

2.2 Water storage surface area

Water regulation quantity can be considered as the difference between the water quantity discharged smoothly by drainage system without causing water ponding and the water quantity which can be discharged by existing drainage network, that is, the difference between rainwater quantity at storm recurrence period P=3 and the rainwater quantity at P=1. Considering that except for a small part of the rainwater being absorbed by the greenspace, the rest is gathered by the municipal rainwater network, the incoming flow duration to the regulation pond can taken as the flow duration within the rainwater ditched from the other end of the drainage network. By the formula Q=0.5T（Q3-Q1）, the water quantity to be regulated for each square kilometer is 30,000 m3 to 55,000 m3, take 0.3-0.5m as the water depth, and the water regulation and storage surface area 6ha-11ha.

2.3 Calculation of rainwater quantity

Rainstorm intensity formula of Jingmen City is adopted for the calculation of rainwater quantity.

$$q = \frac{895.33(1 + 0.8541 \lg p)}{t^{0.526}} \left(liter / \sec ond \cdot ha \right)$$

where：P is recurrence period，1 year hereinwith

t---rainfall duration t=t1+t2

t1---surface water gathering time，12min

t2---flow duration within the ditches

m---delay coefficient（2 for culvert）

designed rainstorm water quantity：Q＝ΦF. q

Take 0.48 as runoff coefficient and F the water gathering area.



Picture 6 connection with the town water system

3. Ecological Planning for stormwater regulation system

The core concept of the planning for ecological stormwater regulation system is to manage municipal rainwater discharge and reduce the impact on ecological environment by human development through a serious of diversified, miniaturized, localized and cost-effective measures. “Low impact” is manifest in two aspects: one is to reduce the impact on the macro environment in which the planned area is located; and the other aspect is to reduce the impact on internal environment. Therefore, the planning of ecological stormwater regulation system of Chaihu Town shall not only consider the rainwater drainage within the town, but also conduct overall regulation and control of rainfall flood within the whole region, so as to reduce the impact on theouter and inner ecological environment.

3.1 Overall planning for ecological stormwater regulation system

Properly distribute farmland water resources and promote the stable and high yield of agriculture by constructing farmland water conservancy, dredging field irrigation canal system, improving the fixed channels, constructing auxiliaries and culverts, renovating irrigation and drainage pumping station,reconstructing small irrigation canal, forming a comprehensive network of irrigation and drainage including main ditches, branch ditches, buckets and other elements.

With regard to the connection between the town water network and ditches, several important water ditches are retained, such as Dongyizhi main ditch, 3rd branch ditch, 4th branch ditch, 5th branch ditch and 1/6 ditches. Repair and dredge irrigation and drainage networks on the farmland via constructing farmland water conservancy.



Fig. 7 water system of “two circles and five catchments”

3.2 Ecological Planning for stormwater regulation system within the town

3.2.1 Water network of “two circles and five catchments”

Based on the existing 3rd branch ditch, 4th branch ditch, 5th branch ditch, 1/6 branch ditch, Wanjiahe river, Dongyigan branch ditch, improve the water system landscape environment. Based on the current water system, add small amounts of water system and water scenic park, avoiding major excavation and major construction and protecting the existing ecological environment. Construct annular water scenic system, and form a water network of “two circles and five catchments”.

(1) Two circles

“Two circles” means outer water circle and inner water circle. The function of the outer circle is to receive and drain the rainwater, and to avoid the impact on the inner side by the water from outside; the function of the inner circle is to receive and drain the rainwater in the area. Both circles are interconnected.

(2) Five catchments

“Five catchments” refers to water parks with greenspace and water surface which can serve as water gathering area for rainfall flood regulation and storage system. Sunken lawn is planned in each water gathering area, through which runoff flows into rivers. By these measures, city microclimate can be regulated, ecological balance can be kept, rainwater runoff can be controlled and reduced, water discharge from each water gathering area can be reduced, impact on other areas can be reduced.

Based on the analysis above on the capacity of rainfall flood ecological regulation and storage system, the regulation and storage water surface area is planned as 6ha-11ha. Therefore, the regulated water surface ratio is no more than 10% of the total land area. Through the construction of natural ecological water network of “two circles and five

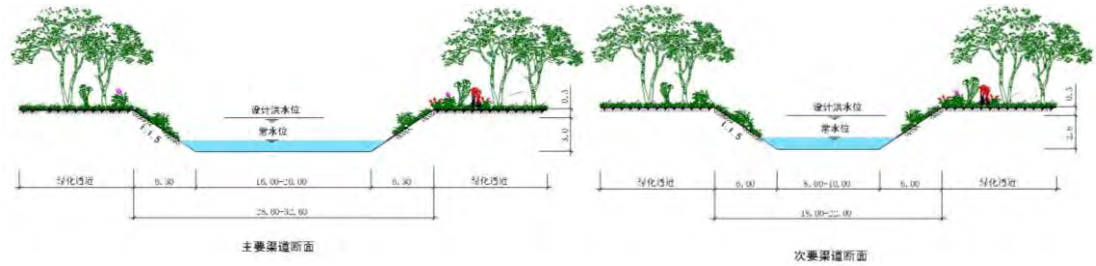
catchments", the rainwater can be regulated, stored, diverged and purified.

3.2.2 Rainwater drainage system of grass ditch and drainage pipe

Large amounts of water networks are retained. Rainwater pipe will not be buried along main roads, and ditches will serve as the main drainage facilities in the town area. The ditches will be drenched and protected to make them interconnected; and grass will be planted on the bank slope to create ecological ditches. When rainwater runs on the grass ditches, large quantity of water will infiltrate into the grassland; and the pollutants in the water can be removed by the plant system and the filler. In addition, as the grass ditches has a certain regulation and storage capacity, the peak flow can be reduced, and the impact of the city flood can also be reduced. The drainage ditches adopts the standards of 20 year flood protection, and the cross section is trapezoid. For the main drainage ditch cross section, the bottom width is 16-20m, water depth is 2.5-3m, and margin is 0.5m. For the secondary drainage ditch cross section, the bottom width is 8-10m, water depth is 2.4-2.8m, and margin is 0.5m.



Picture 8 grass ditch structure



Picture 9 cross section of main and secondary drainage ditches

Since the north of the town is newly established industrial zone, considering that the industrial drainage is more than the drainage of sanitary sewage, the drainage system here is mainly of traditional type.

Chaihu Town adopts the rainwater gathering and discharging system of grass ditch + rainwater pipe + regulation system. Compared to the traditional planning of rainwater system, the length of drainage pipeline is greatly reduced. The LID mode has both ecological and economic advantages since it not only regulates rainfall flood and protects hydrology environment, but also reduces construction cost.

3.2.3 Drainage ditches as landscape corridor

LID mode has another advantage over the traditional rainwater discharge technology, that is, the decentralized and small scale application of LID can be combined with the landscape construction, which can not only reduced the construction cost, but also increase the added value of the surrounding land by improving the scenic environment quality. Chaihu Town is a small town with unique water characteristics on the Jianghan Plain, the major difference between a small town and city is its small scale, and its landscape and its pastoral atmosphere. In the Planning for ecological stormwater regulation system, the drainage water system and scenic system are combined, making the waterside space an attractive and vibrant public space, which ensures good scenic quality in both high water period and low water period. The water network of "two circles and five catchments" can not only be an ecological corridor, but also a scenic corridor.

The outer water circle can be a display of country landscape and farmland landscape. Establish an integrated natural ecological system. For the cross section arrangement, gentle slope pavement will be used except for the highway area where rigid pavement will be used. Local plant such as rice, reed and green bristle grass will be used for plantation.

The inner water circle can be a display of city scenery and green landscape. Establish a slow pace system consisting of walking and bicycling, and forge an inner water circle of green and low-carbon. For the cross section arrangement, gentle slope pavement will be used. Small scale of arrangement like waterside platform, bridge plank will be constructed. Local plant

such as calamus, reed, lotus will be used for plantation.
The five water park can reproduce the waterside town scenery of Chaihu Town, as well as the wetland landscape. Combining with the surrounding large public buildings such as the memorial hall building, museum, folk architecture, theater and commercial complex, the water parks can bring to the public a variety of leisure experiences.

4. Brief summary

Using the LID mode and based on the current hydrology situation of Chaihu Town, this article established a sustainable ecological system for stormwater regulation. Such a system can meet the requirement of regulation and storage of rainfall flood, maintain the existing hydrology condition, and show the landscape characteristics. A water network of “two circles and five catchments” is established by retaining and reconstructing the existing water network and ditches. These water network and ditches have not only ecological functions of rainfall flood storage, filtration and discharge, but also scenic functions of displaying, sightseeing and entertainment. Therefore, compared to the traditional rainfall flood control system, the ecological stormwater regulation system based on the LID mode has its unique ecological, landscape and economic benefits. It can meet the development requirements of small towns and has a good application prospect.

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Track 5: Environment, Ecosystem and Climate Change

50th ISOCARP Congress Proceedings



Main Title: Environment, Ecosystem and Climate Change

Title: Urban Transformation of Coastal Cities-Case Study of the Eko Atlantic Shoreline Protection and Reclamation Project

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Synopsis

This paper examines how the land reclamation and development of the Eko Atlantic Shoreline Protection and Reclamation Project affect communities on the Lagos coastline. It suggests mitigating tools as a re-vitalization planning strategy to preserve, manage and protect the Lagos coastline beaches that have become endangered. The controversial Eko Atlantic project which is portrayed by Lagos State Government (LASG) and developers as a model of sustainability, climate change adaptation and economic growth, is an example for the difficult process of reconciling the three conflicting interests of protecting the environment, promoting economic development and striving for social justice for all.

1. Introduction

Lagos, the commercial centre of Nigeria is the fifth largest city in the world with a population estimated at 18 million and projected to hit 24million by 2020(Ilesanmi,2010) much of this rapid population growth(an estimated 75%) can be attributed to rural to urban migration (Adelekan,2009). Concerns about the coastline of Lagos-which nearly fills the entirety of Lagos state) generally focus on the vulnerability of the landscape to flooding combined with the rapid population surge in the city which has increased despite almost no provision of infrastructure. An estimated 3 million people live below the two- meter contour in the greater Lagos urban area (French et al, 2011).

Lagos is situated at the western part of Nigerian coast around the tidal inlet which leads to the Lagos lagoon. In 1908, man started to interfere with the natural coastal system by the construction of three harbour moles, i.e. the West Mole, East Mole and the Training Mole, at the tidal inlet connecting the Lagos Lagoon to the South Atlantic Ocean. The tidal inlet is now called the commodore channel and it constitutes the seaside entrance to the Lagos harbour see Figure 1. According to (van Bentum, etal,2012), at the completion of the moles, the lighthouse beach, situated up drift of the inlet, expanded 800 meters over circa hundred Years due to sediment trapping at the west mole. Consequently, the Bar Beach, located down drift of the inlet suffered enormous rates of erosion. These moles disrupted the natural flow of the ocean and set up tidal action that would, over the next century, erode more than one kilometre of Bar Beach coastline. (Ogunlesi, 2012).



Figure 1: Overview of Lagos coastline (after Google Earth, 2010)

van Bentum, etal (2012), further postulated that there are two main factors determining the morphological behaviour of the bar beach: 1) the sediment trapping at the west mole, and 2) the sediment import into the lagoon and into the commodore channel. Due to the sediment sink these processes constitute, the sediment volume bypassing the east mole is limited, therefore the coast downstream of the tidal inlet, the bar beach erodes.

Since the late 1950s there have been several unsuccessful attempts to keep the ocean at bay, by sand-filling. By the turn of 21st century, the Atlantic had crept dangerously close to the heart of Victoria Island, eventually washing away half of the Ahmadu Bello coastal road. (Ogunlesi, 2012).

An additional problem at Lagos is the growing population, entailing large space demands for residential, commercial and recreational activities. To cope with this space deficit and the land loss due to the erosion of the Bar Beach, Eko Atlantic City is currently being built on a 10 million square meters of sand-filled land reclaimed from the Atlantic Ocean, directly east of the East Mole, see Figure 2. The multi-billion dollar development, a joint venture between the Lagos State Government and South Energyx Ltd., is expected to generate over 150,000 jobs and accommodate 250,000 inhabitants (Eko Atlantic, 2013).

More specifically, the project plans to offer a long-term solution to flooding and coastline erosion by building the Great Wall of Lagos, a barrier of concrete armoured blocks (revetment) along the 8-kilometer outer edge of the city (Royal Haskoning, 2011.)

This paper takes a case study approach to determine the sustainability and viability of Eko Atlantic Shoreline Protection and Reclamation Project.

2. The Eko Atlantic Shoreline Protection and Reclamation Project

2.1 Project Location

Eko Atlantic city's story started in 2003 when the Lagos State Government was in search of a permanent solution to protect Bar Beach in Victoria Island from the effects of severe coastal erosion, and to safeguard Victoria Island from the threat of flooding. Between 2003 and 2005 South Energyx Nigeria Limited, the developers and city planners of Eko Atlantic, engaged in a feasibility study with international experts to solve the problem once and for all.

This new Nigerian city will rise from what was in existence over a hundred years ago. Land reclamation work is already on track to create solid foundations extending over ten square kilometres. This will support a new urban development the size of the Manhattan district of New York City. The project site is located adjacent to bar beach, at Victoria Island, Lagos, within the Eti-Osa Local Government Area.



Fig 2: Land Reclamation View from Space: Comparing Progress Between 2009 and 2013
Source: http://www.ekoatlantic.com/media/image-gallery/

2.2 Project Description

Eko Atlantic is evolving rapidly from a visionary design concept into reality. Infrastructural road works are already in progress and underground surface drainage pipes are being laid along major routes in the new city. Piling works are also underway for the many bridges in Eko Atlantic. The Great Wall of Lagos sea revetment, which is being built more than two kilometres offshore and had reached 3.5 kilometres in length by early 2013, is now protecting over 5 million square metres of Eko Atlantic and Victoria Island as a whole.

The reclamation works will form approximately 1000ha of land which will be for the future development of the modern city. The new land will be realised using approximately 90 million m3 of sand, dredged offshore from the coast of Lagos state from the sea-bed of the Atlantic Ocean. The main reclaimed area will be approximately 7.5km long, with a width of 2.3km on

the western end, tapering to 0.5km on the eastern end. The outer edge of the reclaimed area will be protected from the sea by an approximately 8km long rock revetment to provide shoreline protection to the new land and to Victoria Island.

Eko Atlantic city has the following planning components and urban design concepts.

The Boulevard

The most impressive feature of the Business District will be a spectacular central boulevard that will be about 2 kilometres long and 60 metres wide. It will be similar in size to the Champs-Élysées in Paris or Fifth Avenue in New York. The whole Business District will be spread over some 700,000 square metres of signature development opportunities. At the northern end of the boulevard stands an iconic building, which will be about 50 storeys in height and its acquisition represents the highest level of investor confidence in our emerging city. The boulevard will have a six-lane carriageway for traffic and a world-class landscaped central reservation.

Harbour and Ocean Views

A careful blend of commercial and residential developments will shape the character of this high-end waterfront area that looks across the wide entrance to Lagos Harbour and the Atlantic Ocean. The architecture that has been planned is intended to have an international appeal. A modern ferry transfer terminal, where passengers will be able to change from regional river craft to public transport, lies to the north of this exclusive district. The Marina District of Eko Atlantic will be adjacent to the Harbour Lights district. It will have views of the ocean from one side and of the entrance to the port of Lagos on the other. This area will extend over 1,154,500 square metres and its water surface will be 76,677 square metres. The planned building plots within the Marina District will be 5,500 square metres and the average building height will be 70 metres.

Many of the buildings within this huge development will provide homes for residents but it will also be a centre for leisure and social activities and is expected to be popular with tourists and visitors. A promenade will surround the Marina district and will be 18 metres wide, acting as a viewing platform for the whole area and providing plenty of opportunities for pavement restaurants and al fresco dining.

Recreation and Relaxation

The Marina District itself will offer multiple berths for boats and other marine craft making this land very attractive to investors. Taking a boat out offers the chance to enjoy the quiet waters of the internal city waterway or to be more adventurous and set a course for the ocean.



Fig 3: Eko Atlantic City Master Plan
Source: http://www.ekoatlantic.com/media/image-gallery/

Maximising the Space

The eastern part of the Marina District will offer fabulous views of the harbour, waterway and the ocean. Moving west, the district will take on a more dramatic, urban appearance. Buildings of varied heights will be clustered and spaced to form some narrow streets and some wider, tree-lined boulevards, with shops, restaurants and bars. City squares will be a major feature in the Marina District, ideal for socializing and meeting friends. Downtown is encircled by four areas of the city: Business District, the Marina District, Harbour Lights and Eko Energy Estate. It will become a densely built-up sector with varying sizes of buildings set in tree-lined streets with elegant squares. Downtown also provides opportunities to develop land for residential use, offering an envious style of city life with easy access to the Business District.

Eko Island is situated at the very heart of Eko Atlantic. This ingenious urban design feature is surrounded by waterways on all sides, hence its designation as an island within a city. Given Eko Island's location within the Master Plan and the emphasis on mixed-use development, with a big residential influence, it will give this district a uniquely different character. This area of Eko Atlantic is distinctive in its own right. It offers outstanding potential for residential growth, commercial activity and recreation. It will also contain a variety of smaller and larger buildings for office space. Avenues take its name from prominent green boulevards that will sweep through the district. It is a place to live, work and play in, surrounded by stylish gardens and trees, which will be functional as well as beautiful. As in other parts of Eko Atlantic, careful attention will be given to creating mixed-use developments everywhere in the district so that Avenues will be a safe and pleasant place at any time of the day or night.

While Avenues will contain a large percentage of residential property, the district will also have space for a multitude of commercial outlets for both residents and visitors alike. The district of Four Bridges is named after carriageways that span waterways to the north and south of Eko Island. The characteristics of this development reflect a lower-density district than Avenues or Downtown. The urban planning design calls for mixed use as well as being highly residential and offering mid-rise residential buildings.

The Four Bridges district will serve as a pivotal link between Victoria Island, Eko Island and the Ocean Front promenade.Eko Drive will feature a well-designed mix of commercial and residential developments. This district will be adjacent to Victoria Island along its northern border, providing rapid commuter access between Lagos and Eko Atlantic. This exciting development with its sensitively designed tree-lined streets and pleasing views is truly a place in which to breathe as it wonderfully combines cosmopolitan living with landscaped open spaces.

Eko Energy Estate is spread across about 250,000 square metres of newly reclaimed land in the north-west corner of Eko Atlantic city. Planning is underway for a large-scale development of offices and residences aimed especially at the oil and gas sector.

2.4 Project Development



Fig 4: Land Reclamation at Eko Atlantic City
Source: http://www.ekoatlantic.com/media/image-gallery

The reclamation activities and associated works include the following tasks:

- Dredging of sand for reclamation from offshore borrow areas;
- Pre-construction – strengthening of the East Mole by quarry materials to enable use of the mole as an access road;

- Construction of the sea defences, using several grades of quarry materials, geotextile fabrics and pre-cast concrete amour units; and sand placement for reclamation.

Dredging and reclamation works are carried out under the supervision of Haskoning Nigeria Engineering Consulting Ltd.

3. Eko Atlantic Environmental impact Assessment- a summary

Below is the summary of the purported environmental impact assessment carried out on the project by Haskoning Nigeria Engineering Consulting Ltd.

Costal environment

- The Project will provide a long-term solution to the coastal erosion at Victoria Island.
- Eko Atlantic will not further contribute to the overall erosion along the entire shoreline east of the project.
- It should be noted that the alignment of the Eko Atlantic sea defence was engineered in such a way to allow the flow of sand to minimize the possibility of any erosion down the coast.

Land environment

- The majority of construction activity for the Project would be restricted to the marine environment and therefore the potential for impact upon the terrestrial environment is limited.

Cumulative effects

- In order to assess the cumulative effects of the Project on the environment, all other relevant Projects within the Eko Atlantic area were identified. Those Projects which would potentially impact upon the same receptors as the Eko Atlantic Project within the same time frame were selected for review. The overall conclusion was that the Project would not significantly contribute to in-combination effects within the Study Area.

4. Findings and Discussions

4.1 Environmental Impact Assessment Procedure and Report

Considering that climate change and the environment are the proponents' apparent main concerns, one would expect the EIA process to be at the heart of the project, providing extensive coverage on all possible impacts of the mega city on the ecosystem of Lagos and its surrounding communities. Yet, this has shown not to be entirely true. A major area of concern in the whole process of actualising the Eko Atlantic city is the lack of consideration for due process. According to Okorodudu-Fubara et. al, The Eko Atlantic City project has

breached the fundamental provision of the EIA Act and the following critical issues can be identified with respect to the EIA report prepared in respect therefore:

- LASG commenced dredging activities in 2009, while the EIA report was completed in April 2011. This was in clear contravention of the EIA Act which provides that EIA must be carried out before embarking on any developmental project.
- The failure to carry out an EIA prior to the commencement of dredging activities has defeated the purpose for the EIA because here was no collection of credible baseline data against which to bench mark the findings of the EIA
- The EIA report lacks information about the impact the project will have on the stability of the ecosystem. This is a serious omission in the EIA process and will likely have far reaching consequences for the environment including but not limited to loss of biodiversity and ocean surges.
- The EIA report has not taken due consideration of the relevant stakeholders and the effect that the project would have on the status, environmental health and way of life of the of the host communities in the proposed project area. It is important to note that apart from the host communities, neighbouring coastal and littoral states shall be affected by the Eko Atlantic City Project.

4.2 Land Reclamation and its Impacts on the Communities

Information obtained from the developer's website http://www.ekoatlantic.com reveals that 95million cubic metres of sand have to be dredged from marine shelf water to reclaim 900 hectares of land for the project. However comments from environmental experts as cited in Eko Atlantic Project Fact Sheet (www.ng.boell.org) indicates that the current stock of offshore sand would be inadequate for such a project. Further research according to the experts also indicates that the offshore sand bed of the ocean in the Lagos area has not been replenished naturally. This is due to factors such as the sand drifts along the west African coast, where-amongst others –the ports constructions of lome and cotonou have reduced the amount of sand deposited in the Lagos area. They posited further that sand currently extracted for Eko Atlantic City yields only 30% of pure sand per ton, whilst the remaining percentage is made up of mud and silt, which is not suitable for construction. This increases the amount of sand needed to be dredged from the ocean. It has been estimated that over 300 million cubic meters of sand rather than the claimed 95million are needed to fill the area for the proposed project.

The " Draft Final EIA" available at the Federal Ministry of Environment confirms that the Project might shift the erosion of bar beach eastwards with a major adverse effect of 3km to the east and a moderate adverse effect up to 10km to the east. The S-shape design of the project is suppose to minimize those effects. In addition, a three phase monitoring and mitigation program was suggested with close monitoring during and after the construction phase and ultimately beach nourishment if required. The document proposes that if erosion becomes problematic, hard coastal structures should be considered-without being more

specific. The necessary stakeholders' involvement was limited to local communities at Lighthouse Creek, Middle Creek, all located on the westward side of the Eko Atlantic City construction site and not affected by its impact. The communities along the eastward side of the construction, where waves are likely to hit the shore with higher speed and potential for damage, i.e. communities along the Lekki-Epe axis were not part of the consultation processes.

However, findings reveal that erosion rates directly downstream east of Eko Atlantic City project increased significantly between years 2009-2012(period dredging began). The main driver of this increase in erosion and ocean surges has been determined in van Bentum et.al (2012) to be the presence of the revetment of the Eko Atlantic city. Consequently, there has been a huge depletion of the Lagos coastline. Several communities in the Eti-Osa LGA have lost properties and sources of livelihood, public infrastructures destroyed and access roads washed off. Several beaches on the Lagos coastlines are facing extinction also. The socio-economic implications of this loss are huge and devastating. Figure 5-8 below shows the various environmental degradation and economic loses, lack of proper planning has brought to the communities adjourning the Lagos coastline caused within the period construction started on the Eko Atlantic city.



Figure 5: Vanishing Coastlines of Lagos, 2013 (www.premiumtimes.com)



Figure 6: Atlantic Ocean overflowing its banks on Lekki Peninsula,2013 (www.environewsnigeria.com)



Figure 7: Eko Atlantic Surge, Kuramo Beach, 2012(www.saharareporters.com)



Figure 8: Tragic Ocean Surge on Lagos coastline, 2012 (www.nigeriainfo.com)

4.3Threat to Marine Life

The lancelets, which are also known as amphioxi, are also sources of food to some pe*ople* and their animals. Following up is report on November 6, 2011 on the Eko Atlantic City project, The Guardian Newspaper learnt that lancelets, precious marine organisms, are being wiped out in the area despite its social, economic and scientific significance. Although the proponents of the Eko Atlantic City said they had done a good impact study, critics of the project insist that the study did not take into account some issues in the biological sciences such as the case of the lancelets. (www.guardianewspaper.com)

5. Concussions

From the analysis above, we can draw the following conclusions.

(1) The controversial Eko Atlantic project which is portrayed by Lagos state government and developers as a model of sustainability, climate change adaptation and economic growth, is an example for the difficult process of reconciling the three conflicting interests of protecting the environment, promoting economic development and striving for social justice for all.
(2) Synergetic effects to the surrounding areas are neglected by the Eko Atlantic City Project
(3) Serious erosion is happening along the coastal areas identified as vulnerable in the draft final EIA. The affected areas have to be protected immediately; at the same time, a consensus is needed to find alternative solutions to the proposed hard coastal structures.
(4) The key messages of a strategy to check the destruction of the Lagos coastal communities will have to be an integrated agenda centered on an acceleration of growth to reduce poverty, the management and reduction of risks of disasters.
(5) Need to urgently regenerate the other beaches to avoid future erosion of the beaches and diminish the surge.
(6) The benefits of artificial wetlands in the mould of the Orlando Easterly Wetlands reclamation project in Florida , USA could be employed as a mitigating and re-vitalisation planning strategy to preserve , manage, and protect the Lagos coastline beaches that have become endangered.
(7) Lagos and other Africa coastal cities need a paradigm shift in their coastal management. The approach must change from flood resistance at any cost to flood accommodation wherever possible.

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Flood vulnerability: Impending Danger in Sabon-Gari Minna, Niger State.

Adeleye, B. M. and Ayangbile O. A.

Synopsis

High demand for housing in Sabon-Gari has prompted landowners to develop their properties with little regard for Government's approved set-backs and even along water ways making the inhabitants highly vulnerable to flooding. This study examines building vulnerability to flooding and the danger poised at Sabon-Gari, Minna, Niger State.

1.0 Introduction

Flooding is one of the most devastating natural phenomenons in the world claiming lives, destroying properties and displacing many. According to Harris (2001) flooding has claimed millions of lives in the last hundred years alone, more than any other weather natural phenomenon. In Nigeria, the National Emergency Management Agency (NEMA) reported that a total of 7.7 million people were affected by flooding in the year 2012, of which 2.1 million were officially registered across the country as internally displaced persons and over 300 people were killed during that period. The raging flood (2012) cut across 23 states of the federation with Niger State having her own fair share. The Niger State Emergency Agency (NSEMA) in her report, disclosed that over 1000 families and 47 persons were displaced and killed respectively, by the flood which affected over 500 communities across the State. It was reported that the raging floods has been the worst natural disaster the country has experienced since 1936 (West Africa insight, 2012 and Stanislav 2012).

There has been an increase in recognition by both governments and multilateral agencies of the need to mainstream flood risk reduction into development plans. Nigeria's (2003) agenda 21 document spelt out objectives to combat floods which include providing a master plan for flood control and relief measures for victims; mitigate floods through the relevant land use laws and edicts; improve institutional capacity for flood prediction and public awareness programmes and minimize the impact of floods through the provision and maintenance of appropriate infrastructure (Nabegu, 2014). Nabegu (2014) However, believes that governments in Nigeria have consistently failed to systematically treat risk reduction from floods as an integrated, cross-sectoral objective. Instead, they have dealt with flood risk primarily within the very narrow

framework of flood control, improved preparedness, relief and rehabilitation and preparedness capabilities and expose support to affected groups, consequently, flood hazards continue to cause great damage to infrastructure and loss of life.

VanWestern and Hosfstee,(2000) believes that Mitigation of flood disaster can be successful only when detailed knowledge is obtained about the expected frequency, character, and magnitude of hazardous events in an area as well as the vulnerability of the people, buildings, infrastructures and economic activities in a potential dangerous area. Often times these detailed knowledge is always lacking in most urban centres of the developing world especially Nigeria (Ishaya et al, 2008a and Ifatimehin et al, 2006). Ishaya et al 2009 are of the view that, One way to mitigate the effects of flooding is to ensure that all areas that are vulnerable are identified and adequate precautionary measures taken to ensure either or all of adequate preparedness, effective response, quick recovery and effective prevention.

In-spite of government’s effort in flood mitigation, the residents of Sabon-Gari Minna, Niger state has failed to learn from the raging flood experience that once besieged the state. Increase in agglomeration and competition for building space has led to unguided planning, building contraventions along water ways, indiscriminate waste disposal in water channels and silted drains has made the study area; " Sabon-Gari" highly vulnerable to flooding. It is against this background that this paper tends to assess flood vulnerability in Sabon-Gari area of Minna, Niger State using Geographic Information System as a tool. Over the years Geographic Information System has been used in flood assessment and this has proven effective. According to Jayasselan (2006) and Ishaya et al (2009) , an integrated approach of Remote Sensing (RS) and Geographic Information System (GIS) has proved to be the most effective (Jayasselan, 2006), and perhaps the only option to flood hazard preparedness and to reduce potential risk.

1.1: Focus Of the Research

I. Map the vulnerable areas using Digital Elevation Model and satellite imageries,
II. Carry out spatial analysis of the flood prone areas in Sabon-Gari,
III. Determine the number of buildings vulnerable to flooding and create a vulnerability map,
IV. Suggest strategies to ameliorate for future flood disaster and risk mitigation in the study area.

2.0: Study Area

Sabon gari is one of the 22 neigbourhoods of Minna, Niger State. Sabon-gari is located on

latitude 9^0 37' N and longitude 6^0 33' E. The typical climate of the middle belt zone of Nigeria is a good reflection of Sabon-gari's climate, with rain season settle around April and last till October with mean annual rains is 1334mm (52 inches) September, recording the highest in March at 300mm (11.7 inches). The mean monthly temperature is highest in March 30.500c (850F) of lowest August at 22030c (720F).

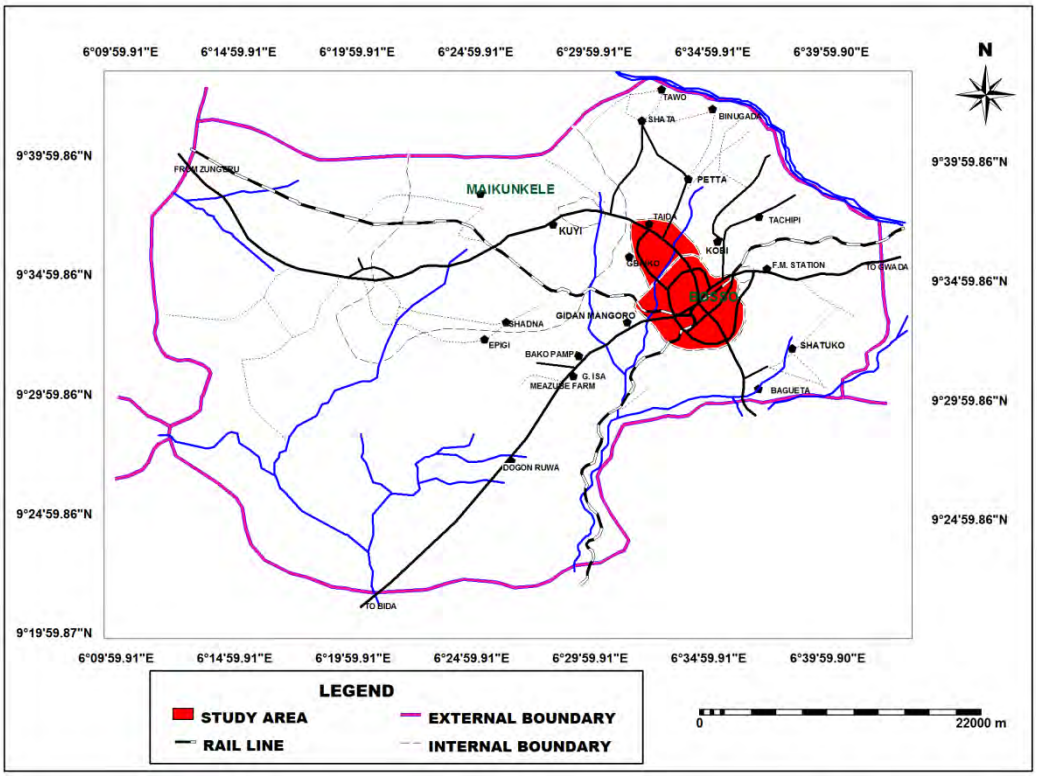


Fig 2.1: Minna in local context.

Source: Department of urban and Regional planning, FUTMINNA.

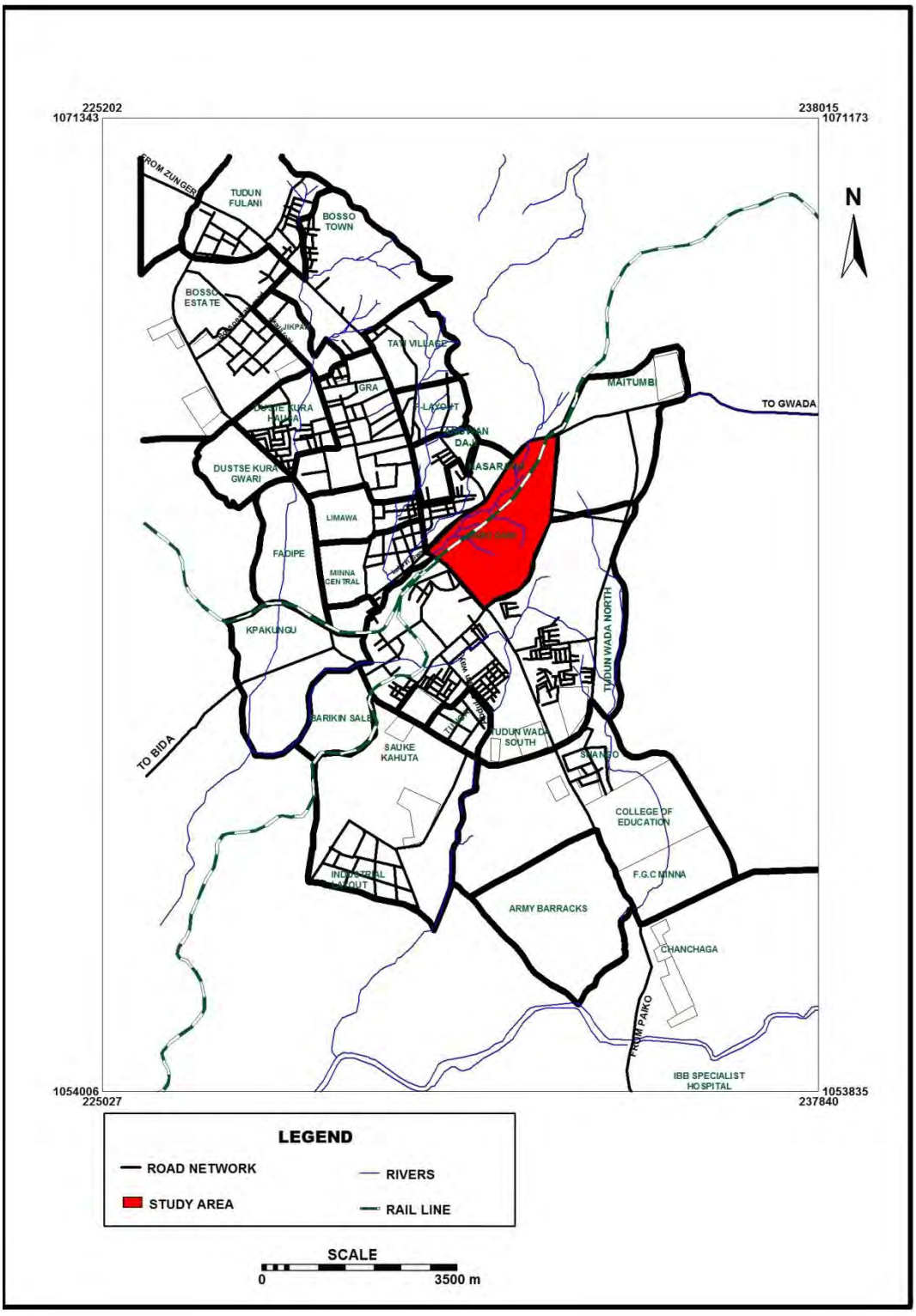


Fig 2.2: Sabon-Gari Highlighted in the Street Guide Map of Minna.

Source: Department of urban and Regional planning, FUTMINNA.

3.0: Methodology

Geospatial based techniques were used in the research. At the first phase, several points (X,Y, and Z data) were picked at regular interval on Google earth application in other to determine the terrain of the study area. These data (X, Y and Z) were recorded in excel sheet and was then imported to Surfer 8 software where the contour map for the study area was plotted. Topographic map plotted was exported to Ilwis 3.3 Academic software and was converted to segments map where the contour were digitized and interpolated to generate digital Elevation Model (DTM).

At the Second phase, A buffer of 15metres (the government Approved Setbacks for Gorges, water Channels and Drains) was created on the subset image of the study area using the "Arc tool box" on Arcgis 10.0. A flow accumulation model was created using the DEM, thus various class of risk were created.

3.1: Field Survey

Interviews was conducted with residents of Sabon-Gari area in reaching adequate conclusions and making relevant recommendations. The interview consists of 40 respondents drawn from four areas within the Neighbourhood that is, Old kure market, Angwan Kaje, Sabon Gari Neighourhood and kuta Garage. Random sampling method was employed in selecting the interviewees. GPS was also used to acquire data on the point of distinguishing land use and points of elevation

3.2: Data Processing Techniques

The data processing techniques adopted for this research include: Data evaluation, Buffering, Georeferencing, Data sub-setting, Terrain modeling, water body and settlement update from satellites images and integration.

4.0: RESULTS AND DISCUSSION

To fulfill the aim of this research, some analysis were carried out. The digitized contour map was interpolated to generate the Digital Terrain Model(DTM) for Sabon-Gari. This is shown in figure 4.1 and figure 4.2 respectively. The DTM shows the slope characteristics and the elevations of the study area which ranges from 254.0m to 256.0m above sea level. The DTM

shows that the lowest elevation (254.0M) is found along the major water channel south ward. While the other low elevations (254.4 M and 254.8M) are found along other water tributaries within the study area. The mapped DTM also shows the highly flood vulnerable areas falling between 254.0M to 254.8M above sea level and this reveals that ample of the lands in the study area are on a low elevation and this makes the area vulnerable to flooding.

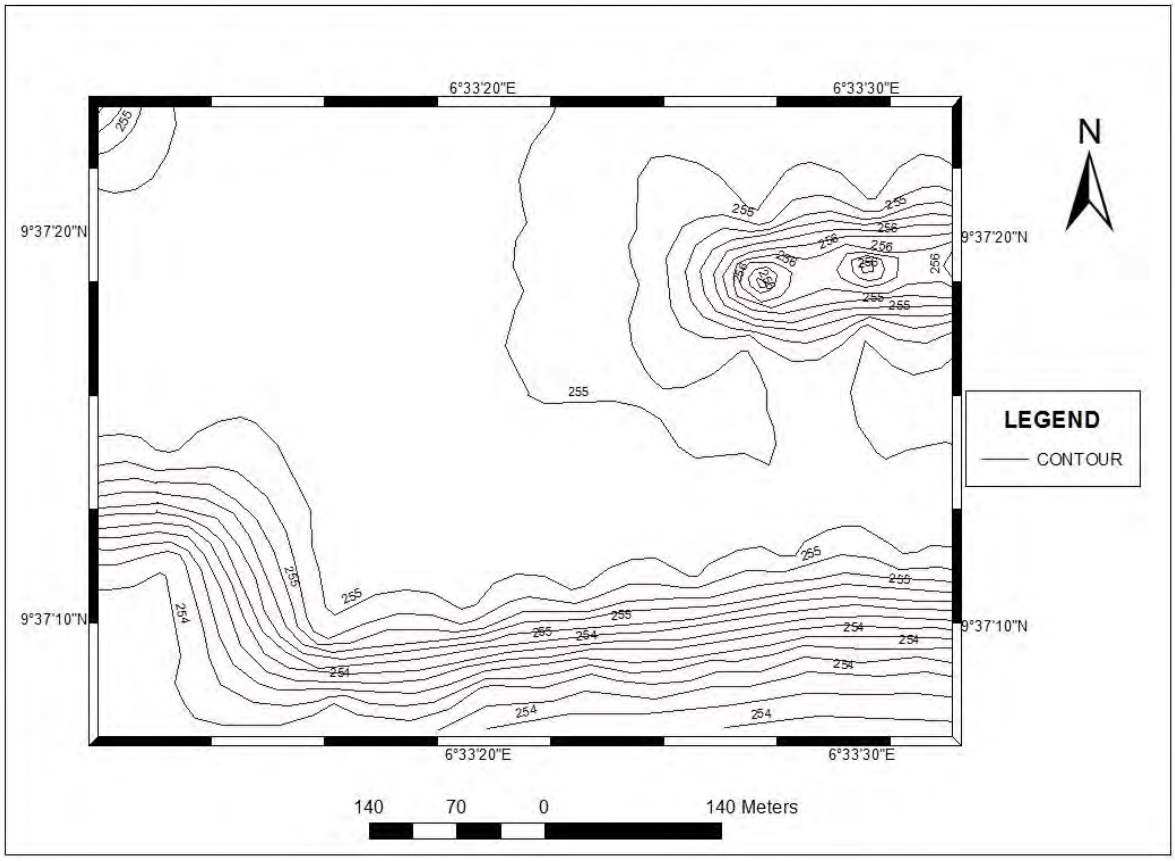


Fig 4.1: Topographic Map of the Study Area.
Source: Author Field's Survey, 2014.

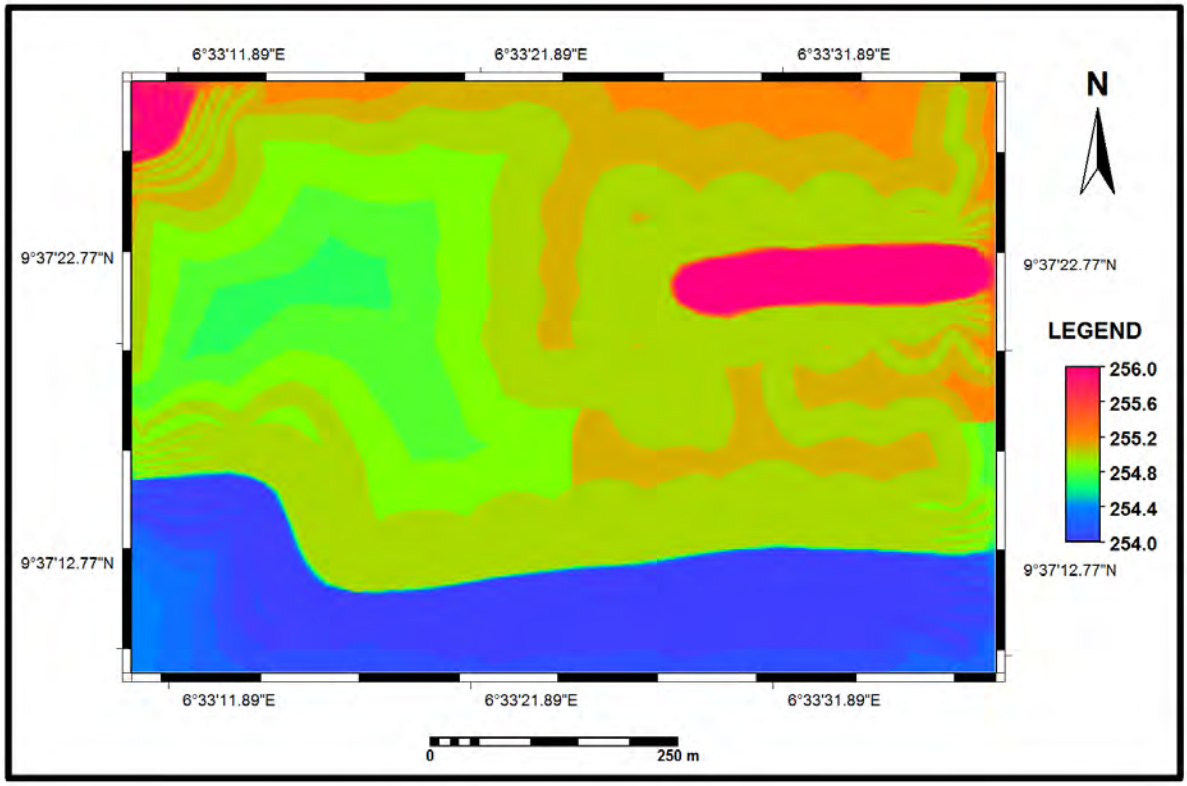


Fig 4.2: Digital Terrain Model for the Study Area.

Source: Author Field's Survey, 2014.

To determine the number of buildings vulnerable to flooding in the study area, a buffer of 15 meters which is the state government approved set-back for Canals, Gorges and drainages was created along all the water ways within the study area using ARCGIS 10.0 software . Buildings that falls within the buffer created were digitized and were termed as vulnerable buildings. More so, these buildings are said to be contravening the approved building set-back designated by the state government. a total of 254 buildings falls within the buffer and these buildings are said to be highly vulnerable and are represented in colour red; this is shown in Figure 4.3.

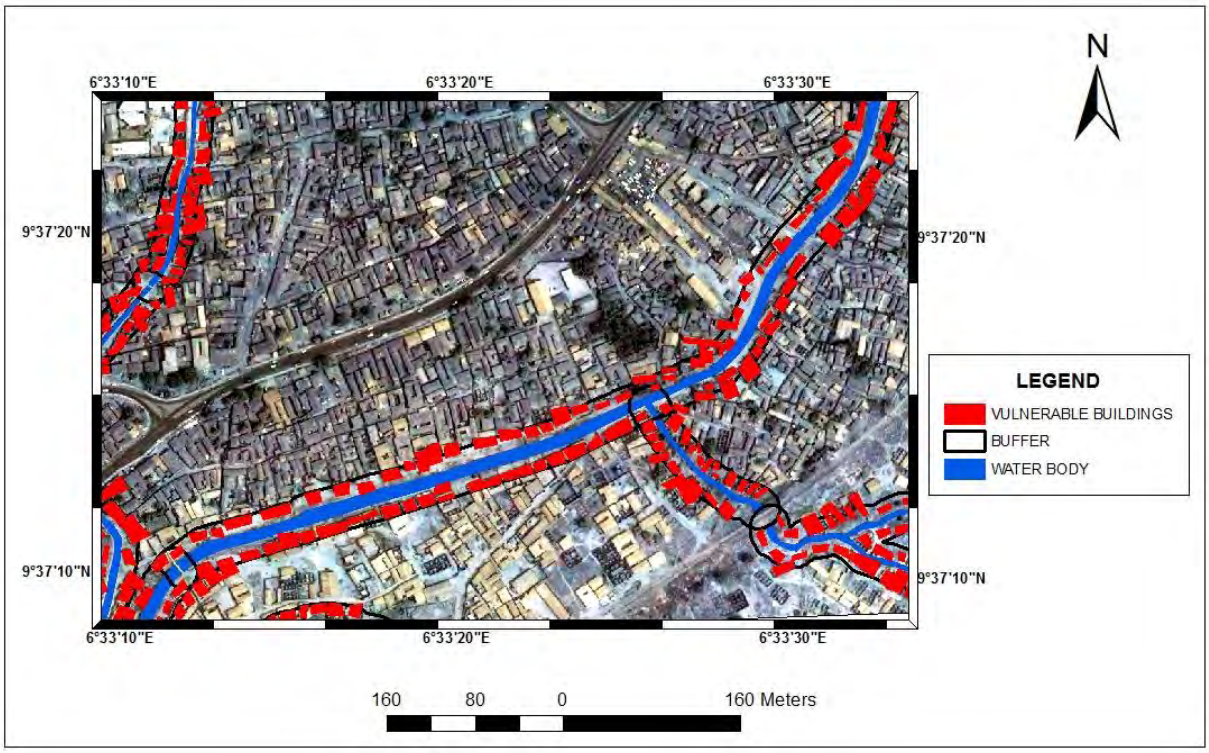


Fig 4.3: Vulnerable Buildings in Sabon-Gari.
Source: Author Field's Survey, 2014.

To determine the level of vulnerability in the study area a flow analysis was carried out to know the natural drainage pattern of the study area and an overlay analysis was also carried out to determine buildings on low and high elevations in other to ascertain the buildings at high risk, moderate risk and low risk. Figure 4.4 shows the level of vulnerability in the study area. Areas at high risk are represented in red while areas at moderate risk and low risk are represented with yellow and green respectively.

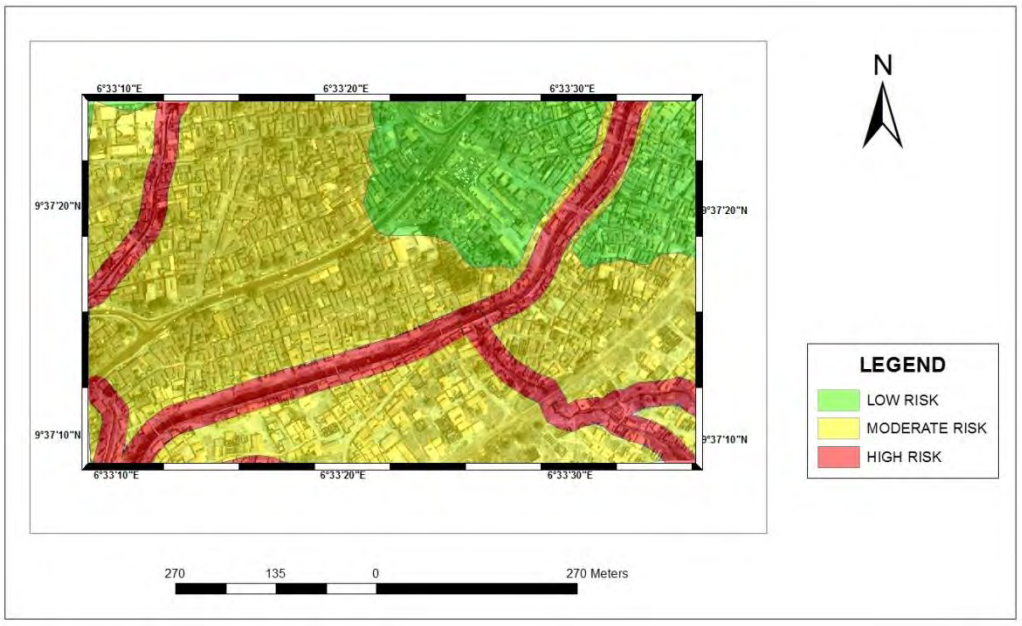


Fig 4.4: Vulnerability Map in Sabon-Gari.

Source: Author Field's Survey, 2014.

Table 4.1: Level of Vulnerability

Class	Area (M^2)	Percentage
High Risk	79586.28	15.9
Moderate Risk	281571.00	53.38
Low Risk	166350.00	31.54
Total	527507.28	100

Source: Author Field's Survey, 2014.

From the table above (4.1), 15.9% of the buildings in the study area are at high risk of flooding. The buildings in this category give little or no regard for the mandatory building setbacks from the water channel. Thus, these buildings are located along water channels on lands with low elevation. The buildings designated as high risk constitute 79586.28M^2 of the total land area.

A number of buildings were identified as buildings with moderate risk vulnerability to flooding. Distance from the water channel is relatively safe and only in the event of high volume of runoff from the water channel can these buildings be prone to the risk. These buildings are also located on lands with low elevation however the distance of these buildings from the water channels makes them less vulnerable to flooding. Buildings in this category occupy a total land

area of 281571M^2. Low risk buildings constitute 31.54% of the total buildings in the study area with total land coverage of 166350 M^2. These buildings (low risk) are located on high elevation. During the field observation it was discovered that ample of the buildings in the study area are located on flood plains with their drainages either silted or used as refuse collection points during dry season (Plate 4.1 and 4.2). This illicit act exposes Sabon-Gari to an impending danger of flooding. The research conducted interviews to corroborate the findings of the GIS analysis. Result of the interview shows that 62% of the respondents expressed an awareness of the risk posed by flooding before acquiring properties (land) and settling along water channel (plate 4.3). The respondents stated that they were forced to acquire property along the water channels as a result of high cost of accommodation in the low density area. These respondents also believe that an impending flooding and heavy precipitation may put them at a risk of losing their lives and properties but the pray that such an occurrence should not happen.



Plate 4.1: Silted drainage at Sabon-Gari during dry Season

Source: Author Field's Survey, 2014.



Plate 4.2: Water ways filled with refuse during dry season.

Source: Author Field's Survey, 2014.



Plate 4.3: Buildings along waterways.

Source: Author Field's Survey, 2014.

A number of the residents (31%) at Sabon-Gari take proactive steps in mitigating the adverse effect of flooding during rainy season by employing common measures such as: clearing of drainages and use of sand bags for flood breaks. Figure 4.1 shows a typical example of how sand bags are used as mitigating tools (embankments and channelization of water) at Sabon-Gari during rainy season.

69% of the respondents attributed their inability to employing mitigation strategy to lack of funds. It is a pity to note 35% of the respondents are still not knowledgeable about the dangers that accompany flooding. In the light of this, a vulnerability map that would be easily understood by the public was created in the research. This map would serve as a tool for early warning against flood disaster.



Plate 4.4: Flood breaks using sand bags at Sabon-Gari during rainy season.

Source: Author Field's Survey, 2014.

5.0: CONCLUSION

This study was carried out with the aim of assessing flood vulnerability in Sabon-Gari area of minna, Niger State. Geospatial techniques were employed for the mapping and analysis of flood vulnerability in the study area. These techniques involve the use of Simple methodology that is, the use coordinates and elevation data which are subjected to different GIS applications (Arcgis 10.0. Ilwis 3.3 Academic, Google Earth and Surfer 8). The study successively created a vulnerability map and a number of vulnerable buildings were identified. Areas lying along the water channels within Sabon-Gari are at locations that are most vulnerable to flood. Rapid agglomeration of people and low cost of accommodations as led to the erection of illegal structures along water channels; Danger lies ahead if early mitigation measures are not put in place.

Recommendations:

The following are hereby recommended as a way forward in ameliorating future occurrence of flood hazards in Sabon-Gari:

- Stiffer measure should be put in place by law enforcement agency to check the problem of indiscriminate waste disposals in drainage. waste collection points should be provided in strategic locations for easy access.

- Buildings along water channels should be demolished and the government approved setbacks should strictly adhere to. more so residents should be strongly discouraged from settling within the flood plains.

- Silted drainages should be cleared, embankments and other structural flood control measures should be constructed at areas of high risk.

- Public awareness campaigns should be organized by government and NGO in sensitizing the residents of sabon-Gari on the dangers of flooding and the problems that accompany it.

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"Conservation and Revitalization of River Yamuna and its Ecological Reserves for National Capital Territory of India, Delhi"

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1. Introduction

The capital city of India, Delhi, presently known as the National Capital Territory of Delhi, has witnessed the rise and fall of seven empires, the last being the British empire in 1947. According to various archaeological records and findings, it has been observed that the 22 kilometer stretch of River Yamuna within the city divides it into two unequal parts, and has played a crucial role during their existence, fortification of these empires in the past and spatial development of the city. However, post-independence of India in 1947, the city has transformed and manifested the negative marks of its development on the major natural landscapes of the city like River Yamuna. However, the city's governance and its administrative issues shadow the much needed environmental protection of such ecological and water reserves of the city. The main problem is the continuous neglect of the river to the extent that its Biological Oxygen Demand (BOD) level has fallen much below the threshold limit. Earlier, the sand mafia had been active in extraction of large quantities of sand from the river bed of Yamuna in Delhi, which has now come to an end. The problem is aggravated by the release of large amount of untreated sewage and industrial effluent into the river. As a matter of fact, all this is happening right under the nose of the administration. The main problem lies in the fact that the River Yamuna has very little or no flow for most part of the year and therefore, the capacity to naturally replenish and support the aquatic life is not possible. The Delhi Development Authority, formed in 1957, responsible for planned development of the city of Delhi, has tried to protect the river and the ecologically sensitive area around it by declaring it as a 'No construction zone'. However, from time to time, under various political pressures, the boundary of the zone has been modified. In order to restore the quality of river, the Government of India (GoI) initiated the Yamuna Action Plan (YAP) in 1993 and later Yamuna Action Plan II in the year 2004. However, the results of the two plans remain more or less insignificant.

Hence, in the present paper, an attempt has been made to understand the evolution of spatial planning of the city of Delhi along the River Yamuna. To further explore the current situation and the problems, this paper evaluates the government interventions and efforts made so far in order to conserve and protect the ecological reserve and water quality of River Yamuna. This paper also discusses the various views of government officials and experts gathered through the process of primary survey and interviews. The present paper after analyzing the ground realities highlights the recommendations to overcome the complex unsolved issues and ensures the positive impact of city development through conservation and revitalization of water and ecological reserves (River Yamuna) of National Capital Territory of Delhi, India.

2. The Seven cities of Delhi

"Some cities are defined by their history, some by their memories, some by their architecture, some by the people who live in them. Delhi maybe said to have all of these, but something in addition" (Singh & Varma 2001, p.1). The city is a blend of old and new, with layers of history with its succesion of glory and disaster. The city is an epitome of various cultures inculcated over the centuries, with diveristy of people in terms of their religion, occupation, beliefs, etc thus evolving a diveristy of portrait of the city formed in the eyes of its people. The city is located in the Indo-Gangetic Plains (Figure1), which "is the most important zone in terms of human concentration in India. It is a vast enclosed basin of numerous small and large rivers, separated by alluvial divides" (Agarwal & Narain 2008, p.72).

"New Delhi was born from the womb of the past, as the child of the future. The significance of New Delhi lies in its having betrayed the original purpose for which it was built. History shows that each new city in Delhi created itself by cannibalizing the ones before. Seven cities were built to fade away in the dusk of time" (Singh & Varma 2001, p.207). "Unlike other major cities, its geographical location has changed several times (Figure 2). The city is now situated on the banks of the Yamuna but earlier it was not so" (Agarwal & Narain 2008, p.74). It is believed that around 1450 B.C., the first city of Delhi, namely Indraprastha was established on the right banks of river Yamuna, to serve as the capital of the Pandava brothers of the epic battle of Mahabharata. It is believed that Indraprastha led the foundation for coming up of seven cities of Delhi with the New Delhi of British India as the eighth city. Qila Rai Pithora (1052 AD) was the first amongst the seven cities, which situated itself at a distance of 18km from the river Yamuna. Due to its location amidst the rugged hilly terrain and high elevation of the site, the water demand of the city was met through rain water harvesting using large constructed tanks. Currently, "the tanks have silted up and their catchment area has been encroached upon by private builders and the Delhi Development Authority(DDA)" (Agarwal & Narain 2008, p.75). Then, came up the city of Siri (1307 AD), in close proximity to Qila Rai Pithora and used large constructed tanks to meet water demand. With the fading away of Siri, rose another city named Tughlaqabad built by Ghiyas-ud-din Tughlaq (1320-25 AD). Although the site was close to Yamuna, but owing to the need of fortification, the settlement was situated in a rocky terrain and water was brought from nearest natural drainage channel with the help of canal which is now converted into a dirty drain (Agarwal & Narain 2008, p.75). The fourth city of Jahanpanah (which means shelter of the world) came up in 1325-51 AD, which was succeeded by the city of Ferozabad (1354 AD). The latter established itself next to river Yamuna. The sixth city that came up was known as Shergarh (1534 AD), built by Mughal emperor Sher Shah Suri. The seventh city, known as Shahjahanabad (commonly known as 'Old Delhi') was built (1627-58 AD) by mughal emperor Shah Jahan. The city shifted from rocky terrains of Aravalli ranges of Delhi towards the plains of Yamuna. To meet the water demand a system of canals connecting the river Yamuna to the settlement were built.



Figure 1: Location of Delhi in the Indo-Gangetic plains of India (source: Agarwal, A. & Narain, S. (2008) Dying Wisdom: Rise, fall and potential of India's traditional water harvesting systems, New Delhi: Centre for Science and Environment

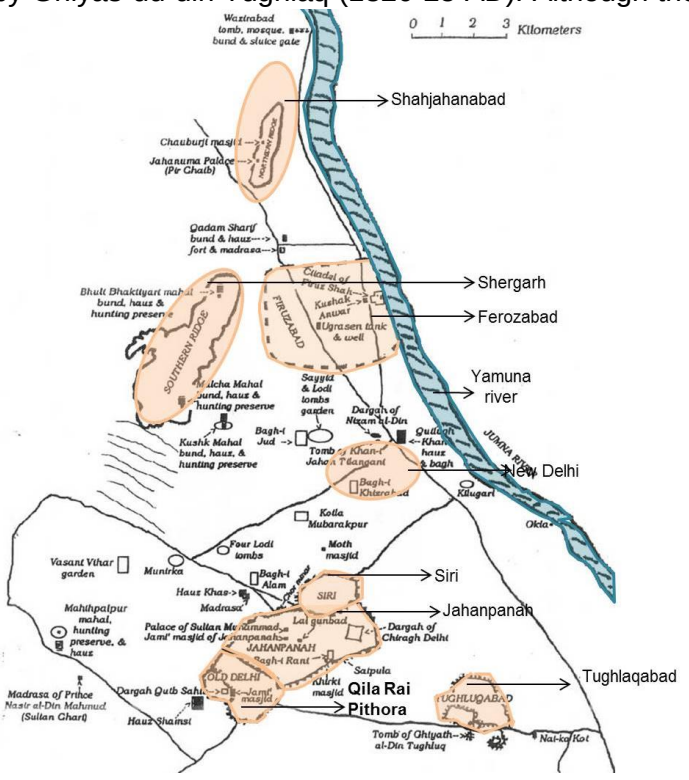


Figure 2: Location of cities of Delhi (source: Fanshawe, H.C. (1998) Delhi, past and present, New Delhi : Asian Educational Services). Graphics by author

In December 1911, the 8th capital city, New Delhi and its creation as capital city of British India was announced by King George V. "Under the Viceroy, the supreme government of India had, until then, been at Calcutta for the four winter months. Shimla was the seat of government for the rest of the year. Delhi was chosen because it was considered centrally located, with a healthy climate and ease of access. It was a junction of six railway lines and connected the north-west with the rest of India" (Singh & Varma 2001, p.67).

However, the British India soon lost its control over India as its colony and was overthrown by the united citizens of India in 1947 when India gained its independence. However, the independence from British rule was followed by partition into India and Pakistan in 1947. This led to influx of refugees and increase in demand for basic needs of life (housing, water, sanitation, employment,etc) beyond the capacity of the city to absorb the surplus need. Moreover, the mantle fell upon the city bodies of Delhi Development Authority (DDA), Public Works Department (PWD), Central Public Works Department (CPWD) and Municipal Corporation of Delhi (MCD), to ensure planned development of the city.

Thus, the evolution of spatial planning of Delhi as a city depicts the trend of the city moving towards the north-east direction, i.e. towards river Yamuna, with the first four cities of Qila Rai Pithora, Siri, Tughlaqabad and Jahanpanah located in the rocky terrain as factor of security played an important role in site selection. Whereas, the cities of Ferozabad, Shergarh and Shahjahanabad located themselves within close proximity of river Yamuna. However, the 8th city located itself in a location where it could glorify its superiority (hilly area) and at the same time enjoy from the vast green spaces of Delhi Ridge. For establishment of New Delhi, neither fortification nor water supply from river Yamuna, were site deterministic factors, i.e. River Yamuna begins to get alienated from the planning purview.

3. River Yamuna turns into a city-drain

"Myth has it that the river Yamuna has been named after Yama, the god of death in the Indian pantheon. With alarming levels of pesticides, heavy metals and definite accumulation of carcinogenic chemicals like benzene hexachloride (BHC) in the waters, mythology could well have a touch of prophecy here" (Banerji & Martin 1997, p.48). The river enters the city at Wazirabad (Figure 3) and exits at Okhla. The water of this river is harvested to feed the population of Delhi at Wazirabad and Chandrawala waterworks. Before entering Delhi, industrial waste is discharged into the river and also, the agricultural chemicals and pesticides mix into the surface run-off while passing through Haryana. Due to more than 1.7 crore population of Delhi and inadequate sewage treatment plants, about 58% of untreated sewage is dumped into the river water. Although, with the intervention of Hon'ble Supreme court of India, Common Effluent Treatment plants have been established in Industrial areas, but the quality of treated industrial effluent is still not up to the mark. Also, owing to the non-availability of freshwater for most of the year, the pollution of the river reaches alarming proportions and rather, becomes a dirty drain with high level of BOD, low dissolved oxygen, high fecal coliform and toxic chemicals with heavy metals.

As discussed earlier, the river Yamuna has played an important role in siting the city of Delhi. However, the natural landscape has experienced several changes and many of them have been for worse, transforming the river from a water channel that fed people and met irrigation needs to becoming a drain that carries the burden of human negligence towards their environment and its resources. Post 1947, India not only regained its independence but was also the victim of partition of India and Pakistan. Delhi being the capital city of Independent India, became the center of attraction for not only the refugees flocking from parts of east Punjab, etc.; it also continued to be the administrative and political head of the country post British India. Delhi was under pressure to meet the demands of the growing population, the city started to malfunction when the limited resources that the city could supply could not meet the surplus demands. "Urbanization seems to be an inevitable consequence of economic development. With that development comes imbalance, some cities, some

regions, prospering to the detriment of others, investment being attracted to the successful areas" (Singh & Varma 2001, p.169). With the rise in population, and limited resources the city could offer, people who could not afford housing options available resorted to inhabiting flood prone areas lying within the river basin of Yamuna. Many unauthorised constructions came up, some of them (like the Akshardham temple) spanning over acres of the fertile basin, while some of them are the refugee colonies, most famous amongst which is the Tibetan colony. "The area is flooded almost every year during the monsoon season, and the measures taken prior to the actual occurence of events include issuance of warnings, laying down of cement bags to create a barrier, ensuring proper working of life saving boats, amongst other such temporary measures" (Kumar, Interview). Another interview with the Special Secreatry (Agrawal, Interview) of the same department, that is, Flood and Irrigation department, Government of Delhi; revealed the government efforts and concerns concentrated over the engineering aspects that govern the mitigation efforts prior to

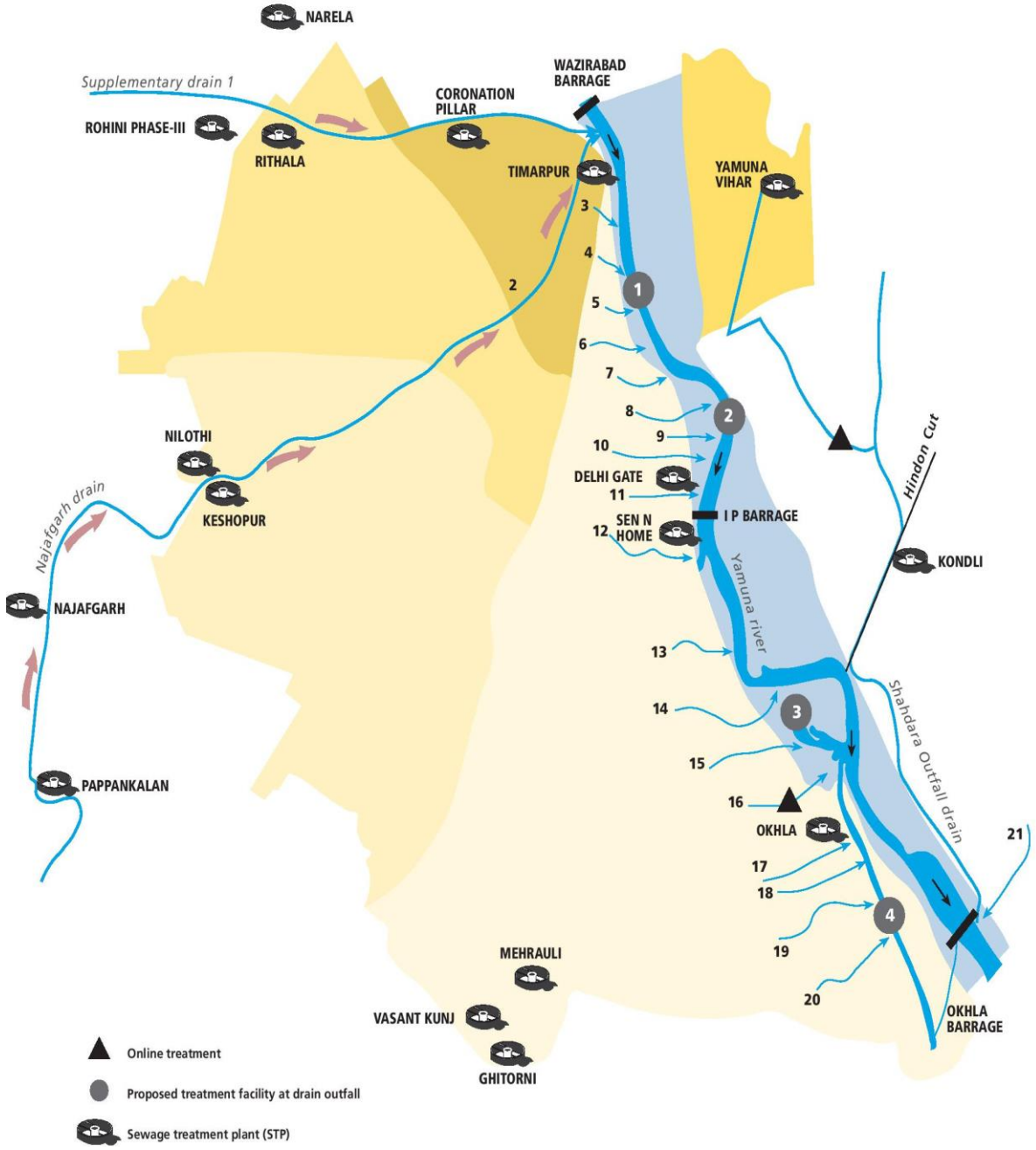


Figure 3: Location of Yamuna in Delhi (source: Narain S., Seth, B.L. & Babu S.(2007), Sewage Canal: How to clean the Yamuna, New Delhi: Centre for Science and Environment)

monsoons and various rescue missions during the monsoon season, when the level of river rises above the flood level. He also expressed deep concern related to lack of efforts to mitigate the loss that the inhabitants residing in the flood plains of river Yamuna in Delhi, are struck with every monsoon season.

Delhi Development Authority was established in 1957 to prepare a plan document that would guide the development of the city in a planned manner. Their efforts were supported by Ford Foundation and Central Government's Town and Country Planning Organisation and a Master Plan for the city of Delhi was drawn up in 1962. The plan was based on the principles of self-containment, developing regions around Delhi which could act as counter magnets and relieve some of the pressure off the capital, checking land usage and in particular illegal encroachments" (Singh & Varma 2001, p.169). The plan also proposed a ring road network that would circulate traffic in the periphery and contain the population expansion, but instead of limiting the area of expansion, this road alienated the river Yamuna from the cityscape and with time and due negligence, the river turned into a drain.

It is believed that Yamuna was once a majestic river with temples, ghats (series of steps leading down to water body) and buildings along its bank. Presently, the river is the source of water supply to Delhi and at the same time the dumping ground for large amount of untreated sewage and surface run-off flowing through poor sewerage network of the city. Water from Yamuna is supplied to Delhi from three main points- Chandrawal and Wazirabad in North Delhi, Haiderpur in west Delhi and Bhagirathi in east Delhi. The Okhla plant in south Delhi had to be closed down when the potability of water fell below the benchmark.

The ecology of the river and reserves around it continues to deteriorate due to the overlapping instituional jurisdictions. "The Ministry of Environment and Forests (MoEF) claims that its job is to keep track of industrial sourcesof pollution, such as traces from a pesticide plant and other industries. In instances, where the pesticide traces from agricultural fields, the MoEF is supposed to inform the Ministry of Agriculture" (Banerji & Martin 1997, p.49). Similarly, the agencies involved in monitoring the pollution levels tend to underplay the issue saying that pesticide traces settle in the river sediment which gets washed away during monsoons. A senior scientist working at Central Pollution Control Board, corroborates on such findings: " There have been many instances when dead fish were found in the river as soon as the monsoons were underway. This is beause of the sudden rise in pesticides and other pollutant levels" (Banerji & Martin 1997, p.51). Although, the Delhi segment of river Yamuna is shortest in coverage within the entire length of river (Figure 4), but it is the largest contributor to pollution levels of the river. Thus, the real problem lies in the mismanagement and

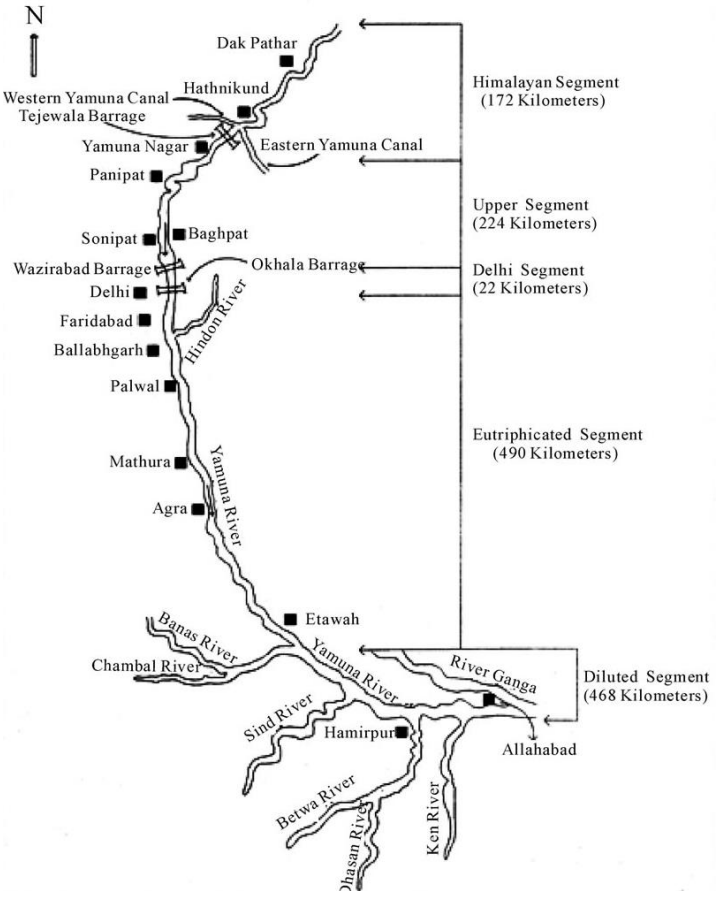


Figure 4: Segments of River Yamuna (source: Agarwal, S. (1996), Point pollution into the river Yamuna: A grossly polluted river system in the Indian Subcontinent, New Delhi : CPCB)

negligence of the resource and not its scarcity.

"The health of Yamuna in Delhi is aptly summarised by (CSE 2007): 'Yamuna in Delhi is barely 2 per cent of its entire length but according to CPCB it contributes over 70 per cent of total pollution load. Monitoring data shows that pollution measured in terms of BOD load has increased 2.5 times from 1980-2005. BOD load, which was 117 tonnes per day (tpd) in 1980 increased to 276 tpd in 2005. The river has no fresh water flow for virtually nine months. Delhi impounds water at the barrage constructed at Wazirabad. What that flows subsequently is only sewage and waste" (Jain 2009, p.30).

Hence, without any doubt we can say Yamuna is nothing less than Delhi's sewage drain. "In 1999, the Central Pollution Control Board estimated that Delhi produces over 2,547 MLD of sewage of which only 885 MLD is collected through the sewage network for treatment and the bulk — over 75 per cent flows into storm water drains and then into the river. By late 2000, treated sewage had increased to1,333 MLD as had the quantity of sewage —still over 50 per cent of the city sewage was dumped into the river" (Narain 2002).

4. Government projects and policies - All in vain?

"Life, prosperity, and civilization revolve around water in the Indian subcontinent" (Black & Talbot 2005, p.1). Although, Yamuna is the source of about 70% of Delhi's water supply, but the available treatment facilities continue to remain incapable of removing the pesticides and toxic chemicals resulting from the run-off from industries, towns and agricultural hinterlands. The same water is supplied to the homes of Delhi citizens and unknowingly they have been drinking a "cocktail of chemicals in the belief that they are drinking clean water" (Banerji & Martin 1997, p.47).

To monitor and protect the river Yamuna, there exists many government organisations and agencies, namely Central Pollution Control Board (CPCB), State Pollution Control board, Delhi Jal Board (DJB), Ministry of Environment and Forests (MoEF), National Green Tribunal (NGT), etc. The cleaning of river water is the top most priority for Government of National Capital Territory of Delhi. One of the initiatives taken by the Government is the interceptor sewers project which is being implemented by Engineers India Limited (EIL) for the Delhi Jal Board (DJB). In an interview with Delhi Jal Board official (Jaglan, Interview), it was revealed that the government is taking number of efforts to increase the water supply to Delhi, but none of them are discussing on the issue of inequity of water distribution. He also discussed, in an hour long interview, that the state is provided with ample amount of water, sufficient for the entire population of Delhi, the problem is that certain areas of Delhi, where the beauraucrats reside are blessed with abundant water supply to manage and maintain their lavish government housing lawns, while the poor get left behind. According to him, rather than further depleting the river Yamuna for its freshwater, he emphasises on adopting green technologies and judicious use of water that is already available to us. The other initiative is a move to construct dams on the river Yamuna to allow more water for dilution which is essential.

4.1 Master Plans of Delhi

Despite the various efforts taken up since the first Master Plan of Delhi-1962, to relieve some of the pressure of the capital, construction of ring road to contain the population within the ring, Delhi continues to act as a "far more attractive business centre than any of the surrounding towns" (Singh & Varma 2001, p.170). The measure of Delhi's expansion can be calculated in terms of its ring roads. It is now on to its third, or outer – outer ring road, and that no longer circumscribes the capital, so there are plans to build an expressway, even further from the city centre" (Singh & Varma 2001, p.173).

In the first Master Plan of Delhi which came out in 1962, the policy interventions proposed to conserve the flood plains, i.e. the ecologically important reserves of Yamuna river basin, included recommended development of District parks, biodiversity parks, playgrounds and

open spaces on the western bank of river Yamuna and in the areas south of Wazirabad barrage. "To maintain the verdant garden look, a system of 'green linkages' was maintained, joining up the various old cities of Delhi and their historic monuments in a manner of 'planned hierarchy of green spaces'" (Singh & Varma 2001, p.104). Other proposals put forward included the shifting of Rajghat and Indraprastha thermal power plants after their machinery became obsolete (Delhi Development Authority 2006).

In the second Master Plan, namely Master Plan of Delhi-2001, the aim to make the river pollution free was targetted. To achieve this end, it was proposed that on the banks of the river large recreational areas shall be developed and integrated with other urban developments so that the river forms an integral part of the city, both physically and visually. It also proposed to channelise the river and encourage riverfront development, in consideration with all the ecological and scientific aspects before taking up any project (Delhi Development Authority 1996).

The current Master Plan of Delhi-2021 envisages rejuvenation of river Yamuna through a number of measures including adequate flow in rivers by release of water by riparian states, refurbishment of trunk sewers, sewering of areas with no sewerage system and treatment and recycling of industrial effluents by the use of common effluent treatment plants. The plan also laid the foundation for river zone as no construction zone, called as Zone-O of Delhi. However, within the time period of 2012-2013, the boundary of the zone changed several times during the master plan review process and certain forms of development, like few colonies (serving the vote banks of many political leaders), commonwealth games village, Akshardham temply,etc were excluded from the river zone and legalised as authorised constructions (Delhi Development Authority 2010). Interview with an official (Singh, Interview) from the Delhi Development Authority, insights were provided to the distant sources of pollution to the river. He spoke about the various drainage channels, some natural and many of them being man-made which are carrying the city waste and not just the rainwater, in its untreated form to the river Yamuna. He believs that the government efforts focussing on construction of new and many more sewage reatment plants and effluent plants is not going to be successful, until and unless, it is ensured that the coverage of sewerage network within the city limits is 100 per cent.

4.2 Inter-State Treaty

Realising that the water supply from Yamuna cannot fulfill the demand of city's growing population, in 1983, the city resorted to other rivers of Punjab- Ravi, Sutlej and Beas; from the Ganga and its tributaries; and from groundwater wells in and around the city. Thus, Delhi's dependency on water shifted from consumer city to neighbouring five states of Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana and Uttar Pradesh. However, this water supply system will work as long as the rivers on which it depends provides water, and the states and their ruling government remain docile to Delhi. Should anything go wrong the whole water grid will go haywire (Agarwal & Narain 2008, p.78). The Director (Kumar, Interview) of the Department of Environment, Government of Delhi, in an interview quoted the 11th Five year Plan of India prepared for the time period of 2007-12 as "per capita availability of water in cities like New Delhi exceeds that in Paris, where water is supplied round the clock" (Government of India 2008, p.163). He believes that the city is endowed with abundant natural resources, the Delhi ridge and the river Yamuna being its prime jewels. However, what lacks is the zeal to protect and conserve the same resources, availability of which is enough to meet the demands. Conclusively, it can be highlighted from the above discussions that there is a dire need to reduce this dependency so that the city can meet its requirements within its own territory .

4.3 National Green Tribunal

In a judgment passed by the Supreme Court of India, on February 27, 2012, mining of minor minerals such as sand, gravel, clay, marble and other stones was banned in the country

without the approval of the Central government. The Supreme Court, in the judgment on February 27, said all such mining leases by the state governments and Union territories will need environment clearance from the Union Ministry of Environment and Forests (Srivastava 2012). Hence, the rampant sand mining by the construction companies from the river basins across the country was finally put to rest on paper, however in practicality, the fight to stop the practice continues.

In a recent effort, the National Green Tribunal recommended the government to declare a 52km stretch of the Yamuna in Delhi and Uttar Pradesh as a 'conservation zone' as the environmental flow through this stretch was envisaged to play an important role in restoring the ecological functions of the river in the lean season. The report had been prepared by the Ministry of Environment and forests (MoEF) panel and was submitted to the Tribunal during a hearing on environment activist Manoj Misra's petition against the dumping of waste on the foodplains of Yamuna (Nandi 2014).

4.4 Yamuna Action Plan

The Yamuna Action Plan (YAP) is a government initiated project with collaboration between the Government of India and Japan. It is one of the largest river restoration projects in the Indian history. The government of Japan is providing the financial assistance through its Japanese Bank for International Cooperation (JBIC), to carry out the project, which is being executed by the National River Conservation Directorate, the Ministry of Environment and Forests, and the Government of India. The YAP-I was launched in 1993, in order to conserve and revitalize the river but due to its limited success, the plan was revived in 2004 as YAP-II. Under the Yamuna Action Plan II, the most critical stretches of Yamuna have been taken into account, with special emphasis on the Delhi stretch, where the city dumps more than 58% of the total sewage it generates.

Under YAP-I, two major schemes were initiated. One of them pertained to the launch of various sewerage schemes wherein the construction of 29 STPs (with a total capacity of about 726 MLD), 58 pumping stations, and 179 km of sewers was proposed. In another scheme the installation of non-sewerage facilities such as 1282 public toilet complexes, 96 crematoria, River front development, plantation and public awareness and participation were proposed. The Plan also proposed to construct 5 mini sewage treatment plants and 10 micro sewage treatment plants for some of the community toilet complexes (CTCs) to examine the feasibility of decentralized wastewater treatment system and on-site treatment of sewage, respectively. The other component of the plan was focused on public participation and awareness program involving several NGOs which was further supplemented by carrying out river pollution study to estimate future pollution loads into river Yamuna from different sources in 33 major towns of the Yamuna river basin.

Due to the delays incurred (For example, the total sewerage component of Delhi was over estimated in YAP-I and the Sewage treatment plants built in concurrence to the YAP-I, remain under-utilized to the extent of 25-45%) in achieving the objectives laid out in the YAP-I, the plan was revived and launched as YAP-II in 2004. However, despite the efforts and initiatives taken by the government, the situation of Delhi and its river Yamuna remains poor and does not meet the minimum required standards of Dissolved Oxygen and Biochemical Oxygen demand values (The water quality of Yamuna : DO values< 5.0 mg/l and BOD values >3.0 mg/l) (Sharma & Kansal 2011).

4.5 National Water Mission, 2009

Realizing the importance of water in Delhi and across various other states, the National Water Mission was launched in 2009 under the stewardship of Ministry of Water Resources (MoWR), with the aim of "Conservation of water, minimizing wastage and ensuring its more equitable distribution both across and within States through integrated water resources management" (Ministry of Water Resources 2009). As discussed earlier, "Delhi depends on

the river Yamuna for its water needs but the disputes between the basin states of Himachal, Punjab, Haryana, Rajasthan, Uttaranchal and Delhi have made the utilization of the Yamuna contentious" (Mehta 2009, p.32). The National water mission prioritized the cleaning up of river Yamuna. To achieve the same, the Delhi Jal Board took initiatives of constructing the interceptor sewers to trap the waste water and treat it before discharging it in the river. However, the success has been insignificant. The mission also aims at increasing the efficiency of water use by 20% through use of better regulatory measures and differential pricing of water. "Today whether it is the rich or the poor all pay the same cost and while the distribution system in rich areas is better and hence the availability, the same is not true of poorer areas of the city" (Mehta 2009, p.32).

5. Recommendations

"Throughout history, water sources have been sacred, worth of revenue and awe. The advent of water taps and water bottles has made us forget that before water flows through pipes and before it is sold to the consumers in plastic, it is a gift from nature" (Shiva 2002, p.129). Throughout the Indian history, river water has held a special value, the value of being sacred. Rivers are considered as manifestations of divine gods of Hindu mythology. Hence, it is of no doubt that the river Yamuna, a tributary of river Ganga is sacred as well and holds utmost importance in the lives of those which inhabit areas falling in its catchment.

Delhi is one of the cities falling within the basin of river Yamuna. Unfortunately, the dynamic city of Delhi and its ever increasing demand over resources has turned almost every natural water channel and source of water into a drain. Accompanied with the natural decay of rivers accentuated by the apathy of the government, ever increasing population of Delhi, insufficient public initiatives, insufficient Sewage treatment plants, etc. has culminated in an almost complete degeneration of the river and its ecological reserves.

To protect whatever is left of it, there is a dire need to critically re-evaluate the city's existing legislation pertaining to water and sanitation, specifically. Already " 4500 crores of public money has been spent on cleaning the river in past 20 years but not much has changed so far" (Singh 2014, p.04). Hence, the recommendations shall be such that the issues of the proposals in the past and the needs of the future are addressed at the same time. To begin with, historical water sources such as step-wells and large tanks, etc used by the rulers of seven cities of Delhi, which are no more in use, can be explored, in order to help alleviate the scarcity of water in some parts of the city. After all, there is no harm in learning from our forefathers, who seem to have been more sensitive to the environment and sensitive towards the importance of local water resources, than we the 'modern Indians' could ever be. There is an urgent need to trap maximum rainwater at the places, where it falls to avoid further depletion of groundwater.

Last, but not the least, the issue pertaining to the multiplicity of government agencies and overlapping jurisdictions needs to be resolved. A possible path that can be taken to meet the desired end can be the establishment of a single authority for the monitoring, management and regulation of the floodplains of Delhi and its river Yamuna. The new formed authority, shall be the nodal agency with which all the decisions that could affect the river and its ecological reserves would be dealt and the members of the authority to include the representatives of the organizations currently involved in matters of Yamuna. The effort also needs to include the representatives to the States of Haryana, Uttar Pradesh, Jammu and Kashmir and Himachal Pradesh. The authority shall be held responsible for monitoring the levels of pollution in the river, regulating the land use and formulation and strict enforcement of stringent regulations to guide the development pattern in the ecologically important area under its jurisdiction. In order to include the people of the city, people participation needs to be emphasized, by organizing them into neighborhood groups and allocating them with the task of reporting unauthorized activity in the floodplain area. The regulations so framed shall

emphasize on zoning the area according to the sensitivity of the reserve. Activities can be zoned into prohibited uses (like mining, industries, etc); permitted land uses with imposition of controls (like, forestry) and activities that need protection and conservation (like the traditional ghats).

In Delhi, it has been observed that Common Effluent treatment plants, are not being operated to ensure proper treatment of industrial effluent. Regular and stringent monitoring is required with imposition of heavy penalties on the defaulters, along the line of 'Polluter Pays' principle. Further, to ensure 100 per cent treatment of sewage in Delhi, interceptor sewers project and all other STPs must be completed in a time bound manner. It may also be proposed that an increase in the height of Wazirabad barrage say by around 3 meters, to increase the capacity of water reservoir, will not only ensure more potable water but may also, be used for release in Yamuna during dry period. At the small scale, the approach of dual pipeline for the inflow and outflow can be strictly enforced to ensure that potable water is supplied for cooking and drinking purposes and the non-potable for flushing. At the same time using dual pipeline system for collecting the waste water can help reduce the load on centralized waste water treatment plants. The wastewater from kitchen, washing dishes, etc commonly called as grey water can be collected at neighborhood level and recycled using decentralized wastewater treatment systems , for re-use in irrigating fields. Whereas, only the black water coming from the bathrooms shall then be sent off to Sewage treatment plants.

6. Conclusions

Economic development accompanied with urbanization, more often an unplanned form of urbanization is encroaching upon and filling up natural drainage channels and water bodies to use the high-value urban land for buildings, illegal colonies and industries. The subsequent increase in paved area has created city as a 'concrete jungle of buildings' where the soft surface is reduced and the heavy downpours over Delhi run-off to the river Yamuna. Lack of percolation into the ground increases the surface run off and Delhi has been the witness of heavy floods in past. The rainwater is not only getting wasted, it is becoming toxic as it flows over the concrete and ends up polluting the river Yamuna. The pollution levels are further increased by the lack of proper sewerage network and lack of freshwater flow in the river stretch within Delhi. With time, the river and its natural qualities to replenish are degrading and the city agencies are entering into agreements with neighboring states to meet the water demand. The resource within the city lies in neglect. To add to the problems, multiplicity of organizations and lack of clear jurisdictions encourages the blame game and the river continues to be the victim of 'tragedy of the commons'. There is a need to look into the history of Delhi and realize the importance of rain water harvesting structures used since centuries but now lying useless. The city agency need to realize that as much as the river revitalization is important to them, it is of much more importance to the citizens of the city and need to incorporate them in the process. After all, we are all at the guilt for the damage caused.

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[i] This paper is based on extensive research conducted in the city of Delhi, with key informants including a mix of current and former government officials serving the departments which monitor ad manage the river Yamuna and its ecological reserves. The secondary data collected is restricted to the latest figures available.

Spatial-environmental Planning for Coasts and Maritime areas: Greece in the Mediterranean context

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1.Introduction: the Mediterranean Sea, its Coasts and the need for an integrated policy

Coasts and Seas are among the most vulnerable and sensitive ecosystems, and their management presents various problems and difficulties especially in the era of climate change in which coastal cities and populations face serious threats: Rise of sea level greenhouse effect and desertification are making their presence felt ever more acutely as they pose a serious threat to the coastal and marine ecosystems. There can be no doubt that in Greece and the Mediterranean countries coastal and maritime areas are facing ever greater risks from natural disasters and human pressures alike.

In fact, while the Mediterranean's coastal zones account for just 12% of the surface area of the nation-states bordering the Mediterranean, they are home to 33% of their populations. In addition, while the Mediterranean accounts for 7% of the world's population, the tourists who chose to holiday there account for roughly 33% of the world's tourists. (UNEP/Blue Plan 2005). Building construction pressures stemming from tourism are expected to lead to an increase in both the permanent population of the Mediterranean and in visitor numbers, which are forecast to rise from 200 million in 2008 to 300 million in 2025, a leap of 50%.

The situation described above, in particular coastal urbanization and linear development, creates serious environmental problems as well as raising the cost of the necessary infrastructure. Integrated spatial and environmental planning for the coastal and adjoining marine zones is thus essential. There is a great need to look ahead to new organizational structures with a view to a wise management for coasts and seas and therefore the critical issue of the spatial organization of these areas is a key priority for Greece and Mediterranean. There is also an urgent need to incorporate/adapt/codify legislation relating to Spatial Planning in order to coordinate the activities and programs of all the parties involved. The integrated coastal zone planning management remains a complex issue and a difficult project requiring systematic approach and data gathering. In Greece the existing structures in the various ministries, regions, prefectures and municipalities that are usually called upon to solve the problems relating to environmental protection and management, are insufficient.

The paper aims at investigating policies and related planning instruments from United Nations and European Union launched during past decade and still in progress, in relation to an integrated policy for environmental protection and spatial planning of coastal and maritime areas. In this framework the paper is attempting a critical approach for the substantial implementation of the following legal and policy documents -adopted by Greece:
a) the Protocol on *Integrated Coastal Zone Management (ICZM) in the Mediterranean* (UNEP/MAP/2008), b) the Marine Strategy Framework Directive of the European Parliament and the Council on *establishing a framework for community action in the field of marine environmental policy* (2008/56/EC), c) the Communication from the Commission: *Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU*, (COM 2008/ 791, Brussels: EU).

2.International Policy for Coasts and Seas in relation to the Euro-Mediterranean Region

Mediterranean policy -for the sea and the coasts- essentially began in 1975 when the Mediterranean Action Plan (MAP) was set up in Barcelona in the context of the United Nations Environment Programme (UNEP). The MAP, the first scheme of its kind, was set in motion by the UN to protect the planet's regional seas. Structurally, it is comprised of a coordinating unit, which has had its headquarters in Athens since 1982, plus six Regional Activity Centres based in six Mediterranean cities (Split, Palermo, Sophia Antipolis, Barcelona, Malta and Tunis) which occupy themselves with a range of issues and programmes, the most important of which are: a) The Blue Plan / Plan Bleu based in Sophia Antipolis, which seeks to analyse environmental problems and achieve viable Mediterranean development by means of an interdisciplinary systemic approach, and b) the Priority Actions Program/ Programme d'Actions Prioritaires, which is based in Split and focuses on the integrated coastal zone management with an emphasis on solving the problems created by the increasing urbanization of the Mediterranean coast.

It was within the MAP framework that the Barcelona Convention was signed in 1976 by the representatives of the Mediterranean's coastal states in Barcelona. Originally entitled the "Convention for the Protection of the Mediterranean Sea Against Pollution", the convention came into force in 1978; amended in 1995, it came into force in 2004 as the "Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean". It should be noted that a number of sub-regional conventions were signed as a direct result of the Barcelona Convention, and numerous international committees formed with members drawn from neighbouring coastal states and a view to protecting the Mediterranean coast

One of the Barcelona Convention's core functions is the publication of technical protocols on a series of crucial environmental issues (Table 1). One of the recent protocols, the supremely important Integrated Coastal Zone Management (ICZM) protocol, was signed in Madrid in 2008. Although the protocol represents a compromise between the conflicting interests of the states involved, it still constitutes an important legal obligation to protect the Mediterranean coast, and is a realistic document drawn up by a team including representatives of accredited NGOs which takes international experience into account. However, it has been ratified by just three states to date: France, Albania and Slovenia. Innovative and ground-breaking, the protocol is a unique legal instrument on ICZM in the entire international community in the context of the Coastal Area Management Programme (CAMP) and is unprecedented on a regional level (UNEP/MAP/PAP-RAC 2010)

Turning to its content, it is interesting to note that the protocol adopts *inter alia* the spatial -ecosystems- approach, the principle of the *non edificandi* zone and interdisciplinary analysis. We are of the opinion that the protocol would be hard to implement, and that the use of national spatial planning instruments (see section 4) is therefore essential to enable problems to be dealt with and solved, including the need for bodies and measures to be coordinated, for control mechanisms to be introduced with regard to the implementation of the legislation, for land policy to adopt mechanisms for the acquisition, of land to the public domain, and for measures to be taken in the light of climate change. The Coastal Area Management Programmes / Programme Activity Centres (CAMP-PAC) set up in many countries are one of the fundamental means of implementation for the ICZM protocol (UNEP/PAP-RAC 2001) Figure 8 shows the areas where these programmes have been run or are currently running.

Various noteworthy examples of policies and instruments on the national level should also be noted, including the *Conservatoire de l' Espace Littoral et des Rivages Lacustres* (CELRL), a French national protection body for coastal spaces, lakes and rivers set up with a view to acquiring land from the public sector (DATAR 2004)

In parallel and in combination with the activities of the UN and the Barcelona Convention, the EU has undertaken initiatives relating to Integrated Coastal Zone Management in all its member-states. Thus, a pilot programme was set in motion in the late 1990s (1997-1999) whose conclusions led to the submission of a Proposal for a Recommendation (EC 2000a) and the issuing of a Communication (EC 2000b) to the Council and the European Parliament, which made a Recommendation on 30/05/2002 relating to the implementation in Europe of the ICZM (EU-Council 2002). The Recommendation refers to the need for a strategic approach, the application of core management principles, national strategies and cooperation. In 2007, the Commission published a Communication (EC 2007) in the form of a report to the Council and the European Parliament evaluating the ICZM Recommendation in the light of previous evaluations (by the European Environment Agency –EEA- the indicators working group etc.).

Table 1: Protocols of Barcelona Convention

Date (adoption/entry into force)	**Content**
16-02-1976/12-02-1978	Dumping Protocol (from ships and aircraft)
16-02-1976/12-02-1978	Prevention and Emergency Protocol (pollution from ships and emergency situations)
17-05-1980/17-06-1983	Land-based Sources and Activities Protocol
10-06-1982/23-03-1986	Protocol concerning Mediterranean Specially Protected Areas
14-10-1994/Not yet	Offshore Protocol (pollution from exploration and exploitation)
10-06-1995/ Not yet	Dumping Protocol (from ships and aircraft or incineration at sea) (amended the Dumping Protocol of 1976)
10-06-1995/ 12-12-1999	Protocol Concerning Specially Protected Areas in the Mediterranean (replaced the Protocol concerning Mediterranean Specially Protected Areas)
10-06-1995/12-12-1999	Replaces the Protocol concerning Mediterranean Specially Protected Areas of 1982
07-03-1996/11-05-2008	Protocol for the Protection of the Mediterranean Sea against Pollution from Land Based Sources (replaced the Land-based Sources and Activities Protocol of 1980)
01-10-1996/18-01-2008	Hazardous Wastes Protocol
25-01-2002/17-03-2004	Protocol Concerning Cooperation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea (replaced the Prevention and Emergency Protocol of 1976)
21-01-2008/ Not yet	Protocol on Integrated Coastal Zone Management (ICZM)

Source: Relevant Official texts of Barcelona Convention protocols

This document also refers to the reports produced by 14 of the EU's 20 coastal member-states –Greece among them- which had been presented to the Commission. The evaluation revealed that, despite the positive impact made by the Recommendation through its championing of a "more holistic spatial planning", there had been delays and no significant progress. The national reports provided only limited information on the effectiveness of implementation mechanisms, while few countries and regions had contributed to the analysis of the environmental indictors. Moreover, the evaluation report recognized that the environmental degrading of the coasts remained a serious problem, and linked future progress in relation to ICZM with: a) the Green Paper on maritime policy, b) the ICZM protocol within the framework of the Barcelona Convention and c) the INSPIRE directive (2007/2 EU L108) which aims at a combined environmental information system (relevant policy documents in Table 2).

Table 2: Coastal and Maritime Spatial Planning in Europe: Policy Documents

Date	Content	Form
1999	Towards a European (ICZM) Strategy General Principles and Policy Options	Reflection paper
08-09-2000	Implementation of Intergrated Coastal Zone Management in Europe	Proposal for Recommendation
27-09-2000	On Integrated Coastal Zone Management: A strategy for Europe	Communication
06-06-2002	Implementation of the Integrated Coastal Zone Management	Recommendation
07-06-2006	Towards a future Maritime Policy for the Union: A European vision for the oceans and seas	Communication Green Paper
07-06-2007	An evaluation of Integrated Coastal Zone Management (ICZM) in Europe	Communication
10-10-2007	An Integrated Maritime Policy for the European Union	Communication Blue Paper
25-06-2008	Establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive)	Directive
25-11-2008	Roadmap for Maritime Spatial Planning: Achieving Common Principles in the EU	Communication
26-06-2008	Guidelines for an Integrated Approach to Maritime Policy: Towards best practice in integrated maritime governance and stakeholder consultation	Communication
15-10-2009	Progress Report on the EU's integrated maritime policy	Communication

Source: Relevant EU Official texts

As far as the seas are concerned it must be said that since the last decade EU has adopted a strategy comprising a proposal for the good condition of the marine environment. (European Commission 2005a) (European Commission 2005b). This strategy for the sea was incorporated in a broader framework of policy which was launched in June 2006 with the Green Paper “Towards a future maritime policy for the Union: A European vision for the seas and the oceans” (European commission 2006). In 2007 European Commission approved the Blue Paper ‘An Integrated Maritime Policy for the European Union’ (IMP). This paper proposes an ambitious action plan with many initiatives (European Commission 2007). Next year was published the directive 2008/56 “Establishing a framework for community action in the field of marine environmental policy” (Marine Strategy Framework Directive) which constitute the environmental pillar of the IMP and obliges all member states to achieve good environmental condition of their seas until 2020.

In November 2008, in the framework of this policy the Commission announced a ‘Road Map for Maritime Spatial Planning: Achieving Common Principles’ (European Commission 2008). According to the Communication the Maritime Spatial Planning (MSP) constitute the principal means for the implementation of the IMP by contributing in the coordination of the action of all bodies involved for the benefit of the development and the protection of environment. Road Map encourages the promotion of the MSP at national and European levels in combination with two other horizontal tools: the unified surveillance of the seas and a strong data and knowledge base. Furthermore, ten principles for the SMP are adopted as the cohesion between land and sea planning, the trans boundary cooperation, the legally binding character of the SMP etc.

According to IMP *“ The SMP is a fundamental tool for the sustainable development of maritime and coastal zones as well as for the restoration of Europe’s of marine environment*” (European Commission 2007). It has to be noted that SMP has a three dimensional character because it deals with all uses and activities (on the surface of the sea as well as in the water column and the sea bed) which are often competing (e.g. fisheries, transport, aquacultures, leisure, tourism, energy production, oil extraction etc.). Furthermore SMP must be combined with the Integrated Coastal Zone Management (ICZM). A similar combination must be realized with all other EU policies which influence the maritime space.

The Road Map also reveals the need for SMP to be related with other international policies like

a) the protocol of London Convention adopting the precaution principle concerning wastes b) the very important United Nations Convention on the Law of the Sea –UNCLOS signed in 1982 in Montego Bay. UNCLOS adopts the Exclusive Economic Zone (EEZ) which is extended 200 nautical miles from the territorial waters. EEZ is a zone of exploration and exploitation of all natural resources from the surface to the bottom of the sea. In this regard it replaces the concept of Continental Shelf which is based on geological terms.

Finally it must be noted that many actions for the benefit of coastal and maritime space are undertaken by NGOs of environmental character and local and regional authorities. An characteristic example is the Conference of Peripheral and Maritime Regions (CPMR) which comprises 161 regions as members, belonging to 28 countries representing 200 millions of people.

3.The case of Greece. A Critical Approach to the Existing Situation and Spatial Planning Efforts for Coastal and Maritime Zones.

In formal, official terms, Greece, a EU member-state, is considered a developed nation in accordance with every UN human development index. In essence, however, Greece is geographically part of the Balkans, south-eastern Europe and the Mediterranean, with all that entails in terms of influences from neighbouring states. Due to its geopolitical position, but also to its domestic policies and cultural and social traditions, Greece has problems which relate to its political system, its productive infrastructure, its administrative organization, to the development or research and technology and—above all—to the organization and planning of its space: urban, rural and special categories like coastal space.

That Greece has more coastline than any other European or Mediterranean country is a fundamental consideration in its spatial planning as well as its environmental and developmental policies. In fact, Greece has over 3000 islands and islets which represent 20% of its surface area and 14% of its population. In Greece, with over 15,000 km of coastline, every square kilometre equates to 114 m of coast or “sea front”, compared to an EU average (27 member states) of 6.5 m, and a world average of just 4.3 m! The Greek coastline accounts for roughly a third of the entire coastline of the Mediterranean, and to almost a quarter of that of the EU (27 member states) (Karyotis 2010) With over 70% of Greece’s population and over 90% of its tourists concentrated in its coastal zone, the possible consequences of climate change are likely to render this zone especially vulnerable to flooding and rising sea levels.

Recognizing, analyzing and interpreting the structural features of the coasts is an essential prerequisite for any institutional regulation and planning which seeks to bring about their viable and integrated protection and development. A study of the brief history of spatial planning in Greece reveals that the regulation of coastal space (institutional instruments, planning techniques etc.) has mirrored the course of spatial planning in general, which, due to social, economic and technological developments, has moved from small- to large-scale regulation. Thus, initial efforts sought to address the problems facing the coastline—meaning the coastal zone where water met land—with corresponding legislation (Law 2344/1940, later replaced by Law 2971/2001). Then, in the early 1980s, Law 1337/83 sought to tackle the problems of unregulated construction and access to the sea in a 500-metre coastal setback zone in which enclosures were forbidden. Finally, from the 1990s on, the focus has been on regulating the spatial organization of the coastal zone in general and on instituting new zones (in addition to those mentioned above) with a view to integrated coastal zone management, the removal of conflict between different land uses, free access to the sea and the regulation of pedestrian and vehicular traffic. The development of the core legislation (not including previsions from other legislation dealing indirectly with coastal zone) is summarized in Table 3.

Table 3: Core legislation relating to Greek coastal zone

Date	Type and content of institutional regulation	Comments
1940	Compulsory Law 2344/1940 "On the Sea Shore (foreshore and backshore)" OGG 285/2001	
1983	Law 1337/83 Articles 23 & 24 "On the protection of coasts and coastal roads", OGG A33/83	Never implemented
1984	Presidential Decree 236/84 "On enclosing coastal land", OGG 95/84	Never implemented
2001	Law 2971/2001 "On the Sea Shore (foreshore, backshore etc.)", OGG A285/2001	
2012	National Guidelines for the Spatial Planning & Sustainable Development of the Coastal Zone - Ministerial Decision	Not yet approved

Source: Relevant issues of the Official Government Gazette (OGG), Hellenic Ministry for the Environment, Physical Planning and Public Works (in 2009 was renamed: "Ministry of Environment, Energy and Climate Change"

The coastal zones and the regulations applying to each will be examined in more detail below.

3.1 The Sea Shore: Foreshore and backshore zones

The foreshore (the 'amphibious' part of the coastal zone exposed at low tide) and the backshore are the most sensitive and critical coastal zones from an ecological and environmental as well as a social, economic and developmental point of view. The space of the foreshore is delimited by nature. According to the current legislation: "The foreshore is the zone which is wet by the largest non-extraordinary waves" (Law 2971/2001/OGG A285/2001). In contrast, the backshore is a social product defined by the state ("The backshore is the terrestrial zone added to the foreshore which is defined as having a breadth of up to fifty (50) metres from the upper limit of the foreshore to serves communication between land and sea and vice versa"). As spatial zones, the foreshore and the backshore are organically and functionally linked. There can be no foreshore without a backshore, which is the functionally public space necessary for enjoying the environmental and social good of the foreshore and for providing free access to it.

Law 2344/1940, the first legislation that sought to regulate the foreshore and backshore zone, dates back to the end of the interwar period and was ground-breaking for its time. It would be amended on several occasions during what would prove a long active life (over 60 years), the most important amendment, from an environmental point of view-in view of the accelerated urbanization of the coastal zone during the post-war period (see the following subsection) - being the institution of a new and larger backshore width (raised from 30 to 50 metres) in 1983. Clearly, this initial legislation could not foresee the developments to come in the contemporary period, which included tourist development, coastal erosion and a rise in sea-levels due to the greenhouse effect.

Still, the efforts which began in the early 1980s to thoroughly overhaul the special legislation relating to the foreshore were slow in bearing fruit, delaying the process excessively until the first decade of the 21st century. And while the Hellenic Ministry of Finance sought to modernize the relevant institutional framework in technical, administrative and bureaucratic terms, despite the last-minute amendments, the new institutional framework ultimately proved unsuccessful both in ensuring the public good it was supposed to have defended, and in ushering in genuinely new conditions. For instance, the institutional protection provided for coastal zone could have been bolstered—as the circumstances of the age demanded, with the proliferation of building without planning permission—by legally setting the coastal setback at a minimum of 50 metres from the upper limit of the foreshore.

To be truly effective and beneficial, any legal framework governing the space, development and environment of the foreshore and backshore would have to take a contemporary and innovative approach to land policy issues. For instance, the provisions relating to the expropriation of property in the backshore zone would have to come packaged with the means

(financial resources) for purchasing these properties. Otherwise, other land policy instruments will have to be found for acquiring the backshore land, which must, in accordance with the core aim expressed by the law itself, be both public and for common use. Moreover, on a larger scale, the zone must be spatially and geographically linked to the coastal zone as a whole—of which the strip comprised of the foreshore and backshore constitutes a spatial subset—to an adequate depth both landwards and seawards.

3.2 500-meters coastal setback in which enclosures are- in principle-forbidden

Law 1337/83 on the extension of cities and settlements, which formed the basis for the Urban Reconstruction Operation, also included provisions relating to the protection of the rural environment, primarily through the institution of the Controlled Construction Zone and the 500-metre setback from the coast in which enclosures were forbidden, both to protect the coasts and to ensure access to them—a perennial issue in Greece. This second provision has proven of critical importance in protecting the coastal zone, even though it has not been applied as widely as expected, despite the importance of the issue for Greece and Greek public opinion being supposedly sensitive to the issue of 'liberating' the nation's coasts. These innovative and radical provisions addressed two issues as crucial in today's social context as they were then:
a) The exclusion -as the rule- of enclosures in a 500-metre setback zone from the shoreline intended to ensure free access to the sea; in those cases were enclosures were permitted, guidelines were provided for their positioning and construction in accordance with the use to which the enclosed land was to be put. It should be noted that the Presidential Decree was formulated and published with the application of this provision specifically in mind;
b) The creation (through the expropriation of privately-owned property for the public good) of public access routes to the sea and the shore. These routes are chiefly foreseen as pedestrian, without this precluding the creation of roads for vehicles with the required parking spaces but without provisions for roadside plot divisions and building constructions. It should be noted that the law foresaw the demolition of existing enclosures blocking access to the coast -a radical measure by the standards of the time- as well as the removal of buildings on the shore and the transfer of the ownership of these buildings to the local authorities or to organizations for the public good until their demolition. However, while these provisions were considered reasonable by all parties and satisfied the 'sense of public justice', they have -with very few exceptions- not been applied, due to the familiar inertia and involvement of the governmental bodies and the corruption and clientelism of local politics. However, this does not rob the provisions of their importance even today, since all remain in force and can be activated at any time, demonstrating once again that Greece has a well stocked and well-provisioned -though inactive, unused and sometimes undermined- spatial planning armoury.

3.3 Zones foreseen in the national guidelines on coastal areas

The need for the coastal zone to be organized and administered in a more integrated way and on a larger scale in the context of the guidelines laid down in international and European treaties and conventions necessitated the drawing up of national guidelines on the basis of an institutional instrument foreseen by Law 2742/99: the Special Framework for Spatial Planning and Sustainable Development (SFSPSD). However, although drafting of the framework -which addressed Greece's coastal space and islands- began in the late 1990s and the result was presented in 2003 as emergency legislation on Greece's coastal and island space, it has yet to be implemented. The latest version of the Framework, which was submitted to the Ministry of the Environment for discussion in 2009, is substantially different from the original, due to developments in international and European-Mediterranean space, as well as to changes in Greek spatial planning policy.

Specifically, the Framework now adheres to European models in promoting Integrated Coastal Zone Management (ICZM), defining the coastal zone more broadly both landwards and seawards, and introducing a three-way division of the coastal area into critical, dynamic and other/transitional zones, all of which have a terrestrial as well as a marine section and are subject to different provisions with regard to permissible construction and land uses. The landward limits of the transitory zone extend as far as the administrative boundaries of coastal municipalities, though not beyond or further than the 600-metre index contour line. These zones constitute the hinterland of the foreshore zone, and are equally important for the functioning of the coastal ecosystem and for the production activities that take place there.

Undoubtedly, the Special Framework (national guidelines)for coastal areas is both necessary and useful for planning, since it can coordinate and incorporate the existing regulations governing the foreshore and the 500-metre enclosure-free zone. Still, although it regulates construction in each coastal zone in detail, the Framework does not reference the aforementioned coastal legislation and correspondences cannot be drawn between the two. In addition, the framework does not seem to correlate satisfactorily either with the already approved Special Framework (national guidelines) on Tourism or with regional and local spatial plans.

However, quite apart from problems of internal cohesion and organization, the Framework seems to fail to address substantial issues relating to the degree of protection it provides for the coastal environment: its retention, for example, of a 50-metre setback from the shore for buildings in place of the 100-metre zone enforced in other countries, and its failure to ban roads running parallel to the coast, despite the pressure they exert for road-side constructions being extremely well-documented. It should be noted, too, that other Mediterranean countries (like Italy, Spain and Portugal) have introduced stricter provisions in relation to building on the coast (greater setbacks, stricter control of land uses etc.), while the Framework's provisions aimed at reducing the coverage coefficient in the dynamic zone in relation to the institutional framework for spatial planning in general remain somewhat ineffective.

3.4 Integrated Spatial Maritime Planning

According to UNCLOS Greece has sovereign rights in extended maritime zones the surface of which is larger from that of its inland. The EEZ of Greece incorporates an important part of central Mediterranean with considerable environmental and economic value. In the territorial waters zone there is a constant conflict between the various sea uses characterised by the involvement of many bodies and the lack of coordination of the competent public authorities. In Greece SMP, as defined above, has not yet started up. There is no specific legislation nor a substantial initiative on behalf of public institutions although the above mentioned Road Map provides clear guidelines on the matter. However some sectoral policies (e.g. concerning fisheries) as well as some institutional and planning tools can contribute to improving the situation. It is worthy to mention the Special National Plan for Coasts and Islands (under preparation-not yet approved) in which SMP could be incorporated. Besides, in the Greek institutional framework exist various kinds of zones of environmental protection which can be designated in maritime areas (protected areas: marine parks etc) (laws 1650/86, 3937/2010). Furthermore in the sectors of fisheries, tourism and energy there are regulations which must be combined and harmonized within the framework of SMP.

4. Conclusion

In an era in which the greenhouse effect and desertification are making their presence felt ever more acutely as they pose a serious threat to the coastal and marine ecosystems in Greece and the Mediterranean, we need to look ahead to new organizational structures with a view to integrated planning for coastal regions. The 'usual' offices in the various ministries, regions, prefectures and municipalities that are usually called upon to solve the problems relating to demarcation, protection and administration are insufficient, as a result of which the all-

important issues of coordination and cooperation between the bodies involved and the drafting and application of policy are totally ignored by the proposed regulations as they stand, which all fail to deal with the critical and important issues relating to the policy of creating a reserve of public land for the protection of the coastal environment.

To date, management by means of a powerful and inspired national programme -significantly absent from the post-war planning landscape- has not served to redress this state of affairs. With the experience amassed thus far and the requisite political will, the legal and technical solutions can be found to create free common spaces in the backshore zone, and to do so without burdening the public purse excessively. In the coastal zone, an area beset by problems of land ownership, it is essential that a special mechanism be put in place for their solution, meaning something similar to the French Conservatoire du littoral adapted to the Greek situation, which will help in the drafting of a well thought-out spatial planning policy for our coasts and provide the means for its application.

There is also an urgent need to incorporate/adapt/codify legislation relating to Spatial Planning in order to coordinate the activities and programmes of all the parties involved. The integrated coastal zone planning management remains a complex issue and a difficult project requiring systematic approach and data gathering. This will have to lead to the drawing up of a strategy which will be in accordance with and make active use of the favourable provisions included in the international conventions and EU guidelines as well as in the Blue Plan produced by the UN Mediterranean Action Plan to make it possible –within clearly limits- to protect and develop a valuable natural resource of vast environmental and socio-economic importance.

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Natural Core of Belgrade - Urbanization for Sustainability

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The "Natural Core of Belgrade" Study (Study) contributes to long term Belgrade Waterfront research project, but focuses on the important question: is there a sustainable solution for the development of the 200 ha of the beautiful, mostly natural waterfront area of the European Rivers Sava and Danube, in the heart of the capital city?

The area in focus is the confluence of rivers Sava and Danube, with its close riverfronts: the unique, preserved, natural landscape, surrounded by urban structures. The City of Belgrade Development Strategy (2011) and later Belgrade General Urban Plan (in procedure) formally labelled this area of the city as the "Natural Core", one of three main elements of the city's European identity, the point of its recognition among competitive cities along Danube. As a unique city icon, it has been studied over time and designed in different contexts and occasions, and the latest Study by the Urban Planning Institute (UPI) of Belgrade treated it as a city development resource in context of overall sustainability.

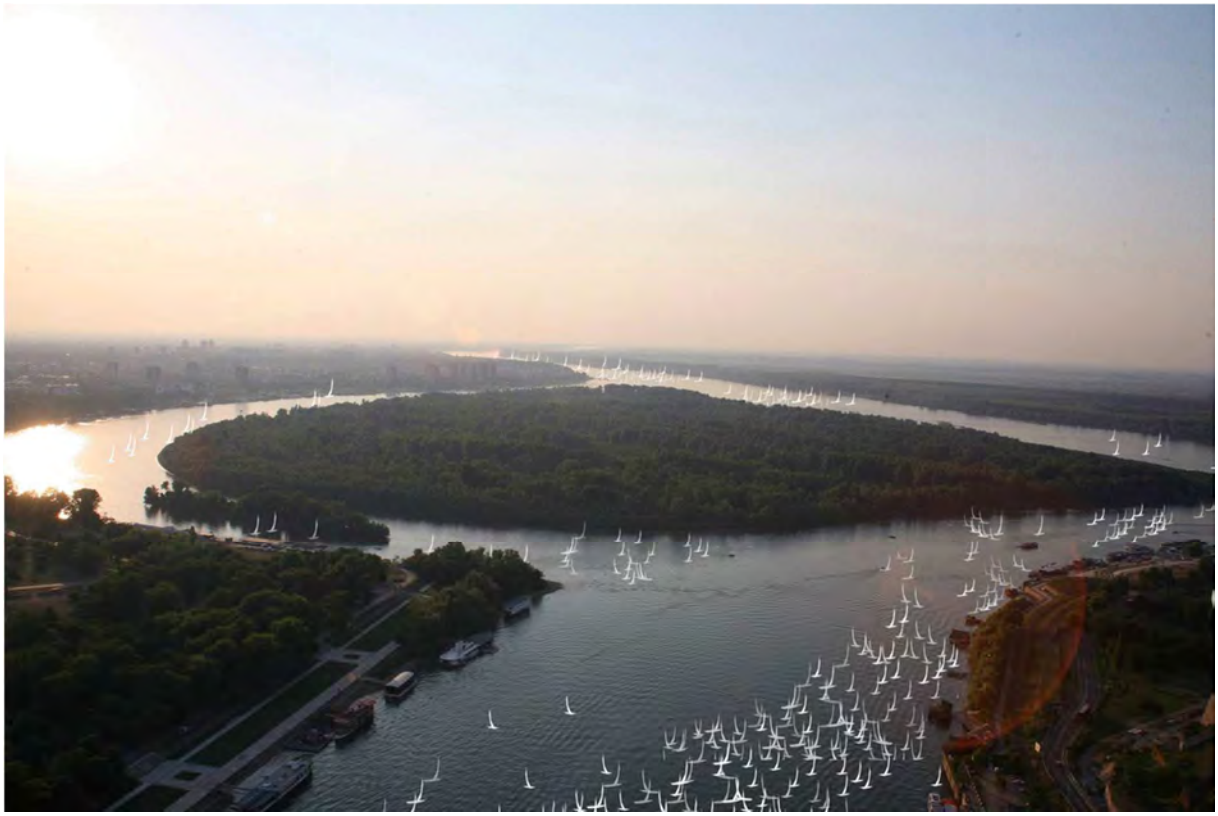


Fig.1 –Maša Bratuša: Metaphoric scene „Boats in the Confluence" in „Water Land" scenario, Workshop in UPI, City of Belgrade Waterfront Study, II Phase, Natural Core of Belgrade, UPI, 2011

1. Context

Following the global trends of the XX Cent., the City of Belgrade has studied its waterfronts in aim to develop the planning strategy, since the year 2003. The first phase of the *Study* addressed the quantitative and qualitative analysis of the two rivers in the city administrative boundaries, providing arguments for planners to focus on rivers and their waterfronts as the

main resources for the further city and metropolitan area development. Although almost 200 km long, Belgrade still did not integrate its riverbanks, and the fact that they are longer than the whole Montenegrin coast was the trigger for planners and the local governments to start actions in planning, using, and promoting rivers for tourism, leisure, and transport and the waterfronts areas for the city marketing.

The *Study* was also important for the promotion of Belgrade as the destination for investments, as in "Financial Times" Real Estate competition of European Cities and Regions. The City was represented by the inner city development Master Plan (M. Ferencak, Z. Gligorijevic, 2006), where the basic concept of "Three Cores of Belgrade" promoted the main elements of the city identity: authentic natural core, three historic urban cores around it, and the spaces of industrial heritage and undeveloped waterfront, in between first two. The history of Three Cores represents the history of Central Belgrade that makes that dramatically interesting landscape even more attractive for investments. Belgrade gained the title South European City of the Future for 2006/07 and started active campaign for attracting developers.

The overall waterfront study was finalized in 2008, the year when Global financial crisis was affecting Europe, but Belgrade has still been an interesting destination for important international projects. Names and offices like Daniel Libeskind Studio, NYC, and Ghel Architects, Copenhagen, joined efforts in the Master plan for the Danube Port redevelopment in 2009; ABBA Consulting, Belgrade, presented Sava Shipyard redevelopment project, and the City organized few international architectural design competitions, such as the one for the design of Beton Hala Centre, in the old Sava Passenger Port (City of Belgrade and UPI, 2010). Most of these projects were incorporated in the Revision of the Belgrade Master plan 2021, adopted in 2009, optimistically proposing Belgrade High-rise study for the new developments, raising density, enabling new greenfield developments along the ring-roads, brownfield redevelopments in the inner city area, etc.



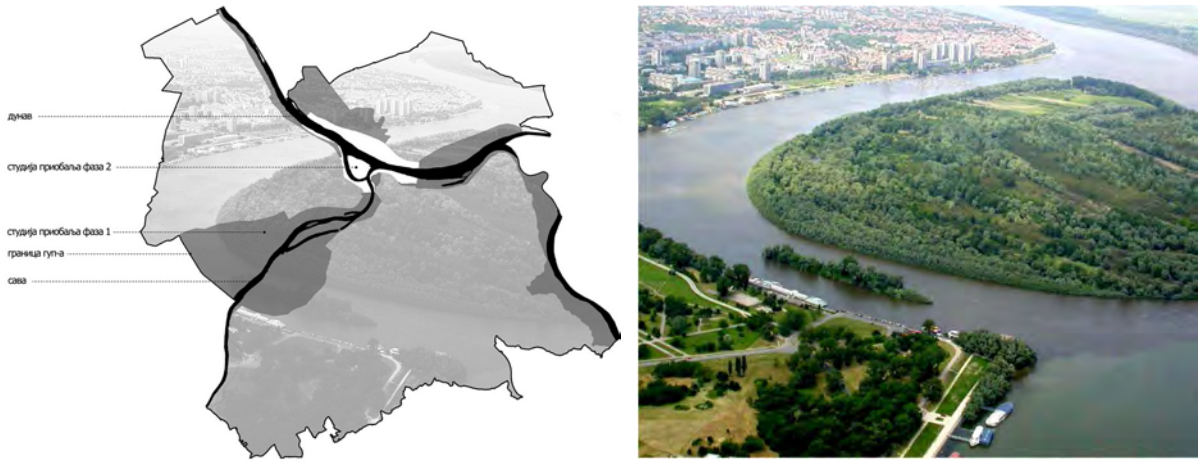
Figs.2, 3 – The Port of Belgrade redevelopment Master Plan, Daniel Libeskind Studio & Ghel Architects, 2009; and Beton Hala Centre Winning design, Sava Passenger Port, Sou Fujimoto Architects, 2011

Only few months after the optimization of the city General Master plan, the consequences of the crisis made developers pause or move their businesses, and planners change the focus to new challenges: environmental threats, floods, climate change, carbon footprints, energy efficiency, etc. The need for new jobs became an issue as well, making planners think about local economy as a vital constituency of sustainability. There was an excellent occasion for the Urban Planning Institute to start the second phase of the Waterfront Study, following the action plan from the City Development Strategy, to express and develop the idea of the Natural core of the City and, at the same time, to open the discussion about environmental topics and sustainability in the Global paradigm change in city planning. The work started based on the common methodology, involving all possible stakeholders in aim to gather impressions, ideas, knowledge and visions related to the important city natural area, surrounded by the urban matrix.

Fortunately, the Natural Core and all its elements were kept in all the strategic and urban city plans, including City of Belgrade Development Strategy (2011). It was promoted as the main element of the Belgrade European Identity, together with the Belgrade Fortress, and should be explored, developed and promoted in the same manner. The team explored possible scenarios of its future maintenance and development.

2. The area, motives, and objectives of the *Study*

The area of the *Study* covers app. 2050 ha, out of which 800 ha of water, 10 km long part of Danube River that differs in width from 450 to 800 m, and app 2, 0 km of Sava River, 250m wide. Although the area in focus is surrounded with the “lungo fiumo”, pedestrian path along the riverbanks, and makes the natural “whole”, it was divided in 13 zones for the purpose of efficient research. The notion “waterfronts” in this research stands for: riverbanks with their all hydro-technical structures, related and belonging land, planned, arranged, and developed for different uses and facilities that predominantly gravitate to rivers, and the rivers themselves, waters with all the river islands and armlets.



Figs.4, 5 – City of Belgrade Master Plan Area and the Natural Core aerial photo (Confluence of Sava and Danube Rivers, Great War Island and Park Prijateljstva, New Belgrade, from the UPI archives)

Motives for the *Study* were numerous, diverse, complex, from different fields and sometimes controversial, as the area itself. It consists of several historic and natural monuments, like Belgrade Fortress, national landmark, located on a hill overlooking the confluence of the Sava River into the Danube. The Romans were the first to build a fort at this site in the late 1st century AD. The Great War Island, the symbol of the city and the protected monument of nature (2005),[i] in picturesque landscape, with habitats of protected species and rare natural settlements is the next attribute of the site. Two international rivers and two transportation paths are merging under different jurisdictions; different urban areas with functionally, aesthetically, and technically different riverbanks are merging in this rare natural basin, still in the heart of the big city; the riverbanks are sometimes not quite accessible, and waterfront areas are sometimes lacking attractions for diverse population, etc.

In the early 2000s, speculations concerning the future of Great War Island emerged in public, including the ideas of turning it into a grand amusement park, possible relocation spot for the Belgrade Zoo, or ethno-park of international native cultures, in which case the island would be renamed to “The Danube Island”.[ii] The need for the sustainable solution and the strategic decision has been the research motive since that time.

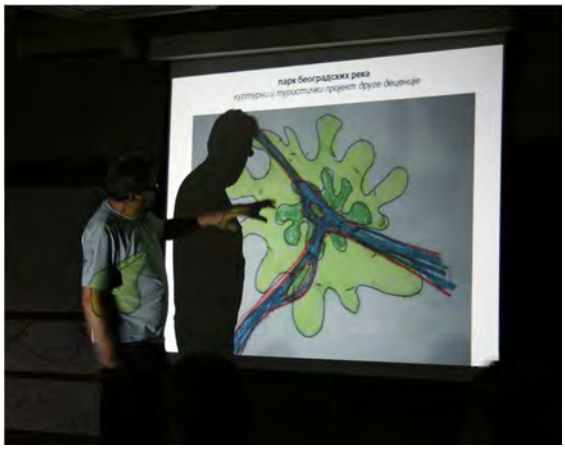
Last but not least, there is a need for cooperation between cities on Danube, on numerous topics, from common management to shared environmental issues, where this *Study* can be the base or the argument for discussion for EU funding.

The main goal of the *Study* was to explore and to offer possibilities for the sustainable and feasible development that provides: heritage maintenance, use of resources, natural disaster mitigation, creating chances for the contemporary and green construction, investments and use, broad education for local population, promotion of the national and local values, and finally, creating opportunities for new activities, products, and jobs.

3. Methodology and the process

In search of the widely acceptable answer to the rather demanding inquiry, the UPI team used a complex, innovative research method, similar to corporate planning, that involved various experts: hydrology engineers, geologists, biologists, ornithologists, transportation planners, architects, artists, landscape architects, psychologists and public opinion, in all phases, from analyses to synthesis. The team of about 20 researchers tried to mediate conflicting standpoints and to evaluate arguments for different development scenarios for the area, assuming moderate economic growth of the city and the region in the forthcoming 20-year period.

The basic hypotheses of the research were: the area should be maintained as the natural resort, with recognizable meaning and function, the entirety of the predominantly public space with new, attractive, meaningful services and activities, especially on the riverbanks.
Part of the process was the open discussion with academics, professionals, institutions, and decision makers, about the future character, design, and use of the area. The poll included more than 35 state and city institutions, 25 professionals, and more than 1000 citizens of Belgrade, explaining their habits, emotions, and expectations from the area. Such a wide poll and the involvement of all the professional institutions and the city authority, in several cycles of discussions, were prerequisite and the warranty for the feasible and sustainable proposed development solutions. Several sources were consulted in aim to provide that proposed vision would be the articulated intersection of different interests, innovative in topics, tools, and methodology.

Figs. 6, 7 – Creative Workshop in Urban Planning Institute of Belgrade, September 2011

The workshop on development scenarios for the research area was especially creative. It involved four multidisciplinary teams of architects, artists, planners, geographers, mechanical engineers, environmentalists, biologists and archeologists, from private, civic and public sectors, practice and academia. First part was the learning process: about the history of the site, area in question, technical issues, water management, natural conditions, planning restrictions etc. The second part was the inspiring boat and field trip organized to build partnerships between co-authors, guided by planners and specialists. The third and the most productive part was the workshop itself. The results, thirty thematic analyses with presentations on all the aspects of the research area and four scenarios of the proposed development for the Natural Core were evaluated and incorporated in the proposed development scenarios.

The *Study* consists of four parts: the basics, starting points, the development scenarios, the program vision by zones, and the action plan for the implementation. The Vision of the area was prepared through the synthesis of the proposed scenarios by zones, and is one possible development vision for the Natural Core as a whole and in parts.

Finally, the *Study* offers explanation for criteria of the scenarios' evaluation and proposals for the further implementation of the vision, including so called "small" interventions as a set of ideas for the fast improvements in limited budgets.

4. Building the sustainable vision

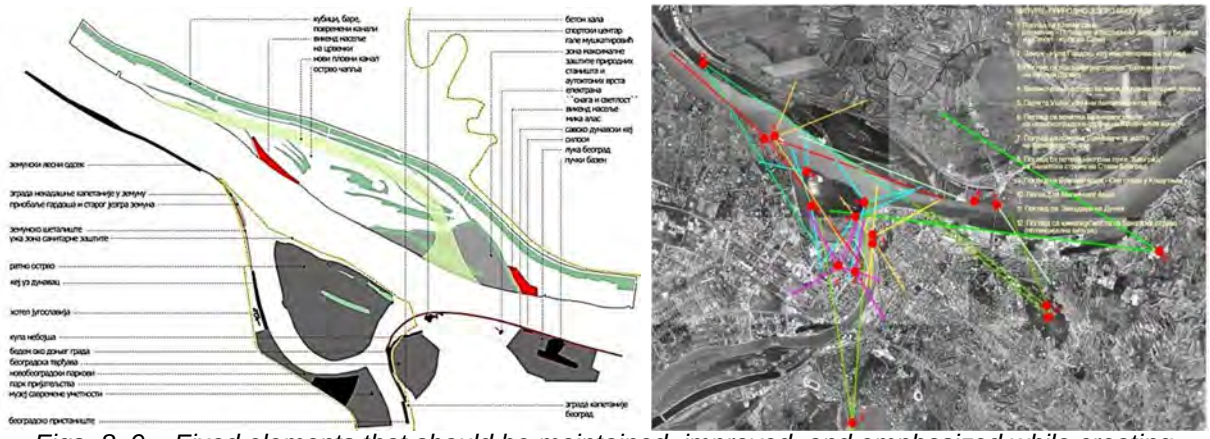
The basic postulate of the *Study* was that Natural Core of Belgrade was the important city area that should be explored, planned, and developed in an environmentally, economically, and politically sustainable manner, aiming to contribute to the significant historic identity of Belgrade.

The first step in defining objectives for the project was to involve public opinion by asking 1000 Belgrade citizens between the age of 18 to 60, what were their habits, their needs, and the expectations from possible intervention on the rivers, riverbanks and waterfront (Research Report, *Ipsos Strategic Marketing*, Belgrade, and July, 2011). Over 90% of the respondents visit the rivers regularly, majority for the leisure and just walking, mostly in Ada Ciganlija, „Confluence" and the Zemun quay. Summer afternoons and evenings were noted as the most appropriate times for visits, the majority of people came to the riverbanks by car or using public transport. The most appreciated characteristics of Belgrade riverbanks were: open air, vastness, natural landscape, surrounding water, the ambiance „given by nature".

The next important activity was to define *tendencies* and *objectives* of the activities related to improvement of the Natural Core of the City, which was challenging for their similarity. The aspirations, tendencies advocated by this *Study* were components of the desirable sustainability of the Natural Core of the City. The objectives are real, concrete intentions, activities in maintenance, arrangement, design, and development of the area, whereas tendencies should be the attributes of the action applied in achieving the objectives (V. Macura, 2011). Two notions are closely related, where each action in achieving the goal should contribute to the specific characteristic of the Core.

The list of objectives was established in aim to be feasible, based on the existing planning documentation, results of the public opinion survey, reports of the professional teams, and the assumption of the economic development of Belgrade in the next two decades. They were: raising accessibility to rivers and riverbanks (a), protection of cultural and natural heritage (b), establishment of the new touristic and recreational areas (c), opening possibilities for the new constructions (d), improvement of water management, and the maintenance of the waterway (d). The list of tendencies (towards sustainable Natural Core) is: strengthening of the symbolic function of the Natural Core, Services adjusted to human needs, beautiful and arranged city, economic feasibility and efficiency, EE and renewable energy. One more argument in favor of the high aesthetic component of space comes from the Competition regulations given by HOLCIM Foundation for sustainable constructions, where the contextual and aesthetic influence makes one of the five elements of the notion „sustainability". The aesthetic demands have the strongest support and promotion in theoretical, esthetic, and practical fields in development of the better, nicer space.

Another important decision was made by establishing Fixed elements of the Natural core, the constituents of its already formed identity: in functions, structures, forms, and systems, natural or man-made, recently or in ancient history. The team imposed 31 elements related to the area and presented them to expert – groups, individuals, and institutions involved in the research, in aim to restrict developing ideas and activities that might threaten each of them, as the inherited value of the Natural Core of Belgrade (*Fig.8*).



Figs. 8, 9 – Fixed elements that should be maintained, improved, and emphasized while creating developing scenarios for the Natural Core area, and the most important views to and from the area

5. Ideas and Scenarios

The *Study* team led overall analyses of the various spatial elements, including comparative analyses of Cities on Danube and their riverfront planning and management. From Ulm on the North, Regensburg, Linz, Bratislava, Gyer, Budapest, Novi Sad, Turnu Severin, Braila, to Galati in Romania, the planning team compared: topographies, urban typologies, land uses, landscapes, and activities that create relations between the city and the water. This parallel research confirmed the hypothesis that there was no city on the whole Danube basin with even similar geographical position as Belgrade. The second important conclusion was that natural environment was an important economic, social, and ecological potential that can be integrated with other compatible uses like culture, sport, or leisure, which all could be developed in the research area.

Research team was then studying planning history of the site, cultural and natural heritage, hydrology, archeology, and sociology, explored chances for sustainable tourism, leisure and sport activities, new city economy, renewable energy and carbon neutral development, urban farming, river transport, etc. and proposed development scenarios. Arguments were shaped in context of climate change, context-related sustainable constructions and landscape design, energy issues, need for constant promotion of existing values and education on sustainability, economic arguments for environmentally friendly based development, etc.

One of the research context contributions was the proposal given by the “League for the Ornithological Action of Serbia”, combining protection of nature, education, and the specific type of tourism development. The organization is protecting the birds through the preservation of their species, habitats and sites; it campaigns for the conservation of birds and biodiversity of Serbia, and is dedicated to education of local people about the importance of protection of birds and enjoyment in bird watching. From threatened Pygmy Cormorants and Saker Falcons to majestic White-tailed Eagles, Belgrade certainly offers an exciting birding experience. Ornithologists have recorded 127 bird species within the urbanized areas, where the “Great War Island” island harbors 196 species, practically within the heart of the city. The wider Belgrade area provides habitats to over 220 bird species that by no means represents the final number.[iii]

Another interesting contribution to the research was the continuation of the international Project „Danube River Park on the New River Island “Heron”, within international collaboration project “City to City”, between Belgrade and Florence. It was established in Urban Planning Institute of Belgrade (M. Ferencak, V. Macura, E. Dimitrov) in year 2003, and further developed with R.Palosha, G.Ruffini, and P.Moscatto in 2008, with the Municipality of Florence and the University of Florence. The main idea was establishing a new, the most natural park of Belgrade. Its green massif and channels system encircles water spaces and parks core of Belgrade. Intensive activities of the city center should take place around the

green and river space central point - and not inside of it. The new area, the central point of Belgrade stays designated to parks, recreation, tourism and maintenance of the ecological system and knowledge. Green spaces should be permanently protected and upgraded. The solution of the big navigable canal was given up, replaced by the network of small canals for sport and recreational boats, with new lakes in the background, in aim to control water regime. There was a possibility to develop the rows of floating homes with specially determined features in the new lakes.



Figs. 10, 11 – Danube River Park on the New River Island "Heron, 2010, and the renewed idea about constructing new Danube Waterway, 2011

This time, in year 2011, the research question was: is it possible and feasible to imagine and develop the previously abandoned idea of establishing the new Danube waterway? It would be organized close to the embankment of the left bank of Danube, making the area of "Heron" a new Danube Blue Green Park, free in the wide riverbed of Danube for the recreation and leisure on the water? This brave hypothesis was developed in consultations with the relevant scientific Institute, "Jaroslav Černi", and was presented and evaluated as one of the development scenarios.



Fig. 12, 13 – Zemun urban landscape seen from the Danube, and development idea from September Workshop

The proposals of four multidisciplinary expert teams, as results of the creative Workshop, were inspiration and the base for the later elaboration and evaluation by the *Study* team and involved institutions. Each team developed a consistent idea that was developed in narratives, collages, drawings, action plans and presentations. Their four creative concepts were evaluated, according to the established criteria, objectives of the *Study, and the most* acceptable solutions were incorporated in UPI proposals for the implementation (Table 14).

Scenario activity/objective	Implement all	„Park of Belgrade Rivers“	„Rhythm Beo-Riverbanks“	„Water Land“	„Discovery Of the Belgrade Core“
Accessibility	***	***	**	*	**
Protection of natural heritage	*	**	**	***	***
Protection of cultural heritage	**	**	*	***	*
New tourism and leisure capacities	*	***	***	*	***
New Constructions	***	*	*	***	*
Improvements of Water management	*	***	*	**	**

Table 14 – Evaluation of the 4 expert-groups scenarios and grade according to the main criteria for sustainable program and design solution for the Natural Core area



Fig. 15, 16 – Concepts “Water Land” (Vladimir Milenkovic team) and “Rhythm of BEO Riverbanks” (Zoran Djukanovic team)

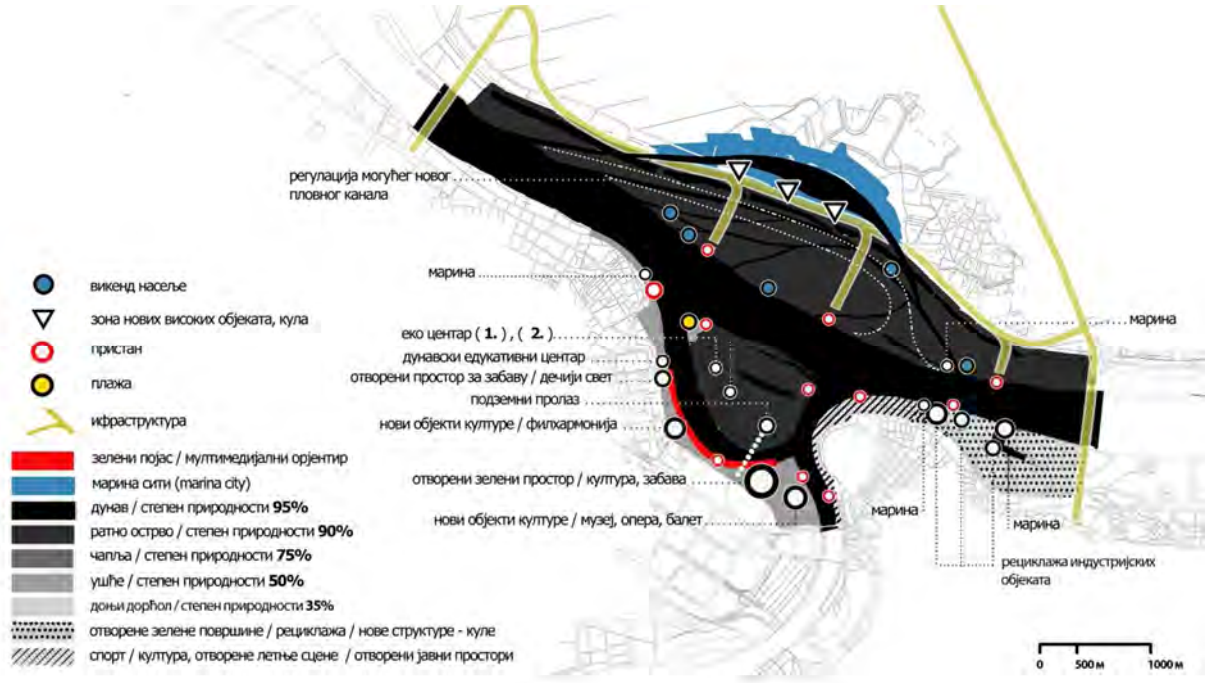


Fig. 17 – The Synthesis of the 4 creative concepts

The UPI research team was developing scenarios based on the professional knowledge, actual planning ideas, suggestions and initiatives from the institutions, city secretariats for culture, environmental protection, tourism, water management, green management, etc. The proposal for each of the 13 zones consisted of integrated solutions that were offered by experts, citizens, or institutions during the research and all of them are proposed desirable solutions. Since the main function of the UPI is to serve as the consulting office for the City of Belgrade in fields of urban and regional planning, there has been a sense of common ground in envisioning the future of the city. The gap between the desirable and feasible solutions is sometimes hard to bridge and therefore the UPI team offered the action plan for implementation of the results and proposals, and a set of “small interventions”. There is a list of achievable proposals for immediate actions, temporary use, or in the low budget situations for the local or the city community. These actions, in the “urban acupuncture” manner, were not only meant to punctually improve the conditions of the riverbanks and the joy of using them through realization of the short term projects, but also should support the common vision, hold the enthusiasm, improve the ambiance, and keep the level of energy involved in this project for all parties and stakeholders.

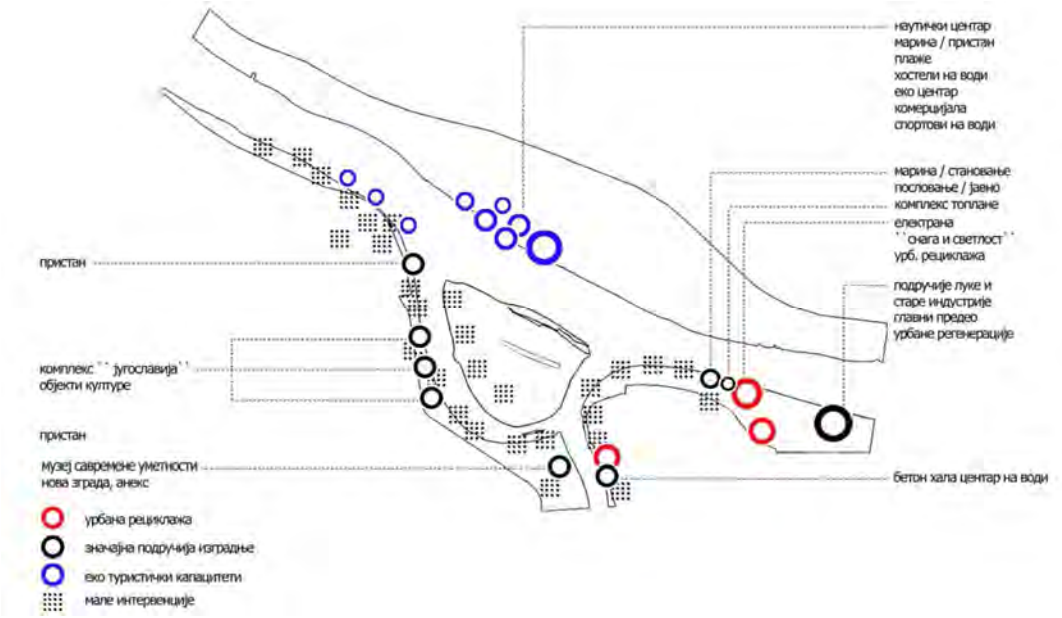


Fig. 18 – Locations for long term development and small interventions

Study TO DO! List

- *Build, then maintain and develop unique vision for the future development, adopt Development Strategy for the Belgrade waterfronts;*
- *Provide dynamics, polyvalence, and phases in development by moving the focus to specific zones – places, according to the priority or activation capacity of surrounding space;*
- *Recognize and develop the highest values of waterfront as a whole and specific values of its parts, by offering special city programs;*
- *Emphasize and insist on the specific character of the waterfront as a public space and public good;*
- *Provide activities and services that would enable active and day-long use, throughout the year, by managing the space in cooperation with the local community;*
- *Develop the waterfront area through the line of different destinations, impose target points in dynamic order and link them all, encouraging pedestrian mobility;*

- *Provide public access from the land and water using different types of transport, and link the connecting points;*
- *Plan new developments in accordance with natural values and cultural heritage, putting the public interest above the private or particular.*

Waters of Sava and Danube with all development possibilities and real functions should be the incentive for the related and following new activities and structures development.

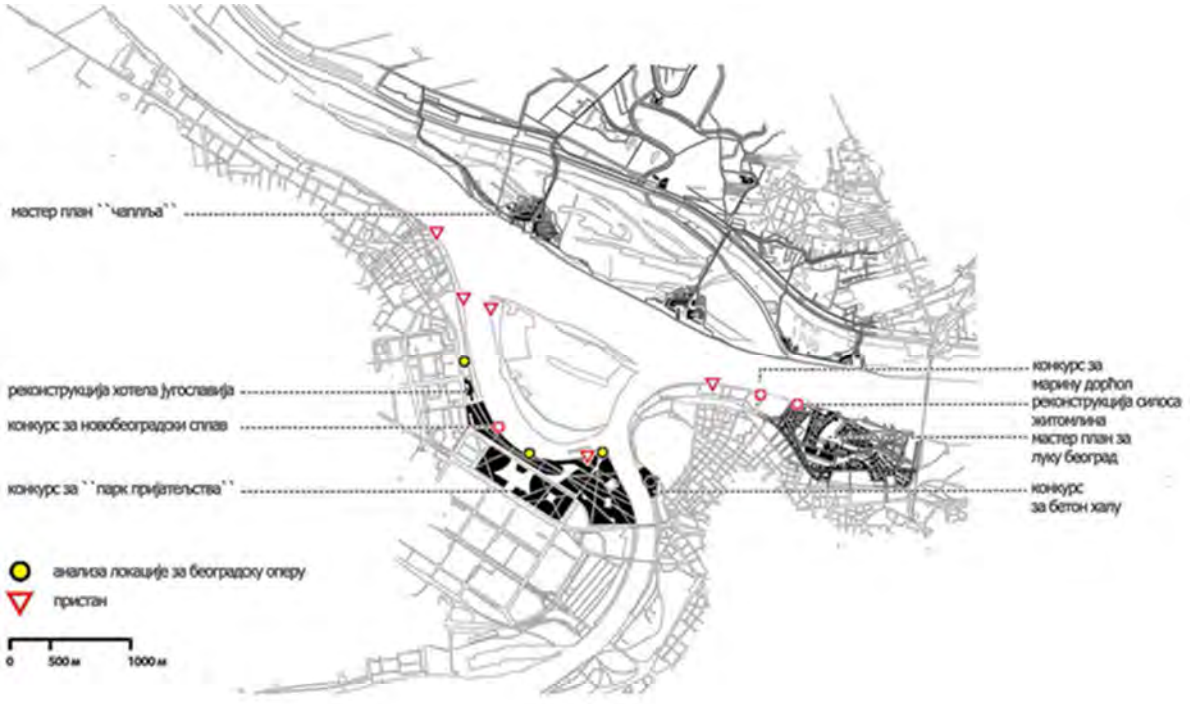


Fig. 19 – The Best-case Scenario, „Implement all"

6. Conclusion

The *Study* contributes to the long term Belgrade Waterfront research project, but opens a new chapter in planning of the capital city: in challenging times, sophisticated, fragile natural environment, burdened with the inherited identity and demanding from the contemporary sustainability point of view. With respect to all previous planning, academic, and artistic ideas related to the site, the *Study* is an important reminder about the context and resources, the articulated path for the city planners in context of sustainability and nature related construction, it is offering inherited mechanism for mitigation of the climate change based natural phenomena, city marketing tool, and the limiting argument for the city planners and authorities in ideas that may arise in attracting developers to this city on two rivers.

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[iii] *http://www.ptica.org/engl/info/mission.htm*

China’s Water Sensitive Urban Design and Its Sustainable Management

——Case of Wisdom Valley of the Suzhou Science and Technology Town Urban Design

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Abstract: With the speeding up of China's urbanization progress, the combination of water resources management and urban design has become a key problem for the sustainable development and residential environment construction in China. There is a universal phenomenon in China, it is that many ecological planning projects have the characteristic such as abundant investment, but poor adaptability and relationship and unobvious stage which result in uncertainty in capital return as well as ecological benefits.

This paper mainly discusses how to combine local geographical status and climate to construct strong initiative water ecological environment, with the aim of transforming from traditional and monopolistic water resources management to competitive water resources management strategy with multiple benefits. The difficulties lie in how these elements (for instance: city, architecture, landscape, water resources) can be combined to make a sustainable operation ecosystem during the whole process from the launching of the project to the period of project acceptance.

Based on the mature domestic and foreign concept and approaches of Water Sensitive Urban Design (WSUD), this paper takes Wisdom Valley of the Suzhou Science and Technology Town as the promoter region with the characteristic of the Southern China for example. The place of this project located in the west of Suzhou (Yangtse River Delta Region) as the typical city with abundant water resources in Southern China, and the water resources is vital in this project. Wisdom Valley as the name implies is surrounded by Green hill slope. This paper aims at exploring Water Sensitive Urban Design and sustainable management with Chinese characteristics through this project, including utilization of Rainwater Collection System, Rainwater Management System, the construction of wetland hydrological cycle system and forming the domestic water landscape, in order to realize the disaster prevention and reduction, ecological continuation and fusion with the regional characteristic design. This project as a China’s Water Sensitive Urban Design will not only provide experience for the development of residential environment construction in China in the future, but also contribute to the global urban sustainable development.

This paper uses mature domestic and foreign concepts and approaches of Water Sensitive Urban Design to guide water resources management in typical city of Southern China, aiming to support the construction of ecological planning projects.

Key words: WSUD, Water management system, Wisdom Valley

1 Introduction

1.1 The influence of climate change on cities

From the point of view of urban planning, there are two main factors that easily affected people's lives in city by the disaster. They are climate change and urbanization.[1]The influence is a serial of most conspicuous natural disasters caused by different climate affairs such as tropical cyclone, storm surge, extreme precipitation, river flood etc. And this also brings more pressure on the construction and maintenance of urban infrastructure like urban traffic, water and sewer, communication and sanitation facility infrastructure.

In the process of urbanization, the negative effect on ecological environment is inevitable. The Ecological environment is irreversibility and brittle, however, human who living on the natural and ecological environment system has to alleviate the current disparities between urban production development and environmental development. City as the most important special carrier of our production and lives consumes energy sources and natural resources every year, which account for 80% of the world energy and resource consumption.[2]Therefore, City is the key to save energy and resources, establishing "Ecological City" is essential way to adapt to the climate change all over the world. Many scholars focus on the influence on urban planning by climate change and how to adapt to the change. As a result, the different factors such as water, CO2, haze, earthquake in specific places comprised the ecological system are divided into independent system.

1.2 The influence of water change on cities

With the development of human civilization, water has played an important role all the time. Since the ancient times, many villages laid out along the river and grew to complex and huge city. However, along with science and technology progress, the water is not only the logistical and resource channel, but also abundant with cultural meaning and has urban ecological function. Hence, the Green and water landscape system are important carriers of the urban ecosystem, which have the irreplaceable position compare to other systems. Meanwhile, the climate change also brings different disasters by water in different places. For example, the climate change may cause flood, tsunami, extreme precipitation, tropical cyclone etc. On the other hand, city is vulnerable to suffer from climatic disasters. The key reason lies in the fact that the city carries too many human and economic activities to defend climate hazard. There is a research launched by The World Bank and Asia Development Bank finding that until 2050, an extreme fearful climate disasters, which only happens once 50 years will change to once 15 years, take place in Bangkok. Seasonal average amount of precipitation may increase 4% in Manila. In conclusion, more places and people will face threats caused by climate change.[3]

1.3 The necessity of improving water management system in China

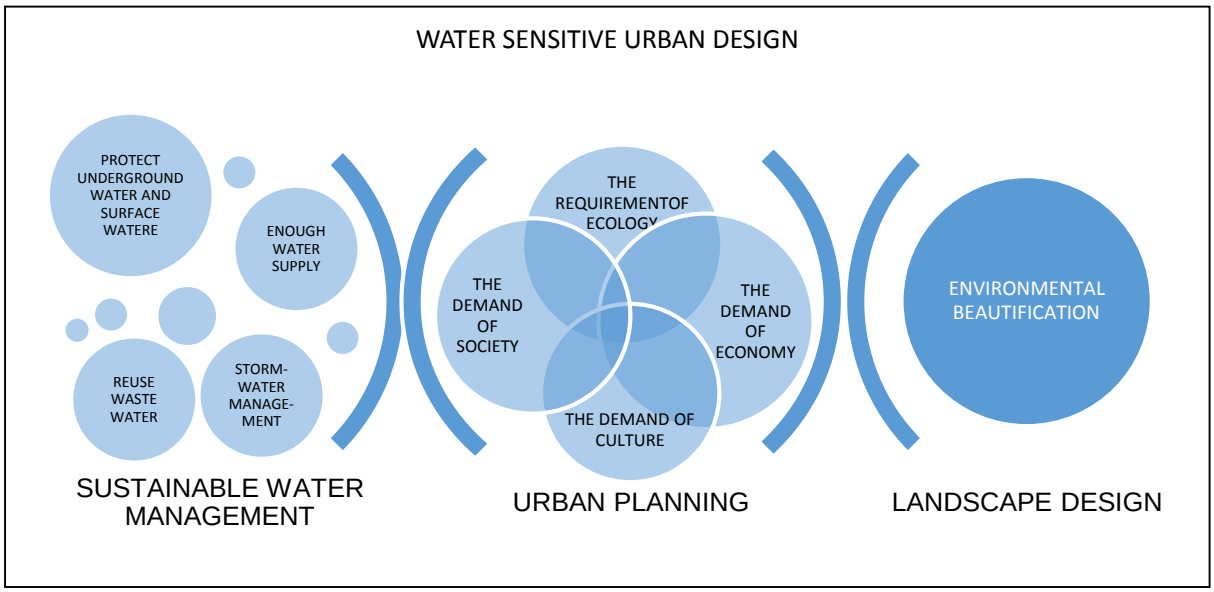
Although China has vast size of territory and abundant resources, recently, the annual rainfall records have been broken consistently in China. And the water disequilibrium brings about the shortage of drinking water, flood, the decline of groundwater level etc. in different cities. For example, from 2009 to 2012, the city of Kunming cannot afford enough drinking water for

476600 people and 229000 livestock, and nearly 29 rivers and 88 reservoir were once drought off. [4] Beijing as china's capital had suffered torrential rain and flood in July 2012 that cause deaths of 37people and 7 people are missing. At the same time, there is more precipitation in south of China, which has caused the paralysis of urban infrastructure. And some citizens quipped "to see the sea on our viaduct", "to see the waterfall in our metro station" etc. From the research of the World Bank and Asia Development Bank, it is mentioned that until 2050, the precipitation will increase 2-5%, the extreme weather events like torrential rain will easily trigger a series of city problems including traffic jam, the spread of disease, the shortage of food supply and damage of infrastructure etc. As a result, with the recognition of the distribution of water resource, Chinese government has concentrated their attention to sustainable water management of city system such as Water Sensitive Urban Design.

2 background

2.1 The introduction of Water Sensitive Urban Design(WSUD)

With the recognition of the distribution of Chinese water resource, many experts and scholars put more efforts on how to design Water Sensitive City. The term of Water Sensitive Urban Design first appeared in 1990 in Australia aiming to emphasis on the water management, the water treatment engineering technology and the combination of urban design and water utilization etc., The Australia national committee puts forward that the concept of Water Sensitive Urban Design (WSUD) is a urban planning and engineering technology approach which integrates the urban water cycle From urban development strategy to various stages of construction, including structural and non-structural measures, aiming to improve urban livability, reduce the impaction of water disaster and minimize environmental degradation.[5] Therefore, the connotation of WSUD is not only integrating the full water cycle, urban planning and landscape design together, but also keeping the sustainable development of urban space by a low-cost way.



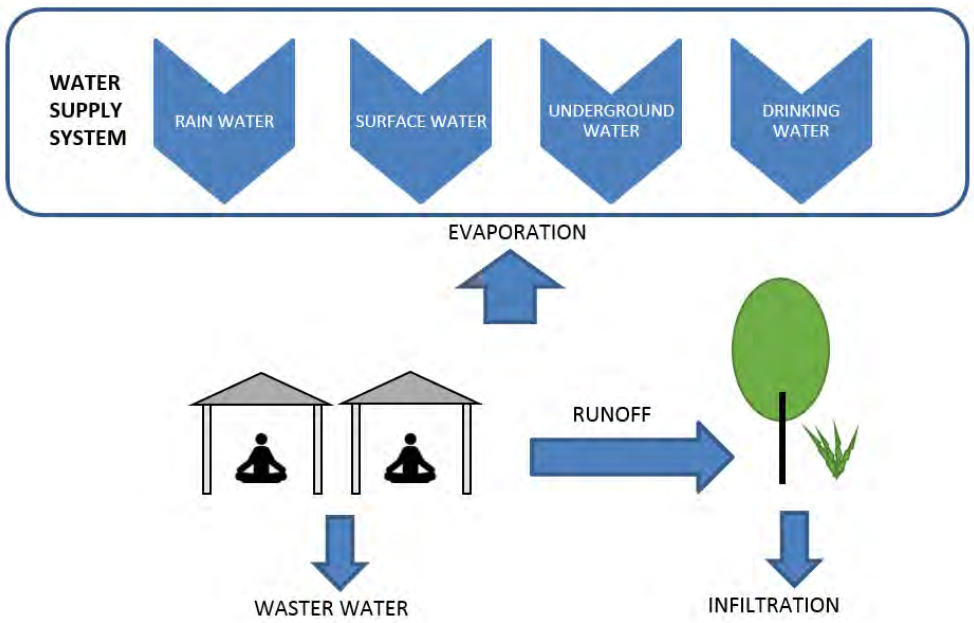
Pic 1: Different Parts of Water Sensitive Urban Design

The key principles of WSUD are as follows: First of all, the natural ecological principle which means to protect natural and potential waterways so that urban development can support the eco-systems that rely on them and remain valuable natural assets to improve community habitability. The second principle is that integrate the stormwater management system with the landscape design so that the water cycle system can reduce the volume and frequency of stormwater, increase the water quality before it flows into waterways and reuse the surface water and wastewater though landscape design and engineering technology rather than drain it all to waterways. The last but not list, WSUD also embodies the multiple benefits such as low-cost drainage system, alternate supply etc. by minimizing the drainage infrastructure development costs by remaining the natural waterways, rivers and lakes while reducing pipe sizes.

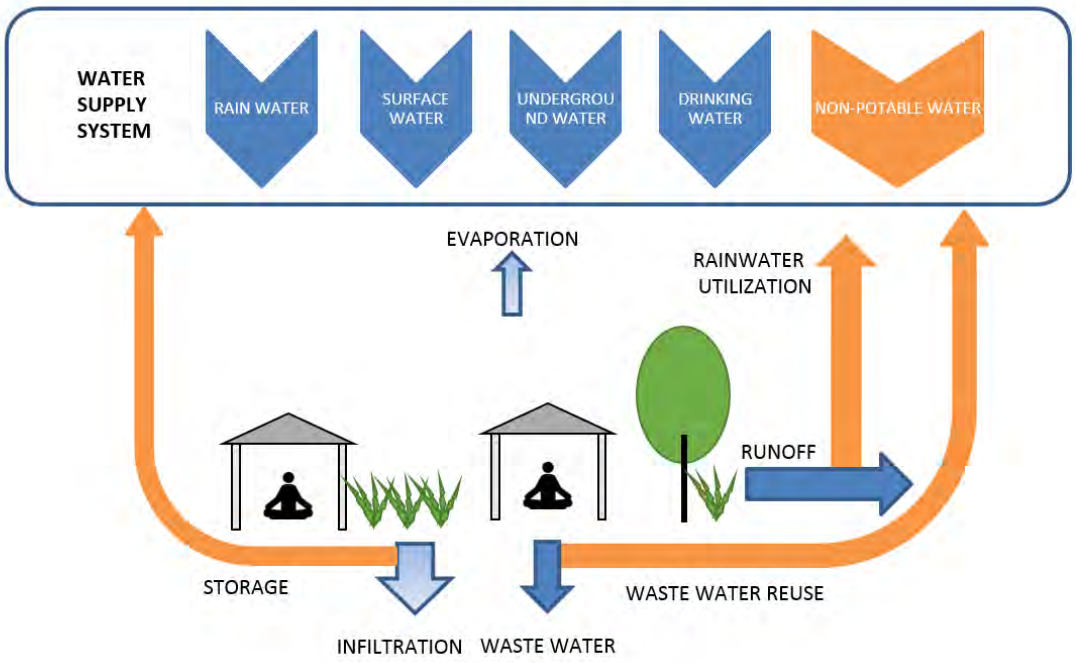
2.2 The differences between the conventional Chinese water management and that of WSUD

The conventional Chinese water management is different from that of WSUD including the water supply, development process and patterns. However, the water management system of WSUD is an enclosure system integrating artificial and natural water system rather than a single artificial water supply and drainage.

Firstly, the traditional water management meet the demands via increasing water supply with low permeability, strong evaporation while water sensitive management system offer different qualities of water such as drinking water, non-potable water as the resources of the system by rainwater, waste water harvesting and reuse, storage etc.. In other words, it means that the system increases the usage of non-potable water during water supply and treatment on the basis of corresponding purposes in order to speed up the natural water cycle and improve water utilization.

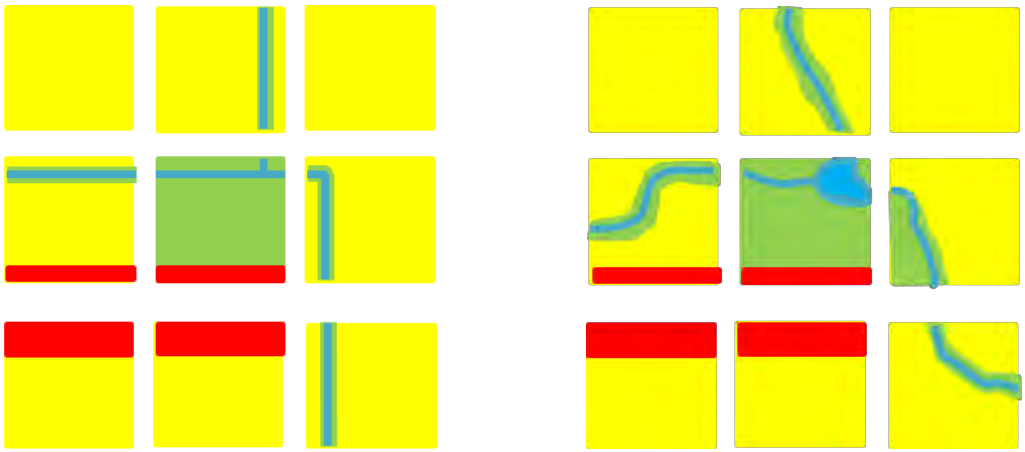


Pic 2: Traditional Water Management System



Pic 3: Water Management System of WSUD

Secondly, the traditional water management system concentrates on land use and water discharge but scorn the protection and usage of water resources. In general, vast majority of Chinese traditional urban plans change the direction of rivers and fill in water area which exacerbate the speed of non-main stream disappearing, flood detention capacity reduction, water area decreasing and the waste of water resource under the background of urbanization. However, an idea of WSUD is maximizing and retaining the natural water resources based on the natural waterways as one principle to adjust the land property. And even this urban design defines water protection zone by GIS spatial analysis. Furthermore, if there is river, the design method of WSUD is taking all the buildings and putting them beside the open spaces along the river for maintaining integrity and continuity of water and green corridors.



The Traditional Land Use-Rationalism

The WSUD Land Use-naturalism

Pic 4: The Contrast of Land Use between the Traditional Urban Design and WSUD

Thirdly, the drainage way of WSUD integrates water treatment and water discharge together in different aspects rather than traditional system that drained off water only by sewage pipe. For example, the community builds roof garden and vertical landscape to reduce the volume of water runoff, and also Sediment basins and Bio-retention swales to accumulate and filter contaminant, and use new materials to enhance the permeability in order to speed up the water discharge.

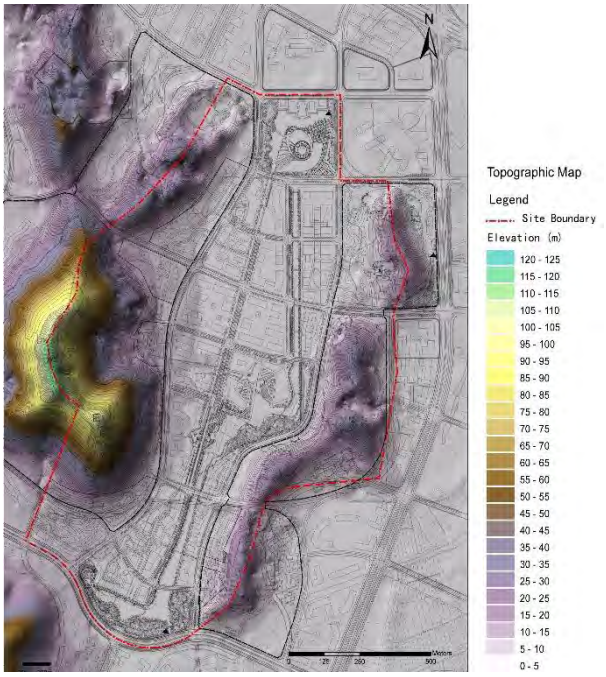
3 Take Wisdom Valley in South China as an example

3.1 The location condition of Wisdom Valley

The Wisdom Valley With the area of 1.45 square kilometers is located in the west of a famous city named Suzhou of Jiangsu province in China. Suzhou used to be mentioned as the old saying: “there is a paradise in heaven, while there are Suzhou and Hangzhou on earth”. The site is east to the ancient city of Suzhou, west by Tai Lake, and back against National Forest Park of Mount Taiyang. And it is also the first large-scale of science and technology innovation base co-building by The Ministry of Science, the government of Jiangsu province and the government of Suzhou city.

3.2 The natural situation of Wisdom Valley

The site shaped like canyon U by Mount Wulong, Mount Xiaomao and Mount Jingfeng. Most area of the site is a flat watery land and the average altitude is at 3-4 meters (9.84-13.12ft). Mount Wulong altitude of 120 meters (393.70ft) is the highest mountain in our site. The highest point of Mount Jingfeng and Xiaomao are with the altitude of 40 meters (131.23ft) and 25 meters (82.02ft) separately. The average slope of the site is around 3%, and the closer to the mountain, the steeper the slope is, which can reach the slope of 50% at some parts of Mount Wulong.



Pic 5: The Topographic Map (Urban Design Of ZHihui Valley for the Suzhou Science And Technology TOwn)

Pic 6: Flow Direction Analysis (Urban Design Of ZHihui Valley for the Suzhou Science And Technology TOwn)

The site is subjected to the influence of eastern subtropics oceanic monsoon and has a mild and moist, moderate climate, and distinctive four seasons with mildly cold winter and humid summer. The annual average temperature here is 15.4℃（59.72℉）and the extreme high temperatures is 40.1℃(104.18℉) in June 1934 while the extreme low temperature occurred in January 1931, at -12.7℃(9.14℉). Each year it has a very long rainy period named “Plum Rain Season” as spring turns into summer, and there is typhoons happened here between the end of summer and the beginning of autumn. Compare to Australia, the annual rainfall of this area averages 1035.9mm that is over twice the amount of Australia annual average rainfall. And there are approximately 127 rainy days in average annual year. In addition, the annual average rainfall intensity is 9.4mm/d, and the amount of the heaviest rainfall during an hour appeared in 1997(65.0mm) and the amount of the heaviest rainfall during 10 minutes reached 22.2mm in 1985. There is sufficient surface water with flow direction from south to north in the site and there are three main water catchment points located in the center of the valley and the south mouth of the valley.

3.3 The construction situation of Wisdom Valley

The current situation of the site is flat tree nursery, some mountains and building blocks. The previous planning of the Wisdom Valley is implementing. Roads are already constructed while the building blocks and relevant accessorial facilities are still under construction.

4 WSUD practices

One of the vital elements of WSUD is the management of urban stormwater, both as a resource and for the protection of receiving water ecosystems. In order to combine the current situation and local natural environment, how to implement the water management of WSUD in southern cities of China is the key issue. In the following parts, this passage will introduce the practice of WSUD in the construction of Wisdom Valley.

4.1 Planning Strategy of Rainwater Management System

From the perspective of collecting stormwater, in consideration of the rainwater collection system of the whole city and then based on the existing swales, basins, channel, wetland and ponds, the rainwater collection system in Wisdom Valley should be connected to the natural water cycling system with the scope of this district. In the whole district, there is a lake named Nuober’er located in the north of our site which connects to the tributary of Grand Canal from Beijing to Hangzhou of China. In our plan, we dredge the existing river canal along the road in the northeast of the north mouth of Wisdom Valley, and add two water channels with green belt which connect with the water bodies of mount Qing and Nuobei’er Lake. All these water ways are also connected by the rainwater collection system of Wisdom Valley to form the organic microcirculation of urban water and natural water management system in this area so this can keep water flowing and increase the time of water oxidation. Furthermore, this design can reduce eutrophication of water bodies in some extent to ensure the water quality.

However, for the internal water cycling system in the site and based on the flow direction analysis, we try to enlarge the nature as one strategy so that we can prevent the site suffered flood damage and reduce the artificial damage to the natural drainage pond, slopes and water

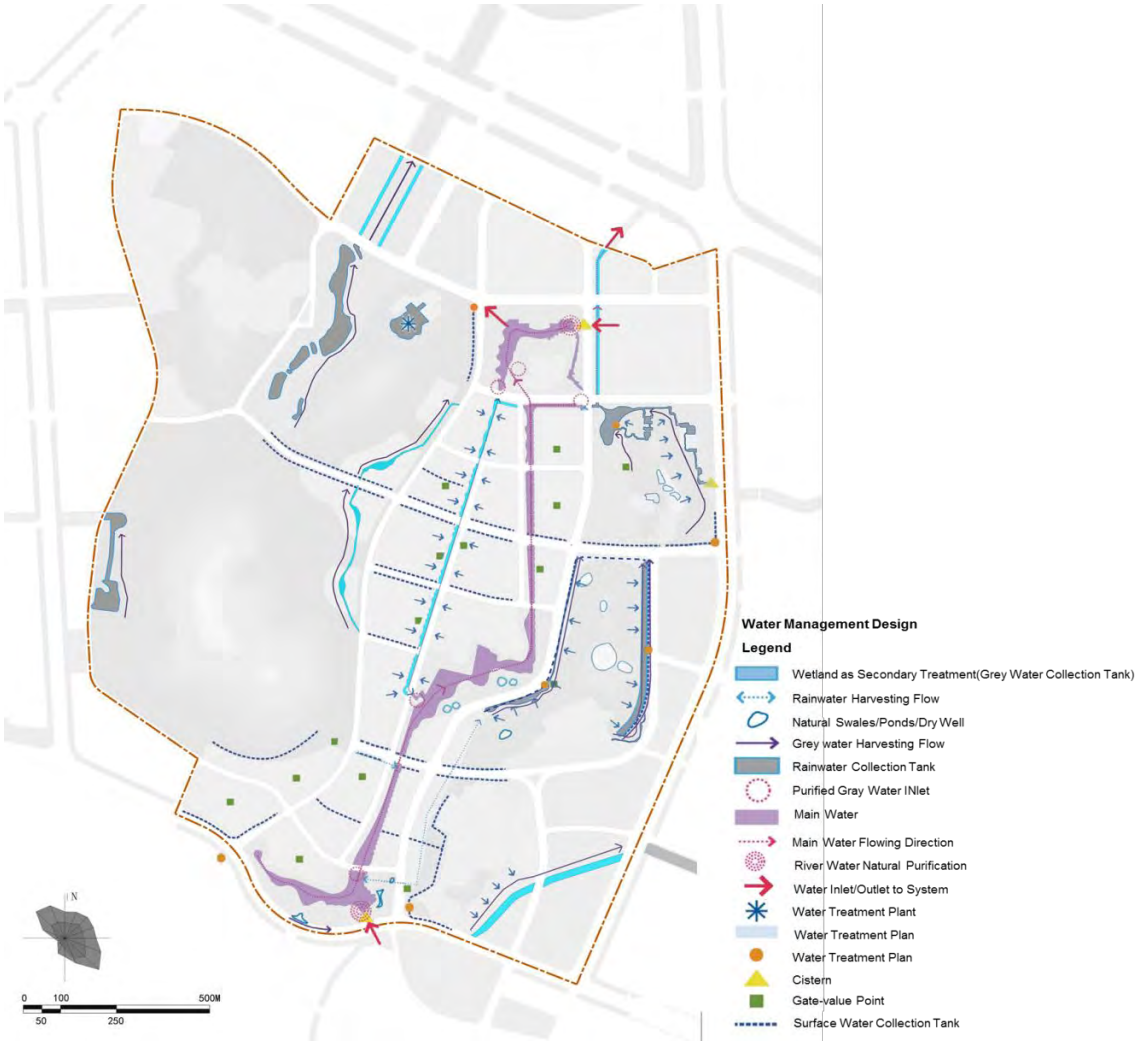
sheds during the constructional process, finally, to maintain the stability of the water flowing. The specific approach is that we utilize the water basins and catchment points in the center of our site to dredge one central wetland water belt running through the whole site connecting the north wetland pond with the south wetland pond. And then build a large area of water bodies in the center of Wisdom Valley which not only can be temporary water storage to accommodate peak flow requirements against usage rates, but also maintain the feed of water quality, resolve the dry and inundation of the river canal and improve air humidity and temperature to reduce the consumption of energy resources like the energy supply of refrigeration system.

4.2 Design Strategy of Rainwater Management System

From the perspective of the protection of receiving water ecosystems, firstly, we increase several ways to collect rainwater as the elementary treatment in some degree instead of using artificial water supply by drainage pipes, from underground, ground, indoor, outdoor such as roof gardens, sediment basins, bio-retention swales, bio-retention basins, rainwater harvesting pond etc. based on the topographic and slope analysis. All these design elements of WSUD consist of Water Bio-retention System which has been located beside the road or along the boundary of mountains and there are three main specific approaches. One is construction of bio-retention swales on both sides of the roads so the rainwater can be collected and reused by the residential and commercial districts. There must stay back a certain sector between building blocks and water bodies. Then the buildings should have roof gardens or vertical green spaces which can effectively reduce heat radiation and the surface temperature of the buildings when there is water peak runoff so that the extra water can directly inflow dry or wet swales or landscape wetland. One approach is construction of filtration tank and buffer zone on the both side of roads and in the open spaces. Considering of the feeling of passengers, open planting ditches should combine road green belt along the road to accumulate and filter pollutants; then we leave enough space for vegetation buffer zone around fluctuations in the water line along the boundary of water bodies to reduce water turbidity, and then increase and improve the ability of aquatic photosynthesis in the artificial wetlands which are formed by a variety of submerged, floating, emergent aquatic plants and wetland plants as purify rainwater retention system. And also the roads and water should be separated by vegetation belt to increase the area of buffer zones. In short, we can improve the water ecological environment though the establishment of long-term stability of aquatic eco-system.

Pic 7: Water Management System of WSUD in Wisdom Valley

The last main approach is construction of permeable pavement in less traffic lanes, smaller loads driveway, parking and walking areas like Karma Town in Sydney. The materials of pavement can choose recycled glass, ceramic and porous aggregates made of new building materials with permeability. Therefore, we can build different operation intensities of roads by adjusting the permeability of the material and the ratio of non-porous aggregates. On the one hand, this approach can raise rather than lower the area of roads so that it is another key to improve surface rainwater runoff of the road. Through this system the collected rainwater can be brought into water treatment system which consisted by grey water collection tank, river water natural purification and water treatment plant as secondary treatment. In these structural water management facilities, wetland aquatic plants can be planted in them between mountains and roads so that not merely purify the water quality but also store the water for irrigating plants and landscape design. Moreover, it can provide eco-rich environment for wild animals in the mountains. On the other hand, when we design the more natural river canals including torrents, deep pools and stream flows, except for cooperating landscape plants, putting logs, stones, wave structure and mental net are necessary. It is worth mentioning that grey water is the main water for household and site construction except drinking and bathing, however, the places where can use the grey water should be with low requirement limited water consumption, so we choose tiny tubes to save water and use “ECOMAX” high-technology to reduce the pollutant in the water treatment plants.

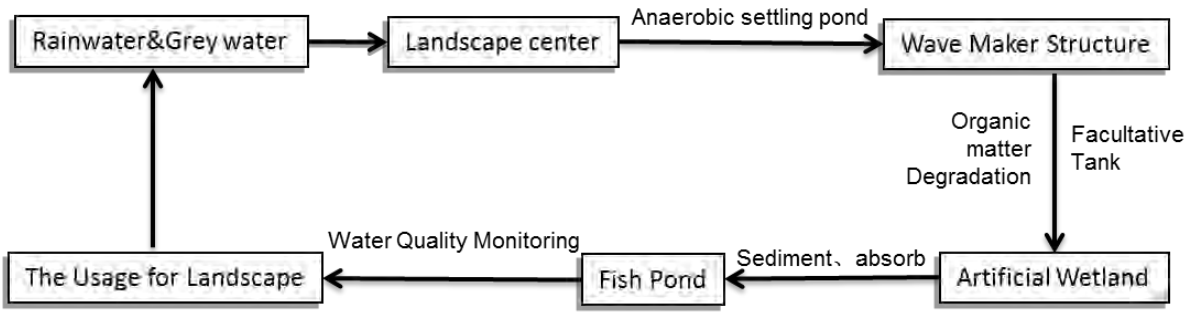


Pic 8: Water Management Design in Wisdom Valley

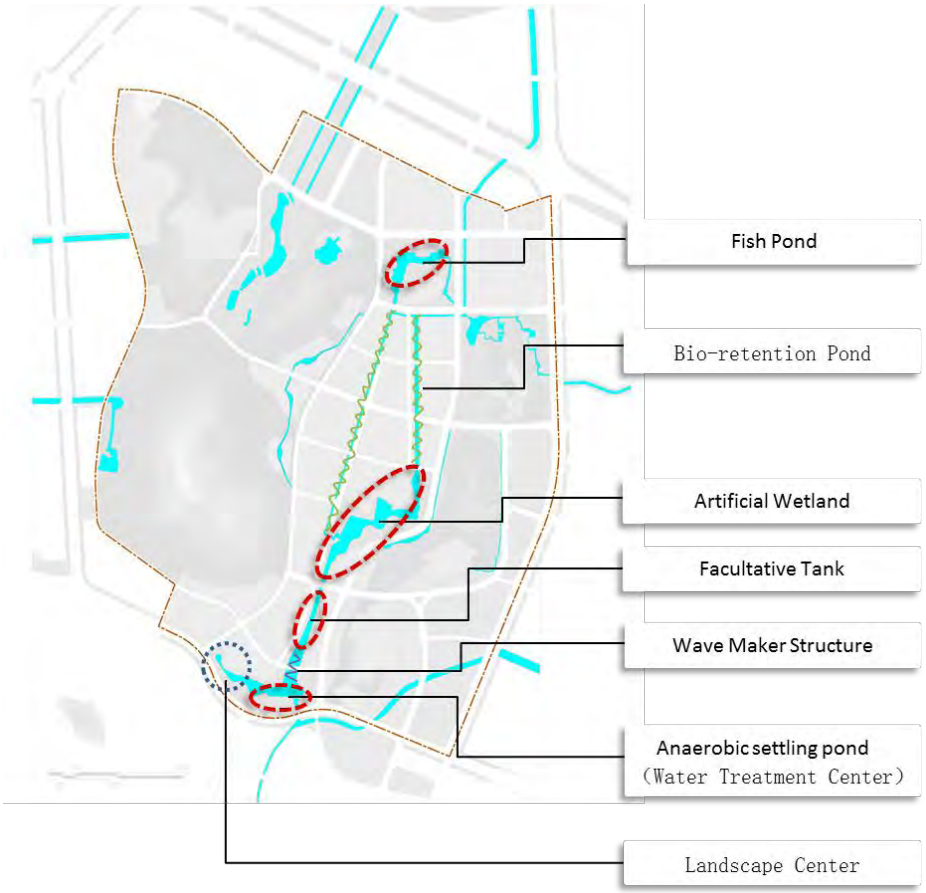
(Jiangsu Institute of Urban Planning and Design Suzhou Branch)

4.3 Combine water management system with water landscape

The landscape system design combines with water ecological design, as a result, the waste water and rainwater cannot only reach water-quality criteria but also increase the fun and diversity of landscape design through the serial water collection and treatment systems. The first step is that the landscape ponds use the collected water by water collection system for fountain with sculpture, then the water flows into the anaerobic settling pond with silent and grace water landscape. After that, there are many wave maker structures made by stones with interesting shapes which can degrade organic matter while people can sit beside the wave maker structures and fall heat. Meanwhile, people can follow the stream along the road passing through beautiful leaves and the foot of mountains. Because the change of road red line width by reducing the paved area, road width and other methods can create a flexible street space. Although the construction of roads and buildings will influence the intensity of water sensitive urban design, we still can maximize the combination of landscape, roads and drainage plan together making the landscape more natural attributes. The fourth step is the treatment of artificial wetland where can build wetland landscape with different plants. For example, we can utilize a unique method of traditional agricultural production especially in south China to improve water quality such as terraces landscape of seasonal crop rotation combined with wetland which can also achieve the effect of natural wetland for purifying water. This can reduce the loss of fertile soil and minimize the number of mosquitoes. Next step is that let the water stay in fish pond to monitor the water quality to ensure that the water can be used in other landscape facilities, water source heat pump(WSHP) and house use etc.. This facility can not only purify water quality but also create multi-benefits of landscape for people. To be more specific, dozens of species of aquatic plants like water hyacinth, umbrella grass, lotus, water lily, ceratophyllum, reeds are planted, and at the same time, the pond raises ornamental fishes so that people can appreciate the fine view of fishes, play games with fishes and organize educational activities with integration. Based on this, the ecological principles of water purification in this pond is that these plants produce oxygen through photosynthesis for fish to breathe and degrade organic pollutants in the water, and fish faces just as fertilizer to promote plant respiration. All these establish a good ecological water circulation system to improve the ability of purification of fish pond. Another characteristic of fish pond is that building step-water platform rather than traditional flood wall which can make people closer to natural environment to fully experience the beauty and magic of nature and also has a flood control isolation. The plan of Wisdom Valley as a network of water sensitive urban design integrates the multi-functional spaces of open space system like public development spaces, habitat and rain corridors constitute the buffer zone of the natural vegetation which can protect the water hydrological features, improve visual corridors and increase public access and passive recreational activities, moreover, it also plays a significant role in the establishment of visual contact between public landscape and private spheres.



Pic 9: Water Management System with Landscape Process Table in Wisdom Valley



Pic 10: Water Management System Design with Landscape Design in Wisdom Valley

5 Implications

With the development of environmental habilitation with high standard, the safety and eco-function of water resources have attached people's attention domestic and abroad. So do the methodology and theory of WSUD. Many experts and scholars do more researches from the perspective of landscape. However, the practical project from the water management system is limited in China. Especially, the South of China has abundant water resources by atmospheric precipitation, plentiful underground water and numerous rivers, so it is much more necessary to study the method and theory of WSUD for southern city in China.

As the content mentioned above, managing the urban water cycle not only needs to be

underpinned by key sustainability principles of water consumption, water recycling, waste minimization and environmental protection, but also needs to combine the high-tech engineer and management system of stormwater with urban design so as to increase the resource usage , reduce the risk of flood and other disaster, maintain the water quality criteria.

In the future, we still need to do more effort mainly on water management system from three aspects below: First of all, it is necessary to build a model to calculate Cost-effective analysis like Australia who has already exploded a software named “MUSIC” which can simulate the procedure of stormwater runoff under the Urban Stormwater Management Plan. Because in China we still do not have such accurate monitoring technique. Second, we need to establish stormwater and flood warning system including predict disaster related to weather forecast, risk assessment and etc. so the comprehensive information management platform involved all aspects in different sectors can be constructed. Thirdly, it is important to strengthen disaster evaluation of key district. For example, the underpass high ways, underground places where can easily suffer flood and waterlogging. In a word, we should prevent the catastrophe rather than remedy the loss caused by disasters.

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Integrating land use conflicts

Resolving conservation and development conflicts through an adaptive approach in Northeast Coast National Scenic Area

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Abstract

The research aims to redefine how adaptive planning approach can help traditional spatial planning system to deal with conservation and development land use conflicts through a set of adaptation plans.

As most planning systems in the world, spatial planning in Taiwan in concerned with both plan-making and the control of development (Chen & Shih 2010). Hence, the Northeast Coast National Scenic Area (NCNSA) Plan is the master plan of the traditional comprehensive model dominating land use and regional planning since 1976. In addition, the designation of slope land in Gongliao (the dominating administrative area of NCNSA) by the Rules of Slope-land Conservation and Utilization Act regulated and restricted the built area development. The NCNSA master plan combined with zoning plan reflects the ESAs guidance in regional level and strictly protects landscape from development. As a result, the contradiction areas are mainly overlapped with the settlements in the floodplain and mountain villages along the Shuangxi River valley. However, the rigidness of land use regulations not only eliminates the possibilities for specific type waterfront development along the Shuangxi River valley, but also leads to conflict relationship between the designated conservation areas and the locals.

Three research questions will be answered in this study: (1) What are the conservation and development conflicts in the case study area? (2) What are the priority spatial development principles? (3) What are the strategies to integrate conservation and development land use conflicts? The research methods include official document review and landscape analysis. A set of adaptation plan will be used to illustrate as a development strategy between nature conservation and development. The conclusion will help the completeness of existing local development plan response to national and regional policies as well as local needs.

Keywords: Adaptive planning approach, conservation and development conflicts, National Scenic Area

1. Introduction

1.1 Planning background

Adaptive approach in environmental planning has been advocated not only by ecologists, but also political scientists and land use planner (Briassoulis 1989). Representing a mentality of prepared responsiveness, the adaptive approach consists of a series of successive and continuous adaptation of human activates to variable, over space and time, environmental and socioeconomic conditions (Holling 1978; Briassoulis 1989). The planning system in Taiwan is concerned with both plan-making and control of development. A constant comprehensive review of the master plan is the main mechanism to evaluate the effectiveness of plan implementation. The change of land use distribution demonstrates new policy and adaptation action of previous plan. However, the implementation of plans usually takes long period and not always conducted adaptively. Kato and Ahern argued that the lack of operational adaptive methods, agreement on clearly stated goals, unsupportive institutional setting, and complex social values and interests are the reasons for slow adoption of adaptive approach (Kato & Ahern 2008). Since social and ecological relation changes, traditional planning method cannot always deal with the change of land use demand. Hence, the change of land use distribution in Northeast Coast National Scenic Area (NCNSA) master plan third comprehensive review draft report (2010) and civilian economic improvement action plan (2011) resulted in serious against by local residents. While facing the change of land use, the planning practice has been looking for an adaptive approach that could integrate land use conflicts and facilitate collaboration among multiple actors' demands. Therefore, an operational method for adaptive planning approach will be addressed in this study.

1.2 Research goal and research question

The research goal is to redefine how adaptive planning approach can help traditional spatial planning system to be capable of dealing with the land use conflicts in Northeast Coast National Scenic Area. Three research questions are as follows: (1) What are the conservation and development conflicts in the case study area? (2) What are the priority spatial development principles? (3) What are the strategies to integrate conservation and development land use conflicts?

1.3 Methods

The methods include official document review, spatial analysis and design practice. First, the official report review included spatial development reports, environmentally sensitive area strategy reports, and built environment regulations in national level, regional level and local level. Second, the spatial development principles will be defined according to the conclusion of current planning policy and spatial issues. Third, a set of adaptation plans will be illustrated as a test of adaptive planning approach in dealing with land use conflicts. The adaptation plan will be a strategy to help traditional spatial planning system be capable of dealing with conservation and development land use conflicts. The conclusion will help the completeness of existing local development plan response to spatial policies as well as local needs.

1.4 Case study site: Northeast Coast National Scenic Area (NCNSA)

The case study site Northeast Coast National Scenic Area (NCNSA) locates in Gongliao. The northeast coast area is a place with more than 60 kilometers coastline along Pacific Ocean and 15 kilometers waterfronts along Shuangxi River, which locates in the northeast starting point of the Snow Mountain Range in Taiwan. In general, the whole territory of NCNSA is overlapped by environmentally sensitive areas (ESAs) include ecologically sensitive areas, landscape sensitive areas, resource production sensitive areas, and natural hazard sensitive areas (Ministry of Interior 1992; Huang, Jen & Hung 2006). The development in these areas is either prohibited or subject to strict regulation by different types of laws and regulations. The diversity of geographic landforms also makes the Shuangxi River valley the most unique and diverse combination landscapes of the valley, mountain villages and fishery villages in Taiwan. However, the extreme climate leads to higher storm and flash flood threaten the safety of lower Shuangxi River flood plains and its riverfronts, where are indicated as flood prone area by Taiwan Water Management Agency.

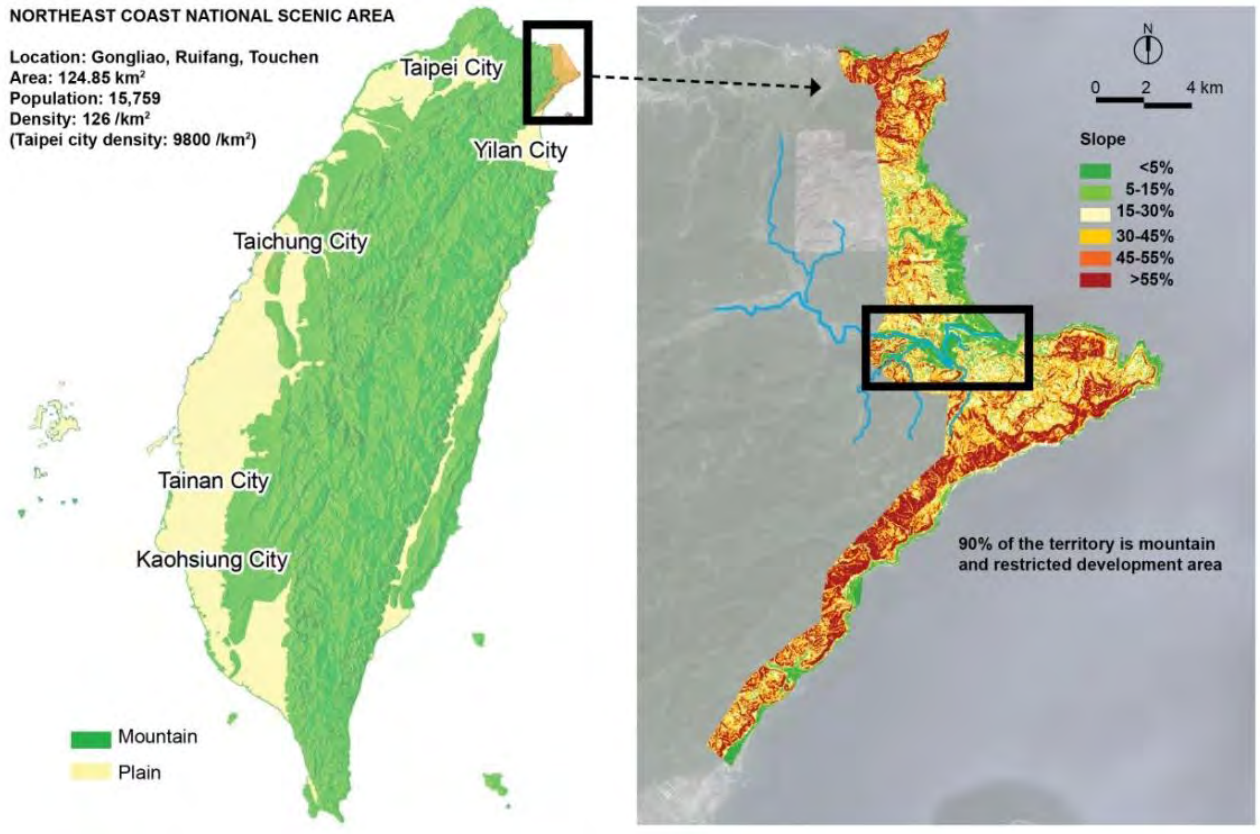


Figure 1. Location of Northeast Coast National Scenic Area in Taiwan

Source: Draw by author

2. What are the conservation and development conflicts in the case study area?

2.1 Topography and dynamic landforms restrictions

The mountainous slope land covers 90 per cent of the territory of the Northeast coast area, the rest 10 per cent of plain areas that mainly located along the coastline or riverfronts. The few gentle slopes which allow for human activities are mainly located along the Shuangxi River bank and coastal areas are indicated as flood prone area. The landforms determine the land use pattern, which is highly related to soil and water conservation function. In this case, the spatial development issues are inevitable to deal with flood mitigation and soil and water conservation tasks.



Figure 2. Landform elements in Shuangxi River valley. *Source: Draw by author*

2.2 Waterways and flood prone areas

The flood prone areas are mainly located along Shuangxi River and Fangliao Stream. The main river Shuangxi River with a length of 28.6km originated from the mountains with a height of approximately 700m to 500m. Due to the short river length and flesh storm rainfall amounts, the villages in the Shuangxi River valley and the lower Shuangxi River flood plain, Tianliaoyan areas, are threatened constant flooding events in the raining season. During the raining and typhoon season, a considerable amount of rainfall from the mountains often inundates in the lower Shuangxi River flood plain Tianlioayan (see Fig 3). According to the local senior farmers' experiences, flood plains in Tianliaoyan and terraced paddy fields in Fangliao Stream used to serve agriculture wetland with flood mitigation and ecological function in the lower Shuangxi River valley. When daily precipitation excessed 150mm per day, the terraced paddy fields and flood plains could adjust the water level of Shuangxi River. The abandoned terraced paddy fields and waste farmlands indirectly reduce the flood mitigation function in the Shuangxi River valley.

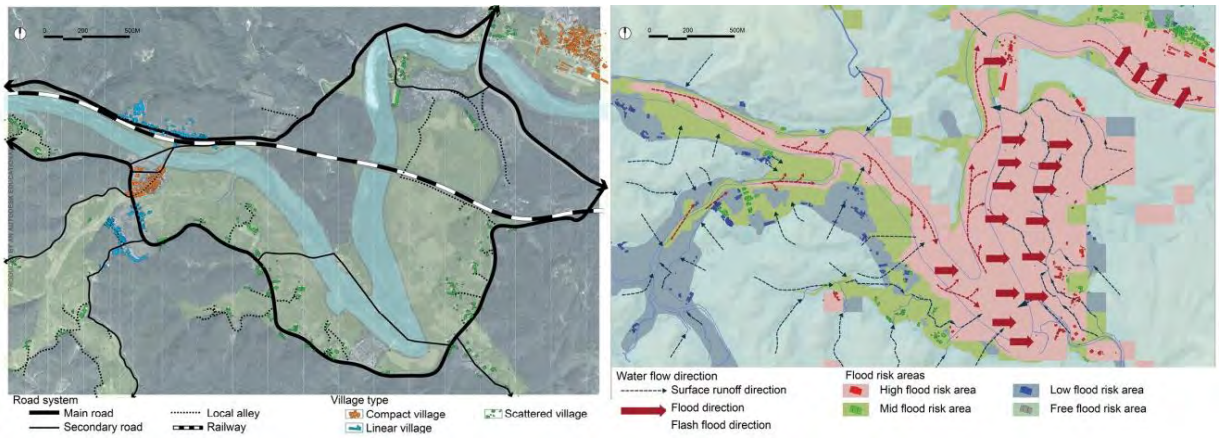


Figure 3. Flood prone area along Shuangxi River *Source: Draw by author*

2.3 Decline of population and farming industry

The population in Gongliao showed negative growth. The average annual growth has declined in the past ten years as the population growth rate is -0.67 % (CPAMI 2010). In one hand, the topography restriction and development constraints decrease local investment and job opportunities, which results in the younger generation population moving to surrounding cities. On the other hand, the terraced farming was the traditional agricultural methods and landscape that support soil and water conservation system.

Among 563 hectares agricultural land, 406 hectares agricultural land is abandoned in Gongliao. (Gongliao District Administration Office, 2012)Since traditional terraced farming methods cannot replace labor force with machinery on slope lands, a big amount of the terraced paddy fields has been abandoned due to lack of agricultural labor force and social reasons. The decline of population and abandoned of terraced paddy fields bring make it more difficult to support soil and water conservation without changing existing landscape structure.

2.4 Unsupportive institutional setting and competing social values and interests.

The existing institutional structure is based on plan-making and development control instrument, which is unlikely to accommodate competing social values and interests. In addition, the decision makers are likely to have different social values in local planning practice (Kato & Ahern 2008). For instance, the complex values among private sectors (farmers, dwellers, and developers) and public sectors (Soil and Water Conservation Bureau, Forestry Bureau) in the limited territory along Shuangxi River results in severe conflicts (see Fig 4). Due to many key stakeholders are unlikely to share interests that can yield new knowledge, which make it even more difficult for local plan response to spatial conflict adaptively.

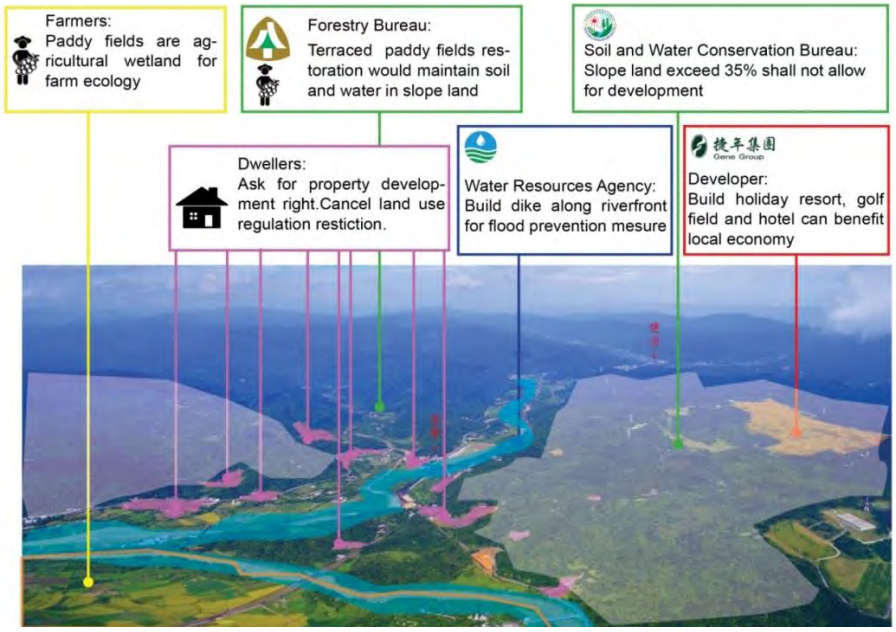


Figure 4. Land use conflicts between different development proposals in the Shuangxi River valley.

Source: Draw by author

2.5 Local development plan disputes

The latest comprehensive review of the NCNSA Draft Master Plan (CPAMI 2010) and the Civilian Economic Improvement Draft Plan (CPAMI 2011) proposed an expansion plan for the current settlement area instead of the improvement of current mentality. In order to attract investment in Gongliao, CPAMI proposed to change of land use from conservation zone into hotel zone, recreational zone and residential zone. However, the new proposal had little effect on resolving current spatial problems such as waste farm lands and undeveloped residential zone, the decline of living environment quality under development constraints (see Fig 5). The locals and environmentalists concerned the new plan would result in exploitation in forest area and destroy its soil and water conservation function. In other words, the extension plan may lead to a more challenging task in the conservation and development issue, which fundamentally against the original purpose of the setup of the National scenic area.

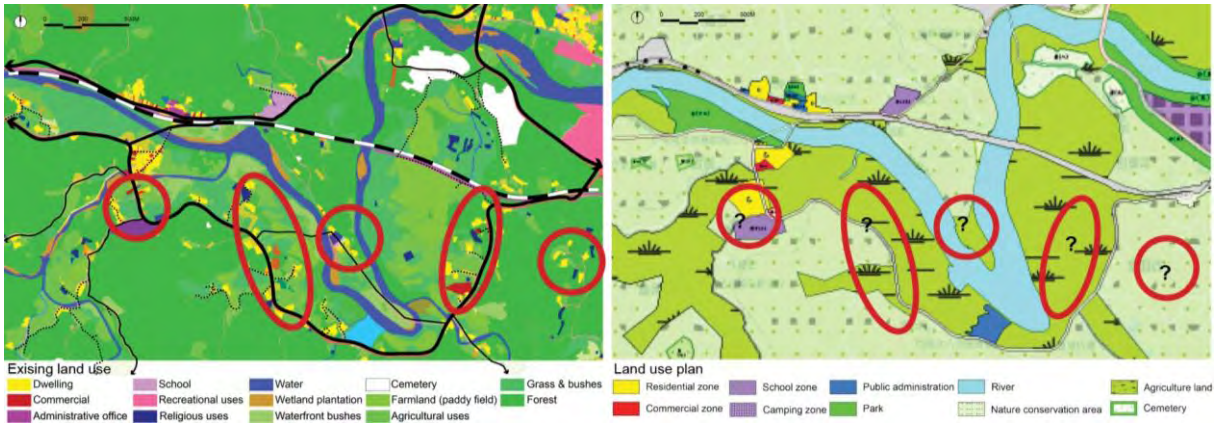


Figure 5. Land use conflict between current uses (left), and land use plan map (right)

Source: Based on current national land use survey (CPAMI, 2010) and NCNSA Land use plan (CPAMI, 2010)

3. What are the priority spatial development principles?

Through the problem define stated above, it is necessary to make the future spatial development with multi-function and compact land uses. The spatial development principle aims to integrate existing concepts and facilitate land use conflicts through a set of generic policy. Concerning the changing land use demand, the development principle highlight the general development direction and main value, which should be the main consideration for both new and current development proposals (see Figure 6.). Priority spatial principles are the following:

3.1 Live with nature

Live with nature means the enhancement of harmonious relationship with human activities and nature environment. Both development and adaptation plans should contribute to enhancing the vitality of the ecological system.

3.2 Live with water

Live with water means the improvement the living environment quality and safety with water landscape. Demonstrate the living environment relation with the water landscape through integrating flood prevention program with an urban redevelopment project.

3.3 Reinforce of local identity

Reinforce of local identity means the establishment of connections between the environment characteristics with relevant actors. A location related knowledge and long term interrelationship benefit to the society, the local economy and environment.

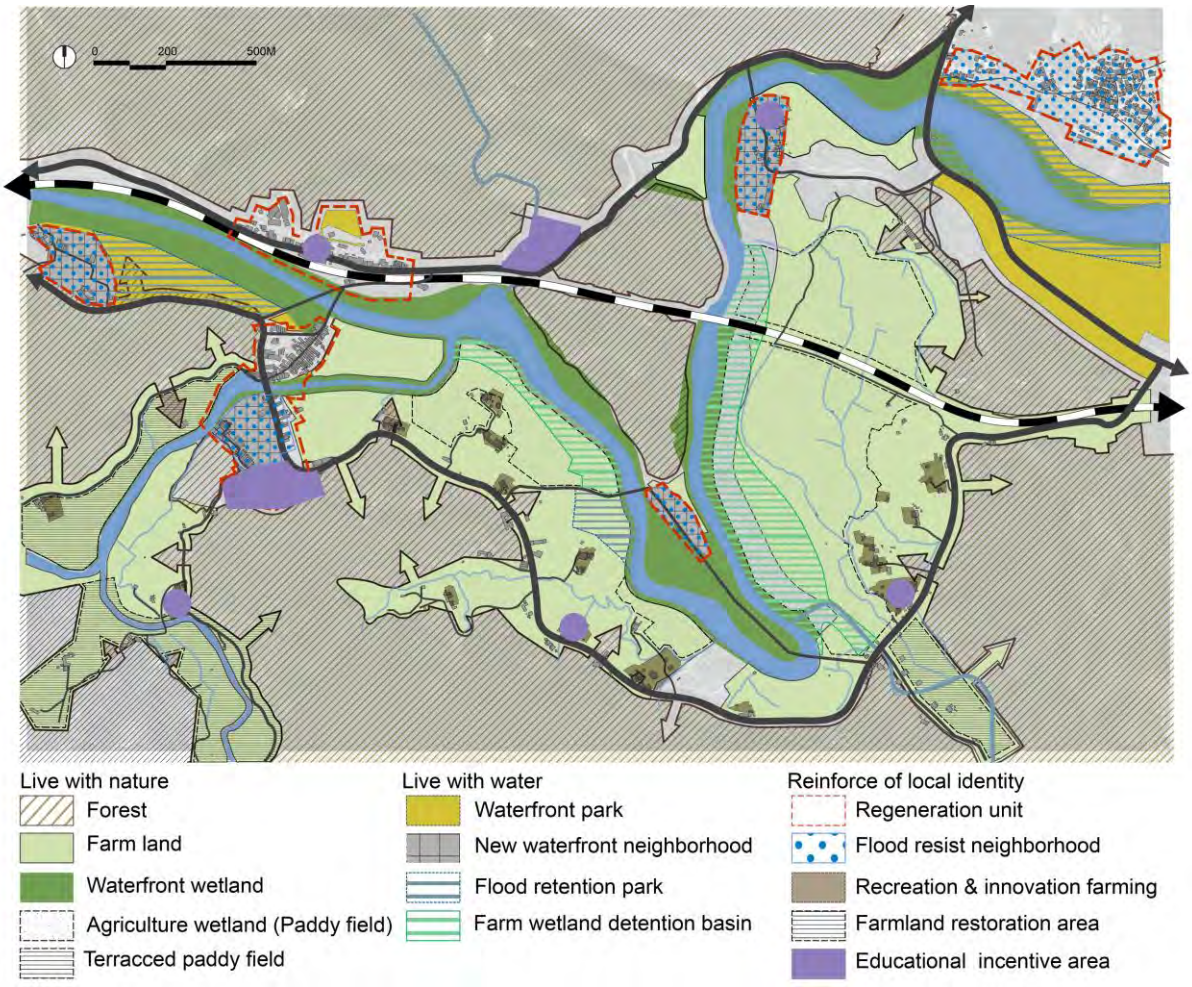


Figure 6. Adaptation plan in the Shuangxi River valley

Source: Draw by author

4. What is the strategy to integrate conservation and development land use conflicts?

This study proposes six strategies to integrate conflicts into new development adaptation methods. These adaptation methods are based on current natural area conservation policy, flood mitigation policy, and local civic organizations' proposal, which focuses on soil and water conservation and forest protection in upstream, and flash flood mitigation method in lower stream. The development principle highlights the general development direction, which should be the main consideration for both new and current development proposals. The

waterfront wetlands, agricultural wetlands, paddy fields, secondary forests and mountain villages are recognized as one system that can co-evolve with social-ecological contexts. The proposed adaptation methods are multi-tasks resolving strategy, including conservation-oriented and development -orientated methods. The conservation-oriented adaptation methods (increase ecological vitality, integrate landscape function, enhance waterfront function and quality) focus on preserving natural landscape function by enhancement and improvement of ecosystem function. The development-oriented adaptation methods (flood-resist neighbourhood, the new alliance of the tourism industry, local knowledge educational program) focus on upgrading built-up area quality by redevelopment and renovation of urban function. A set of conservation oriented strategies and development oriented strategies is presented as follows:

4.1 Increase the ecological environment vitality

The environmental condition will be improved to maintain the uniqueness of riverfront and wetland landscape. In the future, the forest in the whole Northeast coastal area will be the nature and culture landscape heritage, which provide ecological and recreational function to Taipei region. In addition, the Shuangxi River valley will become one of the most diverse wetland habitats for seasonal migrant birds. Methods and considerations of ecological conservation include: (1) the quality of the natural landscape and the security of current settlements should be considered as a priority. (2) The mountain, valley and coast provide a dynamic land use function to maintain soil and water conservation conditions in environmentally sensitive areas. (3) Revitalize the wetland systems and restoration of forest, farmland will improve ecological diversity and make Shuangxi River valley become the favorable seasonal migrant bird's habitat.

4.2 Integrate landscape function

The old farmland properties are modernized to meet the demand of contemporary land use, especially support soil and water conservation and innovation agricultural /non-agricultural uses. Farm lands could offer the place for the extension of city mentality and transitional landscape from built-up area into the natural environment. Methods and considerations of integrating landscape function include: (1) Restoration of upper stream terraced paddy fields and maintenance of floodplain paddy fields is the aim to build a connection with the cultural landscape with flood mitigation methods. (2) Restoration of farmland is a strategy to maintain the cultural and natural landscape, which will create a local characteristic and attract the younger generation to stay and live in the hometown. (3) Innovation farming area is an opportunity to improve living environment quality through development.

4.3 Enhance waterfront function and quality

Enhance waterfront quality by integrating wetland with ecological, agricultural, and recreational function. The restoration of wetlands is a combination of ecological methods and recreational function for storm water storage. Methods and considerations of enhancing waterfront function and quality include: (1) Instead of building a new dike and dam, rebuild

current riverfront parks as a detention pond, river front wetland as a buffer area to collect flash flood water. (2) The agriculture wetland plays not only food production function, but also flood mitigation and agricultural wetland ecosystem functions.

4.4 Flood-resist neighborhood

Flood-resist neighbourhood refers to a solution allows the existing settlement to be resilient to flooding issues. Methods and considerations of upgrading flood resist neighbourhood includes: (1) Designate urban renewal unit and integrate flood mitigation method as the priority. (2) Redevelop the vacant residential area with amphibious function, which allows living with water and nature environment.

4.5 The new alliance of tourism industry

The new alliance of the tourism industry refers to establishing connections between farmers, local dwellers, developers and the general public in order to strike a balance between profitability and landscape conservation. The main idea is to improve existing neighbourhood quality through tourism development. Methods and considerations of establishing a new alliance of tourism industry include: (1) Owing to the limitation development capacity, new investment should intensify the current settlement and its environmental quality in designated village regeneration unit. (2) Instead of the big scale development in forest area, small scale renovation project related to in innovation farming, eco-tourism and will be the main development direction.

4.6 Local knowledge educational programs

The future development will bind with local vision. In order to maintain the knowledge and productivity for the next generation, a unique knowledge to live with nature and water in Gongliao should be shared. Gongliao and Shuangxi River could be a demonstration site to illustrate the possible lifestyle to live with nature and water. Methods and considerations of enhancing waterfront function and quality includes: (1) Set up local culture and ecological foundation and training program. (2) Share knowledge with residents as well as tourists.

4.7 Recommend collaboration forms in the decision making process

In order to widely gain local support to the adaptation plan, involving all relevant stakeholder stakeholders already in an early stage of the planning process to achieve wider support to the resulting of spatial development plan (Healey 2006). Considering the relationship between private and public sectors are complex and consist with conflicting social value and interests, the recommend collaboration forms should change of collaboration forms is to move from P-P-P (public-private partnership) to P-P-P-P (people, public-private partnership). A successful plan also relies on a constructive dialogues and consensus making among multi stakeholder. The constructive dialogues is on the basis of open communication involving the exchange of information between relevant stakeholders, including central and local competent authority, councils, agencies, bureaus, civic group, NGOs, and local dwellers. The recommend collaboration forms, please see figure 7.

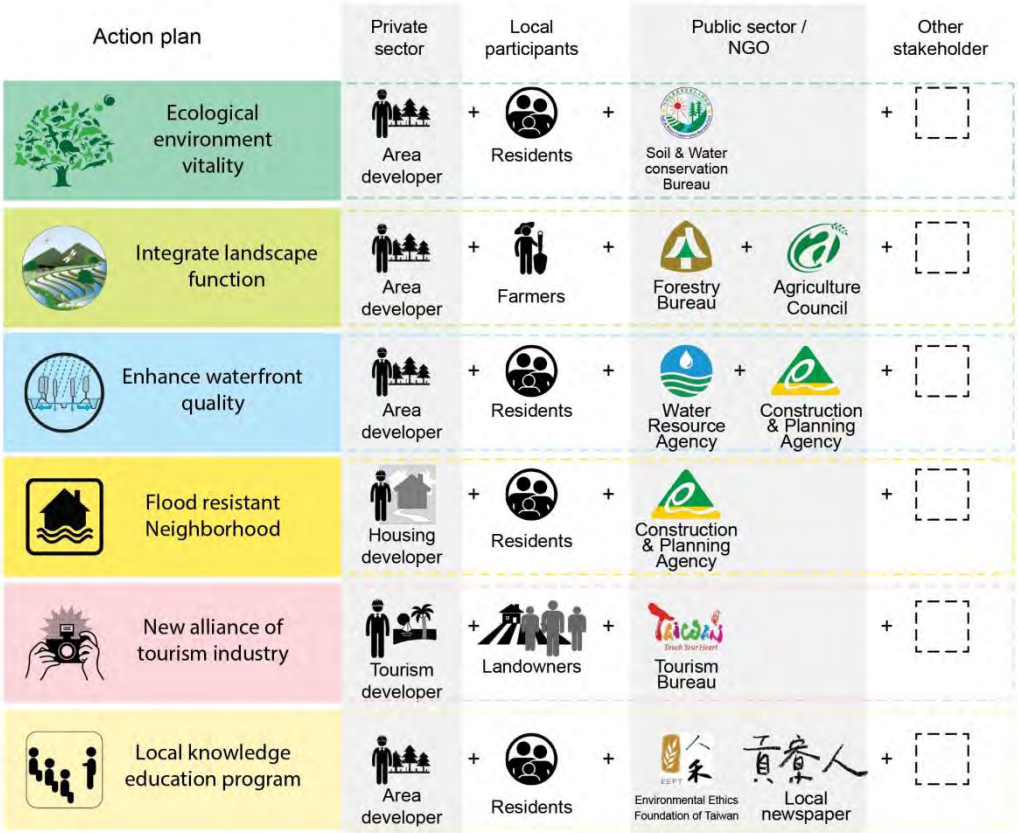


Figure 7. Recommend collaboration forms in the decision making process.

Source: Draw by author

5. Discussion and conclusion

This research aims to tackle with a territorial management issue in the dynamic environment area. Therefore, this study tries to find a possible solution to dealing with territorial conflicts in Taiwan national scenic area. The current planning system in Taiwan adopts comprehensive review of master plan and change of as a means of adaptation method. The comprehensive review of the master plan is the traditional method to evaluate the plan's effectiveness and conduct zoning control and the change of land use as instruments. But the change of land use distribution does not resolve the conflict relationship between conservation and development nor improve the living environment quality. The traditional method is unlikely to resolve land use conflict actively therefore it may not be responsive to deal with conservation and development conflicts.

The following conclusions summarize the research conclusion and indicate the possible direction to help traditional planning system to be more capable of dealing with conservation and development conflicts.

5.1 A clearly stated goal and spatial development principle are the basis of future development vision.

A clearly stated goal and spatial development principle are the basis of future development vision. The principle can be the standard and criteria when the local initiatives or government

proposal against the general development vision. The development principle proposed in this project is a multi-function land use and compact network development, which is the core value of the adaptation plan in Shuangxi River valley demonstration site.

5.2 Facilitate existing problems and avoid conflicts

The proposed adaptation methods try to integrate current planning proposals instead of proposing new strategy. The adaptive planning approach could be a platform to accommodate competing social values and interests. Therefore, a holistic problem is defined in spatial, social, economic and institutional context can avoid the planning practice aggravating existing problems.

5.3. An operational method is the strategy to integrate spatial issues and avoid conflicts.

An operational method is the strategy to integrate spatial issues and avoid conflicts. In order to make the policy be operational, three themes and six implementation strategies were demonstrated in the previous chapter. Instead of proposing rigid rules, the adaptive methods used in the Shuangxi River valley are regarded as a demonstration to integrate conservation and development conflicts. In other words, this approach intends to resolve conflicts by providing alternative options instead of achieving definite objectives.

5.4 Use experimental implementations to advance the planning method

In order to advance traditional planning method in the premise of adaptive planning approach, the adaptive methods were tested in this study as an experimental opportunity to facilitate spatial problems. The planning agency can designate experimental demonstration sites as a platform for the locals and the planning authority to test the development ideas.

5.5 Robust and flexible policy is still necessary

The development control and zoning are still an effective way to prevent the natural environment from destroy, a robust and flexible planning framework is necessary. Since the spatial development principle is a generic spatial policy that could apply to the whole Northeast coast area, adaptation plan is the supplement of location specific strategy to demonstrate how adaptive approach could work in the existing spatial context.

In summary, the main concept to resolve land use conflicts is to integrate the existing spatial concept into adaptation plan in the current planning system. Since the existing planning regime in Taiwan is still looking for alternative instruments to accommodate competing interests and conflicts, this research in Northeast Coast National Scenic Area will be an exemplary case to understand how to integrate conflict and generate possible adaptation plan in high landscape value areas. An adaptive approach that considers environmental, economic, and social factor in the conservation area management will transfer as an international spatial planning comparative analysis for further research.

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Ecological Planning Approach for City Water System—A Case in the County Center of Luoning in Henan Province, China

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Synopsis: Based on previous research findings, this paper proposes an ecological planning approach for city water system and applies it to the project in Luoning which is a small Midwestern county in China.

1 Introduction

From ancient times till today, as an important part of the city's ecological system, city water system has always been playing a significant role in maintaining the ecological balance, regulating microclimate, providing habitats and so on. Local governments in China are increasingly aware of the need of making full use of these ecological functions during city construction. However，it is encountering a great deal of resistance in practice. It is not uncommon to see small tributary streams being filled in or covered to construct roads or buildings. Even for the big rivers, in many cases, it is difficult to escape the fate of being curved cut-off. Other destruction acts, such as canalizing river and building artificial embankment, are found in the construction of water conservancy and flood control engineering. To change the current situation, besides shifting opinions away from only pursuing economic profit to pursuing both economical and ecological benefits, it must be seriously considered the demand for a way to allow the city water system to function.

2 Ecological Functions of City Water

2.1 Ecological Functions of City Water

City water system includes natural river, artificial canal, ditch, river, lake and reservoir. The city water ecological system not only has basic ecological functions like water supply, water volume regulation, climate adjusting, self-purification, habitats providing(Amigues *et al.,* 2002; Chen, 2008; Loomis *et al.*, 2000), but also possesses derivative ecological functions, such as recreation, culture, green space providing, contribution of urban landscape diversity(Ward *et al.*, 1996; Wilson and Carpenter, 1999).

2.1.1 Water Volume Regulation

Rivers, lakes and wetlands play a significant role in regulating the river flow. They are able to weaken the flood peak, delay the flood process and undoubtedly reduce economic losses caused by the flood (OuYang *et al.*, 2004). Due to the adjustment capacity of soil and vegetation on both sides, a certain amount of rain water or flood water can be absorbed, and then released gradually, before running into river or permeating into ground aquifer. This is good for relieving urban drought and flood disasters (Chen *et al*., 2006).

2.1.2 Climate Regulation

The high heat capacity of water and the liquidity of it as well as the wind above the river are hugely important to mitigating heat island effect. In addition, the carbon sequestration process conducted by the green vegetation and algae in the water and the organic matter accumulation process conducted by peat bogs make the water ecological system helpful for slowing down the rising of global co_2 (Xiao, 2006).

2.1.3 Biodiversity Preservation

A variety of habitats that offered by flood plains, wetlands, marshes and river canals in river ecological system provide all kinds of biological species with breeding sites. These breeding

sites contribute opportunities for biological evolution and the generation of bio-diversity because good genetic specimens can be conserved and improved.

2.1.4 Self-purification and Shielding Effect

Running water in the river has good self-purification ability. The aquatic plant can absorb, decompose and utilize nitrogen, phosphorus and other nutrients as well as bacteria and viruses in the water. The concentration of metals and toxic substances by aquatic plant stands as another barrier to the pollutant from coming into the river. In summary, the self-purification and shielding effect of water system work well when both organic and inorganic solutes, as well as suspended solids are Intercepted, toxic substances are transformed.

2.2 Vital Affecting Factors for River Ecological Functions

By analyzing the ecological functions of water system, the conclusion comes out that it is the natural characteristics of river that support and guarantee the effectiveness of its ecological functions. Those natural characteristics can be concluded as three main factors: river structure complying with topography, native river morphology and continuous river space (Brierley, 2002).

2.2.1 River Structure Complying With Topography

The complex and diverse topography, physiognomy, climate, vegetation and soil conditions of China give birth to the variety of drainage patterns and structures. According to the combination differences between mainstreams and tributaries, natural river system is divided into dendritic pattern, trellis pattern, parallel pattern, pattern of fan, pinnate pattern, etc, as shown in Figure 1 (Ma, 2005).

A: dendritic pattern
B: trellis pattern
C: parallel pattern
D: radial pattern
E: circular pattern
F: centripetal pattern
G: network pattern
H: comb pattern

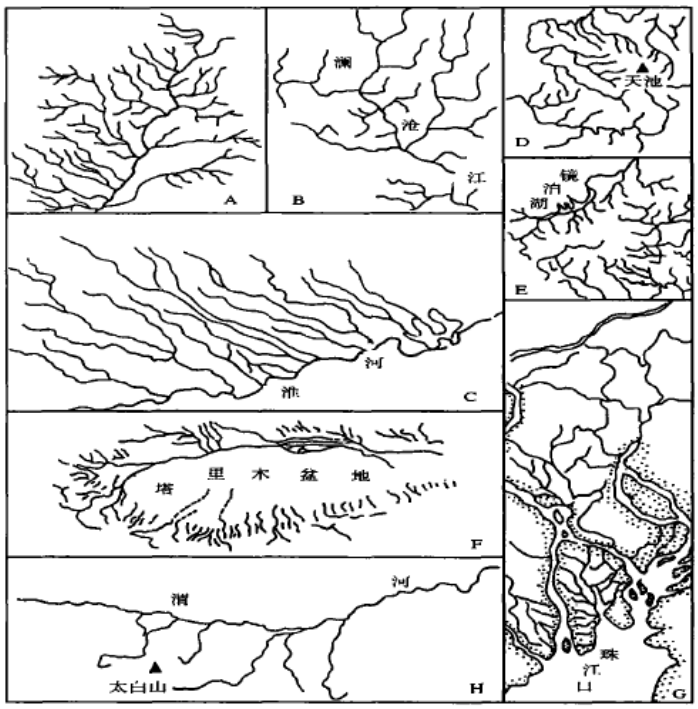


Figure1 river system patterns
(source：Ma Xiumei.[2005] "Study on water system programming for plain river network area", Master thesis: China University of HoHai.)

No matter what kind of river system pattern is, they are all shaped by natural process. The water source, mainstreams, tributaries, wetlands, lakes connected to each other, estuaries, etc, form the whole native river pattern. However, in many cases, urbanization destroys the integrity of the water system: It is not uncommon to see small tributary streams being filled in or covered to construct roads or buildings; a great number of small waters like depressions

and ponds disappeared. The resulting reduction of water surface ratio and water network connectivity exerts great influence on the ecological function of water system. Especially in the fields of flood resistance and waterlogging drainage, significant reduction of tributary streams not only speeds up the surface runoff speed, shortens the runoff concentration time, which results in a rapid increase of river water and surface water after heavy rain, but also shortens the arriving time of flood peak.

On one hand, the original natural structure of water system is being destroyed. On the other hand, planners sometimes don't respect the topographic condition and current water structure much in their planning area. They create a lot of artificial channels and big lakes from the perspective of space structure and economic use of land and these new-born waters are usually against nature. It brings severe damages to the original ecosystem as the concentration paths are being changed, the water discharge pressure of municipal pipe network is growing up obviously and the habitats are being threatened. Besides, it can't be ignored that the construction and maintenance of these artificial waters cost much more than natural ones do. Thus, when facing a water system planning task, we should first of all pay great attention to the overall space layout of water system: retain the original water surface as much as possible and create new waters according to the site hydrological and topographical conditions if necessary. In a word, the goal is to make the water flow and circulate with minimum interference and in the most cost effective way.

2.2.2 Native River Morphology

Natural river has a diverse landform types and winding patterns. Those landforms such as meandering, deep pools, shoals, flood land, water moor and so on, which are formed under long-term fluviation process, have enormous contributions to weakening the flooding pressure and reducing the peak flow of downstream. The patterns with deep pools and sandbars, rapid and slow flows, as shown in figure 2, can also support a variety of biological communities.

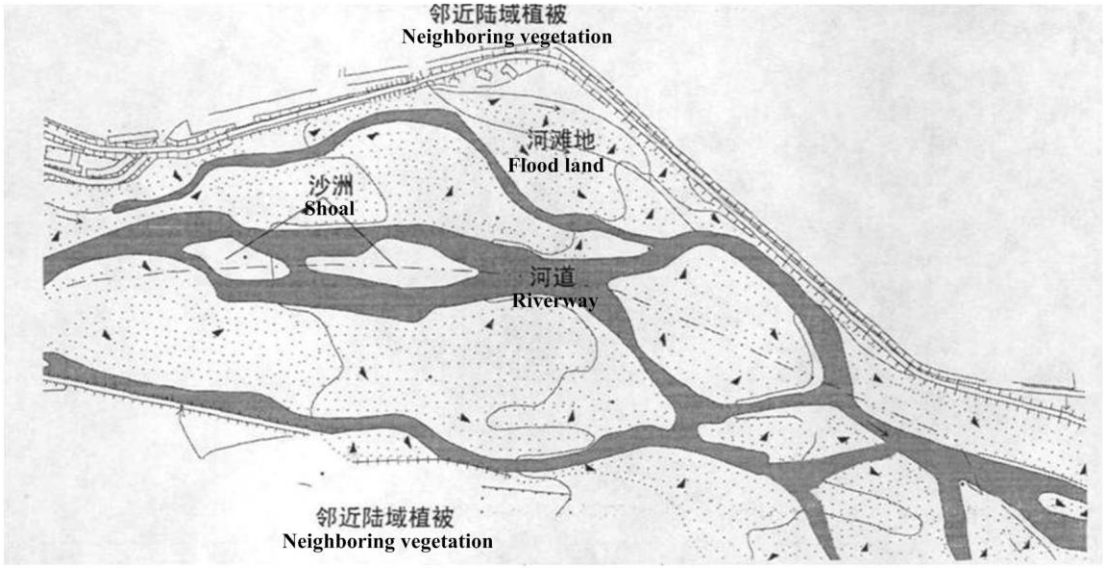


Figure 2 natural river formation

(source：Chen Lin.[2008] "Space countermeasures for the protection and recovery of urban water system's ecological functions", Master thesis: China University of Southwest Jiaotong.)

Winding and zigzag form is an important characteristic of river given by nature. Curved river can reduce the flow speed, which is beneficial to both river ecosystem and river regimes. Researches on the river biological community find that most aquatic animals and plants like to live in the waters with low flow rate (Xiao, 2006), thus keeping the river winding and the section morphologically natural is very necessary.

The traditional water system planning focuses more on flood control, drainage, irrigation and shipping than on ecological functions. In order to keep the water flowing fluently, the

natural rivers are curved cut-off. However, the straight riverway concentrates water energy, makes the river bank eroded and the riverway unstable, and finally destroys the natural ecosystem of the river itself. The principle of the riverway treatment today considers more about how to keep the diversity of the characteristics of the river on the basis of meeting the requirements of flood discharge.

2.2.3 Continuous River Space

The water continuity means a lot to ecological functions of water system. The destruction of water continuity will inevitably lead to the interrupt of corresponding biological link. Continuity of river space includes three directions: longitudinal (upstream or downstream), horizontal (cross-section) and vertical (depth). Longitudinal continuity mainly affected by hydraulic engineering. For instance, to control flood and impound water for landscape needs, dams are built above the river, which, from the perspective of ecology, will result in the loss of wetlands, marshes and flood plains situated downstream from the dam since a large amount of sediment and nutrients will be intercepted. The dam construction will also cut off the migration process of migratory species and simplify the aquatic habitats.

Horizontal continuity is mainly reflected in the water permeation from the river to the two river sides. This permeation can nourish the vegetation on both sides and share part of the water into the soil in flood period. River without embankment and the flood plains on its both sides have enormous water storage capacity. As the water level rises, the flood plains closed to the riverway will be submerged and at that time they will become the flood channels. In arid and semiarid areas, the water stored in the wetlands of flood plain has special meaning to recharging the underground water.

Besides, the permeable riverbed also makes it possible to recharge underground water, ensuring the sustainable utilization of water resources. In the construction of artificial rivers in cities, for the purpose of water saving, we usually use the concrete to curve the channel or do the anti-seepage treatments to the riverbed, making the vertical continuity broken.

In conclusion, river structure complying with topography, native river morphology and continuous river space are three vital affecting factors for river ecological functions. At present, Germany, Japan, the United States, the Netherlands and many other countries have started to reform rivers back to nature. Their actions include changing concrete embankment to ecological one, representing the water storage area on the river sides, rebuilding straight riverway to winding one and so on. They have gained obvious return up to now. While in China, seriously influenced by the traditional water planning thoughts and fettered by the relative standards, we are still lack of reliable experience in the field of water system planning in terms of both theory and practice.

3 A Case in the County Center of Luoning

3.1 Planning Overview

Luoning is a county located in the western of Luoyang in Henan province. The Luo River runs through the entire territory. Considering that the country center may expand across the river, it is necessary now to make an overall planning for the city water system. The water system is expected to be an important ecological infrastructure of the city. By the means of controlling the vital affecting factors for river ecological functions, we want to guild and improve the subsequent space planning as well as the ongoing construction projects to build Luoning an ecologically livable county in the Midwest of China.

3.2 Present Situation of Water System

The present distribution pattern of water system can be summarized as: one river, one canal, several streams. “One river” refers to the Luo River, running across the south of county center. Luo River is one of the tributaries of the Yellow River, originated from the south foot of Hua Mountain in Shanxi province, 11.5km long within the scope of planning. “One canal” refers to a canal running through the whole county from west to east. Several streams go down from the northern mountains into the Luo River. Besides, there is another south-north

stream born from southern mountain running into the river, as shown in figure 3. The streams are all seasonal streams, mainly undertaking the mountain water during the rainy season and part of the urban life-water for most of the time. Affected by the regulation of the reservoir upstream, two east-west rivers have water flowing all the year round.

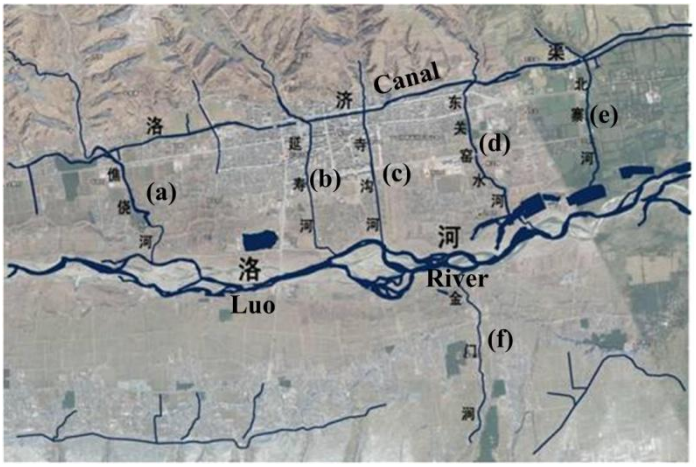


Figure3 present distribution pattern of water system in Luoning county

Except the canal which is an artificial engineering project, the other streams and the Luo River are all natural waters, only some of their natural characteristics disappeared during the process of county construction. For example, part of stream b has become underground river due to the construction of commercial pedestrian street; part of stream c has also been covered to construct market; most of the riverbeds inside the county have already been hardened. Even the Luo River is ongoing cut-bend project. For the foreseeable future the winding riverway, the current river islands and wetland will disappear and be replaced by a river with boring shoreline and unified cross-section. If they continue heightening the embankment in accordance with flood prevention standard of 50 years, the permeable river side will be replaced by rigid concrete bank, as shown in figure 4.



embankment project on Luo River



the beach of the Luo River



the riverbed of the Luo River





Stream c



Stream b



The canal

Figure4 present condition of water system in Luoning county(photographed by auther)

3.3 Planning Objectives and Principles

3.3.1 Planning Objective

In order to promote construction of ecological civilization, according to the actual situation of Luoning and planning requirements, we put forward the general thought of water system planning: take water as the skeleton; make full use of its special natural resources (fronting water and with hills on the back, multiple drainage corridors connecting northern mountain and southern river) to give full play to the ecological function of water system.

3.3.2 Planning Principles

Combined with the requirements from the assignment book, we define the following terms as our planning principles:

1) Ensuring the water security;
2) Combining "ecological priority" and "people-oriented";
3) Fully respecting the natural conditions and making full use of original waters to save construction investment;
4) Considering the demand for waterfront green space.

3.4 Analysis Process

3.4.1 Physical Feature Analysis

Luoning has a complex terrain. We use ArcGIS-3D Analyst modules to establish digital elevation model for our study range which is larger than our planning area. Based on the DEM data, we make further analysis on the slope factor supported by the expansion module of Special Analyst. Elevation and slope analysis diagrams directly and clearly reflect the physical features of the site. The planning area is located in the relatively flat river valley, as shown in figure 5.

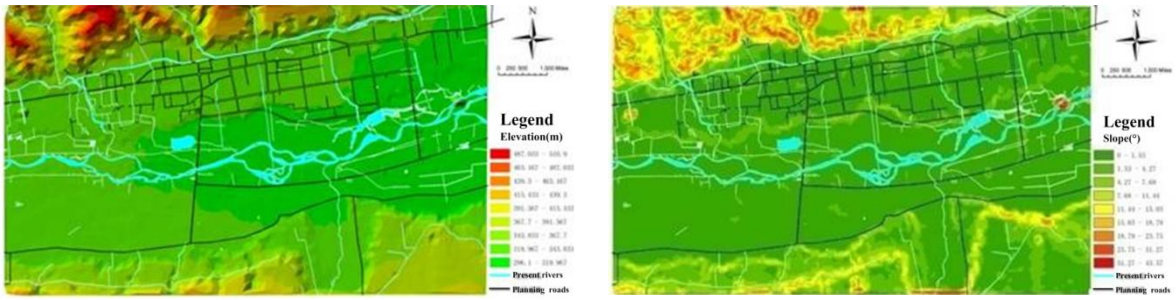


Figure5 elevation(left) and slope(right) analysis diagram

Through analyzing the physical feature of the planning area, we determine the main content of our planning work: comply with the site topography; make full use of the existing water system; on the premise of meeting with flood discharge requirement, consider ecological and landscape demands to apply irregular shoreline and revetment with complicated structure.

3.4.2 Surface Runoff Analysis

Again we take GIS basin analyst as the technical method, use hydrologic analysis tool (Hydrology) to extract natural catchment paths within the planning area, and classify the extracted drainage network composed by the catchment paths according to the flow accumulation. Higher the class, larger the accumulation quantity is, as shown in figure 6. Then, we extract the catchment paths of higher classes and superimpose them with present water network, as shown in figure 7. From the superimposition result it is clear that there is no obvious catchment path around many of the present streams inside the county, which indicates these “isolated” streams have already lost their capacity of converging runoff.

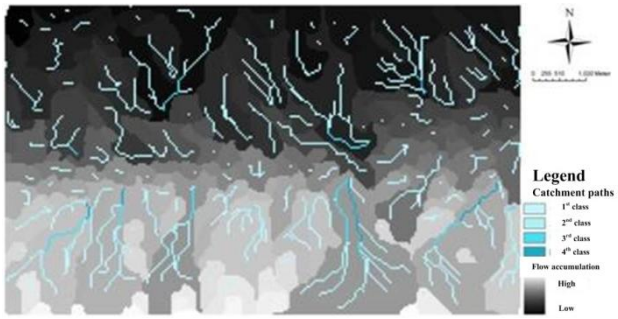


Figure6 natural catchment paths



Figure7 superimposition of catchment paths and present water network

3.4.3 Flood Submerging Analysis

Assuming that in the future there is no artificial embankment on the Luo River, then we must set aside enough flood plains on both sides of the river. The size and location can be determined by hydraulic calculation and flood submerging analysis.

1) Flood Elevation Determination

a. Flow Accumulation Calculation

In this case we use the urban outdoor drainage (rain) formula to determine the regional flow accumulation, in which the storm intensity formula is drawn up according to the results of mathematical statistics from the ministry of machine-building industry (Chen and Ma, 2007).

$$\left.\begin{aligned} Q &= \psi q F \\ q &= (3336(1+0.872\log p))/(4(t+14.8)^{0.88}) \\ t &= t_1 + m t_2 \end{aligned}\right\} \quad (1)$$

In formula (1), Q is the designing peak flow, Ψ is the integrated runoff coefficient, q is the designing storm intensity, F is the catchment area, t is the designing rainfall duration, t_1 is the ground water catchment time which is chosen 15min in this case, t_2 is the rain flowing time in tube, m is the reduction coefficient and p is the reappearing period.

In combination with land uses, we determine the integrated runoff coefficient to be 0.6. Through calculation, the regional flow accumulation is 12677230 m³ with reappearing period of 20 years and 14738230m³ with reappearing period of 50 years.

b. Flood Elevation Determination

Applied with Area and Volume tools in 3D Analyst, the flood elevation of reappearing period of 20 years and 50 years is worked out to be 304.3m and 305.5m respectively.

2) Watershed Discretization

In this step, we determine the drainage basin area using Basin in Hydrology tools.

3) Size Determination of Submerged Area

The paper calculates the submerged area by the non-source flood analysis, and proposes the sizes of submerged areas under the conditions of different flood elevations from step 1). The final sizes are obtained after artificial discrimination towards connectivity, as shown in figure 8.

3.5 Overall Structure Planning and Form Design

3.5.1 Overall Structure Planning of Water System

The extracted catchment paths of higher classes are recommended as the referenced layout of water system. At the same time, we enlarge the water surface at the lower catchment area to make water landscape node. The planned water system well complies with topography and basically achieves the demand of minimizing the modification of the original terrain after digging new waters. The designed north-south longitudinal waters play as the important landscape rivers and also the rainstorm runoff corridors to ensure the water security of the county, as shown in figure 9.

Although satisfying the demand of complying with topography, the overall structure planning of water system based on the catchment paths may conflicted with the existing road

network or cut a complete block in the actual situation especially in old district reconstruction. In these cases, the construction cost besides water system building rises. Therefore, it is necessary to do proper optimization such as abandoning some isolated small paths, adjusting path directions to make them consistent with the future road directions as much as possible, etc.

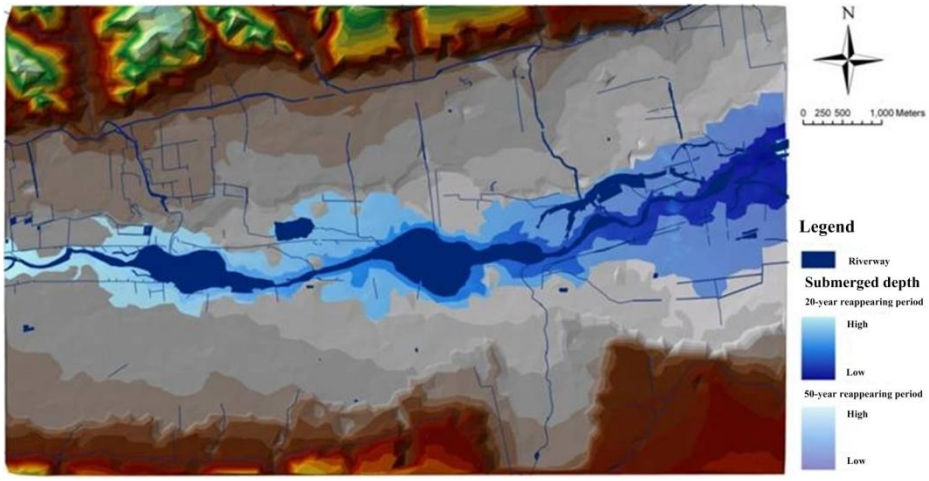


Figure8 submerged areas(flood plains) of different reappearing periods

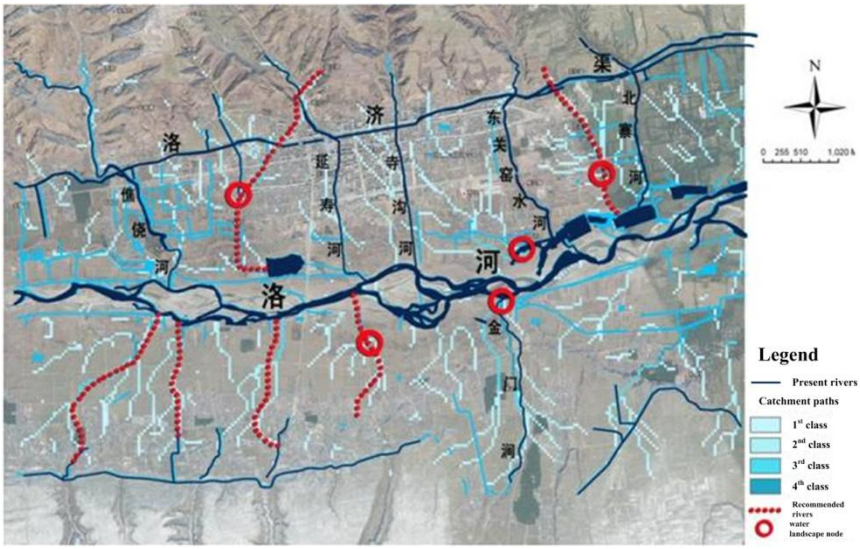


Figure9 schematic diagram of overall structure planning

3.5.2 River Form Design

Based on the idea of making room for flood, we define the river corridors of Luo River in accordance with the extent of its submerged area and determine the blue line according to the corridor boundary.

From the analysis result shown in figure 8, it is clear that the submerged area of 50-year reappearing period is large. Considering that parts of the river segment have already been embanked with 20-year standard, we decide to broaden the riverway properly on the foundation of 20-year submerged extent and adjust the boundary as the blue line of Luo River. Besides, we recommend the flood plain between the blue line and the submerged line of 50-year reappearing period to be the protection and ecological land where can place tidal flat, ecological forest, waterfront park and so on.

As to the cross-section design of Luo River, the existing river regulation planning is about to heighten the north bank and broaden the top of the breakwater as the future waterfront park. The plan is also going to build new artificial embankment on the south side. It is predictable that after this kind of regulation the original riverway will be partly occupied by the

embankment. And then in order to reach the flood control standard, it has to dig the riverway deeper to increase the flow area, as shown in figure 10, which will result in the disappearance of the diverse river landforms.

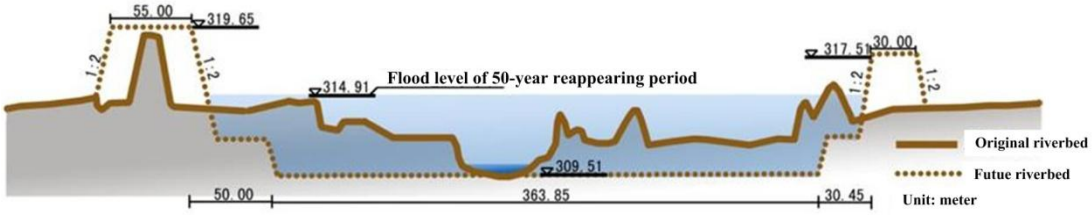
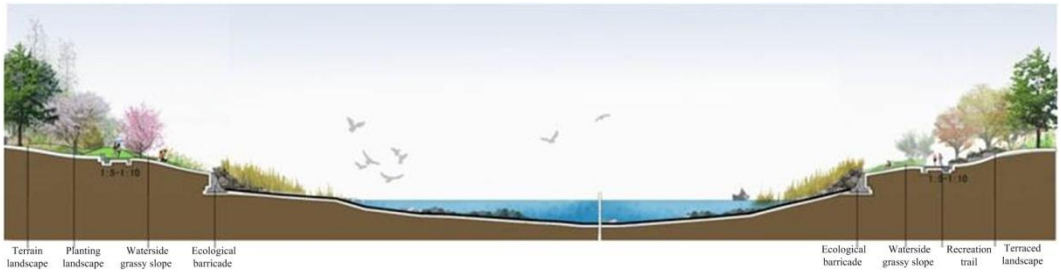
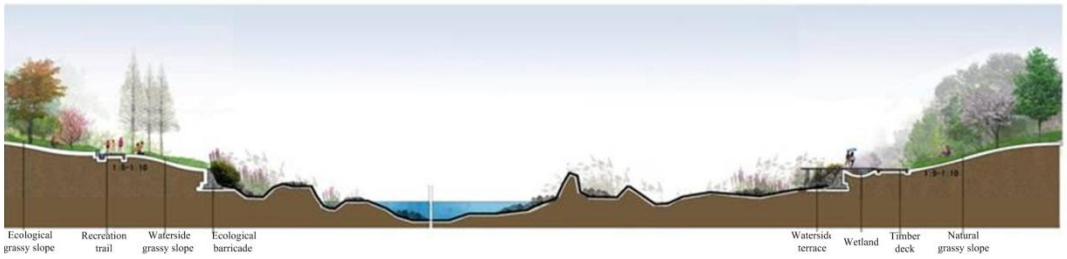


Figure10 cross-section comparison of current and the planned

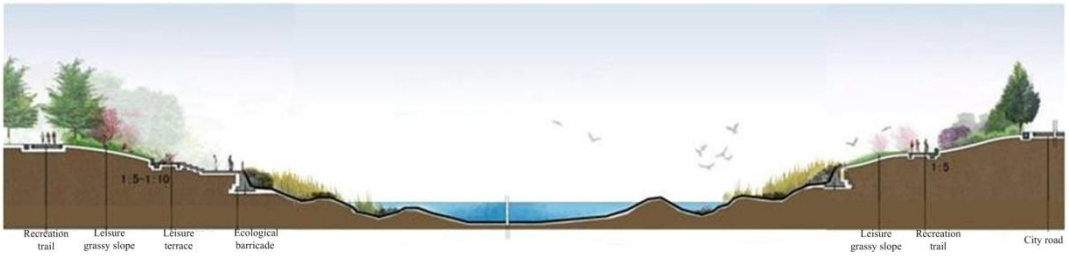
In order to keep the horizontal continuity and at the same time meet the needs of flood discharge and spatial reachability, we design several compound section structures according to the river corridor width, as shown in figure 11. When the big flood come, part of the green space on both sides will be submerged and this space is the urban open space in normal times. However, it is worth mentioning that this method will occupy more land than the traditional one does, so it may not suit for the river regulation in old districts. In the case of Luoning, there stands a shelter forest belt with width from 200m to 900m and the south side is still undeveloped with good ecological environment. So at this situation, if enough ecological land can be set aside early in the planning stage, it will lay a good foundation for the ecological environmental construction when the county center expand across the river.



designing cross-section a



designing cross-section b



designing cross-section c

Figure11 designing cross-sections based on the idea of "flood detention ecologically"

4 Conclusions

Urban water system is an important part of urban ecological system. To exert the ecological function of urban water system, first of all, we must fully understand that the original characteristics of the water system are the vital factors for river ecological functions. During the planning process, it is essential to set up the concept of respecting, compiling with and protecting nature to make the maximum the ecological effect of water system with minimum interference to the site and in the most cost effective way. At present, China has begun to focus on the ecological construction of water conservancy project. We really need to rise up the status of water system planning in the planning stage in order to avoid repeating the model of "destruction first, treatment later".

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Ecosystem Services and Urban Resilience – Case of Stockholm.

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1. Abstract

In the current context of urban densification and climate change the role of adaptive management of space in cities becomes crucial. This has significant consequences for the resilience of urban environments, and our understanding and framing the role of open space and vegetation in cities. Urban ecosystem services (ES) are currently promoted in Sweden in the planning for more dense and sustainable cities. Despite the vital importance of ES, the methodology for planning of ES has not been developed. Of particular concern to scientists, environmentalists and planners are tools and methods addressing ES in urban planning and construction in Stockholm. Thus, the findings are particularly interesting as Stockholm city and region are often used as the best practice examples in the literature on the management of ES. This article identifies some of the challenges and opportunities in Stockholm involved in the process of integrating the concept of ES into planning for urban resilience.

2. Introduction

The notion of urban resilience is gaining an increasing attention within the literature and contemporary discourses on the climate change and risk of natural hazard events. The concept of resilience has been transferred from physics to social sciences via ecology (Provitolo, 2013). Resilience is perceived as a key concept for analyzing ecosystems and was for a long time a domain of ecology sciences. It can be defined as the capacity of an ecosystem to integrate a disturbance without modifying its qualitative structure (Provitolo, 2013; after Holling, 1973).

There is a broad consensus among researchers that in order to be prepared for climate change, firstly cities must become resilient to a wider range of stresses, and secondly the efforts to foster climate change resilience should be connected with efforts to promote urban development and sustainability (Leichenko, 2011). Urban areas contribute to climate change the most and it has been estimated that up to 80 per cent of the global fossil fuel CO_2 emissions originate in urban areas (Simonis, 2011). In Europe they account for 70 per cent of energy use and for the most greenhouse gas emissions. Until recently cities have not been considered a focus of climate change research and climate policy. A strong need to ensure the sustainability of cities and produce resilient, adaptive urban areas results in changing the perspectives on urban green and blue spaces. They are often perceived as key sides for building urban resilience and locations providing wildlife habitat; mitigating air pollution and heat island effects, flooding. They offer economic benefits via for example increased property values, reduced damages associated with flooding, etc. Moreover green areas are part of social-ecological systems where linkages between natural and human systems are evident.

Urban ES are currently promoted in Sweden in planning for more dense and sustainable cities. ES can be easily described as the benefits people obtain from the ecosystems (Millennium Ecosystem Assessment, 2005) for example food, water, regulating hazard events, carbon sequestration, urban cooling, and recreation. Green areas like parks, allotment gardens, wetlands, urban forests provide shade and space for recreation, filtering aerosols and absorbing CO_2 emissions, but also support biodiversity and the ability to maintain biological functions (Ernstson et al., 2010; after Andersson et al., 2007). Complex systems involving living societies are adaptive, and based on the research on ES it is now

clear that ecosystems in cities provide great opportunities and arenas for social and ecological change reaching for a sustainable, resilient urban future (Jansson, 2013). The TEEB-Report for Cities (TEEB, 2011) suggests that ecosystem services could be used by cities as a tool. Valuation of ES could help to save on municipal costs, strengthen local (green) economies, or improve quality of life.

Stockholm is an interesting city for studying the planning and management of ES since there is a strong planning tradition for biodiversity management aimed at preserving valuable areas of species and ecosystems for nature conservation (Colding, 2013). The first UN Environment and Development Conference in 1972 was held in Stockholm, and Sweden was the first country in the EU to launch Agenda 21 activities (Gunnarsson-Ostling and Höjer, 2011). In 2010, Stockholm was also recognized for its achievements in the area of environmental protection and awarded the first European Green Capital for the city's environmental activities. A number of projects and self-organized initiatives promote environmentally friendly living. Of particular concern to scientists, environmentalists and planners are the tools and methods addressing ES in urban planning and construction. Of note is development of the Royal Seaport and project C/O City qualifying ecological, economic and social values of ES as a part of the development and planning process (C/O City, 2013). Even though the ambition of politicians is to preserve the green structure in the region (OECD 2013), the diverse urban pressures increasingly reduce and fragment the green spaces (Colding, 2013). It is becoming very difficult to integrate environmental and urban resilience policy into physical planning.
This article identifies some of the challenges and opportunities involved in the process of integrating the concept of ES into planning for urban resilience in Stockholm.

3. Notion of ecosystem services in Stockholm and planning for urban resilience

The notion of ES started to emerge in Sweden in the early 2000s. ES were briefly mentioned in 2000 in a joint report by the Swedish National Board of Housing, Building and Planning (Boverket) and the Swedish Environmental Protection Agency (SEPA) (Lewan, 2000). In 2010 Boverket's report on urban green structures highlighted the importance of urban ES for climate change adaptation. For the last 20 years ES are present in many projects in Stockholm (Elmqvist et al., 2004; Ernstson et al., 2010) due to regional policy and high expectations regarding the role of urban nature and ES in urban development. The 26 municipalities of the Stockholm region have engaged in quite ambitious joint activities to develop regional strategic planning documents, such as the Regional Development Plan for the Stockholm Region (RUFS, 2010) and Vision 2030. In these policy documents ES are included but more attention is paid to environmental quality, growth combined with policies that reduce environmental impact (OECD, 2013). City of Stockholm has developed recently The Walkable City Plan as an addition to its comprehensive plan. Plan contains a strategy for the city's parks and nature (Stadsbyggnadskontoret, 2012). New plan also outlines urban development strategies for more integrated and interconnected city. Urban areas will have to accommodate 200 000 new residents by 2030. The strategy is to increase density in the expanded city centre, as well as in the outer strategic nodes in the suburbs linking them with public transport and establishing more attractive parks and green spaces.
Environmental criteria have played an important role in the city's policy making which resulted in high environmental quality (OECD, 2013). It is acknowledged that CO_2 emissions per capita in Stockholm are among the lowest in OECD metro areas. Water quality is excellent, organic waste is efficiently used for a production of biogas, and very little waste goes to landfills. Former brownfield sites are being increasingly redeveloped; parks and green spaces are strongly protected. Still Stockholm needs visions to identify more explicitly environmental and sustainable development initiatives.
The big challenge is to identify and evaluate specific tools and strategies for the ecosystem management. Despite the vital importance of ES the methodology for planning of ES has not been developed (Chan et al., 2006).

Sweden will be affected by climate change, regardless of the level of success in mitigation of climate change and reducing greenhouse gas emissions. In order to reduce the risk, adaptation must be integrated into the country's urban planning and development. Yet Sweden has not developed an official national adaptation strategy. The report on climate strategy for the Swedish government, titled "Sweden Facing Climate Change: Threats ad Opportunities" released by Swedish Commission on Climate Vulnerability (2007) stressed the need for adaptation strategy commensurate with the increasing risk of floods, landslides, erosion in many regions and highlighted risk of "dramatic changes" in the ecosystems of Baltic Sea. In 2009 City of Stockholm published an act, titled "The City of Stockholm's Climate Initiatives". This report estimates that by the year 2100, the average annual temperature in Stockholm will have risen by 2.5 to 4.5^{o}C. The report also expects more rain and other forms of precipitation, rising water levels from the ocean and the lakes. The sea level is expected to rise 1 meter until 2100 (global level) and 50 cm in Stockholm. There is a believe that green areas which include eight nature reserves and a National City Park, will help to moderate the flow of water, filter out contaminating substances in the soil, and will help to produce oxygen. Districts' ability to deal with future climate change with increased rainfall, a warmer climate and rising sea water levels should be reflected in the areas' physical design. Furthermore City of Stockholm promotes "Green area factor" ("grönytefaktor") in urban development projects highlighting the benefits coming from "greening the urban spaces". Green sites help to improve biological diversity, work as a part of storm water system, help to mitigate the impact of climate change effects and contribute to recreational quality of the urban environment (Fig.1).



Figure 1: Example of climate adaptation design (source: City of Stockholm and Tema landskapsarkitekter, figure comes from the quality programme for block Norra 2 in the Royal Seaport, http://bygg.stockholm.se)

4. Projects and initiatives promoting ecosystem services and urban resilience in Stockholm

Policy makers, urban planners and other actors have to balance different types of chances, challenges, and development drivers. Stockholm has the opportunity to innovate technological and governance solutions to problematic challenge of building resilience (OECD, 2013). City continues to implement new projects in Royal Seaport and other locations in Stockholm but at the same time tries to encourage better co-ordination of regional policy.

4.1. Co-operation on the adaptation planning around Lake Mälaren.

Climate analyses in the Stockholm region released that the level of Lake Mälaren is likely to rise. The Lake Mälaren is a river basin for a large area of 22 650 km^2. Today the level of the lake varies and must be regulated. Moreover the risk of flooding from the lake is extremely high. The climate change scenarios show that the sea level will rise. The level of a lake is today about 70 cm above the sea level. A big concern of adaptation planning policy in Stockholm region is to prepare new regulation and construct a new lock between the lake and the sea. In 2100 the level between the sea and the lake will be reduced.
The recent example of co-operation initiative of five County Administrative Boards abutting the lake is the initiative to develop common strategies on adaptation planning regarding drinking water supply. Lake Mälaren provides drinking supplies for over 2 million Swedes and faces contamination through salt water from the rising Baltic Sea. The recent studies offer three solutions to this problem. First is to look for other water resources; second is to use barriers and keep the surface level of the lake above the level of Baltic Sea; or build three or more barriers in the Stockholm archipelago (OECD, 2013; after Renvall, 2011).

4.2. Development of Stockholm Royal Seaport



Figure 2: Stockholm Royal Seaport – Visualisation
(Source: City of Stockholm and BSK arkitekter; photo mantage of Hjorthagen in the Royal Seaport; http://stockholmroyalseaport.com/sv/rd-projects/co-city)

Stockholm region currently faces the challenge of considerable population growth. Densification of land use functions – housing in particular – is the dominant policy and planning goal. Stockholm Royal Seaport is planned to be a world-class sustainable city district promoting environmentally friendly development with high ecological, social and economic standards, as well as the environment free of fossil fuels and adapted to climate change (OECD, 2013). It is located on a former brownfield industrial area of 236 hectares that had been used previously for gas, oil depots and containers.
Building on the experience of another developed district in Stockholm – Hammarby Sjöstad, the City Council decided to support high density development close to public transport, and green cluster innovation projects.
One of the projects evaluating ecosystem services in Stockholm Royal Seaport is C/O City. Project aims to promote ecological, social and economic values of the nature and raise awareness of the potential of ecosystem services in urban environment to strengthen urban resilience. Research includes visualizing and quantifying urban ecosystem services, developing tools for planning and monitoring, analyzing the data and showing the relationship between ecosystem services and urban resilience.

The project applies and develops tools such as the „Green area factor" (GAF)[1] in order to control urban green cover (C/O City, 2014). The GAF expresses the ratio of ecologically effective surface area to the total land area.

$$\text{GAF (BAF)} = \frac{\text{ecologically-effective surface areas}}{\text{total land area}}$$

Figure 3: GAF calculation

In this calculation (Fig.3), the particular parts of the land (a plot or block) are weighted according to their "ecological value". In Järvakilen in Stockholm, where the Royal Seaport is located, is one of the three areas that are study cases. The parallel studies are undertaken in Pildammsstråket in Malmö, Sweden and Rio Coco in Frotaleza, Brazil. In these locations selected ES are evaluated: recreation, food production (urban farming), regulating storm water, connectivity (biodiversity, functional groups), regulating urban cooling, regulating air quality and noise reduction (in a biotic environment).



Figure 4: A model of the green wall, Malmö Testvägg, Malmö (http://stockholmroyalseaport.com/sv/rd-projects/co-city)

The results from the project will be presented in reports, seminars and workshops. One of the results is a Handbook for integrating the concept of ES into planning process.

4.3. URBES project - Urbanization, Biodiversity and ES

Research conducted by the European BiodivERsa project – Urban Biodriversity and Ecosystem Services (URBES) and the international group of experts from twelve world-leading research institutes[2] was created to help bridge the knowledge gap between

[1] *Green area factor (GAF) is an innovative development standard designed to increase the quantity and quality of urban landscape by maintaining the current land use. GAF originates form Biotope Area Factor (BAF) developed by experts in Berlin as a scoring system to promote attractive and ecologically functional landscapes, including ecosystem elements such as green roofs and walls, permeable paving, tree preservation, and food cultivation. BAF and related factors were adopted by many cities including Stockholm*.

[2] Stockholm Resilience Centre (SRC), Humboldt-University (HU), Technical University of Munich (TUM), University of Salzburg (US), Beijer Institute of Ecological Economics, Kiel Institute for the

urbanization and the demand, creation ad provisioning of ES in urban regions. The research builds on case studies in Europe and US: Stockholm, Rotterdam, Berlin, Lodz, Barcelona and New York City. The URBES project works to communicate research outcomes by engaging key stakeholders responsible for decision making in the city/ region in a series of participatory workshops and in-depth interviews. The research explores how urban planning and management can contribute to urban natural environments that meet the needs of people.

In Stockholm two land use scenarios were developed by URBES scientists: "Utopian Green Capital" and "Vibrant City" (Fig.5) as a vision of resilient Stockholm 2050 demonstrating the potential and requirements of urban ES and linking long term strategies and land use planning to the demand and supply of ES. These scenarios are used to discuss a potential role of urban ecosystems in the future including opportunities and challenges for integration of ES into urban development.



Figure 5: Visualizations of Stockholm 2050, A- "Vibrant City", B - "Utopian Green Capital", 1- Brommaplan, 2 – Haninge, 3 – Hammerbyhöjden (author: A. Kaczorowska)

"Vibrant City" is a vision of an attractive node in Northern Europe for both businesses and living secured through large scale and sophisticated technical systems for energy, drinking water, sewage and waste. "Utopian Green Capital" is interesting vision to study in terms of how urban nature more efficiently could deliver a number of important urban functions and qualities as well as new standards for sustainable urban development. This scenario introduces more new innovative "green" solutions, urban design elements (green roofs, terraces, ponds and infiltration areas) and urban nature highly integrated into buildings and

World Economy (IfW), Mistra Urban Futures (MUF), Erasmus University Rotterdam, University of Helsinki (UH) University of Lódz, University of Barcelona and the New School New York.

other structures. Creating reach opportunities for recreation and urban farming this scenario could contribute more to improved food security and socioeconomic cohesion.

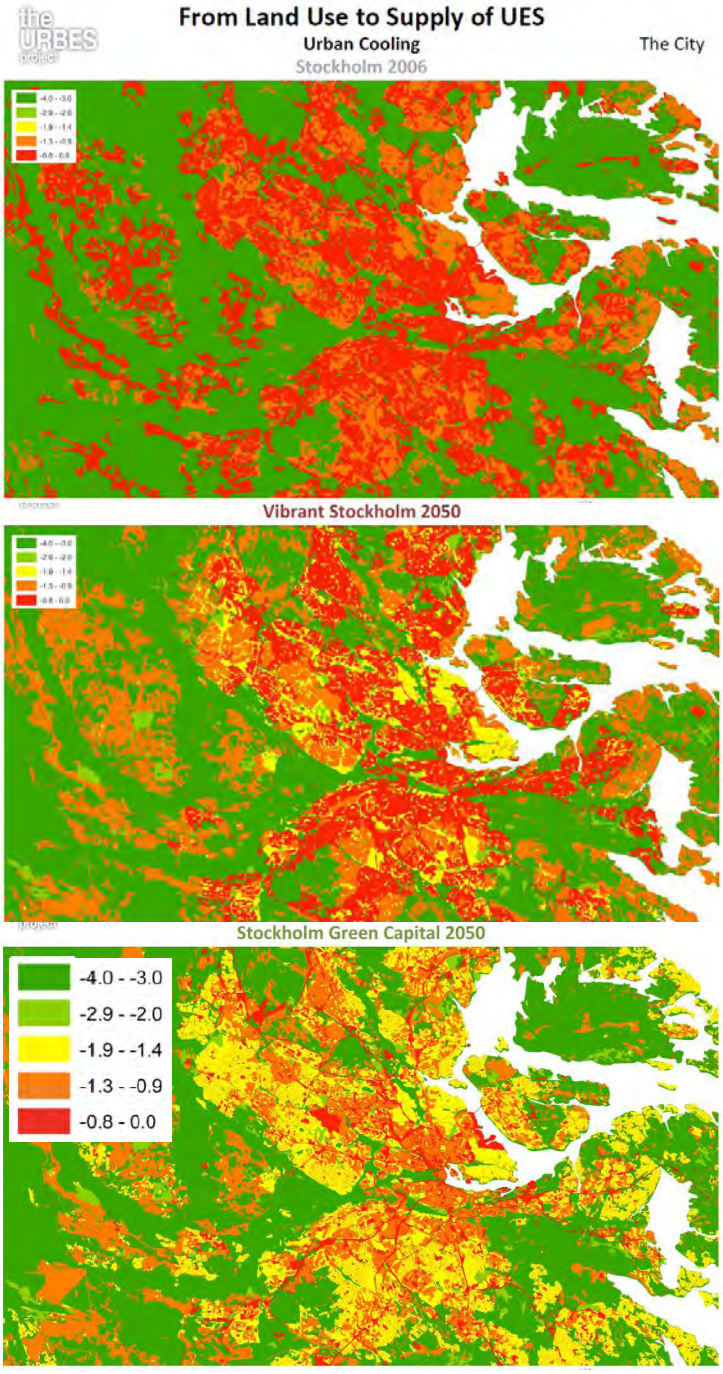


Figure 6: Supply of ES: Urban Cooling (cooling potential measured in the temperature change -^{0}C; Source: URBES project, visualizations by Humboldt University, Berlin)

The study of Stockholm as a cooperation in research of universities within URBES project evaluated provisioning of urban ecosystem services calculated from land use classes (Fig.6). Within the study a set of indicators were chosen representing eight important urban ecosystem goods and services: food supply, energy supply, air quality regulation, urban cooling, carbon sequestration, storm water retention, physical and mental recreation. For example for the climate regulation and air-quality regulation indicators like 'surface emissivity,' 'f-evapotranspiration,' 'tree cooling potential' and 'carbon sequestration' were selected. They were tested using spatial data along an urban–rural gradient including Corine Land Cover (CLC) raster data provided by the EEA. Land use classes for the future scenarios for Stockholm 2050: "Utopian Green Capital" and Vibrant City" were translated from developed scenario narratives and zoning rules.

The results from the study confirm the land-use change has a vast impact on the supply of ecosystem services and their ability to contribute to human well-being (Larondelle and Haase, 2013; Lautenbach et al., 2011). Moreover core cities do not necessarily provide fewer ecosystem services compared to their regions. In addition strategies of "greening urban development" create higher chances to provision from ES. Study of tested possible future scenarios helped to illustrate the trade-offs or synergies between different ecosystem services. Study illustrates the spatial patterns of ecosystem services supply based on possible variables of land use classes or zoning.

The results from a study can be effectively used in urban planning (Larondelle and Haase, 2013) and study provides an overview of what ecosystem services are supplied in the core cities and their surrounding regions. They may be helpful to initiate communication between

urban and regional planning, reduced uncertainty and better quantitative knowledge that all in all will help to reduce the growing ecological footprint of cities.

5. Concluding remarks

Stockholm has an opportunity to innovate technological and governance solutions to the difficult challenge of building urban resilience. Projects of eco-districts in Royal Seaport show that Stockholm can encourage climate change policy and integration of the concept of ES into land use planning. It can also play valuable role internationally to raise greater awareness of the need for adaptive strategies but also commercializing its own learning from eco-projects.

The study on urban ES assessment in Stockholm contributes to better understanding of how urban ecosystem service provisioning is distributed in the city core and region today and in the possible future scenarios. Moreover, the study of Stockholm shows that city centre provides a range of ES and environmental issues should be prioritized and emphasized within urban planning and governance. The focus of the future research should be on identifying and evaluating the synergies and trade-offs between different urban ES.

Presented studies revealed that the adaptation process to climate change needs to address long-standing challenge of dealing with inadequate regional administrative capacity (OECD, 2013). On the local level in Stockholm region municipalities have already started to expand the regional powers to deal with problems requiring broader focus. There is observed a big engagement of informal institutions in the local ecosystem management in Stockholm, where practices of civil society groups play meaningful and crucial role (Colding, 2013). Ernstson et al. (2010) suggested that developing ways of analyzing spatial social-ecological networks is the key factor in improving ES management in Stockholm.

Co-operation on the adaptation and planning around Lake Mälaren is a good example of the governmental initiative of climate change adaptation addressing a fairly wide range of risk including: sea level rise, risk of storm surges, effects of extreme weather events, climate change-driven diseases, effects of climate change on energy use and water availability. Still the contribution of ES in the urban resilience and planning for chance events is not much discussed in Stockholm. The URBES workshop in April 2013 revealed a practical difficulty to embrace a complexity of urban ES in the context of climate change.

Finally all studies respond to the growing need for data and information on the values of ES for urban citizens. This will require an interdisciplinary approach and integration of qualitative and quantitative information on ecological, social and economic factors, especially in the face of the predicted increase in urbanization in Stockholm.

Acknowledgements

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The transformation in a waterfront community in the Mekong Delta, Vietnam: conflicts between urban planning and social practices to cope with flooding

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Synopsis

This paper aims to identify the transformation in a waterfront community to reveal how flooding adaptation in the Mekong Delta is in contrast to current urban planning and locals' practices. Findings are feasible to give a voice to local communities in the struggle to guide urban development in flood-prone areas.

1. Introduction

Vietnam is one of the most disaster affected countries in the world with severe damage cause by water hazards or climate-related hazards such as the tropical storm, flood, inundation, drought, salt water intrusion, storm surge, landslide, or flash flood (Ninh, Trung & Niem, 2007). It is also ranked as one of five countries which have been most affected by climate change, according the World Bank's report. Mekong Delta, as a part of the Mekong River basin and the southern coast of Vietnam, is evaluated as a "hot spot" for climate change as one of the three most vulnerable deltas in the world (Otto & Pedersen, 2005).

The Mekong Delta is one of two largest rice granaries of Vietnam, which has an area of approximately 40,000 square kilometres. It is home of 17.3 million people, with the intensity of 435 people per square kilometre spread across in 13 provinces and cities (Ninh et al., 2007). Since the Doi Moi period of the mid-1980s, the Mekong Delta developed as a prosperous economic region, thanks to agricultural intensification and the abundance of seasonal fishery. With approximately 85% of Mekong Delta population deriving their livelihood from agricultural activities, this region is considered as a key agricultural production zone namely "rice basket" of Vietnam.

Simultaneously with the agricultural productivity outcome, there is the outcome of human endeavour to cultivate the water-land under impacts of natural hazards, particularly flooding. Flooding is a dominant natural phenomenon of this region. The natural characteristics of hydrology, climate, soil, and topography, combined with the population habits and livelihoods in areas susceptible to flooding, are considered as the reasons cause floods and negative impacts from flood. According to The International Federation of Red Cross and Red Crescent's report, as of 16 October in 2011, floods had affected the lives of

some 80,686 families and more than 200,000 children were at risk. Forty six deaths were reported. Up to 1,600 houses and more than 27,000 hectares of paddy crops were destroyed (IFRC, 2011).

However, the claim that flooding always causes only devastation in the Mekong Delta is one-sided. In contrast to the severe and unpredictable floods in the center region of Vietnam, the water level of the Mekong Delta floods rises slowly and on schedule (IFRC, 2011). Thanks to the reservoir of Tonle Sap Great Lake in Cambodia, the water level in the flood season in the Mekong Delta can be controlled and managed. Therefore, the flood in this region is considered a "peaceful" flood (Danh & Mushtaq, 2011). Along with these issues, the flooding season in the Mekong Delta also brings intensifying economic benefits. According to Danh and Mushtaq (2011), the flood area contributes 67% of the Mekong Delta's GDP, 75% of total agricultural-fishery-forestry production, 79% of total industrial output, 80% of total services, and more than 50% of Vietnam's total agricultural exports. This natural and social phenomenon have been accepted by residents here since the first settlement in 700CE and the Vietnamese settlement in 17th century (Biggs, 2004). The flood season is called "floating-water" season (*mùa nước nổi*), as a gift from nature to indicate a sign of bumper harvests. A rich aquatic environment has been generated by flooding that have brought benefits to agriculture and fishing for many generations of local Vietnamese. Despite international claims of climate change and devastating floods, there are numerous local people who still want to inhabit the flood-prone areas. It is home to 8.5 million people, of which 2.5 million people are living in deep flooding level (up to 3 metres), while 3 million people are in medium flooding level (up to 1.5 metres) of this area (Ninh et al., 2007). Their lifestyle combines water and land into one that includes houses, traffic, trade, transport, fishing activities (Ni, 2011), and a variety of cultural events. Future urban development may not be sustainable without a deep understanding of how the Deltaic people maintain their distinctive lifestyle.

2. Questions of an appropriated approach to flood control in the Mekong Delta - "hard structure" for a water landscape?

The Mekong Delta is "water" land. It is a combination of riverine, tidal and inland floods, causing an excess of water (OSA, 2010). There are 37 large and small rivers in Mekong River system. In addition, there exists 11,000km canal network which has been constructed in the last 300 years (Tuan & Wyseure, 2007). The network of rivers and canals cover the whole area of the Mekong Delta and create a water grid across the flat plane. Water can be seen everywhere and is essential for agricultural livelihoods, transportation, communication, fishing and all kind of daily domestic activities of the Deltaic people (Kakonen, 2008). Waterways consequently structure the landscape with networks of rivers, canals, mangrove

forests, rice fields and waterfront communities. They create the Mekong Delta's unique physical form, social activities and beliefs. Besides the physical characteristics of the river itself, its canals and vast rice fields, the locals add vitality to this landscape in bustling movements and trading activities of floating-markets with thousands of businesses line the waterways.

As unfolded in the book "Quagmire: nation-building and nature in the Mekong Delta" of David Biggs, the form of the Mekong Delta is the result of long evolution that has been shaped by nature and a variety of "nation-building" projects of Vietnamese, French, and American design. But historically and narratively, Biggs also examined the interaction and negotiation between nation-builder and local residents to alter the natural environment and ecology of the region (Biggs, 2012). Recently, the establishment of planning policies to the whole Mekong Delta outlined a firm "hard structure" approach to this water landscape in varied scales and purposes without involving of local actions. It gradually create the overspreading of a concrete grid that change not only natural landscape characteristic but also the water-related lifestyle of Deltaic people. The paper will review three flood-related planning policies which are implementing in the Mekong Delta including the dyke policy, the resettlement area program in regional scale and the river embankment project in urban scale to generally understand their purposes and concepts. It could reveal the disadvantage points that may cause conflicts to local practices to adapt with flooding which were existed in many generations.

2.1. Dyke policy

According to Vietnam Academy for Water Resources website, the flood-prone area in the Mekong Delta has a system of high-dykes and August-dykes, with a total length of about 13,000km, including 7000km of August-dykes to protect the Summer-Autumn rice. In 2008, Ministry of Agriculture and Rural Development considered about "engineered solutions" with a proposed plans to raise around 10,7 trillion Vietnamese dong (US$676 million) to further extend and upgrade dikes in 15 vulnerable provinces along the Vietnamese coast, including seven in the Mekong Delta (Biggs, Miller, Hoanh & Molle, 2009). that established 1,312,70ha dyked area in the whole Deltaic region in 2012 (Đạt, 2013). The "hard structure" approach to control the flood and develop agriculture still enhances even there was many contrary assessments about the advantage and disadvantage impacts of the dyke system to social-economic and environmental aspects for the whole Mekong Delta region. In Hoa's research (2008), during the 1996-20012 period, the changing of infrastructure such as dredging the canals, raising the dyke systems along canals, upgrading roads to protect settlement areas, and protecting crops affected the flood regime. It could prevent the rice fields from the floods in early of flood season but causes inundations 5 to 10 days longer and 0.2 to 0.3m deeper

in some areas near or between high-dyke systems. The roles and impacts of dyke policy in the Mekong Delta need more studying and reconsidering, particularly in climate change context when the flooding levels continuously increased and broke the highest flooding crest in 2000 that used as the worse scenario to build the dyke system.

2.2. Resettlement area program

The concept of developing safe residential areas in the Mekong Delta was introduced after the historical flood in 1996 in the Prime Minister's Decision No 99/1996/QD-TTg. After the huge flood in 2000, which caused severe damage to human life and property, the program "Resettlement area for flooding prevention" in frequently flooding provinces was established to ensure the Deltaic people safety. In the Decision No 173/2001/QD-TTg on "Socio-economic development in the Mekong Delta in 2001-2005" by the Prime Minister, the resettlement clusters standard level is built base on in the highest flood crest level of 1961 and 2001 flood. Each cluster is formed approximately 2-3ha for 100-120 households as a modern road-based community in the high area, and is scattered throughout the Mekong Delta provinces.

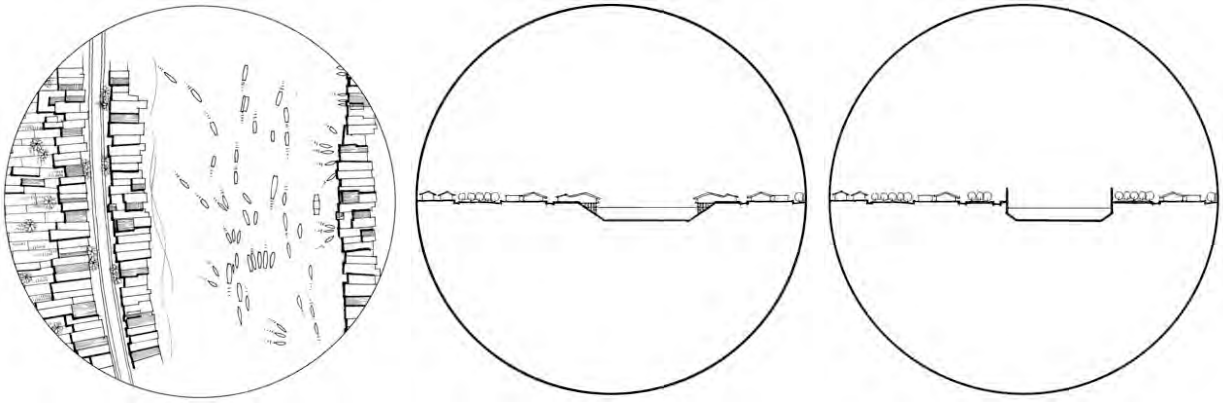
However, with 43% completed clusters by the end of 2013 which was far from the target to relocate 57,252 households in total, the program has not finished yet (see figure 1). In addition, some resettlement clusters are uninhabited due to many reasons. According to Birkmann's research about the relationship between resettlement areas and inland clusters with the dyke system in Phu Hiep commune, Dong Thap province, although people who live in resettlement clusters or on residential dyke are safe and not affected directly by floods, they have confronted with other constraints that change their lifestyles and livelihood activities, for example the far distance to their crop-lands; or the transformation of transportation from closely link with water to adjacent to high dense vehicle road (Birkmann, Garschagen, Tuan & Binh, 2012). Additionally, the high cost in owning a land plot and monthly expense, the low construction quality and inadequate public facilities also cause the hesitance to water-based residents to settle down with a new road-based lifestyle.



Figure 1: Inhabited resettlement area in Hau Giang province and Can Tho city (source: author)

2.3. River embankments project

Preventing locals from erosion and flooding as well as enhancing urban aesthetic along the river were the major targets of the river embankment project. There were some additional purposes to promote the environment quality, local recreation demand and tourism development as mentioned in the report "Landscape design project to Can Tho River embankment in 2010". The river embankment project was implemented in most of provinces in the Mekong Delta with the following common steps: (1) relocate all the waterfront communities along rivers to resettlement areas; (2) building high concrete embankment in two riverbanks; and (3) creating river parks or open spaces. The appearance of a huge concrete structure will replace the unique water-based landscape and built environment patterns to set up a new uncharacteristic and insensitivity face of rivers (see figure 2). It means that the waterfront communities, along with Deltaic identities, local livelihoods, and flood adaptation experiences, will be no longer exist. Whereby, the local traditional knowledge and experience to live with flooding in many generations will be faded and lost.



Waterfront community pattern | *Section of vernacular river landscape* | *Assumed section with river embankment*

Figure 2: Settlement pattern and sections of Cai Rang waterfront community (source: author).

3. Visualized local practices before and during flooding

Biggs marked in his book "Quagmire" the significant contribution around the role of nature in nation –building projects. But as described by Biggs, the results of human actions imprint everywhere in the whole environment (Biggs, 2012). The role of local practices through their daily activities must to be considered as essential as nature in shaping appropriated planning policies. To unfold the question of how local practices contribute in the urban transformation to cope with flooding, the research data were collected in the Cai Rang waterfront communities of Can Tho city during three months in 2013 flooding season to investigate local practices in coping with flooding issues by site observations, interview, house visiting, participant diary (photovoice).

Can Tho city could be seen as the heart of the Mekong Delta because of its regional location and role. The floods here are not only the annual floods like in other Mekong Delta's provinces, but also the urban floods from tidal surges and heavy rainfall that are predicted to increase flooding in the future (Birkmann et al., 2012; Neumann, Nguyen, Moglia, Cook & Lipkin, 2011). In Neumann et al.'s report (2011), the variety of flood extension and depth depends on many factors and an estimated area is between 9,700ha – 36,000ha in Can Tho city under 1m of water. Figure 3 shows the changing of river levels in which (a) is the normal level in dry season, (b) is low level in flooding season, and (c) is the highest level in flooding season. The flooded water level without tide influence could increase 1.20m compare with the average level in the dry season, and could reach 2.25m to 2.5m at tide peak. According to local residents' observation, the flooded water level has dramatically increased in recent three years that submerges most of houses in the Southbank and few houses in the Northbank. Previously, most of stilt-houses and half-stilt-houses haven't got submergence thanks to the high floor level which has been built by taking higher level of 2000 flood peak.



Figure 3: Different river water levels in Can Tho river with (a) normal level in dry season on 4th May 2013; (b) low level in flooding season on 22nd November 2013; and (c) highest level in flooding season on 8th November 2013 (source: Author).

To investigate local practices during flooding, 7 digital cameras were provided to participant to record their daily activities before and during flooding time. More than 6,000 photos present the concrete details of everyday events, activities and the contexts in which they occur, and provide data about community life. Therefrom, the concerns and behaviours of photographer could be revealed. All photo's subjects are mapped on the satellite image to investigate the concerns of local residents with red dots for photos before flooding and blue dots for photos during flooding (see figure 4).

Before flooding, most of photo focused on the floating market and waterscape. They interest in opposite riverside landscape, early morning trading activities and all on-water events such as funerals, fishing and tourism visiting. Boats, merchants, tourists and local residents were their subjects to describe the trading bustles in the floating market. In which

their daily routines are outlined from early morning until late midnight. Although local people now have road-based trend to experience their daily routines but the photos still reveals the strong physical relationship between water and locals through photos of water-based lifestyles, on-river activities and on-water housing types.

During flooding, the greatest concern of participants turn to the flooding impacts to their indoor spaces. They spent a lot of pictures to describe the different flooded water levels inside their houses, the change of the indoor spaces and the family members' activities in flooded water. They also displayed their own activities by asking other people photographed what they did in flooding circumstance. In addition, participants increase their interests in outdoor spaces as the houses next door, alleys, roads, river edge where affected by flooding. The participants who have on-river livelihoods such as boat driver, boat-vendor and boat-merchant even expand their scope of daily activities with a wider traveling radius on the river. The photos sketched a part of locals' daily life with the similarity between before-flooding-photos and during-flooding-photos. It seems that flooding is not a serious event to locals with scarcely influence to their everyday life.

a b

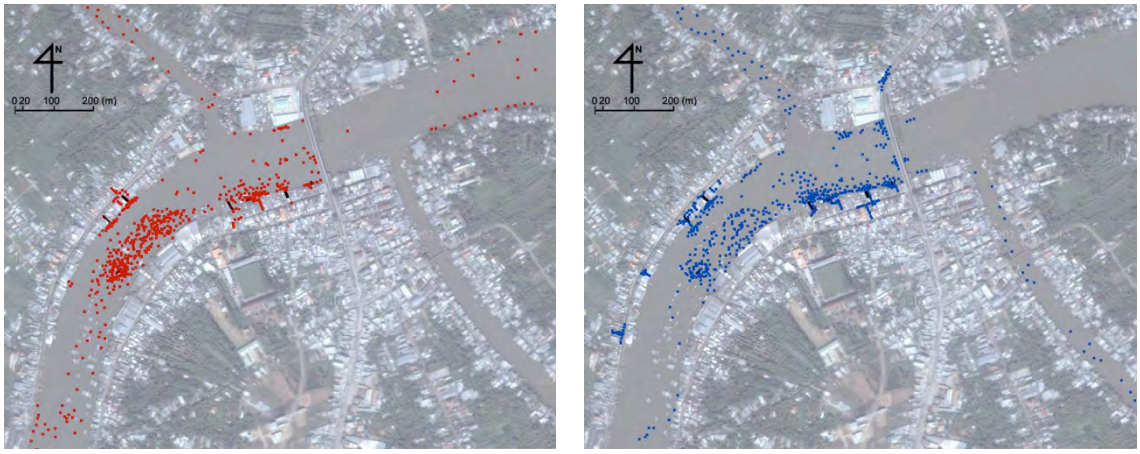


Figure 4: Synthesis of seven locals' concerns (a) before flooding; and (b) during flooding (source: author)

4. Transformation in urban patterns: from on-land pattern to on-water pattern

The community vary widely in its form which represents historically and geographically the social and physical factors of the site and situation. During the long period of evolution, the waterfront community in Cai Rang district has acquired the unique layouts with fine-grain patterns in both two riverside communities and the floating market community (see figure 5). From sparse on-land plots in the waterfronts, there are now a high density place not only on land but also on water. Locals used boat as a house in the floating market at the middle of the river or built their houses on water at the river edge that helped create more living spaces and trading opportunities. Settlement and trade activities along river gradually formed unique physical patterns which well adapt to water environment and flood impacts. Consequently,

the appearance of on-water clusters and floating clusters in Cai Rang waterfront community shows the evident transformation of urban patterns that were formed by local practices in some generations to adapt with river and floods.

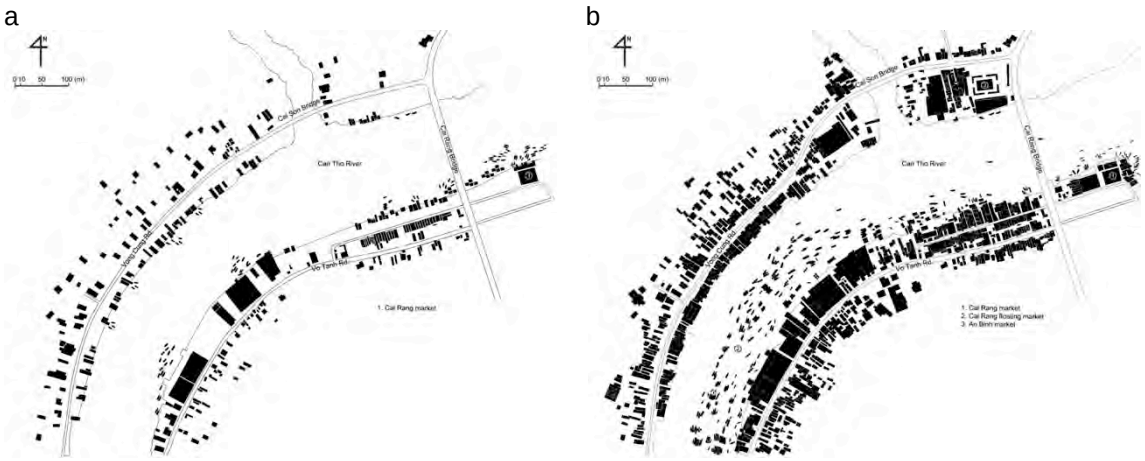


Figure 5: Figure-ground map of Cai Rang waterfront community (a) before 1945; and (b) from 1990 to present (source: author)

5. Transformation in housing floor plan – social practices to adapt with flooding

Finding shows that there are five major types of housing in a waterfront settlement including boat-house, floating-house, stilt-house, half-stilt-house, and on-land-house (see figure 6). They have been existed for a long time in the Mekong Delta although the gradually changing of structure and materials over time. In general, two housing types completely float on water including boat-house and floating house, two housing types are built on water including stilt-house and half-stilt-house, and the remain is on-land-house which is totally built on land.



Boat-house (BH) *Floating-house (FH)* *Stilt-house (SH)* *Half-stilt-house (HSH)* *On-land-house (OLH)*

Figure 6: Five housing types in Cai Rang waterfront community (source: author)

The housing investigation and interview in 15 waterfront houses outlines that the impact of flooded water are different depending on the different types of housing. The occupants in each housing type also have their own different solutions to adapt with flooded issues (see figure 7). Thanks to floating characteristic, boat-house and floating-house have absolutely no impact from flooded water. They float on any flooded water levels that help keeping normal

daily activities throughout flooding season. They themselves are exactly solutions to any flooded water level without changing in floor plans.

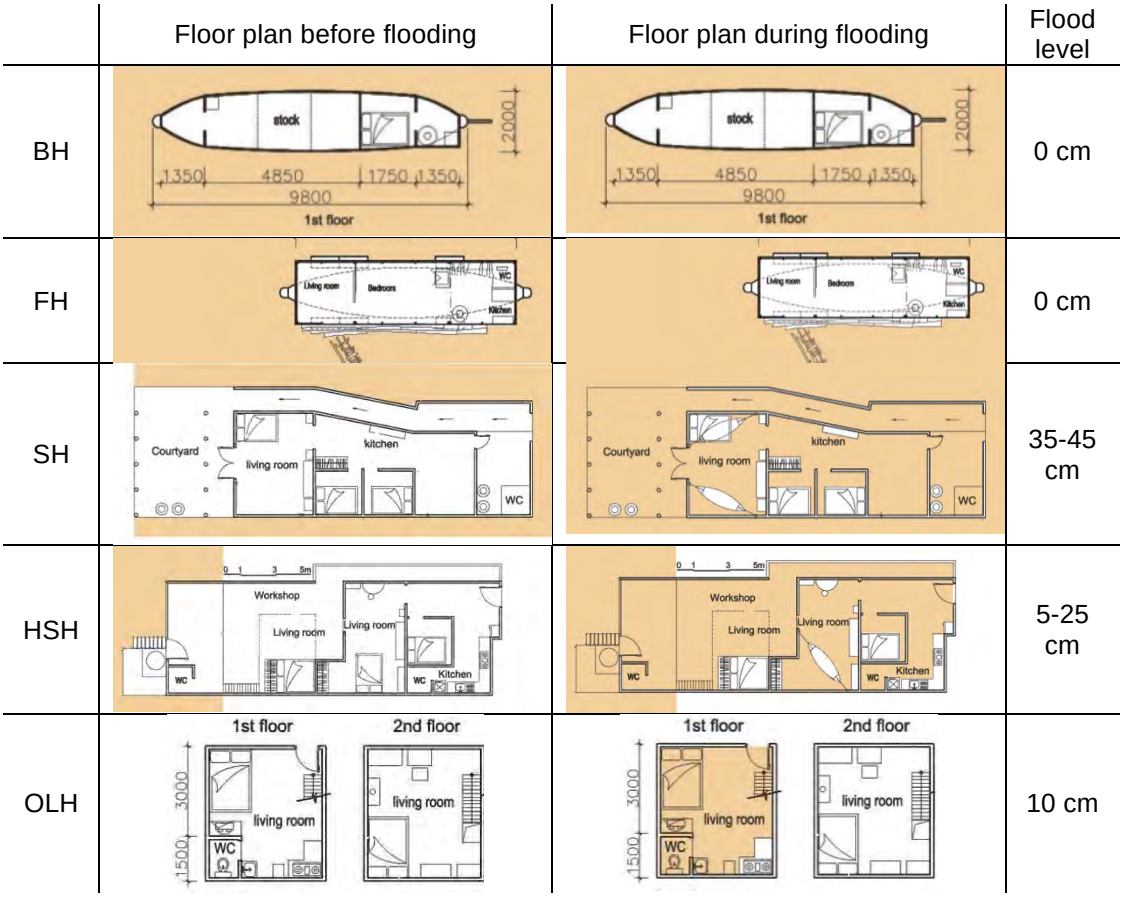


Figure 7: The floor plan of each housing type reveal how local residents adapt to flooding (source: author).

Stilt-house is the most affected housing type by flooded water. Not only the whole house is under water but also all walkways and footbridges to connect to land are totally disrupted because of deep submergence. The only way to approach the stilt-house that time is using a boat. As outlined in drawing of a stilt-house in figure 7, all indoor spaces got flooded but the function of spaces did not change much in flooded situation. The occupant said that she so stress to flooding but she had several actions to deal with it. Her beds were elevated previously to continuously organize everyday activities. One bed was utilized for eating and relaxing purposes. In addition, the householder hung two hammock to create more spaces above flooded water. The courtyard was inundated but still used for motorbike parking and trading, even for playing and swimming.

The flooded levels in half-stilt-house and on-land-house are different depending on the different ground elevations. Most of half-stilt-houses in Northbank have no effect from flooded water which is lower than ground level. Few half-stilt-houses have submergence from 5cm to 10cm in their deck – the lowest part of the ground floor, and few got a whole space flooded. Particularly in Southbank, most of half-stilt-houses and on-land-houses are

flooded at high inundation level from 5cm to 30cm. However, due to the short flooded duration and not too high inundation level, the flooded impact to half-stilt-house and on-land-house in Southbank is not extremely serious. The occupant in half-stilt-house in figure 7 had a serious submergence to indoor spaces. He mostly used movable furniture in living room and bedroom which could be easily tidied up and lifted to higher level. Along with moveable furniture, two fixed beds are always in high level to maintain daily practices for family members. In addition, the occupant used hammock as a temporary solution for daily activities in flooding and built a temporary partition to prevent flooded overflow to living room. The on-land-house in figure has two floors with the permanently structure. The occupant said that she always use upper floor to create an evacuated space during the flooding time as her solution to continue the daily activities.

6. Conclusion

The review of planning policies did not show the involvement of local practices in shaping the hard approach to solve flood-related issues but the new structure and lifestyle that applied to local residents. Meanwhile, the findings from social practices in the waterfront community reveal various scale of local transformation to cope with flooded issues. The large scale is presented through the settlement patterns where locals create their own urban fabrics by on-water clusters and floating clusters to adapt with water environment. The specific scale focused on the transformation in housing characteristics and local actions at indoor spaces to adapt with flooding. Locals have generated their particular housing types such as boat-house and floating-house that are flexibly floated in the water environment and in the fluctuated flooded levels without any flooded impact. They are seems confident to flooding and know how to deal with its issues even the serious submergence situation in most of stilt-houses and half-stilt-houses.

In the temporary context, the Mekong Delta region is predicted to be severely affected by climate change. Under threats from sea level rise, floods and water-related issues, understanding the complex ways that local residents can deal with water issues will become increasingly important. However, the Government and local residents are playing into both state and local efforts to deal with flooding in the Mekong Delta into different visions. With totally contrastive approach respectively are control and resilience or hard and soft, the question for an appropriated planning policies in the negotiation between nation-building projects and social practices is required. Future urban development may not be sustainable without a deep understanding of how the Deltaic people maintain their distinctive lifestyle. Furthermore, in a global context of expected increases in sea level, learning the practices of those living with floods in the Mekong Delta may help other people in the world to survive and adapt to unpredictable floods and new water environments.

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Combating Urban Heat Island Through Spatial Integration of Land-uses and Water Bodies

(peer-reviewed paper)

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Abstract

Climate change is one of the most serious challenge for urban planner and poses a severe threat to the city like Delhi. Moverover, the scarecity of database for Indian cities even reflects a greater challenge for urban planner to combat the climate change issues like 'Urban Heat Island' and sharply reducing water and ecological reserves. This paper goes beyond to analyse the effect of 'Urban Heat Island' and critically appraises the issues responsible for occurance of Urban Heat Island in Delhi.

Delhi is one of the fast growing Metropolitan City of India with present population of about 17 million persons (census 2011) and it is estimated to grow about 23 million population by the year 2021. After Independence Delhi had 1.43 million population by 1951 and has increased to 8.42 million by 1991. Today the city of Delhi is on the central-stage to reflect and cope with the demand of the complex-cultural-traditional-religion-cosmopolitian society. Concentration of intense economic activities resultant in an increase of built up areas on the expense of areas covered by water bodies and ecological reserves. Over the past Delhi is also reflecting increasing warming trends in temperature.

On the objective of providing solution to the complex integrated problems, the present paper examines the alarming impact of change in land-uses on micro climatic zone and there by generating effect of 'Urban Heat Island'. The paper by exploring the remote sensing data, evaluates the temporal variation of surface temperature and air quality data over the change of water bodies and ecological reserves and its role to strengthen the effect of Urban Heat Island. The paper offers the various low-cost, innovative and traditional options to combat the effect of Urban Heat Island through sustainable spatial integration of land-use and conservation of water bodies. Overall this paper aims to offer workable and implementable solutions to combat the adverse impact of climate change and preserve the well being of the urban community.

Keywords: Urban Heat Isand, Climate Change, conservatin of water bodies, traditional technologies, sustainble land-use management, temperature change, air quality.

1. Introduction

In the days of globalization and information highway, Indian cities have a direct consequences of ever-increasing interactions and unprecendented phase of urbanization. As during the last century urban population of India has increased from 27 million to about 270 million and it is expected that another 497 million will be added during 2010 to 2050. These poses the new challenges to accommodate the intense economic activities pressure over Indian cities and thus transforming consumption pattern and resources demand. In combination with this the volume of travel has reached to an unprecedented level and imparting a deep impact on urban physical and social environment. The constant transformation of urban land-uses and water bodies, especially river, lakes, forest, agriculture, green and ecological reserve, put forth into complex urban realities. Moreover emerging threats like Climate Change (CC) or Urban Heat Island (UHI) has added a new dimension to the urban problems. It threatens cities directly through physical impacts of stresses and catastorphic events and indirectly through distress migration due to impact in the hinterland. This forced the city planner to provide innovative solutions with continuous experimental attitudes. Moverover, the scarecity of database for Indian cities even reflects a greater challenge for urban planner to combat the climate change issues like 'Urban Heat Island' and sharply reducing water and ecological reserves. This paper goes beyond to analyse the effect of 'Urban Heat Island' and critically appraise the issues responsible for occurance of Urban Heat Island in Delhi. On the objective of providing solution to the complex integrated problems, the present paper examines the alarming impact of change in land-uses on micro climatic zone and there by generating effect of 'Urban Heat Island' (Figure-2).

Urban Heat Islands (UHI) develop when a large fraction of natural land cover in an urban area is replaced by built-up surfaces that absorb incoming solar radiation during the day and re-radiate it at night (Quattrochi et al. 2000; Oke 1982), or in other words, in urban area presence of high mass of concrete buildings absorbs a greater share of solar radiations than natural landscape and water bodies, during the day and releases it at night. Hence, an UHI effect is caused by the temperature variation is more in the urban areas than its surroundings or rural area. In fact, as per Oke, (1981) and Unger, (2004) the UHI effect generates more temperature variation during the night, as heat stored during the daytime is released in to the atmosphere. Several scientists have observed that urban core area which has higher population and building densities than urban fringe area, has more intense effects of UHI. The studies under taken by Bornstein and Lin (2000), Mullen (1999), Chang (2000), Daly (2000) reflect that UHI effects not only have impact on local precipitation but also create its own weather or micro climatic zone. Intensity of UHI is determined by the regional setting; land-use design and integration; building density, material and height; building bye-laws; zoning regulations; pattern of road design; urban form; area under ecological reserves and water bodies; vegetation density; and other natural and manmade factors (Eliasson, 2000 and Unger, 2004).

Presence of manmade surfaces in urban area like asphalt and concrete lead to lesser heat retention and cooling properties compare with vegetation and water bodies; use of air conditioners and other electrical appliances augment to increase in demand for electricity; high percentage of non-reflective surfaces, less of greenery and vegetated areas, water-resistant surfaces and moisture surfaces cause Urban Heat Island (UHI) effect stronger (Figure-1). Evaporation of water from vegetation, soil and water bodies keep the rural and green areas cooler than urban area, hence, the net solar energy gain is compensated by

evaporative cooling (Ackerman, 1985). Thus, availability of more water (in different form) in rural areas than cities is most important case of Urban Heat Island. Hence, in order to increase 'evaporative cooling' planner needs to think low cost innovative solution to provide more water in urban area or to have 'Water-base Urban Planning' (WUP) in order to support more dense vegetation and water bodies. With this view, present paper is an attempt to look forward the different avenues to conserve and design integration of water bodies and compactable land-uses to reduce the effect of UHI in Delhi.



Figure 1: Causes of Urban Heat Island

With the aim to ensure ecological sustainable development of India and to have National Strategy to adapt to Climate change, National Action Plan on Climate Change (NAPCC) was released by Prime Minister of India in 2008 having eight "National Missions". NAPCC address the measures that promote India's developement objectives, while also yielding co-benefits for addressing climate change viz. Adaptation and mitigation effectively. National Mission on Sustainable Habitat, one of the eight National Mission, is entrusted to Ministry of Urban Development for implementation. Ministry of Urban Development through its various programmes is striving hard to achieve developmental objectives of urban areas in harmony with environment. By analysing the severity of problems and future of indian city Town and Country Planning Organisation, Ministry of Urban Development, Government of India, under taken a research project on UHI effect in Delhi with the main objective to find out the the various low-cost, innovative and traditional options to combat the effect of Urban Heat Island in Delhi through sustainable spatial integration of land-use and conservation of water bodies.

Hence, overall aim of the project is to offer workable and implementable solutions to combat the adverse impact of climate change and preserve the well being of the urban community.

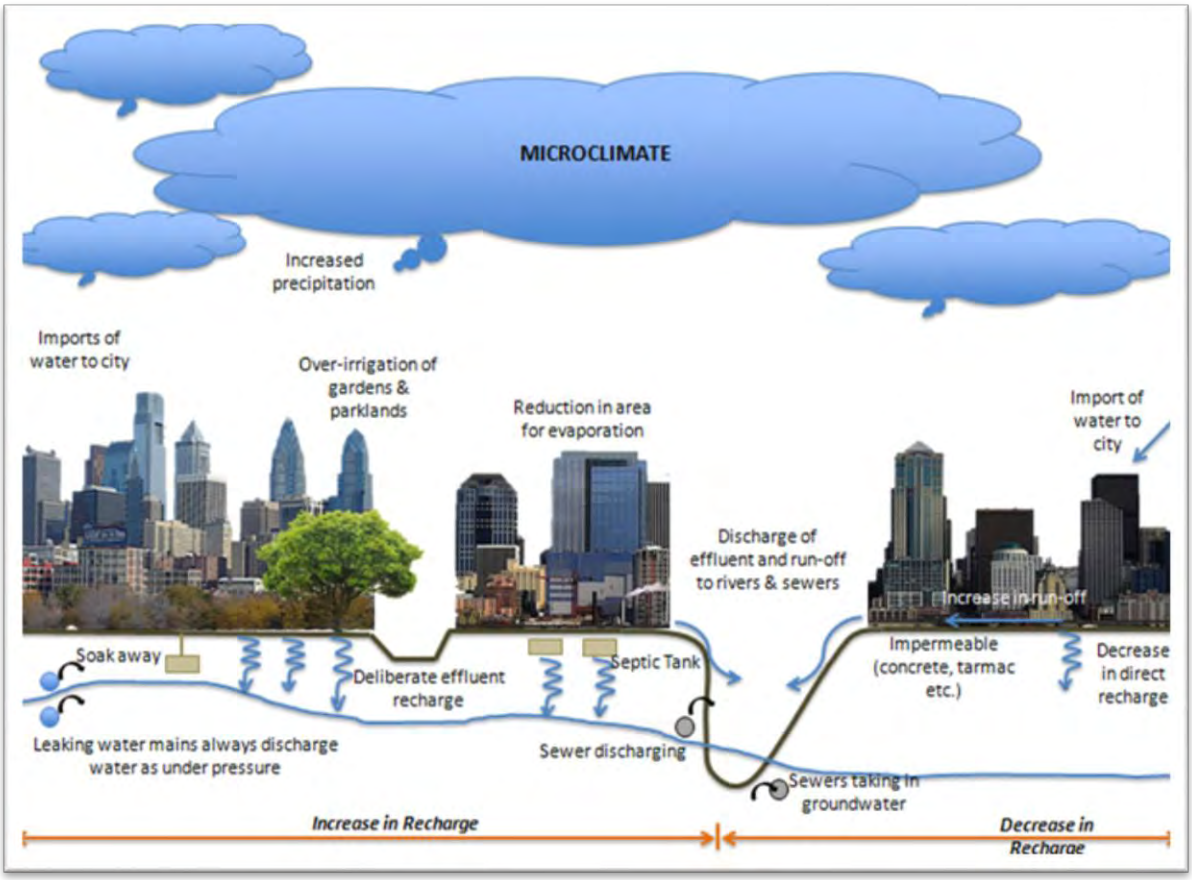


Figure 2: Development of Microclimate through Urban Heat Island effect (Hypothetical Model of New Delhi)

2. UHI Effect on Delhi

New Delhi, the fast growing Capital City of India has presently a population of about 17 million persons (census 2011 under) and is estimated to grow in a 23 million population Mega City by the year 2021. After Independence Delhi had 1.43 million population by 1951 and has increased to 8.42 million by 1991. Despite a land locked situation and with such a big concentration of population, it is a liveable city with natural landscape and with very high percentage of land-use green/open spaces. Out of total area of 1483 sq km in National Capital Territory (NCT) Delhi, about 150 sq km has been proposed as Green Belt at the peripheral area of the city to act as lung spaces for City, 100 sq km land is in River Zone as Green Space to facilitate ground water recharge and about 90 sq km of Aravali ranges and water bodies with biodiversity parks for enriching the environment and natural flora and fauna in its original style in the city. The built up areas also contain more than 15% area in form of

city and neighbourhood level parks allocating about 5 sq km open space per person at city level. The area under recreational/ green use i.e. 7145 ha is in the form of District Parks, City Parks, Community Parks etc. comprising around 15 % of the total urban land area. The norms for City green for Delhi as Master Plan of Delhi 2021 varies from City Park for 100 ha to housing area parking as 0.5 ha for certain population.

Table 1: Temporal Land-use Change of Delhi (1992-2004)

Land-use	1992		2004	
	Area (Hectares)	Percentage	Area (Hectares)	Percentage
Highly Dense Resident	15348.87	10.45	34123.04	23.22
Medium Dense Resident	12039.75	8.19	10706.75	7.29
Low Dense Resident	10661.80	7.26	10324.30	7.03
Rural Settlement	1457.07	0.99	2773.80	1.89
Commerical	396.87	0.27	527.86	0.36
Airport	2261.67	1.54	2160.02	1.47
Institutional	1718.16	1.17	1951.32	1.33
Industrial	689.68	0.47	576.03	0.39
Parks and Zoo	1650.94	1.12	1429.43	0.97
Stadium and Play ground	241.07	0.16	383.22	0.26
Historical Monument	1280.43	0.87	1293.94	0.88
River	1728.60	1.18	1075.87	0.73
Drainage	920.31	0.63	1088.40	0.74
Water Body and Reservior	183.97	0.13	189.08	0.13
Canal	142.95	0.10	185.70	0.13
Agricultural Land	65214.21	44.38	54152.63	36.85
Scrub land	3721.43	2.53	3615.58	2.46
Forest	2331.06	1.59	2127.34	1.45
Ridge	9874.87	6.72	8211.81	5.59
Pature Land	3286.05	2.24	554.25	0.38
Urban Agricluture	8102.82	5.51	4755.28	3.24
Riverine Green	177.41	0.12	164.48	0.11
Open land	3507.95	2.39	4567.80	3.11
Total	146937.92	100.00	146937.92	100.00

Today the city of Delhi is on the central-stage to reflect and cope with the demand of the complex-cultural-traditional-religion-cosmopolitian society. Concentration of intense economic activities resultant in an increase of built up areas on the expense of areas covered by water bodies and ecological reserves. Over the past Delhi is also reflecting increasing warming trends in temperature. The uncontrolled, haphazard development of the

Delhi along with ever increasing paved concrete areas, buildings and tar and asphalted surfaces increases over the expense of natural landscape. This is evident by analysing the temporal change of land-use (1992-2004) distribution of Delhi (Table1). The natural land-uses (agricultural, forest, river and water bodies, green park etc) are declining at the rate 1.17% per year over the expense of UHI supportive land-uses (high density residential, commercial, industrial etc) which increasing at a rate of 1.16% per year. Hence, as per the transformation rate of natural land-uses to concrete and asphalted surfaces, Delhi will loose all its natural landscape in about next 50 years.

2.1 Temperature variation

Puneeta Pandey, Assistant Professor, Central University of Panjab (India) (2012), assessed the summer-time UHI over Delhi by understanding the temporal (2007, 2008 and 2009) relationship with aerosols during summer season using techniques of remote sensing and GIS. As per the study during day time, surface temperature in central parts of Delhi is cooler than the surrounding regions in south and south-west Delhi, whereas in night the temperature over the central parts of Delhi is 4.7^{o}C in April to 7-10o C in May and June. Other than this, the study also observed that effects of UHI is neutralized by the presence of River Yamuna and ridge ecological reserve areas.

Another Study was conducted by Prof. Manju Mohan of Indian Institute of Technology (IIT) Delhi (2008) in order to record the temperature variation over the different land-uses of Delhi in terms of densely built-up area, medium built-up area and less dense built-up area, green areas, open areas and riverside areas. Study reflects that informal commercial land-use like Sitaram Bazar have maximum UHI intensity with 8.3^{o}C where as all green areas have low temperature. Surprisingly, the River Yamuna side area experience higher temperature than green areas but lower than dense commercial land-uses. Hence, polluted water bodies or river devoid of natural vegetation is not going to generate evaporative cooling effects.

Dr. Sandeep Kumar Raut (author of the paper) (2014) in Town and Country Planning Organisation, Ministry of Urban Development, Government of India, has also under taken a research study of sub-zone (Zone F) of Delhi (Figure 3) to analyse the ratio of built-up areas and green land-uses. It has been identified that Bhikaji Cama Place (commercial land-uses) has ratio of 36:24 and thus experiences medium temperature during day and high temperature during the night because of albedo effect, whereas, planned residential area like R.K. Puram Sector 1, 2, 3 and 4 experience low variation of temperature during day and night which have built-up: green ratio – 24:52. High density built-up area like Mohammed Pur, an urban village, has a ratio of 42:14 experiences very high UHI effect. In addition to the built-up and green ratio, hourly observation of temperature and volume of traffic has been under taken and analysed that the volume of traffic during the day adds to the increases UHI effect in commercial and urban village area and by the evening more or less all land-uses have similar temperature variation. But during night UHI effect is recorded highest in urban village. The research study also identifies the measures and adaptations to reduce the negative effect of UHI and the same are discussed under ‘strategies to combat UHI effects’ section.

CAUSES OF UHI IN DELHI	
CAUSES	**CONSEQUENCES**
• Greater heat retention of buildings. •Man-made surfaces like asphalt and concrete. •Reduction in Green land use & vegetation. •Use of air-conditioners & other electrical appliances. •Increase in air pollution. •Heavy precipitation events like thunderstorm / tropical cyclones. •High percentage of building having non-reflective surfaces. •Less of water-resistant and moisture retention surfaces. •Less absorption of ground water and more run-off. •Evaporative cooling is less. •High population of building density. •Ever increasing driving hours. •Urban sprawl or urban expansion over rural land use. •Absence of urban fringe policies for land use. •Building & zoning regulations.	•Increased demand of energy for cooling. •Declining air quality in cities. • Increasing water demands. • Water quality problems. • Increased risk of heat-related mortality. • Contamination of water. • Increased risk of infections, respiratory & skin diseases. • Flooding of urban area. • Traffic jams & delays. • Displacement of people. • Loss of property. • Chance of generation of high winds. • Higher evaporation.

Figure 3: Causes and consequences of Urban Heat Island in Delhi

3. Strategies to Combat UHI Effects in Delhi

In order to combat UHI effects there is need to think cost effective, innovative solutions through an integration and transdisciplinary professional approach with the present day available planning tools and methods. Thus, the present paper is an attempt to make aware and promote smart and locally expectable measures to reduce UHI effects. The sustainable smart city design promises to revitalize the urban environment and through the provision of sustainable zoning regulation which might reduce the intensity of the UHI effect. The planning process in combination with the legal and incentive program with subsidies will create the functional connectivity between physical and social development and implementation of urban policies and approaches.

Generation of micro-climate through provision of shading trees in the parking lots and pavement control the heat generated by buildings. However, it is important to select or grow trees that will perform the best in the city climate. In addition to helping cut down carbon emissions globally, UHI combating planning should aid in improving urban air quality. The

problem of air pollution is one of the most important problems faced by Indian cities like smoke, noise, chemical effluents, garbage dust which act as the chief pollutants of the atmosphere.

Through integration of green spaces and water bodies strategically in combination with the watersheds region can reduce runoff and recharge the ground water and, thereby, controlling the problems of floods in the Delhi. Apart from creating strong biodiversity and ecosystem this will also generate the psychological and public health benefits. Integrated system of land-use and water bodies should be developed in pursuit of synergies derived from combined efforts in waste treatment and environmental preservation. Some of the planning interventions will help to combat UHI effects:

- Strong building regulation and development control in support towards a green building concept.
- Foster the research and training in the field of use of porous materials, thermal efficiency and impact of sustainable environment and town planning through public and private participation.
- Maintaining the balance between the built form and natural landscape including water bodies.
- Creating the knowledge base for environmental system technologies and innovative solutions to solve the urban and regional problems.
- Focusing on energy conservation, eco-material development and integrated waste management
- Contribute to reducing, reusing and recycling of resources and conservation of fresh water reserves.
- Promoting the cultivation of local and herbal varities of vegetation with the help of local community.

Above all urban and regional planner should develop and implement the Water-base Urban and Regional Planning System (WBURPS) which provide incentives on a number of issues that may go beyond their professional boundaries. In order to have predictive model for Delhi to combat UHI effect WBURPS are designed as discussed below.

The physiography of Delhi is dominated by the river Yamuna, and the Aravali Range, and the plains in between, formed by alluvium deposits of recent formation. The Delhi Ridge and its four sections, the northern, the central, the south central and the southern constitute the farthest extension of the Aravali Range, its spurs meeting the Yamuna at two points, in the north and the east. Ecologically, the Ridge acts as a barrier between the Thar desert and the plains and slows down the movement of dust and wind from the desert. This green belt, a natural forest, has a moderating influence on temperature, besides bestowing other known benefits on the people. The Yamuna River and terminal part of the Aravali hill ranges are the two main geographical features of the city. The Aravali hill ranges are covered with forest and are called the Ridges; they are the city's lungs and help maintain its environment.

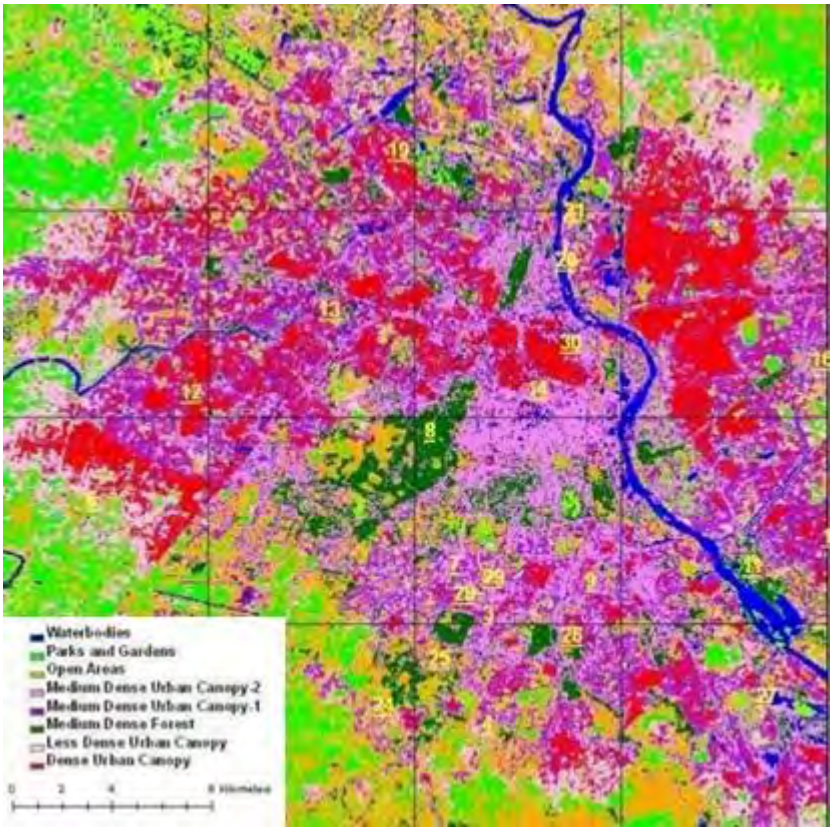


Figure 4: Satelite image of Delhi Urbanization Effect, 2008

The Yamuna River is Delhi's source of drinking water and a sacred river for most of the inhabitants. The Yamuna River originates from the Yamnotri glacier in the lower Himalayas at an elevation of about 6387 mtr. above mean sea level. From Tajewala, the river sluggishly meanders via Delhi to its confluence with the Ganga at Allahabad after flowing a distance of about 1200 kms. The total length of the river from origin to the confluence point at Allahabad is 1376 kms. The catchment of the Yamuna river system covers parts of Uttranchal, Uttar Pradesh, Himachal Pradesh, Haryana, Rajasthan, Delhi and Madhya Pradesh. Even though every year during the summer Delhi face acute water crisis a varying degree of inadequacy in water supply is , however, felt around the year. During this period of crisis the authorities is dependent upon the vast underground aquifers which becomes the supplement of surface water supplies. However, underground reserve is also now showing the sign of depletion and creating the question of environmentally controversial, ecologically unsustainable.

Therefore, in order to recommend more resilient urban pattern, solution of "Urban and Regional Water Harvesting" is to be adapted. As the rainfall in Delhi region is mainly concentrated in the three-months of Monsoon season ever increasing hard urban surfaces has led to the loss of 98 percent of this rainwater through rapid and increased runoff. Hence, with the help of eco-sensitive dams and canals runoff can be reduced and there by controlling the urban flooding can also help in recharging ground water reserves. Thus offer

a cost-effective solution which has a large number of ecological advantages and alter the urban landscape for better quality-of-life and future.

The rain over Delhi region (NCT Delhi) (area 1,483 sq.km) will provide 202,000 million gallons of water annually and if only 25 per cent of feasible rainwater is trapped 50500 million gallons of water can substantially improve the water availability to counter the UHI effect and manage to maintain good quality of green reserve. Presently most of the channels in the process of urbanization constitute part of the hard urban landscape and will hamper the important link in the harvesting of rainwater. Thus, the connection between the water channel system and neighbourhood need to be improved in order to balance the ratio of manmade and natural ecosystem. In order to make water more visible the catchment areas and watersheds are required to be carefully maintained with all forms of development and, thus harmonize the relationship with the regional topography and drainage pattern. The natural water channels would be beautified, shaped, landscaped, deepened where necessary. Their banks would be the green lungs of the city. While serving their primary function of on-channel ground water recharge they would also modify the microclimate (Figure-2) and provide better environmental standards. There are nine major seasonal streams in the vicinity of Delhi, all emerging from the Aravalli ridges. With check dams and on-channel recharge methods employed both surface supplies and aquifers can be augmented.

3.1 Abandoned quarries

In Delhi there are large number of abandoned quarries which need to be identified and improved and landscape through beatification by more sustainable approach and used for storing surplus water from the drainage channels or from their local watersheds. They could become attractive places for business to invest and eco-tourism option, major examples are Bhatti mines and Tajpur Quarry pits where exist hundreds of smaller abandoned quarries. Tajpur Quarry also would store about 2.0 MCM of water (450 MGD).

3.2 Hauz, baolis and village Johad

A few historic water bodies (hauz and baolis) and village *Johad* (pond) constructed in the past could play a vital role in the augmentation of water supply in Delhi, like Hauz Khas, Red fort and Tughlaqabad fort could he easily revived and could play a significant role in groundwater recharge.

3.3 River Yamuna Front Development

The 22 Kms stretch of the Yamuna in Delhi should require to develop a conservation zone as restoring the river's ecological functions is heavily dependent on the environmental flow through this stretch, particulaty in the lean season. The project should aim at urban rejuvenation and reclaiming of the river bank as a public asset to restore the city's relationship with the river. The project should design by allocating large part of its space for open public use. More than 85 percent of the river front land should be reserved for public infrastructure, recreational parks, sports facilities and gardens.

4. Conclusions

Delhi being the city of constant change on the central-stage of world economy paying the heavy price of deteorating quality of life, envionmental pollution, concret jungle, temperature anomilies, erotic rainfall, flooding, depleting ground water and, thereby, increasing the art of Urban Heat Island interlinked problem. The paper by exploring the various studies, evaluates the temporal variation of surface temperature and air quality data over the change of water bodies and ecological reserves and its role to strengthen the effect of Urban Heat Island. The paper offers the various low-cost, innovative and traditional options to combat the effect of Urban Heat Island through sustainable spatial integration of land-use and conservation of water bodies. Overall this paper aims to offer workable and implementable solutions to combat the adverse impact of climate change and preserve the well being of the urban community.

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Public Space Production as a Part of Urban Riverfront Development Scheme: A Contemporary Approach for Turkey, Case of Amasya

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1. Introduction

This paper focuses on "the sustainable riverfront (re)development" on the basis of the waterfront redevelopment/regenaration/revitalization phenomenon which emerged firstly the main industrial cities of Europe and North America and then became the global phenomenon all over the world, elolving in the fifty years up to now. The waterfront re-development can be defined as the transformation of urban lands, confronted decay and decline due to the retreat period of the industry from downtown waterfronts, in terms of economical, ecological, spatial, social, and cultural aspects with the aim of bringing new functions to derelict waterfront zones to be able to become a part of the city again. This phenomenon has led to "return to the water" movement, causing local authorities put their waterfronts on their agendas and reconsider their new roles. In the half century until today, with numerous projects realized all around the world, many coastal cities on various sizes (metopolitan, big, middle, small cities) which have a water body (ocean, sea, river, lake, bay, creek or canal) have radically developed visions, scenarios, strategies, policies, plans, projects to re-vitalize their disregarded waterfront zones not only "abandoned" by industrial uses but also remained "inactive" for so long and to (re)entegrate the city and water, physically and socially. Thus, waterfront re-vitalization became a process in which various actors (central and local governments, politicians, public and private institutions, entrepreneurs/developers, professional chambers, related professions (planners, architects, engineers, restorators, designers, artists, ecologists, urban historists, urban geographists, urban sociologists et al.), academicians, various consultative committees (especially conservation and preservation ones), several relevant economic entities (such as urban tourism companies et al.), non-governmental organizations, community volunteers, citizens, media get involved in order to be in search of thinking and working with their "new waterfront" cooperatively.

This paper is based on **the argument** that each waterfront's unique characteristics and values deriving from the "geography" and "culture" of the city to which it belongs should determine the (re)development strategy. However, in this half century experience, different cities of different countries from different continents all over the world have realized waterfront (re)development scenarios by becoming aware of, having knowledge of, being affected by, and learning from each other. This make the phenomenon get a global character and let us "common issues and concepts" be deduced for developing more successful and more sustainable waterfront re-vitalization organizations.

This paper is based on **the argument** that waterfront (re)development is a long-termed process which compose of interrelated phases that shapes "the final product"; that is, the new waterfront development; and the most critical issue of the final product is "the realization of public spaces along the shoreline" to ensure an interaction between the city and the water. The aim is to make the waterfront be "the focal point of daily life" again as it was in the past; that is, "lively waterfront zone" which had been common, public, and had included various activities. But this time, this interaction should be re-considered and re-constructed by the necessities of this era by regarding the current conditions which shape the public space production. Thus, this paper focuses on the most important component of a sustainable

waterfront (re)development: the provision of a social benefit via the production of successful public spaces along the waterfront and bears the argument that the produced public space system along the shoreline should create “a sense of local identity” which can be only achieved by revealing and referring the natural/ecological characteristics and cultural features composed of historical heritage, social background, past experiences of the waterfront and the collective memory in programming and designing phases.
In comparison with the developments and experiences all over the world, Turkey has been recently confronting with waterfront (re)development phenomenon. Thus, this gained “global experience” is an advantage for Turkey to be able to benefit from positive and negative consequences of them. In this context, within the scope of this paper, it is aimed to reveal the “main components” necessary to formulate a sustainable waterfront (re)development project in general; and then, to determine the “key concepts and issues” for programming and designing contemporary series of public places and events in order to draw a “conceptual framework” for the production of public spaces, which will be specialized for waterfront zones, in the context of sustainability concept.
Based on this conceptual framework, the riverfront development of Amasya, an old historical city of Turkey located on one corridor along the “Yeşilırmak Valley” through which the river called as “Yeşilırmak” runs is evaluated.
In this way, this paper, in general terms, displays the components needed for the organization of a sustainable waterfront (re)development scenario considering social benefit by means of presenting a “conceptual agenda” for Turkish cities, this provide a guiding source which will light the way for further schemes.

2. Sustainable Urban Waterfront Development: Key Concepts

Below, “main components” which make a waterfront (re)development project be sustainable are specified. These components, which are expressed below in the form of fundemental principles adjusted to riverfront (re)development within the scope of this paper, have been developed by integrating the qualitative datas and findings obtained from relevant literature (Wrenn, 1983; Torre, 1989; Charlier, 1992; Knaap and Pinder, 1992; Breen and Rigby, 1994; Breen and Rigby, 1996; Fisher and et al., 2004; Jones, 2007) and “Urban Waterfront Manifesto” (1999) of “The Waterfront Center” (a non-profit educational organization formed in 1981 with the aim of helping the communities enhance their urban waterfront resources through a variety of educational and advisory services) (web 1) by using an “inductive reasoning”.

- to adapt derelict or inactive riverfront zones to the urban fabric and social life with regard to current conditions and needs of the era should be adopted as an “urban policy”
- to ensure a coherent (re)development scheme peculiar to the riverfront, preliminary action should be to produce conceptual (re)development alternatives by analysing economical, physical, social conditions of a riverfront zone, determining potentials and limits of the area
- to determine a (re)development concept in which possible interest groups who can get involed the project should be decided as a result of an examination on these alternatives mentioned above
- an urban riverfront (re)velopment strategy which involves targets to make the riverfront zone be vitalized in terms of economical, ecological, and social by regarding existing unique natural, historical and cultural values should be formulated
- a “master plan” which involve decisions to realise this strategy should be formed
- the improvement of the environmental conditions of damaged waterfront areas should precede from the economical and social (re)development of the riverfront zone

- water quality management and river flood control are prerequisites for riverfront (re)development. Thus, riverbed regulation and river basin reclamation should be the main issues of land use planning.
- natural reserves, historical texture and cultural values, which characterize the local identity of a waterfront zone should definitely be preserved in riverfront (re)development schemes, creating the new image of a riverfront based on revealing uniqueness of a waterfront zone which in the end will promote the spirit of place. This local identitical character of the new riverfront attracts not only citizens but also tourists at the regional, national and international level, motivating local economy
- to ensure the public "accessibility" to the waterfront, "public space production" continuous along the rivershores should be focus of a (re)development scheme, making the social goals be primary; this should be guaranteed in master plan decisions
- to finance costly (re)development projects and accelerate the process public-private sector partnership should be provided, securing public investments and attracting private resources
- to re-establish an interactive relation between the water element and the city, water-based usages, activities, and facilities should be privileged in (re)development schemes
- to realize the strategies developed in accordance with visions and targets of (re)development policy, it should be formed "an organization", which can ensure to conceptualize, implement, and monitor a riverfront (re)development project and it should be developed a riverfront (re)development project management unit, that is a development entity, to ensure the quality and sustainability of the project
- to develop a multifaceted riverfront (re)development project with the participation of different actors to the process, it should be provided an opportunity for an interdisciplinary work (including economists, engineers, geologists, city planners, architects, landscape architects, restorators, art historians, archaeologists, ecologists, environmental artists, urban geographers, urban sociologists, pedagogs and et al.) to think on the waterfront and produce a satisfactory project in common, promoting a team consisting of specialists
- to get support from a clear majority of an urban society for the new river development scenarios, it should be provided opportunities for meetings and common studies between these profession disciplines and politicians, public authorities, entrepreneurs, developers, private organisations, community groups and citizens to consider the needs and demands of different interest groups, creating a social consensus by incorporating citizens who want to have a voice in waterfront (re)development by using citizen right into the process. Especially public participation (generally via non-governmental organizations) in the process is one of the key elements of sustainability of the project

3. Contemporary Public Space Production: A Conteptual Agenda for Waterfronts

Waterfront had been a special urban space on which the city-water interaction had traditionally been "spontaneous" at historical coastal cities. As for our age, this interaction is not spontaneous but "produced", necessitating to be reconsidered and reinterpreted in such a way that respond to the current social needs, urban dynamics, and to the changing meanings of nature, social life, leisure, and recreation.

To re-establish this new relationship between the city and the water, the shoreline should be allocated to "the public use only". This paper hypothesizes that to organise the "public open space system" with the purpose of integrating the water to the city and city life again, "how waterfront lot is addressed" should be defined through planning and designing principles

determined during the successive and interrelated phases the (re)development process, guaranteing the public space production along the waterfront.
Programming and designing "the public space system" along waterfront which contribute to create a "new image and identity" should be based on the distinctive natural and cultural values derived from the "geograhy" and "culture" of a waterfront. Waterfront (re)developments disregarding locality which differentiate one waterfront from all others is expressed by Bruttomesso as de ja vu since it gets difficult for anybody to be able to perceive a location where he/she is in at that moment (Bruttomesso, 1993: 11).
Public space production which can reveal the "site-specific" originality by regarding the natural, ecological, historical, cultural characteristics and by creating a "perceptual, imaginative, mnemonic ambiance" created on the basis of these characteristics should make the waterfront be the main focal point of the city again. Below, "key concepts and issues" required for programming and designing contemporary series of public spaces and events along the strips of the waterfronts are specified. They are summarized from the conceptual agenda which involve the fundamental principles of the waterfront revitalization phenomenon developed in the PhD dissertation (Şimşek İlhan, 2012) of the author of this paper. This conceptual agenda has been formed with the reference of contemporary developments related to waterfront (re)development projects, urban design, the production of urban/public space; of the findings obtained from the case study analyses; of knowledge get from the global information flow by means of international network of non-profit oragizations (The Waterfront Center, Waterfront International Network, Project for Public Spaces et al.)

- to develop designs revealing "the local identity" of the waterfront, it should be made detailed analyses defining the unique natural and urban values and it should be prepared "urban design guidance" to develop a design language corresponding this local identity
- to use historical, cultural, industrial heritage by preserving them, it should be produced interrelated projects to re-evaluate registered buildings and structures by re-functionalizing with appropriate activity types as a tool for the cultural transfer
- to ensure the sustainability of a waterfront project, it should be balanced social and environmental benefits within the scope of public space planning and design. In this context, "the natural characteristics" of a waterfront zone should be determinative in design process; unique natural features of a waterfront should be incorporated to the programming of public spaces and events with the innovative design strategies and solutions of "an interdisciplinary design team". Fragile natural habitats should be taken under preservation; wild flora and fauna of a river and riverfront area should be considered; and natural elements can be used by using methapors in design shemes to be able to make a reference to the nature of the area. In this way, not only the natural environment of a waterfront zone is able to reach an ecological balance again but also citizens and tourists are allowed for a relationship with nature to discover and experince its originality, "promoting the sense of an identity" of a waterfront area.
- to provide a maximum social benefit from a waterfront (re)development scheme, it should be dynamised "to access physically and socially" to the waterfront and along the waterfront at maximum level. To overcome this key issue, it should be reconsidered a transportation and circulation network being able to establish physical links between the city center and the waterfront, especially paying regard to a "pedestrian access", and it should be provided a necessary infrastructure for an alternative modes of transportation.
- to ensure to make an inactive or passive waterfront be a main destination for citizens again, it should be organised "a continious dynamism along the waterfront" by means of creating an interrelated public spaces, open spaces and places, focal points, landmarks, a series of programs and activities both the water-based and the city-based through the shorelines by providing "new types of leisure time activities" in regard to the current recreational needs of a society
- to make a waterfront be an indispensable part of the urban life again, it should be let the shoreline be "accessible" by social groups and subgroups by means of a

"recreational programming" including activities and events which provide all kind of people with opportunities to experience being on a waterfront; that is, the waterfront should be not only physically but also "socially" accessible by responding to a social diversity. In this context, the "recreational programming" should involve activities diversifying passive open spaces to an extensive active usage with "a variety of events and facilities which can magnetize people of all ages, all income groups, all ethnicity for different motives at different times"; provide opportunity for usage at all hours of the day and night, at every day of all seasons

- to seek the opportunities which can make the water element be an essential part of the daily life with the aim of forming an interaction between the water and the city again, the essence of this recreational programming should be based on a creative and innovative thinking in which potentiality of the water element of a city is used; and should be a thematic in which water-based activities related to the transportation, entertainment, culture, education can be associated to the waterfront. In this way, it can be made possible the water element be function as an urban space.
- A design process should be based on giving references to the natural characteristics, historical background, and cultural values of both the water element and the waterfront zone. In this way, an atmospher having speciality of distinquishing characteristics of the waterfront zone can be created and; thus, the local waterfront identity can be established by revealing the uniqueness of the site, providing "a sense of place".

Current literature (such as Francis, 1988; Carr et al., 1992; Craig-Smith, et al., 1995; Madden, 2001; Woolley, 2003; Carmona, 2003; Lang, 2005; Gehl, 2007; Jones, 2007; Carmona et al., 2008; Bertsch, 2008; Shaftoe, 2008 et al.) related on public space, urban design, landscape design, environmental design focuses on developing "planning and design criteria" for the creation of more successful open spaces for a society. Almost all are in substantial agreement on basic concepts by rephrasing and formulating them. Thus; on the basis of these references, "quality criteria for contemporary public space production" can be itemized, not including titles and subtitles, as indicated below.

- publicity
- accessibility to the waterfront
- continuity along the waterfront
- open space system consisting of interrelated parks, green spaces, recreational areas, activities
- legibility of the open space system of waterfront by means of clearliness and orderliness
- permeability of the open space system of waterfront
- functionality by means of variety of uses, activities, and facilities
- vitality
- authenticity
- attractability
- coprehensiveness
- satisfying (sense of belonging)
- enduring
- green and unpolluted
- comfortableness and security
- locality by means of identity and image
- sustainability
- environmental education
- exploration and experience
- safety and health
- quality of materials
- contribution to urban aesthetics by means of land art and public art

- contribution to local economy by means of making the city center a focal point
- community-led design process with community involvement
- monitoring, maintenance, and management for updating and upgrading

The "success criteria of a public space" is to provide the users with adoption and usage of there intensively. This situation is generally associated with "the sense of belonging to there". Thus, especially since 1990s, professions interested in the organization of space (planners, architects, landscape architects, urban designers, environmental artists, land artists and so on) began to put on their agendas the concept of "place-making" which emerged with the intention of the determination of necessary conditions which make a produced public space turn into a public place. The place-making criteria have been developed to evaluate the success of the urban design projects. At the present time, it is inevitably accepted that the production of public space is a critical process which requires an interdisciplinary work which should let the community participate into the process to achieve the production of public spaces which will turn into public places adopted and used by community. The place, placelessness, place-making, place management are the concepts which emerged in relation to the identity of a space. If the identity which is attributed to a space can contribute to the creation of the sense of the place, this space will be designated as a place. Relph (1976), in his book "Place and Placelessness", suggests that the identity of a space is determined by the activities realized with the participation of the users by the way of using and experiencing of the space produced by designers. Relph states that the thing which creates the identity is "persistent sameness and unity being in the collective memory of a society", allowing that place to be differentiated from others (Relph, 1976: 45).

Based on the argument that the meaning and thus the identity of a place should be derived from the origin of the site, an identity of a public space began to be formed by defining systematically the identity indicators concerning to the space by referring to the origin and by to the collective memory of the site. Place is seen as the locus of collective memory and a site where the local identity is created through the construction of memories which be able to link people into the past. Thus, to make references to the natural, historical, cultural, mnemonic background of the site by using metaphors via design became the current common interest of prefessions in the production of public open spaces and places, creating the spirit of place (genius loci) and providing "a sense of place".

Besides these, the studies carried out by PPS on public space production are considerable. PPS (The Project for Public Spaces) founded in 1975 is a nonprofit planning, design and educational organization dedicated to helping people create and sustain public spaces that build stronger communities (web 2). With their own words "Our pioneering placemaking approach helps citizens transform their public spaces into vital places that highlight local assets, spur rejuvenation and serve common needs." Placemaking is "a **people-centered approach"** to the planning, design and management of public spaces. The approach is based on looking at, listening to, and asking questions of the people who live, work and play in a particular space, to **discover needs and aspirations of them** in order to create a common vision for that place to develop an implementation strategy; this immediately brings benefits for the people who use this public space (web 3). Since its foundation, PPS got become the premier center for best practices, information and resources on place-making by completing projects in more than 3000 communities in 43 countries and all 50 U.S. states. Evaluating numerous public spaces all around the world, PPS has determined "four key qualities" in common which successful places should have and has developed the "Place Diagram" (seen in Figure 1) as a tool for evaluating the degree of being place of any public space.

- Access and Linkages
- Comfort and Image
- Uses and Activities
- Sociability



Figure 1: The Place Diagram (PPS)

4. Case of "Amasya": The Historical City of Turkey Running Along a River Corridor

"Hardly any town in Anatolia is as great an inspiration for the painter than Amasya" Seton Lloyd (1997, 201).

Situated in the inner part of the Black Sea region of Turkey, Amasya is a traditional Anatolian town located on a land between the two hilly mountains namely "Harşena" and "Ferhat" fractured by a river called as the "Yeşilırmak River". This riparian city developed on two sides of the "Yeşilırmak River" corridor is contained in a deep valley namely the "Yesilırmak Valley" where these mountains stand as backdrops to the settlement. Amasya is a multi-layered historical Anatolian town settled since the end of the Palaeolithic Age, continuously inhabited by different civilizations of different eras chronologically Hellenistic Era, Pontus Kingdom Period, Roman Period, Byzantine Period, Principalities Period, Seljuk Period, Ottoman Period and Early Republican Period, remaining the historical structures, ruins and traces belonging to each era today (for example, the remains of Pontus castle walls from Hellenic and Roman period, rock-cut tombs from Pontus Kingdom Period, water tunnels and bridges from Roman Period, remarkable monuments from the period of Turkish principalities and mosques, tombs, "külliye"s from Seljukid and Ottoman periods, public buildings of Early Republican Period).
The shape of the city has been dictated by its special topography, allowing a linear growth. While the character of the city changes toward the east and west ends, the middle portion of the city center which is marked by two historical bridges maintains its strong references and sense of orientation. In this portion, the north bank is characterized with "Ottoman Style" traditional houses lined up along the riverfront facade, cantilevering from the ancient castle walls right at the edge of the river (Uraz and Balamir, 2006), giving a distinquishing feature to the city of Amasya. Between the river and the mountain, the north bank is composed of attached houses in parallel rows, called as "the inner city", which has developed by securing itself under a sheltering rock namely the "Harşene Mountain" on which accommodates the rock-cut tombs of the Pontus Kings, giving an unique ambience to the city. Creating a dense urban fabric due to the limited land available, the wooden houses nestling together represent the individual's mortality against the state and religion, as typical to Ottoman dwelling culture (Uraz and Balamir, 2006). Displaying a formal promenade of historic monuments, the south

bank holds more heterogeneous fabric marked with singular structures just as miniature tombs, medium-sized mosques and grand scale külliye (an Islamic-Ottoman social complex), namely the "Beyazıt Külliye" structures, preserving their object positions and strong boundaries (Uraz and Balamir, 2006).
Unfortunately, due to the unplanned urbanization and the lack of vision of taking into consideration the unique characteristics of the city, not only the riparian features, natural characteristics and ecological structure of the urban environment but also the historical heritage, conventional housing settled on the riverfront which is unique to the city of Amasya, and traditional urban districts shaped by the Turkish-Islamic way of life of the Ottoman Period has partly been destroyed over time.

4.1 The Riverfront Promenade: A focal point of the daily life

The Yeşilırmak River's running through the city by fracturing it leads to double-sided viewing between the northern and southern banks. The deep and narrow valley "Yesilırmak Valley" let the city be watched from the heights of it. Therefore, "watching the scenery from different points of view" is an integral part of daily experience of the city of Amasya. Each strip along the two banks of the river forms a scenic importance for the other, allowing people to have a closer contact with the past of the city of Amasya. Although still embracing the historic monuments, structures, buildings and traces, the dwellers and strollers of the south bank communicate with the past then the ones of the north bank having multi-layered historical heritage.
Approximately six meters height stone floodwall constructed for river flood control along the northern and southern banks of the river Yeşilırmak, dates back to ancient times of the city, causing a direct contact of the people to the river be interrrupted. Thus, in time, the water body has turned into be an object just for viewing, catching fish and a waterway running parallel along the riverfront walkway. Promenading, relaxing, recreating, meeting has became the main activities for the citizens of Amasya since the "Ziya Paşa Boulevard" the roadway which continues along the river pedestrianised in 1986 (Özdemir, 2013).
In 1999, a recreation project namely "The Waterfront Promenade" was prepared for the southern strip of the river "Yeşilırmak, situated between the two historical bridges at the city center, at two different levels of which one is under road elevation to let people get closer to the water. This project includes walkway, sitting benches, viewing balconies looking on the river, and an amphitheatre for activities and performances realized at special occassions, and official and religious holidays. Buildings and outdoor spaces of them are directly connected to the riverfront promenade constantly, providing settings for public life, and streets running perpendicular to the promenade open to the river visually by vistas, allowing pedestrians to access the promenade (Özdemir, 2013).
The waterfront promenade project realized in 1999 has not been updated in terms of its recreational programming up to the present. But nowadays an attempt for the re-development of the riverfront remains on the agenda of the Municipality of Amasya. it is planned to construct an inflatable rubber barrage in front of the place of disused "Court House" to keep the water at the same level to the "Istasyon Bridge" situated at the Station District. It is aimed that current flows will be kept under control to provide a still water for touristic boat tours on the Yeşilırmak River. Along a 150-meter-long part of the strips of the riverfront, it is planned to create observation terraces, excursion towers, resting areas, alleys and promenades, also planning to produce hydro-electric energy from the rubber barrage. The project approved by the "Council of Monuments" is planned to be completed within two years (web 4).

4.2 An evaluation on current usage of public open spaces along the riverfront of Amasya within the framework of the conceptual framework developed

By comparison with the "conceptual framework", including key components of a sustainable scheme, presented in this paper, the visions, decisions, strategies, plans and projects by the local authority on the riverfront (re)development of Amasya;

- Does not develop an urban policy to adress the issues of the city and the river as a whole with regard to current conditions and needs of the era and to ensure a coherent (re)development scheme peculiar to the riverfront, by analysing economical, physical, social conditions of a riverfront zone, resulting in a sustainable scheme
- does not display a holistic approach regarding the special topography, the natural reserves and ecological structure, historical heritage, cultural values, and most importantly the water body "Yeşilırmak River"
- does not ensure the interrelation of the successive phases of an ideal (re)development process, resulting in a final product of a sustainable public space production along the strips of the river
- does not ensure to conceptualize, implement, and monitor a riverfront (re)development project to realize the strategies developed in accordance with visions and targets of (re)development policy
- does not make an organization to coordinate various urban actors in order to think and work with their "new waterfront" cooperatively and to consider the needs and demands of possible interest groups who want to have a voice in waterfront (re)development, creating a social consensus
- does not provide public-private sector partnership securing public investments and attracting private resources to finance both the new riverfront development and the historic preservation costs

In conclusion, in terms of balancing the economical, environmental/ecological, and social benefits; it can be stated that the attempts of local authority and public institutions of the city of Amasya by means of producing projects for the (re)development of the riverfront zone in order to handle the basic issues related to the city and the river over time have failed to satisfy the sustainability.

By comparison with the "conceptual framework", including "key concepts and issues" required for programming and designing contemporary series of public spaces and events along waterfront, specified in this paper, "the riverfront promenade project" of Amasya realized in 1999 and not updated until today;

- does not be based on detailed analyses defining the unique characteristics of the area, which will be projected, derived from the "geography" and "culture" of the riverfront zone, not resulting in the creation of "the local identity"
- does not prepared by regarding and by referring the natural characteristics, historical background, and cultural values to create perceptual, imaginative, mnemonic ambiance, not resulting in the revelation of the "site-specific" originality of the riverfront zone and development of local image and identity which can, in the end, cause the produced public spaces turn into public places thanks to the creation the spirit of place derived from the uniqueness of the riverfront
- does not ensure the ecological factors of the riverfront zone be determinative in design process by incorporating the unique natural characteristics of the riverfront to the programming of public space system with the innovative design strategies and solutions, not resulting in providing community with opportunities to explore and experience the natural milieu of the river, promoting the sense of place. In this context, the project fails to satisfy the the issues specified below;
    - to consider the coastal ecology by analyzing the ecosystem structure of a riverfront zone in detail
    - to give priority to the fragile environments which must be designated for land and water reclamation, rehabilitation, preservation in order to make both the riverfront zone and the river re-gain a balance again
    - to establish a buffer zone along the river
    - to enhance the quality of the water rehabilitating polluted land and water
    - to protect wild flora and fauna of a river and riverfront area and to designate wildlife protection areas along the river

    - to use endemic and native plants in public open space design
    - to reveal the natural potentials of a riverfront by means of design in order to make a reference to the nature of the area, promoting the sense of place
    - to represent the "nature" symbolically by using metaphors in parks and public spaces designed along the shoreline
- does not provide a "recreational program" by offering a variety of activities, events and facilities diversifying passive open spaces to an extensive active usage, which can magnetize all people for different motives at different times, at all hours of the day and night, at every day of all seasons, addressing the needs of the 21st century
- does not ensure the "water-related activities" related to the transportation, entertainment, culture, education to be an essential part of the daily urban life of the society, not resulting in the usage of the potentiality of the water, offering experiences which make possible an interaction between the city and the water again
- does not provide "a continious dynamism along the waterfront" consisting of an interrelated public spaces, open spaces and places, focal points, landmarks, a series of programs and activities both the water-based and the city-based through the shorelines by providing new types of leisure time activities

Amasya, an Anatolian city maintaining its traditional culture, is a city which has been oriented to the river "Yeşilırmak", this let the riverfront be continiously accessible physically and socially from the west end to the east end of the linearly developed city, providing an advantage to the citizens. But "the riverfront promenade project" fails to satisfy "the quality criteria for contemporary public space production", which is itemized in the third part of this paper, making the produced spaces be turned into lively places which is adopted, used, and experienced by all segments of the society effectively. If these items are used as a check list for the "the riverfront promenade project" of Amasya, it may not to be put a check mark on most of the items.

Whereas, having natural, geographical, and cultural characteristics; coastal ecosystem; archaeological, historical, and touristic places; monumental structures and edifices of different civilizations of Amasya through the ages; vernacular architecture and urban fabric; and life style of traditional culture, the city of Amasya requires and deserves the meticulous attention to creative and innovative design strategies, schemes, solutions for riverfront (re)development, considering to intervene in precious urban setting having powerful characteristics. Within such a context, the strips of the riverfront at city center of Amasya should be approached by regarding such an amazing historical backdrop, ecological factors, socio-cultural values, and collective memory, which in the end will reinforce the urban identity by revealing "the spirit of place".

5. In Lieu of Conclusion

"Waterfronts present unparalleled opportunities for interpretation and education of natural values, community history and culture… Preserving and interpreting the tangible aspects of the history of a place provides character and meaning to waterfront development" (The Waterfront Center).

This paper focuses on the production of public space along shorelines as a "key issue" of a sustainable riverfront (re)development. To be able to achieve sustainability, a (re)development scheme should ensure "three key issues" by balancing them: healthy environment, an effective social usage, and a vitalized local economy.

The paper hypothesizes that a sustainable waterfront (re)development is a long-termed process which compose of interrelated phases starting with a determination of a new vision for the waterfront and developing a strategy, decision-making, programming, planning, designing, projecting, implementing, and managing, that shapes the new waterfront development. The key point is "an organization" which be able to ensure the "involvement of various actors" at required phases to cooperate for taking part of the project. Thanks to just

kind of organization, it is possible to realize a sustainable project developed by basing upon multi-dimensional analyses (economic, social, spatial, ecological, historical, cultural, aesthetical and so on) of a waterfront zone carried out by different field of study, field of interest, thus, different logics, and in this way, capable of blending the demands of different sectors and current needs of a society. Such an organization can bring the waterfront in the "new image" by ensuring the production of a waterfront development project which can emphasise the distinguishing features of a given waterfront and define the most consistent, most coherent, most suitable, most reasonable arrangement of it, creating the "local identity". With this "sense of identity", one can know where, which "geography" and "culture" he/she is in the world. In this context, the most critical issue of the final product should be the realization of public spaces along the shoreline to achieve the waterfront to be the focal point of daily life again by ensuring an interaction between the city and the water by means of adressing the current needs of the society in the 21st century. To do this, the issue of the creation of publicity and the production of as such public space system must be formulated during these successive phases of this process. The paper hypothesizes that a final product lies behind the process. Thus, This paper is based on the argument that the production of public space system continuously along the shoreline should be used as a tool for creating "local identity"; and this can be only achieved by revealing and referring the natural/ecological characteristics and cultural features composed of historical heritage, social background, past experiences of the waterfront and the collective memory in programming and designing phase of the riverfront zone. In this way, an atmospher having speciality of distinquishing characteristics of the waterfront zone can be created and; thus, the local waterfront identity can be established by revealing the uniqueness of the site, providing "a sense of place".

Based on analyzing the almost half century global experience on waterfront (re)development phenomenon, in this paper, it is aimed to draw "a framework" including main components which a sustainable scheme require and to provide "a conceptual agenda" including key concepts and issues which a successful public open space production, referring the place-making concept to reveal the spirit of place (genius loci), realized along waterfront requires. Within this framework, quality criteria for contemporary public space production is also formulated. Based on this conteptual agenda, the riverfront promenade project of Amasya was evaluated and tested to present to what extent it can ensure these global criteria. Thanks to the natural morphology of the city, the archaeological and historical structures appearing on it, and its traditional culture, the city of Amasya has a distinctive character. Thus, proposal of any planning and design scheme for the banks of the river needs to be made with an approach based on the sense of responsibility towards such an unique environment having historical and cultural heritage.

City authorities can realize unique waterfront (re)developments if they develop their own strategies in the context of their own geography and culture by basing on these "common issues" arising out of this global experience. In comparision to coastal cities of world, inspite of being surrounded on three sides by the sea, it is seen that Turkey, in general, has failed to develop a holistic approach regarding natural, historical, and socio-cultural aspects to their urban waterfront zones and establish a framework form "the integrated coastal zone management" referring to a comprehensive, a multi-dimensional management process which comprises all sectors related to coasts, and aims to generate a progress for all actions of the coasts by considering the sustainability concept. This situation in Turkey has come of the issues and problems derived from the authority disagreement and the disconnection between government departments at the legal, administrative, instituonal, and organizational level.

Considering this fact, with this paper, it is aimed to display the key components needed for the organization of a sustainable waterfront (re)development scenario considering social benefit by means of presenting a "conceptual agenda" for Turkish cities, providing a guiding source which will light the way for further schemes.

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Mexico City: Reconnecting an inland metropolis to water

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Synopsis

Rapid growth of Mexico City caused the disappearance of almost the entire lake on which it was established. The paper will discuss and analyze the rationale of a few visions for the future of the city, which propose different ways to reconnect it with water.

Introduction

Not surprisingly, most research on the connection between water and built environment was performed in cities located along the coast or a major river. However, it is important to recognize that water plays a key role in all kinds of settlements, regardless of their location and size. This paper looks at a rather unusual case of Mexico City – the second largest inland metropolitan area in the world and its different visions and strategies to restore the connection with water that has been lost over time.

The first part looks at the historical development of Mexico City with a special attention to its geographic location and the important role of the lakes, which once dominated in the Valley of Mexico. It is explained how the water was gradually drained through different hydrologic engineering projects. The next section describes the situation today – the different problems caused by man-made alterations in the environment, and the different attempts to combat them. The following part introduces some of the more radical visions of the future of the city which aim at restoring the historical connection to water by establishing a network of lakes, channels as well as rivers and incorporating them into the built fabric of the city. To illustrate the strategies to achieve those visions, two case study projects were selected for a more detailed analysis. One of them is turning a large wasteland into a Lake Texcoco Ecological Park which might become the largest urban park in the world. Another is a proposal for the restoration of the Piedad River, which since 1940s has been channeled underneath a crosscutting freeway near the city centre (for locations of the key sites mentioned in the text, please refer to the map in Appendix).

In the concluding part, it is argued that those visions and projects have a great opportunity to provide something more than ecological qualities. They may be catalysts for recreational, cultural as well as educational uses, contribute to the health and well-being of the citizens and at the same time enhance the aesthetic, social and economic values of space in the city.

History

The origins of the city can be traced back to 1325, when the Aztecs arrived on a small island on the western side of Lake Texcoco, as indicated by their God Huitzilopochtli, and funded Tenochtitlan - a settlement which preceded modern-day Mexico City. This settlement grew quickly and by the end of the 15th century it became the capital of the Mexica Empire and the largest city in Pre-Columbian Americas (Figure 1). Lake Texcoco was one of five big lakes in the Valley of Mexico with an average elevation of over 2,200 meters. The climate was mild, with a steady temperature throughout the year. Presence of large water bodies provided good conditions for agriculture.

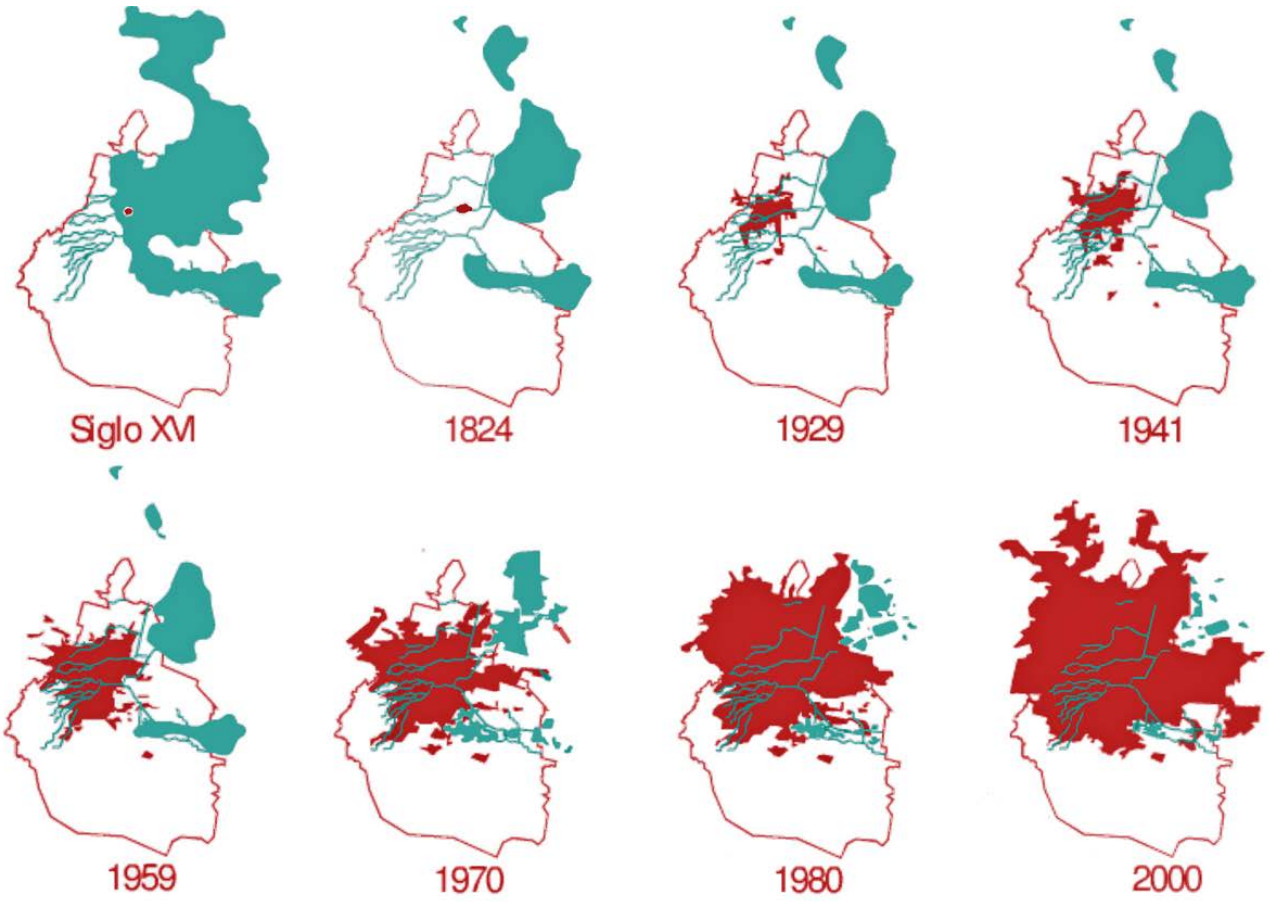


Figure 1. This is how Tenochtitlan might have looked like in the 15th century.
Source: *Latinamericanstudies.org*

The Aztecas took advantage of the shallowness of the lake and developed a system of channels and artificial islands called “chinampas” on which crops were grown. A system of dams was also developed to separate fresh from salty water and to control the level of the lake. Running this sophisticated system to regulate water was challenging, but at the end it seemed that the island community was capable of adjusting and maintaining it for their purpose.

Things have changed after Spanish conquistadors took over Tenochtitlan in 1521 and razed the city to the ground. In order to show their superiority over the Aztecas, the colonists decided to build a new settlement on top of the ruins of Tenochtitlan. They did not have much appreciation for the engineering skills and expertise of the natives, especially for their ability to regulate the level of the lake. Most importantly, the dams which were destroyed during the siege of 1521 have never been rebuilt, which caused frequent flooding in the city. Especially severe floods happened in 1555, 1604, 1607 and 1629; some of them lasted even a few years. The consequences were so serious that the colonial government considered discontinuing the expansion of the city, but eventually it was decided to keep it at its current location (Santiago, 2013). As small interventions to combat the problem of flooding did not work, they came up with

a much different solution. Starting in the 17th century, a series of ditches and canals were build to remove water from the lake and at the same time make space for the rapid expansion of the city (Figure 2). Many rivers and canals that once were among the main features in the city have been redirected or channeled.



Figiure 2. Shrinkage of the Texcoco Lake (blue) and the expansion of the urban area of Mexico City (red) between the 16th century and year 2000.
Source: *Regeneración del río La Piedad como eje de conexión biológico y humano*

The area covered by the lake was getting smaller, but it was not until the mid-20th century that the issues with flooding were under control. By then, however, most of the central part of the lake was totally dried up and developed, with an exception of a large basin in the southern part of the built area. Gradual sinking of the city made further removal of the water more difficult, as the surface drainage channels lost their gravitational advantage, while pumping the water manually was not energy efficient. Therefore, the next and final intervention that contributed to the almost definite disappearance of Lake Texcoco was the construction of the *Drenaje Profundo* (deep drainage) between 1967 and 1975, which consists of a network of 164 kilometers of tunnels that are wide enough to fit a subway car (Ezcurra, 1990). Most of the water from Lake Texcoco was redirected to rivers or were channeled to the rural areas of Valle de Mezquital in Hidalgo State (north of the city) for irrigation. The removal of water from the surroundings of the city might have fixed some problems, such as flooding, but it also caused

new ones, especially worsening of air quality and soil contamination. To satisfy the growing needs for portable water, it had to be piped from sources located far away from the city.

Those concerns were recognized by the government and the academic community, which encouraged a gradual shift in approach and started to embark in projects that aim at repairing the situation. In 1970s, the government expropriated 14,500 hectares of land (11% of all Valley of Mexico) in the North-Eastern part of the city to create a land reserve for ecological restoration of Lake Texcoco (Echeverria, et al. 2010). The main project was the creation of Nabor Carrillo lake (1000 ha) in 1985 and a number of smaller basins, which contribute to the treatment of wastewater. Partial reforestation also took place in order to block the wind which would bring dust storms into the city, a phenomenon that was also caused by the drought of the Valley. However, not much else has been done to date. The land reserve has been closed and guarded from illegal invasions and today it resembles a fenced mysterious wasteland (Santiago, 2013).

Current situation

The history of the city shows how it came a long way from auto sufficiency in the pre-colonial period to a total dependency on imported water from sources located far away. In the meantime, the population grew from less than a few hundred thousand inhabitants to over 20 million in what is today referred to as the Mexico City Metropolitan Zone.

As mentioned before, the drying of the lake basin caused a number of environmental issues that still remain unresolved. One of them is the presence of salt on the surface, which causes problems for local plantation. Dust storms might be much less intense than a few decades ago, but they are still bringing pollution into the city, which causes respiratory difficulties. The little particles carried by wind would normally dissolve in water or be blocked by a tree canopy, but since both are lacking, they make their way through into the city (Santiago, 2013).

Another problem that is very hard to mitigate in the current situation is gradual sinking of the ground in almost all the areas formally covered by the lake, caused by empting ancient aquifers and pumping out water from below the ground. The speed of sinking in the historic centre is estimated to around 10 cm per year, while in some of the areas in the south-eastern part of the city even up to 40 cm (Mendez et al. 2013). Each year, the city pays large amounts of money for lifting up, retrofitting and protecting some of the major tourist attractions which were built on marshlands and unstable grounds. Yet sinking does not only affect buildings, but also entire infrastructure networks, such as subways, sewage and water supply. Another side effect of the instability of soil is an increased vulnerability to earthquakes which frequently occur in this area.

Perhaps the most frightening issue is the warming up of the local microclimate. It is estimated that the average temperature in Mexico City raised 2.5°C in the 20th century alone, which is much more than the average for the entire world for the same period: 0.74°C (Jazcilevich et al. 2000). Scientists from the National Autonomous University of Mexico claim that the raise in temperature is primarily attributed to the drying of Lake Texcoco and the best way to cool down the atmosphere is to recover at least parts of the water basin (Jazcilevich et al. 2000).

The land reserve still exists, but little has changed since it was established a few decades ago. In terms of water bodies, at this moment, there are 11 rivers, 14 sewage canals, 4 wastewater treatment plants and 6 lakes inside the protected area, yet most of them lack proper maintenance and secondary uses (Echeverria, et al. 2010). The few remaining business establishments have moved out, and the empty spaces between the water bodies are filled with garbage and wild plantation. Each year around 300,000 birds of 153 different species come to the reserve from the United States and Canada (Echeverria, et al. 2010). The size and proximity of this site to the city gives it a huge potential, which has still not been realized.

One of the few success stories for reconnecting the city to water with the input of the community was the conservation of canals and chinampas in Xochimilco. It is a south-eastern suburb of the city, which for most of the 20th century was under threat of urbanization, similarly to other peripheral areas in Mexico City. However, in 1987 the remaining Xochimilco canals were declared World Heritage Site by UNESCO and since then the area is protected from urban development. Two years later, the government approved *Plan de Rescate Ecológico de Xochimilco* (Plan for Ecological Rescue of Xochimilco) which proposed expropriation of land and creation of a large lake covering 360 ha which would be used primarily for sports and recreation, yet the plan was abandoned due to the opposition of the local residents and farmers. As a result of negotiations between the stakeholders and the community, the plan was modified, which resulted in cleaning up the canals and the creation of a smaller lake with a market, where local producers could sell their plants and products to visitors (Legorreta, 2005). Although the surrounding area has been urbanized over time, today Xichimilco is the last preserved part of the old lake system, where island-type agriculture is still being practiced (Figure 3). Besides agriculture and its ecological values, Xochimilco also serves as a leisure place for a lot of city residents and tourists, who often hire colorful boats to navigate through the canals.



Figure 3. Chinampas in Xocimilco. Foto: *Marcin Sliwa*

At the same time there has been a gradual shift in Mexico City's planning approach in the recent years towards more sustainable and resilient development. The administration of the Federal District, which governs the central part of the metropolitan area, is demonstrating an active role in promoting environmental initiatives and combating the impacts of climate change. It is especially worth mentioning that Mexico City invests in different transportation-related projects which aim at discouraging car use and promoting public and active transportation. In 2013, Mexico City won the *Sustainable Transport Award* for its achievements in expanding its Bus Rapid Transit (BRT) system and bicycle sharing program as well as revitalizing open public spaces (ITDP, 2013). The BRT (locally called *Metrobus*) was launched in 2005 and today it has 5 lines (110 km altogether), the last of which was opened in November 2013. The *Metro* system is also being continuously expanded. The most recent addition was a 20 km long new Line 12 which connects the southern boroughs of the city. Another important step forward was the new Mobility Law, which prioritizes the pedestrian and recognizes an efficient, safe and accessible transit as a 'human right' (Agencia de Gestión Urbana, 2014). Those kinds of initiatives contributed towards a major improvement of air quality in the entire Valley of Mexico.

Future visions of the city

The 'momentum' for sustainability and resilience to natural hazards in Mexico has also been recognized by a group of local architects, urbanists and landscape designers, particularly Alberto Kalach, Teodoro González de León, Gustavo Lipkau, Jose Castillo and Pedro Moctezuma Barragán. Their work resulted in a number of revolutionary proposals for environmental restoration in Mexico City which form part of an initiative called *Vuelta a la ciudad lacustre* (Recovering the City of Lakes). The main inspiration for those projects came from the historical and geographical circumstances on which the city was established at the first place. "If the Aztecs built a city on a lake, can we recover it and live more sustainable?" (Ramírez, 2012).

The first of those proposals, *La ciudad y sus lagos* (The city and its lakes), was published in 1998 and set stage for other, more elaborate works later on, notably *Ciudad Lacustre* (Lacustrine City) from 2009, *México Ciudad Futura* (Mexico Future City, 2010) and *Atlas de proyectos para la Ciudad de México* (Atlas of projects for Mexico City, 2012). All those ideas are based on the same principle of creating a more sustainable and resilient city by crosscutting the urban area with a system of 'blue' and 'green' corridors and nodes (Figure 4).

The common concept in those proposals is to turn underused or empty spaces, such as service corridors, large parking lots, oversized roads and wastelands into artificial lakes, rivers (which would also serve as alternative transportation routes), urban forests, quality public spaces and ecological restoration areas. Roof spaces might be converted into small scale gardens which would provide an additional source of local food supply. The inevitable increase in population density would be compensated with an improved access to natural and recreational spaces all across the city. This, according to the authors will bring a number of benefits, including the improvement of quality of life and the environment (Kalach et al. 2010, 2012; León et al. 2009; Moctezuma, 2009). Provision of new green spaces and permeable surfaces that would recharge underground aquifers will also slow down the impacts of sinking soil (Rhoda and Burton, 2012).



Figure 4. Alberto Kalach's vision of 'green' and 'blue' corridors cutting through the city.
Source: *Atlas de proyectos para la Ciudad de México*

Alongside with the large scale proposals mentioned above, there have been a number of independent, more specific projects which, if implemented, might provide a good starting point for the realization of those far-reaching visions. Of particular interest are the proposals for the Lago Texcoco Ecological Park and the recovery of Río Piedad.

Lago Texcoco Ecological Park

The idea of establishing a new Lake Texcoco Ecological Park (LTEP) was initiated in 2008 with a public-private partnership between the National Water Commission (CONAGUA) and an architecture firm led by Iñaki Echeverria. The LTEP was not just meant to be a reservoir for ecological restoration, although this was the main motive behind this project. The aims are not only to "reclaim the site as the most important piece of green Infrastructure of the valley" (Echeverria, et al. 2010) but also to create "the largest urban park in the world" with open spaces that would be accessible for all residents (Peckenham, 2011).

The final design for this area has not come as a master plan, but as multiple strategies for this enormous territory, covering 14,500 hectares, which is 23 times more than Bosque de Chapultepec (the largest park in the city) and 43 times more than Central Park in New York (Echeverria, et al. 2010). The authors of the project claim that the LTEP does not just follow what is being done in the 'first world'; but in the future, it will be projects like this that will show example to others and define a "new cultural ecology" (Echeverria, et al. 2010). The original plans for the park also included the territory of the present day Benito Juárez International Airport. This site would serve as a narrow 'entry point' from the city side with more intensified uses. Further east and north, the park expands towards the edges, providing more open spaces and areas for water bodies, forests, wild pastures, orchards, gardens as well as other

agricultural and ecological uses (Figure 5). The most important component of the plan is creation of several new fresh and salt lakes and improvement of the existing aquifers. The lower elevation comparing to the rest of Mexico City provides a good opportunity for redirecting many of the existing rivers and drainage channels back to what used to be the bottom of the original Lake Texcoco and develop an irrigation system for the local plantation and agriculture. The environmental values of the project are evident through incorporating the hydrological cycles in the functioning of the metropolitan area, eliminating the risks of flooding and recovering natural ecosystems that have been lost due to the drying of the lake and rapid urbanization. There will also be place in the park for alternative energy production with solar panels, wind turbines as well as facilities for methane and biomass processing and recycling (Echeverria, et al. 2010).

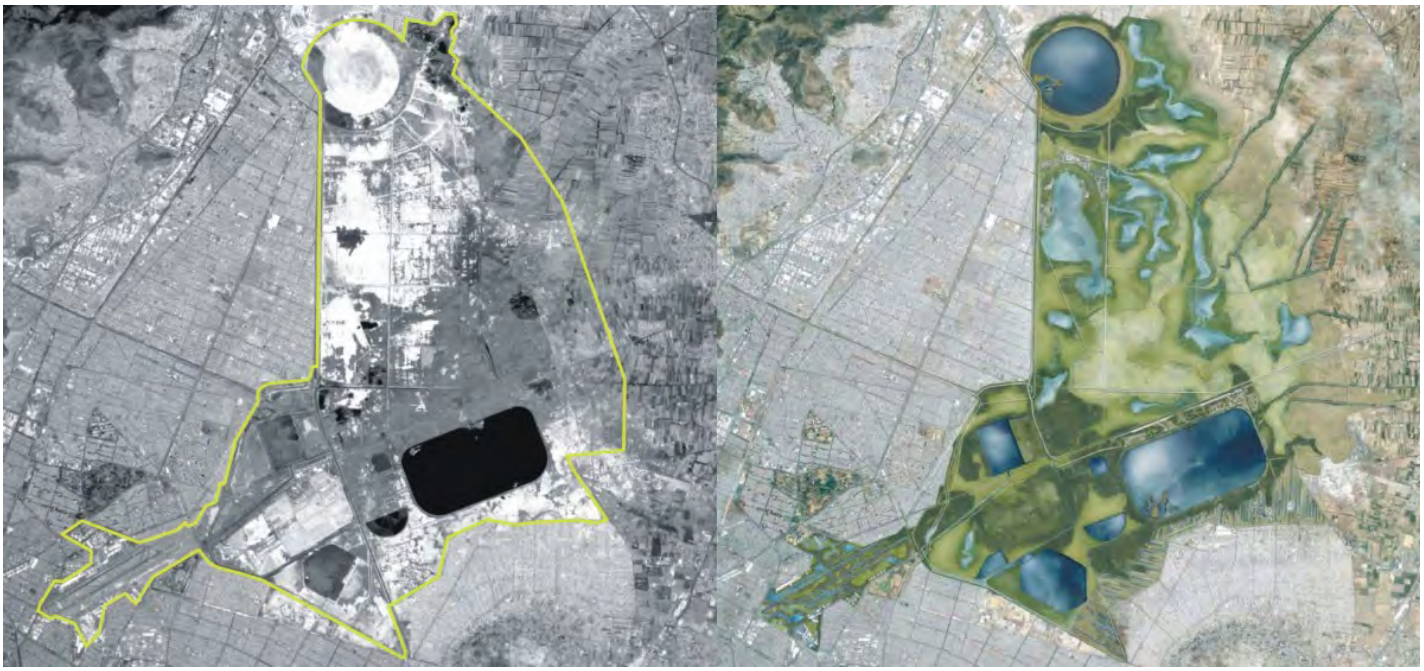


Figure 5. The LTEP site today (left) and the proposed revitalization (right).
Source: *Parque Ecológico Lago de Texcoco*

Perhaps the most important aspect is the incorporation of social and human dimensions to this project. The LTEP will incorporate a variety of recreational, cultural educational and sport facilities, including museums, exhibition pavilions, fairgrounds, playgrounds, restaurants, open community gardens, bicycle and hiking trails, beaches, water sport centers, fields for team sports and many more. Those places will facilitate social interaction, create opportunities for environmental education and provide a much needed open space for recreation.

The area would be well connected to the existing public transportation network allowing easy access for people from all parts of the metropolitan zone who do not own a car. According to the plan drafted by Echeverria and his team, there would be an extension of over 80 km of Bus Rapid Transit lines inside the LTEP zone and a network of feeding local buses running throughout the different parts of the park (Echeverria, et al. 2010). Access points every few hundred meters for pedestrians and cyclists would be provided from all sides of the park.

The design concept of Lake Texcoco Ecological Park was completed in 2010 and presented later that year at the United Nations Climate Change Conference (UNCCC) in Cancún, Mexico. Realization of the first phase has begun in 2012. In the meantime, the rest of the project was put on halt for various reasons, particularly because of the proposal for building a new, larger airport in the middle of the LTEP. One of the proponents of this idea was Kalach, the co-author of *México Ciudad Futura*, in which he provided a number of sketches showing how a new airport could be incorporated with the ecosystem of lakes inside the park (Kalach, 2012). The final option for the location of the air strips has not been chosen yet, but the most likely scenario implies the expansion of the existing airport towards north-east (Reforma, 2014). Regardless of the decision, CONAGUA has already started buying the remaining parcels in the outskirts of the proposed park. This process is scheduled to conclude in 2016 (Arena Pública, 2014).

Recovery of Río Piedad

Drainage of water from the lake over the centuries did not mean that all water from the city center disappeared. Up to the mid 20th century, there have been many open rivers and channels cutting through the entire urban area. This was also the case of Río Piedad, a river which would run 3 km south of the historic core of Mexico City. It originated in the hills in the western suburbs and flowed east towards the low-lying Texcoco reservoir. In 1942, it was channeled to make space for a 13 km long crosscutting freeway called Viaducto Manuel Alemán, which was opened in 1950. Since then, the stream has been running in tubes inside a massive concrete median, collecting rainwater (80%) and sewage (20%) from the nearby areas (Montes, 2013). Figure 6 shows the current configuration of Viaducto.

The plan for the recovery of Río Piedad was proposed by Elías Cattan, founder of the *Taller 13 Arquitectura Regenerativa* in 2010 and was inspired by an earlier successful initiative of restoration of the Cheonggyecheon River in Seoul, South Korea. Cattan's idea is to open up the river and create a linear park along the entire length of Viaducto, all the way to the Airport at Texcoco (Figure 7). Special plantation and natural infiltration methods will be incorporated to treat and purify grey and black water collected from nearby buildings, which would relieve the pressure on the deteriorating external wastewater treatment plants (Suárez, 2013). The establishment of a linear park will provide an opportunity to recover the lost endemic species and provide space for irrigation, which is much needed in such a dense part of the city that lacks permeable surfaces. At the same time, the park will include spaces for leisure and social interaction, such as meditation gardens, open air stages, rollerblading paths as well as small orchards (Cattan et al. 2010).

Perhaps the most radical and controversial aspects of this "urban surgery" are related to the proposed changes to the transportation corridor. Right now, a typical section of Viaducto freeway consists of five lanes for car traffic in each direction divided into express and feeder roads. After the proposed changes, each side will have only two lanes for regular traffic, but there will also be segregated lines for Bus Rapid Transit and cycling. Road tools might also be established to discourage driving, limit air pollution and raise money for similar projects in the future. However, this project is in conflict with another proposal for this transportation corridor,

which implies the increase of traffic lanes by constructing an elevated second floor on top of the Viaducto highway (Montes, 2013). A similar expansion project has recently been completed at the Anillo Periférico beltway in the more affluent, South-Western part of the city.

Nevertheless, there seems to be a significant public support for the initiative to recover Río Piedad. This might not be surprising if we consider that up to 80% of the population of Mexico City uses public transportation on a daily basis and a growing number of city dwellers move around by bicycle (Chavez, 2011). In fact, a number of environmentalists, artists and members of the public took initiative to promote the idea of recovering rivers in the city and since 2011,



Figure 6. The Viaducto freeway today.
Source: *Regeneración del río La Piedad como eje de conexión biológico y humano*

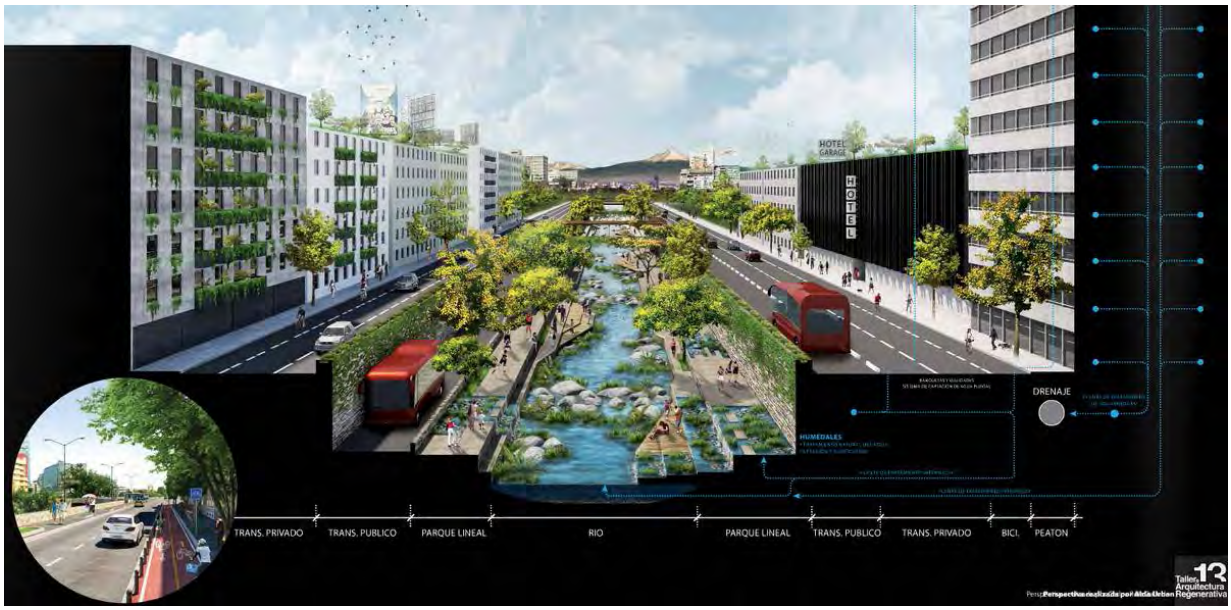


Figure 7. The Viaducto freeway after the proposed changes.
Source: *Regeneración del río La Piedad como eje de conexión biológico y humano*

they have been organizing regular ‘picnics’ on the median of the Viaducto freeway with food, music and artistic performances (El Universal DF, 2013). This demonstrates how much demand there is for open green spaces as well as improved public and active transportation infrastructure in Mexico City.

According to the architects, the recovery of Río Piedad might only be a pilot project, as its successful implementation could possibly spark similar initiatives in other parts of the city. In total there are 45 such rivers and streams that have been covered or redirected to make space for roads and urban infrastructure. The largest ones are the Río Churobusco and Río Consulado, which were channeled the same way to make space for Cirquito Interior, a freeway which forms a loop around the central part of the city (Cattan et al. 2010). As most of those rivers link to the Lake Texcoco reservoir, the creation of linear parks along them could provide a good extension of the natural ecosystems rich of water bodies, different kinds of plantations and animal species. This implies a great potential to truly reconnect large parts of the city to water, on which it has originally been built.

No decision has yet been made in regards to the implementation of the Río Piedad project. According to the architects, it would take around two years to complete and the estimated cost, including the BRT line is between 0,9 and 1.2 billion dollars, which is about double of the price of constructing second floor over Viaducto, but less than a half of the price of a subway line of a similar length (Cattan et al. 2010). Nevertheless, since the proposal is still in its conceptual phase, more detailed information about such aspects as financing and technology is yet to be published.

Conclusion

For a first-time visitor to Mexico City it might be difficult to imagine the amount of water that once covered the entire valley where the metropolis developed. Yet the historical connection to water was lost, as most of it has been either been drained or hidden under layers of steel and concrete, causing serious environmental issues. What can be learned from the case of the capital of Mexico is that in a long term, no city can get away without water and maintaining a natural hydrological balance in the landscape is crucial for its resilience and sustainability, both environmental and social. This is especially true for inland cities, where the relation to water is at least as important and complex as in urban areas located in coastal regions, which without doubt dominate the discourse of urban-water connection.

What is also evident from the projects and visions described above is their inspiration in “the historical context of an urban area”, which then “would be a first step to address urban ecological and social renovation effectively” (Reyes, 2011). The different designs, which are developed to ‘fix’ this what seems to be a hydrologic problem, have to consider that as open space in dense urban areas is getting scarcer, projects like those have to make a profound contribution on multiple dimensions, including human and social. Addressing environmental concerns alone is usually not enough to get the project funded and approved, regardless of how much damage has been done to the local and global ecosystem. The visionary architects who

worked on both the LTEP proposal and the Río Piedad regeneration project seem to have recognized and addressed this demand. This is why so much emphasis was put on incorporating different uses of space such as leisure, recreation, social interaction, sports and improved mobility, all of which would be accessible to all residents of the city.

Perhaps the success of the canals of Xochimilco might also serve as an inspiration for the new proposed initiatives. Being a popular leisure spot, tourist attraction and agricultural hub at the same time makes Xochimilco a good example of an environmental restoration project that serves multiple functions for the city and its residents.

Despite all the good intentions and endorsements, there is a chance that the presented proposals might only be implemented partly or not implemented at all. Although the most recent Urban Development Plan for the Federal District from 2003 recognizes the importance of restoration of the Texcoco reservoir as well as the recovery of urban rivers (Gobierno del Distrito Federal, 2003) no specific master plan in regards to implementation strategies has been published to date.

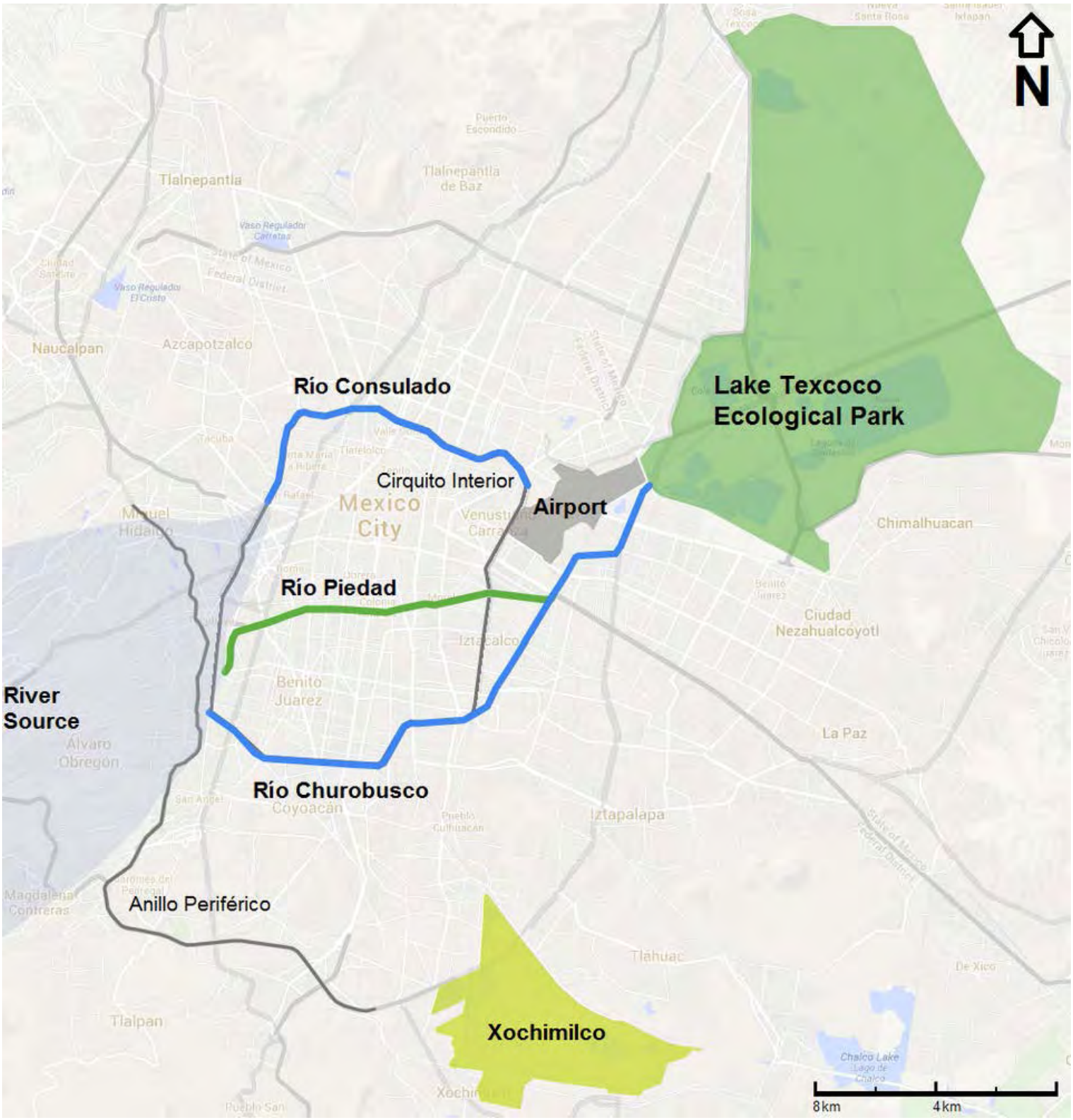
Taking into consideration all the progress in planning that has been made in Mexico City in recent years, it seems that the city is ready for those undertakings. However, it needs to be recognized that public investments in ecological restoration projects may should no longer be seen as merely ‘options’, but soon they may become the only reasonable choices in order to avoid environmental crisis and provide essential open spaces in this rapidly densifying city.

The most likely reason why those projects have still not kicked-off is that they require extensive funding and a long-term commitment that needs to be “passed on” to the new government after the elections. Moreover, implementation of many large-scale initiatives in Mexico City demands inter-governmental collaboration, particularly between the Federal District and the neighboring Mexico State, which governs the suburban municipalities and includes the territory of the LTEP. Conflicts of interests and ideologies between the ‘centre’ and the ‘suburbs’ caused problems in implementing such projects as extension of subway lines or relocation of the airport (Flores, 2001). The modest progress that has been made in the implementation of the LTEP project was mainly due to the initiative of the National Water Commission (CONAGUA), but they alone may not be able to realize the grand vision for this territory.

Finally, the presented proposals are in competition with other ideas which prioritize different approaches to land use. In particular, both the LTEP and the Río Piedad projects are threatened by an interest in improving the traffic flow both on the ground (Viaducto expansion) and in the air (enlargement of the airport). The strategic decisions that the government of the Federal District has to face in regards to those projects will likely have a huge impact on the environmental and social sustainability of the urban area as they may set stage for a completely new approach to planning whose ultimate goal might be to ‘go back in time’, and bring the water back to the city, rather than do ‘business as usual’ and progress with big urban infrastructure development.

Appendix

Map of the central part of Mexico City and locations of key sites



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Planning and assessment methods for climate regulating services Ecosystem services to improve natural cooling in metropolitan areas

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1. Rethinking urban planning in the age of Climate Change

1.1. Green and water in the city

The main task of this study is to understand how some Ecosystem Services (ES), green and water, affect temperature within urban structure, with the final aim of suggesting new strategies and applicative tools for urban planning. In details the role of green spaces in mitigating temperature is analysed, trying to identify what could be the better configuration and distribution of green areas within a built context.
The benefit that green areas and water basins give to natural cooling is well known. Trees and vegetation help in reducing air temperatures trough the evapotranspiration process, in which plants release water to the surrounding air, dissipating heat. In addition, the remaining rate of solar radiation which is not used for evapotranspiration and photosynthesis is reflected and neither absorbed nor emitted back later. This means that, when a vegetation surface is present, temperature values are lower.
The insane and deplorable decay of contemporary cities is even due to a thoughtless use of natural resources in urbanized areas. Historically, city and nature have been considered as opposite entities: where there was city there were no natural elements and vice versa. Natural elements were accepted in the city only for their functional/economic role: as a support of economic activities (ship channels, harbour site), as water supply, as leisure time spaces. The sharp separation between city and green lasted until XX century when the main European cities, urged by the critical hygienic conditions of industrialization, introduced urban natural parks as spaces devoted to leisure time of their citizens. These parks reflected a pastoral idea of nature and were considered as places where meet peacefulness and beauty of nature. Indeed, until recent years, natural elements have never been considered as effective 'building materials' of cities, with a structural role in city performances. Moreover cities are more inclined to erase natural features from their tissue: "Modern cities have literally dispersed and camouflaged the natural substrate of their sites. Many of these substrates have been altered beyond recognition: waters have been covered or diverted, topographies erased or manipulated, forests shredded or fragmented - the list is without end" (Girot, 2006). The underpinning concept of this kind of urban development, was that cities could go ahead without nature or even despite nature. The extreme outcome of this concept concerns the climatic comfort of cities and buildings. Air conditioning introduced the idea that technology could do better than nature and replace natural cooling, warming and air change mechanism with technological provisions. The speedy spread of building entirely depending from air conditioning has lead cities to increase their energy needs and GHG emissions, worsening the overall urban climate conditions.
That's why now there is a call for a new ecologically informed urbanism. It is important to reconsider the importance of the ecological role of natural features within cities and rethink green and water as elements able to improve urban ecosystem working.

1.2. Cities and climate change adaptation

Climate change (CC) is one of the defining problem of the 21st century and its impact on cities will be severe, as foreseen by the last report of the Intergovernmental Panel on Climate Change (IPCC, 2014). It will include higher temperatures and pollution, with consequential risk to human health and human activities. Cities are the focal centre of many strategies of mitigation and adaptation to CC since the relationship between urbanization and greenhouse gases (GHG) emissions is inextricable and the role of cities in addressing GHG reduction is of crucial importance. Traditional urban planning models and approaches are inappropriate to respond to CC, on the contrary, some of those largely contributed to the present crisis now faced by humanity (UN-HABITAT, 2007). Nowadays, it is possible to recognize the inability of traditional urban planning tools to cope with the disastrous environmental condition of contemporary cities. These challenges require a rethinking of urban planning and a reassessment of the discipline itself. To face this challenges urban planning need to create new tools to improve cities climatic performances and new ways to use the urban 'structural materials'.

This study focuses on the rising of high temperatures in urban areas during summer heat waves with the aim of developing intervention strategies to mitigate heat waves effects in metropolitan areas. Due to CC, in next decades, heat waves are expected to increase in number and intensity (IPCC, 2013). This phenomenon is extremely dangerous for human health: data on the number of deaths (about 35000) due to the European heat wave of 2003 make it one of the more devastating natural disaster of last decade (EM DAT). Projections suggest that 1-in-20 year hottest day is likely to become a 1-in-2 year event by the end of the 21st century in most regions (IPCC, 2013). In big cities, heat waves further increase their intensity and dangerousness due to the phenomenon of Urban Heat Island (UHI). UHI is a thermal anomaly affecting large urban areas where temperatures are higher than surrounding rural areas. The intensity of this phenomenon can be quantified as the maximum difference between the average temperature of urban air and the one of surrounding rural environment. The difference appears to be more pronounced at night than during the day. For instance, during summer periods in daylight the temperature difference between urban and suburban areas can range from +1 °C to +3 °C, while at night it can reach values ranging from +7° to +12° C (Bonafè, 2005).

Metropolitan areas are highly vulnerable to heat waves effect due to the formation of UHI; this vulnerability is due to the widespread overbuilding, the prevalence of paved surfaces on green areas, the use of building materials with low ability to dissipate heat, the morphology of some urban tissues which obstruct natural ventilation, the huge quantity of emissions caused by human activities (traffic, industrial plants, heating and air conditioning systems for household use).

During heat waves, UHI can produce the following problems:

- peak demands for energy consumption with consequent power blackouts in metropolitan areas;
- increasing of air pollution;
- increasing of health problems and mortality (Zauli et al., 2008).

It has been estimated that every degree increase (K) adds a significant supply to the air conditioning load evaluated between 5% and 10% of total consumption (Akbari et al., 2005). As an indirect secondary effect, conditioning increase causes the proportional growing of emissions in the atmosphere of several pollutants, as well as the increased production of GHG. Consumption related to air conditioning in fact determines the emission of tons of GHG

(CO_2 mostly) and other pollutants. Moreover, high temperatures intensify photochemical reactions of pollutants in the air: for every degree of temperature above 22°C, accident by smog increases by 5% (Taha et al., 1994).
UHI could be particularly harmful for human health because the temperatures increase also during the night, threatening human body resilience to extreme heat without giving night relief (Di Cristo et al., 2006).
Until now, UHI has been studied in four different research areas, which almost never have converged in a global and systemic study. Studies have been developed concerning the following single problems:

a) identification of areas interested by UHI phenomenon using different techniques to measure temperatures (remote sensing, temperature sensors) or processing meteorological statistical data;
b) identification of cool building materials which may mitigate heat increase in urban areas, i.e. roof covering, street pavements, green roofs and walls;
c) evaluation of the influence of urban form on temperature increase;
d) analysis on influence of UHI on energy consumption and GHG emissions.

According to literature, acting on urban shape it is possible to reduce the flow of heat stored in urban structure and the anthropogenic heat flux: the geometry, spacing and orientation of buildings and outdoor spaces strongly influence the microclimate in the city (Kleerekoper et al., 2012).
In general, UHI are influenced by many factors concerning urban form as:

- formation of Urban Canyons, where heat is hardly dissipated due to the absence of ventilation (Oke et al., 1977);
- urban tissues exposure considering solar and main winds orientation (Esch, van Bruin-Hordijk, & de Duijvestein, 2007); wind has the function of eliminating major temperature fluctuations, reducing the occurrence of hot spots (Taleb et al., 2013); some studies pointed out that network grids with street canyons parallel to the prevailing wind flow minimize the shelter, increase the wind speed and the dissipation of stored heat, and therefore contribute to mitigate UHI (Radhi et al., 2013);
- localization of green spaces and distance from water basin; several studies hint that interspersing green space into urban patches has a mitigation effect stronger than its concentrated form (Li et al., 2011).

Although some works has been already developed on urban planning and UHI issues there is still a lack of a systematic set of actions dealing with the high temperature problem in the city, there is an overall lack of applicative tools and strategies and a lack of tools to measure the effectiveness of actions developed.

2. Methodology

In order to analyze the links between ES provision (green areas, water basins) and high temperatures in a metropolitan area, a methodology based on the evaluation of the correlation curves "temperature - urban parameters" was developed. This methodology was applied to the metropolitan area of Naples, one of the largest and most populated in Italy.
Climate could depend on many different natural parameters: morphology, altitude, orientation, ventilation, green and water basins. Each one of these parameters affects the microclimate of an urban area determining different zones. Within a homogeneous microclimate zone other atrophic parameters affects temperatures, above all building materials and urban tissue age. The first step developed in this study was the identifying of

Test areas (TA), which should combine homogeneous conditions of natural microclimate with consistent conditions of urban environment.
Metropolitan area of Naples is an interesting field of application for its several different microclimatic conditions, from coastal zones to hill areas, to inner plans. Within the metropolitan areas zones depending on distance from the sea and soil morphology were selected (Test Zones). Within these zones, TA with similar features of building materials and urban tissue age were identified.
Then Check Indicators (CI) were identified. CI should measure the main characteristics of cities affecting UHI as regard urban structure, distance from water, configuration and distribution of green spaces. As regard urban structure CI (Table 1) identified were:

- Non-permeable Surfaces Index (NPSI): expressed by the ratio between paved open areas (i.e. streets, parking areas, courtyard) and the total amount of open areas;
- Percentage of Green Areas (%GA) i.e. the area occupied by vegetation, public parks, pitches;
- Land cover ratio (LCR): expressed by the ratio between the built surface and the surface of TA. The built surface is the horizontal plane projections of the buildings shapes;
- Building density (BD): expressed by the ratio between buildings volumes and the surface of the TA;
- Mean height of buildings (MH).

Specific influence of water was evaluated in relation with the distance from the sea of each TA. A more in-depth study was carried out for green areas through a configurational analysis oriented to understand which should be the optimal distribution of green areas in an urban environment.
To analyze green areas configuration a spatial pattern analysis was carried out using the landscape metrics available in Fragstats 4.2.
Measure of CI and landscape metrics in test areas required the set up of a geographical database for the metropolitan area of Naples including: land use map, topographical database map, polygons of buildings, road maps, orthophoto.
Geographic Information System (GIS) routines and spatial analysis were developed to calculate the main part of Check Indicators.
The comparison between the value of each CI in any TA and the average temperature of each area allowed the correlation analysis among urban structure features and temperature increase.

Code	Name	Calculation scheme	Units
LCR	Land Cover Ratio	(built surfaces)/(area of TA)	m^2/m^2
BD	Building Density	(building volume)/(area of TA)	m^3/m^2
%GA	Percentage of Green Areas	(green areas)/(area of TA)	m^2/m^2
NPSI	Non Permeable Surface Index	(non permeable open areas)/(area of TA)	m^2/m^2
MH	Mean Building Height	(building volume in the TA)/(built surfaces in the TA)	m

Table 1 – Check indicators calculated to analyze TAs urban features.

3. Case study

3.1. Study site and database

The Province of Naples is the most densely populated in Italy. It has an area of 1,171.13 km², and a total population of about 3 million inhabitants.
The geomorphologic configuration of the Province is given by the complex intertwining of volcanic systems, limestone massifs, pyroclastic-alluvial plains.
The inland plain, where urbanization has been spreading out, is interrupted by two volcanic systems: Vesuvius, to the east, and Campi Flegrei, to the west. Among them the highest urban density is polarised. The urbanized area has an average population density of 8000 inhabitants per square kilometres (Figure 1).
The widespread and speculative overbuilding has transformed much of the rural inland plain into a huge periphery. Moreover, this transformation erased the pre-existing rural green areas without providing a suitable supply of urban parks or green areas.
These factors produced a substantial change in natural balance of the inner areas which turned into a significant increase in temperatures. From temperature map carried out these areas show the highest values (in some cases over 50 °C).
As regard the identification of areas subjected to UHI, it is necessary to specify that there are two types of UHI: surface and atmospheric UHI. Surface UHI refers to the temperature of urban surfaces exposed to the sun that are hotter than air. In summertime urban surfaces temperature could reach more than 50°C during the day, while difference with air temperature is smaller during nighttime.

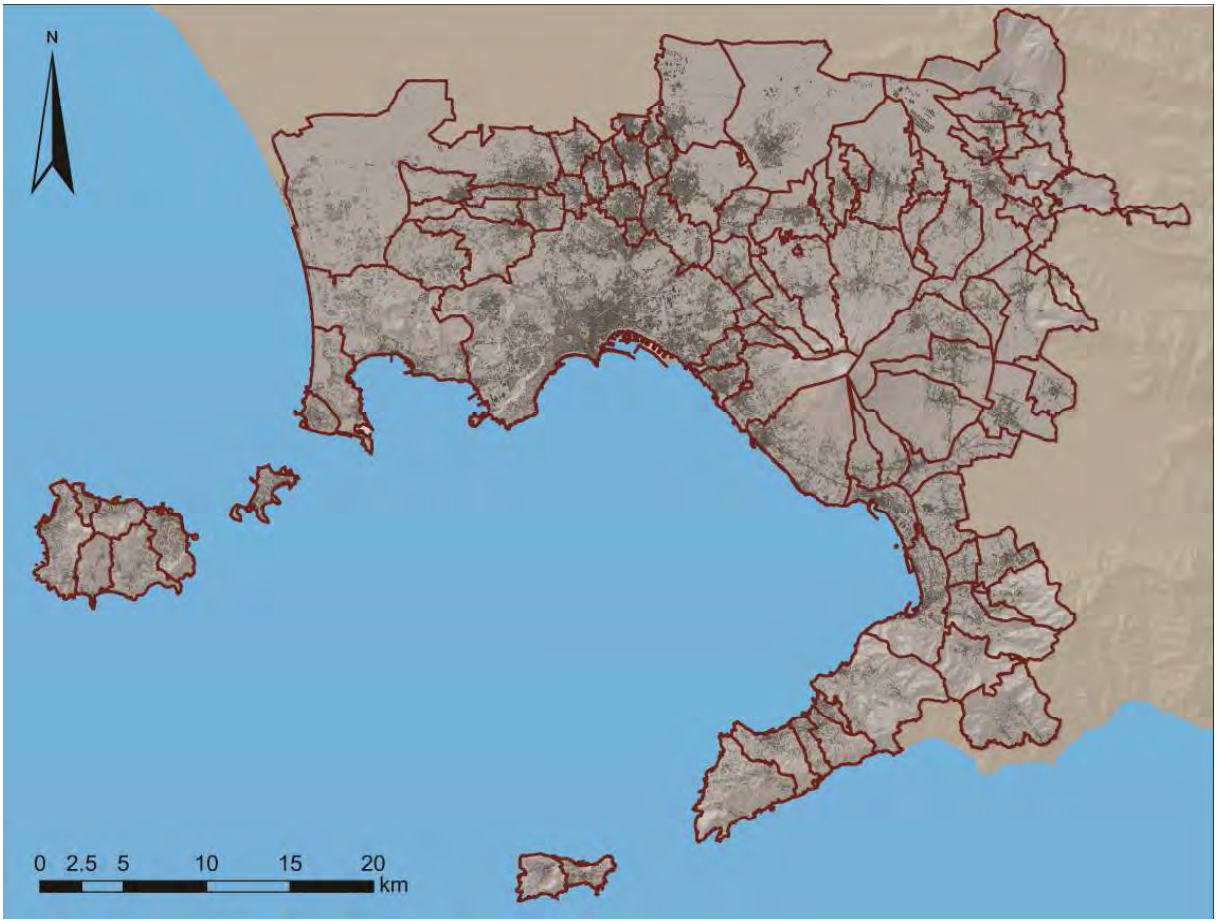


Figure 1 – Province of Naples and its Municipalities.

Atmospheric UHI refers to warmer air in urban areas compared to cooler air in rural surroundings. This phenomenon is weak throughout the day and becomes more pronounced during nighttime due to the slow release of heat from urban surfaces. To identify UHI, scientists use direct and indirect methods. Direct methods such as fixed weather stations and mobile traverses are used to identify atmospheric UHI (Bonafè, 2005; Di Cristo et al., 2006). In this research, remote sensing, an indirect measurement technique, was used to estimate surface UHI. The temperature map was produced by the Geographical Information System Service of the Province of Naples. The map was carried out processing data acquired by the air transported sensor MIVIS (Multispectral Infrared and Visible Imaging Spectrometer) during the summer 2005. The entire detection consisted of 116 strips which cover 1170 km^2 of the entire Province.
The high resolution images obtained (3 $\times$ 3 meters space grid) allowed a precise and detailed analysis of phenomena, so that it was possible to identify the temperature of each single building.
To analyse TA, georeferenced data (UTM-WGS84) made available by the GIS Services of the Province of Naples were used. Two informative layers called "permeable surface" and "non-permeable surface" were extracted by the Topographic Database of Campania Region, derived from the Regional Digital Map (1:5000 scale, edition 2004/2005)
Building heights were calculated subtracting the heights of the Digital Surface Model (DSM) to the ones of the Digital Terrain Model (DTM). Both DSM and DTM has a grid of 1 $\times$ 1 meter and were processed from data detected using LIDAR (LIGHT DETECTION AND RANGING) sensor air transported (flights occurred between 2009 and 2012).
Orthophoto raster images employed were extracted from the Orthophoto of Campania Region scale 1:5000 detected in 2004/2005
To calculate CI ArcGis 9.3 was used, while urban green areas landscape metrics were achieved employing Fragstats 4.2.

3.2. Check Indicators calculation

To examine linkages between temperature, urban morphology, water and green areas, 33 same sized squared TZs (1 km^2) were identified in the west side of the Province of Naples. To take into account the several different urban morphologies recognizable in TZs, each TZ was split into 16 same sized square homogenous Test Areas (TA), to a total of 553 TAs.
TAs were classified according to urban tissue and building features mainly comprised in. Urban tissue classification was derived from Province of Naples Regional Plan, which identifies three principal residential classes:

- Historical centers (HC), made up by tissue located in the central core of cities and towns, characterized by high density, irregular texture of urban block, traditional masonry buildings constructed until 1936;
- Modern high density areas (HD) made up by urban tissues built before 1965, generally characterized by high density, regular texture, regular urban block, concrete buildings, and a satisfying public space provision;
- Modern low density areas (LD) made up by urban tissues recently built, generally characterized by irregular grids, concrete buildings, presence of several rural areas and/or non-built lots, and a scarce public space provision;

Where more than one of the above three classes were recognizable, TAs were classified as Mixed areas (M). Finally, TAs comprising none of this classes and showing a prevalence of rural areas were excluded from the analysis.
To take into account the role of water basin in UHI mitigation, a further classification of TAs was based on distance from sea and lakes. This classification was achieved performing a GIS routine with ArcGis 9.3 to create multiple buffers (1000, 2000, 5000 meters) from the shore line and a single buffer (1000 meters) from lakeside. To each TA was attributed the value of the buffer where its centroid falls into (Figure 2). Anothes GIS routine was developed to assess temperatures of TAs: a specific tool was created using Model Builder to calculate the mean values reported in the temperature map for each TA (Figure 3).
CI were calculated combining different informative layers:

- permeable surfaces, corresponding to the sum of green areas, pitches, fallow non-built lots, rural areas;
- non permeable surfaces;
- built surfaces (containing the height of each building).

The degree of linear dependence between each CI and mean temperature were estimated, for each TA, calculating the Pearson linear correlation coefficient.
A relevant correlation was observed between mean temperature and CI in TAs closest to the sea, while inner TAs only showed a good correlation between mean temperature and Percetange of Green Areas.

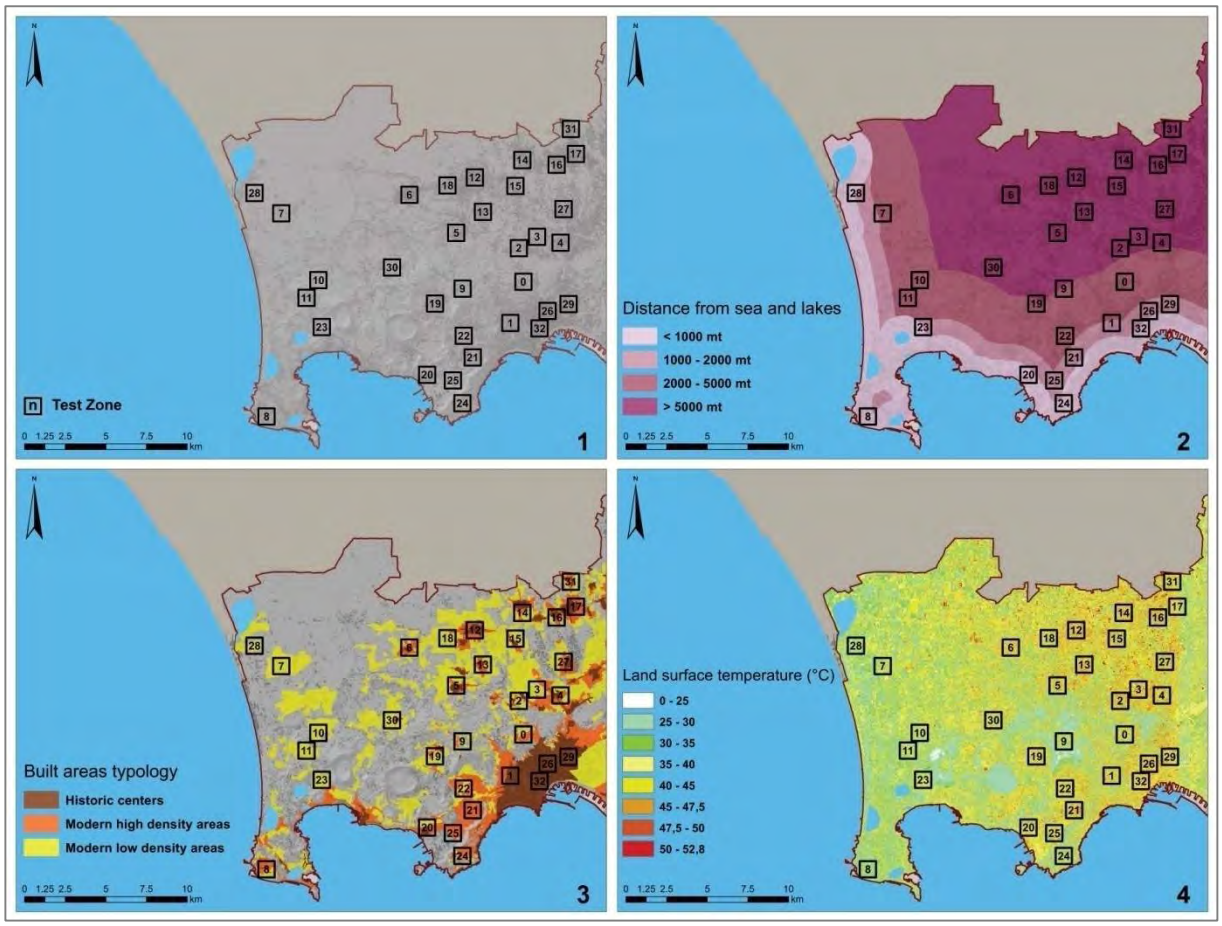


Figure 2 – TAs position (1); buffer distances from sea and lakes (2); built areas typology (3); MIVIS temperature map used in the case study (4).

3.3. Configurational analysis of Green Areas

Configurational analysis of Green Areas were carried out by calculating a set of metrics belonging to the theoretical framework of landscape ecology (Mc Garigal and Marks, 1995) using Fragstats 4.2.

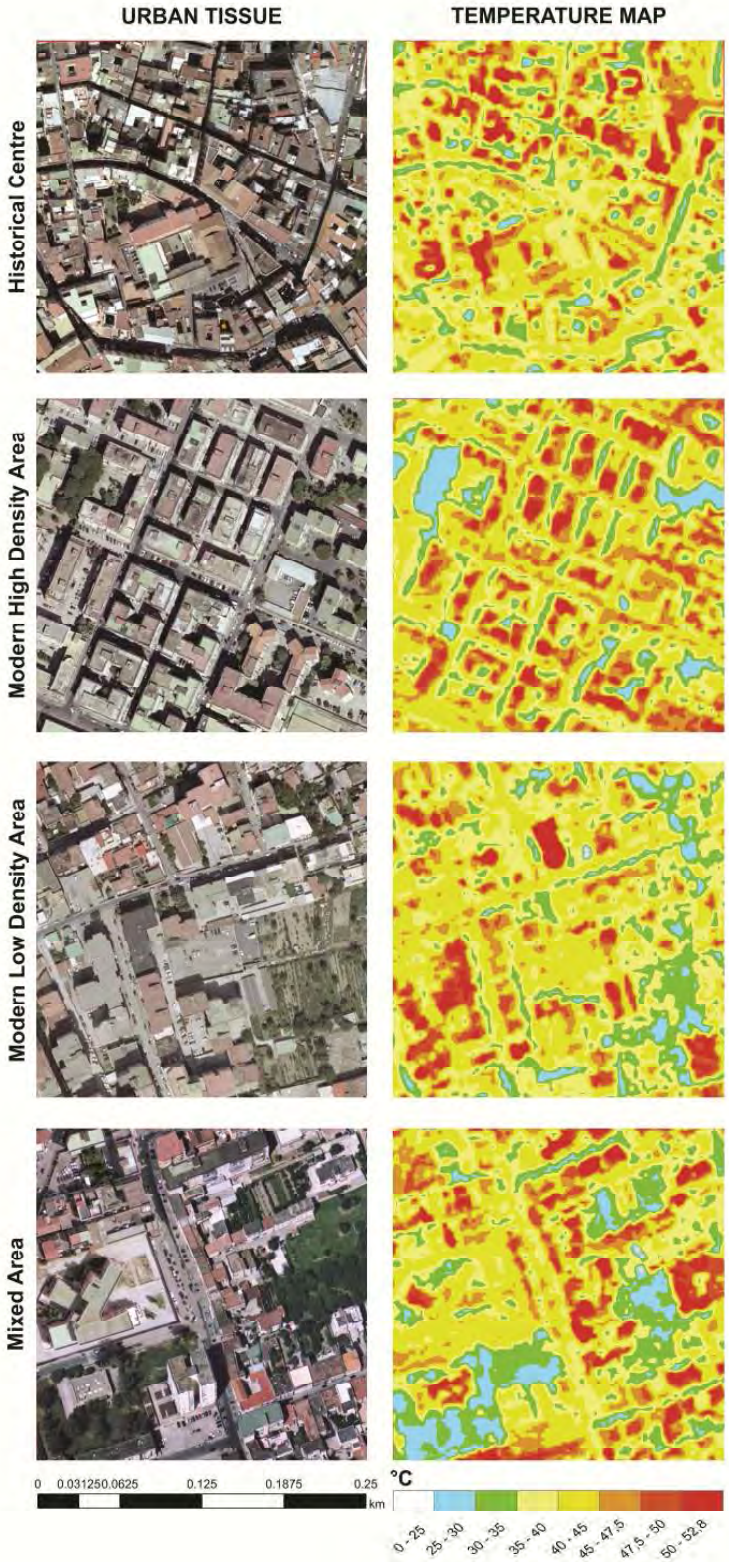


Figure 3 – Examples of urban tissues analyzed compared with the corresponding temperature map.

The selected metrics describe the configuration of Green Areas at the class level providing the most information about Green Areas shape, position and spatial distribution within each single TA, with a low degree of redundancy.
Furthermore, some patch metrics were selected and summarized at the class level using a variety of distribution statistics that provide first-order and second-order summary statistics of the patch metrics for the focal class such as: mean (MN), area-weighted mean (AM), standard deviation (SD), and coefficient of variation (CV) (Table 2).
According to the aspect of Green Areas pattern measured the selected metrics were grouped as follows: area & edge metrics; shape metrics; core area metrics; isolation metrics; aggregation metrics; subdivision metrics.
Finally, the correlation between surface temperature and Green Areas metrics were estimated by correlation coefficient calculation.

Metrics group	Code	Name	Description	Units	Range	Statistic distribution
Area & edge	AREA	Patch area		ha	> 0; no limits	MN; AM; SD; CV
	GYRATE	Patch radius of gyration	It measure how far across the TA a patch extends its reach	m	≥ 0; no limits	MN; AM; SD; CV
	LPI	Largest patch index	It expresses the percentage of the TA comprised of the single largest patch of class; as such, it's a simple measure of dominance	%	0 ÷ 100	
	TE	Total edge	It expresses an absolute measure of total edge length of patches belonging to the same class	m	≥ 0; no limits	
Shape	PARA	Perimeter-area ratio		none	> 0; no limits	MN; AM; SD; CV
	FRAC	Fractal dimension index	It reflects shape complexity across a range of spatial scales (patch sizes)	none	1 ÷ 2	MN; AM; SD; CV
	PARAFRAC	Perimeter-area fractal dimension	It's similar FRAC, but it is applied to a collection of patches at the class level	none	1 ÷ 2	
	CIRCLE	Related circumscribing circle	It expresses the ratio of patch area to the area of the smallest circumscribing circle	none	0 ÷ 1	MN; AM; SD; CV
Core area	CA	Core area	It represents the area in the patch greater than a specified depth-of-edge distance from the perimeter (set equal to 10 m)	ha	≥ 0; no limits	MN; AM; SD; CV
Isolation	ENN	Euclidean nearest neighbor distance	It expresses the shortest straight-line distance between a focal patch and its nearest neighbor of the same class	m	> 0; no limits	MN; AM; SD; CV
	CONNECT	Connectance index	It represents the percentage of all possible inter-patch connections less then a specified threshold distance (set equal to 20 m)	%	0 ÷ 100	
	PROX	Proximity index	It quantifies the spatial context of a patch, in relation to its neighbors of the same patch class	none	≥ 0	MN; AM; SD; CV
Aggregation	CLUMPY	Clumpiness index	It measures the aggregation degree of a patch class	none	-1 ÷ 1	
	COHESION	Patch cohesion index	It measures the physical connectedness of the corresponding patch type	none	0 ÷ 100	
	nLSI	normalized Landscape shape index	it provides a simple measure of patch class aggregation or clumpiness	none	0 ÷ 1	
	IJI	Interspersion and juxtaposition index	It measures interspersion or intermixing of a patch class	%	0 ÷ 100	
Subdivision	MESH	Effective mesh size	It measures the subdivision degree of a patch class	ha	ratio of cell size to area of TA ÷ area of TA	

Table 2 - Features of the used landscape metrics in Fragstats 4.2.

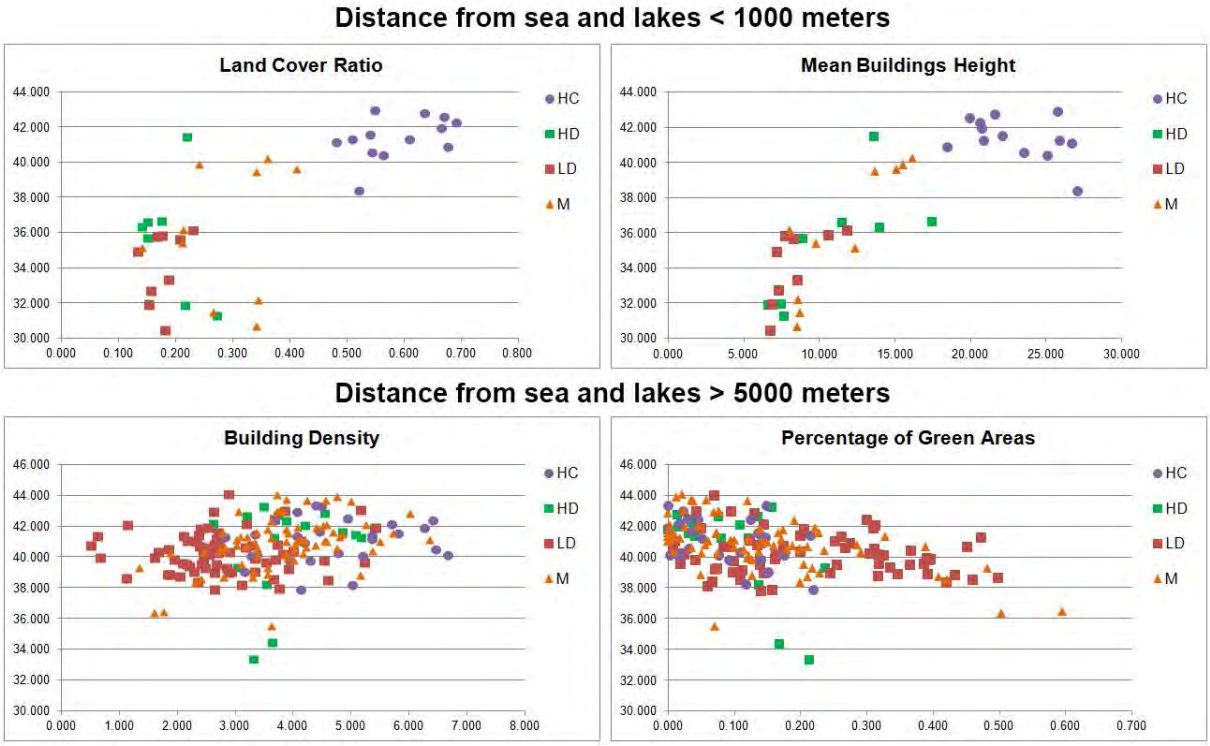


Figure 4 – Relationship between main temperature and some CI, calculated for TAs belonging to different urban tissues and located at growing distance from shore line and lakesides.

4. Results

Correlation cofficient between Percentage of Green Areas and mean temperature is the only one having always a significant value for each urban tissue and each distance from sea and lakes. In addition, the more distance from water basins increase, the more the correlation between mean temperature and others Check Indicators decreases (Figure 4).
Interesting results were achieved from Green Areas configurational analysis. In particular, we observed a beneficial mean temperature decrease in the following cases:
a) with regard to green areas dimension results show that:

- the longer green areas frontline is (total amount of Green Areas perimeters in a TA) the more mean temperature decrease (Total Edge);
- the higher percentage of TA surface comprised in the largest Green Areas the less the temperature is (Largest Patch Index);
- the more heterogeneous Green Areas extensions are the higher is the contribution to mean temperature reduction (SD of Green Areas surfaces and SD of Core Area);

b) with regard to green areas distribution results show that:

- concentration of larger and closer Green Areas have a positive effect on mean temperature reduction (Area-weighted mean Proximity Index);
- the less Green Areas are subdivided the more mean temperature tends to decrease (Effective mesh size).

5. Conclusions

Urban parameters play a different role in UHI arising. The results of correlation analysis between CI and mean temperature show that in TAs further from sea and lakes building parameters have a weaker correlation with mean temperature while Percentage of Green

Areas presents a strong correlation. On the contrary, TAs closer than 5000 meters are more influenced by CI as BD, LCR or MH than the further TAs.
Mean temperature values in TA very far from the sea seems to be independent from urban morphology. It can be attributed to the absence in the inland plans of wind flows able to mitigate UHI.
Moreover the best configuration for Green Areas is a spatial distribution showing a Green Area dominant in size and other smaller areas having heterogeneous size, not so much dispersed and interspersed within the urban tissue. This particular Green Areas distribution amounts to the need of a green network in order to maximize their ecological role and minimize disaggregation and subdivision between green patches. It could be achievable throughout the creation of green infrastructure to connect green areas spread out within urban tissues.

Acknowledgements

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Understanding Population and Fluvial Dynamics for a physically safe Urban Sustainable Development Model for Pucallpa

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Abstract
Substantial changes in river Ucayali volumes and even river-beds superimposed to rapid precarious urbanization of the riverine Pucallpa agglomeration in the Peruvian Amazon rain forest has turned out in ecologically vulnerable areas. The specific nature of this unfamiliar natural ecosystem of the site and its immediate area were altered by colonization prompted by unexpected economic booms and not properly planned government initiatives implementation in the Central Amazon rainforest integration process. An aggressive land use/cover change overcame as a result of foreign population settlement and devastating pace of natural resources exploitation taking advantage of market oriented activities.
Annually an increase in of the Ucayali River´s flow is observed, filling streams and adjacent bodies of water, as the process of inappropriate stocking interstices and riverine strips immediate to the city by migrants' settlements continues unaware of the fragile and complex ecosystem of low terraces and flood plains of the site. The understanding of these processes as well as their impact on water and anthropogenic ecosystems combined with disaster risk assessment is the basis for a proposal and implementation of a sustainable model of this Peruvian urban node, tenth in population and fourth in expansion rate.
The Peruvian National Civil Defence Institute (INDECI) and UNDP are supporting local governments in human development and quality of life improvement with health, life and infrastructure loss prevention caused by natural and anthropogenic emergencies and disasters as a result of hydrological events and other natural phenomena that add up to the existing vulnerability. So as to upgrade city planning and achieve urban security a sustainable development plan has been participatory designed based in hazard, vulnerability and risk mapping, measures and project proposals for critical and feasible urban areas management.

Settlement

The incremental population process where Pucallpa lies is relatively recent.

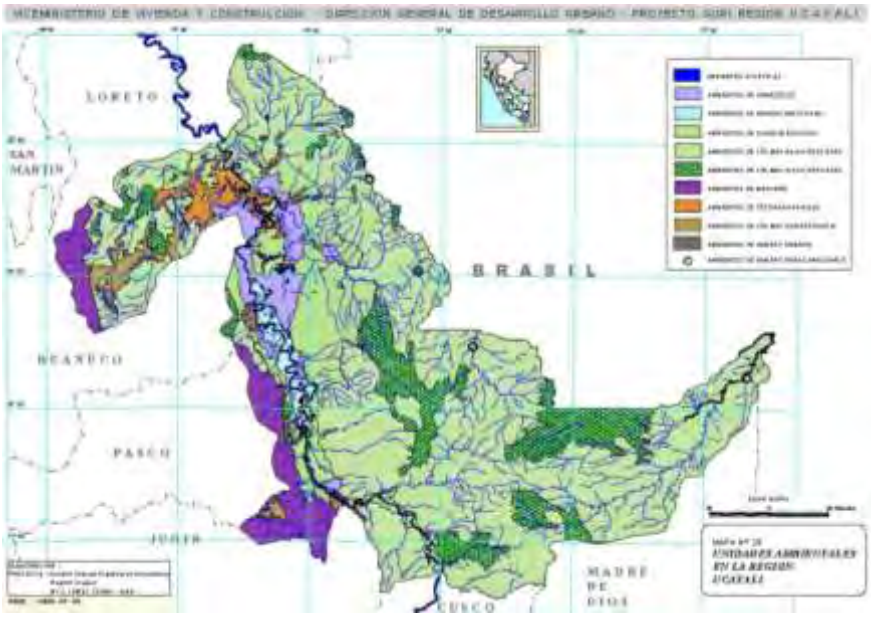
The constant flow of Andean Peruvian population towards the Amazon plain, of warm and humid climate with abundant rainfall, has created important and always expanding urban nodes that were only integrated into the national economy at the end of the 20th century.



Figure 1 – Localization. Pucallpa, Peru
Source: Villa M. (Coord.) et al. INDECI-PNUD: 2011

The climate of the city of Pucallpa, according to the Köppen climate classification, due to precipitation characteristics, humidity and temperature, the area of influence is framed within

a climate of Tropical Rainforest, Biome 1 habitat (WWF ecological classification). Thus, natural coverage of this area is a tropical forest.





Unconsolidated alluvial materials form the relief, which favours the permanent variation of rivers' channels, where lakes, meander beaches and river Islands are located.

Figure 2. Environmental units in o Ucayali department
Fuente: Ministerio de Transportes:1997

The main population centres are located on these reliefs: Pucallpa, Atalaya, Masisea, etc., and it is where the main economic activities of Ucayali Department concentrate.

This vast and rugged Amazon plain was almost exclusively populated by small groups of native communities until the 17th century, mainly by the Shipibo-Conibo. The Aguaytia and middle Ucayali basins were isolated from the rest of the country by, until that moment, impassable Andes Cordillera. Immigration took place in four different stages due to exogenous factors, producing environmental, social and economic impacts that have been in crescendo:

- Since the mid of the 18th century, with the arrival of Catholic religious missions in the colonial era, catechizing was undertaken but also a relatively small land use change took place in the natural ecosystems of the central jungle, but by very small groups, producing low impact.

Immigration waves were produced by unexpected economic booms and non-planned Government initiatives implementation in the integration path of central Amazon rainforest to the national economy. This produced an aggressive change in the Peruvian Amazon central jungle: from vernacular use of the natural ecosystem to economic uses and activities aimed at the external market

- Rubber extraction period, at the end of the 19th century (ca.1883). This foreign born boom led to the establishment of Pucallpa city, due to the navigability of the Ucayali River and possibility of location in a relatively high site
- Air and land linkage to the rest of the Peruvian territory
  Almost in midst 20th century, in order to integrate the territory a national policy on territorial articulation was developed. By extending the national central road that begins in Lima, the coastal capital of the Peru, began the State promoted colonization of the grounds immediate to the road, becoming Pucallpa the activities' centre of this region. The exploitation and consequent logging industrial activity was introduced along with crops and fruit. Flows of investment goods and services arrived in Pucallpa, and the process of spontaneous colonization was intensified.
- Impact of exogenous factors (early 1980s) - Rural Andean and Amazon poverty, introduction of crops for exportation, political violence, drug trafficking, exploitation of gas in the upper basin of the Ucayali

Poverty in rural areas is a population expulsion factor to other areas and cities, especially to those who have certain economic dynamics. The process of migration to medium-sized cities of the rainforest deepened in the last 20 years.
Political violence that unfolded across the country due to outbreaks of small groups that sought to seize power by arms and which resulted in thousands of deaths, especially of farmers, led to a demographic shift of rural population of the sierra and selva regions to medium-sized cities who saw a refuge in them. This period closed in the mid-' 90s with a pacification and return process programs of those displaced by violence.

Coincidentally at this period coca cultivation, raw material for cocaine production, adapted to watersheds, currently existing crops of this plant in neighbouring spaces to the city of Pucallpa. That is why at the end of the century XX this city and above all neighbouring Aguaytía grew dramatically (with intercensal rates of 5.6 and 17.7% respectively). Despite the strong measures taken by the Peruvian Government to eradicate drug traffic, the influence that still have activities related to this crop in the economic dynamics of the city cannot be ignored.

On the other hand, the fact that Pucallpa has direct connection with the coast and the Ucayali River's navigability allows big ships from its site, has strengthened this town turning it to the second port of the Peruvian Amazon. In Pucallpa embarks machinery to the Atalaya port, near the exploitation of gas in Camisea, about 500 kilometres upstream of the Ucayali.

Activities - Environment

Similar to other irrational projects of colonization in the Peruvian jungle, the market-oriented economic activities were supported and to some extent promoted by the Peruvian State. Parallel to the construction of this road, 75 years ago that came from Lima crossing the central zone of the sierra the Ministry of Agriculture awarded lots in concession for forest purposes and agriculture on both sides of this road. It was not taken into account that native communities lived in this territory and that, on the other hand, a population increase is intrinsically linked to a more intensive use of land, expansion of fields coupled with deforestation involving food insecurity and vulnerability in the future.

These malpractices of agricultural frontier expansion, opening of side timber roads, urban expansion, threat not only 13% of its surface which is still covered by forests, but to global climate change. A conservative estimate is that in the last 10 years annual forest loss has gone from an average of 8 000 Ha to more than 13 000 Ha in the region of Ucayali (REALU: 2007, MINAM: 2012). The lots closest to Pucallpa were immediately formally occupied since the ' 50s, but intermittent spontaneous occupation of land by migrant peasants from the sierra extends the footprint of this deforestation due mainly to land dealers, as you can see in figures 3a and 3b. This also worked together with the fact that land titling (formalization) of the informal settlers was conditioned to agricultural development.



Fig. 3a – Deforestation footprints up to 1975
Source: UNEP (2010)



Fig. 3b – Deforestation footprints up to 2007
Source: UNEP (2010)

To stop land/use change, large protected Natural Areas have been selected and programs of payments for environmental services in conservation areas scheduled (PROFONANPE: 2011). Amazon forest and ecosystem services loss could potentially have great impact in the inhabitant's economy but also in the hydrologic basin and flow.

Environmental Repercussions

In this area several processes that contribute to global climate change and the degradation of the local ecosystem has taken place: nutrient cycle's disruption, and the regenerative capacity of forests impoverishment:

- Land - use related vegetation fires and forest conversion for crops and livestock (pastures) in land with poor soil characteristics and the subsequent requirement of fertilizer
- Timber and forest roads for logging.
- Hydroelectric projects, exploration and exploitation of oil and natural gas

This forest biomass removal allows greater runoff along with soil nutrient loss and, if it was performed by forest burning, increases greenhouse gas emission. As rainfall regime and the rate of evapotranspiration are forest-dependent, in the long run negative impacts are produced to the services provided by the forest ecosystem, desertification and the way of life of native communities' threatened.

For monitoring and realistic projections of current trends, MODIS and Landsat satellite images, already geo referenced have been interpreted and programs such as eCognition and ArcGIS used. The data was validated field work so as to produce an official deforestation map of the Peruvian jungle, as you can see in Fig. 5 (MINAM: 2009).

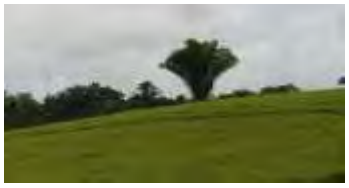




Fig. 4a, 4b Coverage of grasslands and secondary forests close to Pucallpa. Source:GOREU:2008



Fig. 5. Sampling points in the strip of road in Pucallpa's vicinity. Source: REALU 2010

Although the latest multi-model ensemble CMIP5 predicts a likely lengthening and strengthening of the dry season, one has to be careful to assert this, as anthropic factors and national policy may vary. These measurements provide us with data in the current context of knowledge of these changes. (Kay: 2014). A high degree of uncertainty in the projections made on the basis of models still exists, only we can warrant that climate change simulations indicate a risk increase by floods around the world. It is therefore recommended a multivariable integral focus - socio-economic, land and climate systems-, noting changes and proposing the adaptation to them (Kundzewicz et al: 2010).

So as to evaluate the process and recommend actions the REDD + international system has been generated: Reducing Emissions from Deforestation and forest Degradation including conservation, sustainable management of forests and increase of coal reserves or stock. Newly significant advances have been made to curb the deforestation in Peruvian territory within its framework. Eco-tourism projects and reforestation concessions are supported.
Remote sensing scientific studies of land cover transformation in the Amazon tropical forest have been carried out, as already spontaneous high-intensity forest fires in the dry season are observed in the nearby Brazil. In the study of future deforestation prepared by the team led by researcher Soares-Filho using the 'SimAmazonia 1' model, simulations of different sub socio-economic regions in the Amazon basin running scenarios that embrace a probable range of future deforestation outcomes have been made according to construction and paving stages

of highways in rainforest areas, existence and conservation of protected areas, rates of deforestation since 1997.



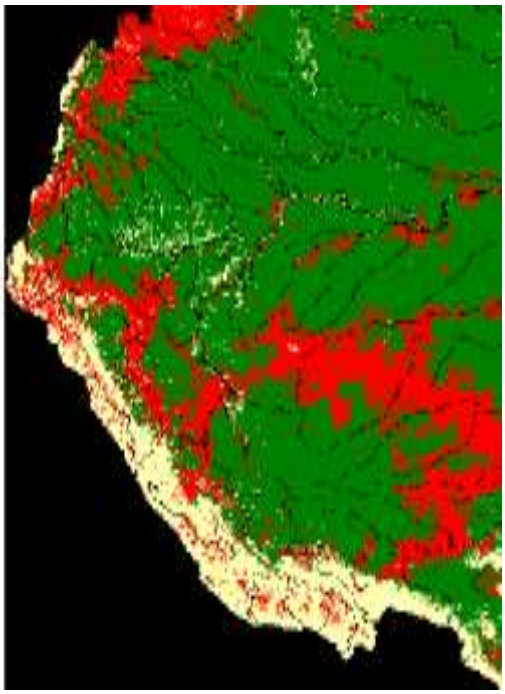


Fig. 6 Forested area Loss
2050 - Governance' Scenario
Source: Soares Filho et al. (2006)

2050 'Business-as-usual' Scenario (BAU)

Urrutia and Vuille (2009) have also made simulations for regional climate changes (RCM) using the Hadley Centre Regional Climate Modelling System, PRECIS (Providing Regional Climate for Impact Studies), on the basis that it is a better suited Model to be used for the geographical complexity of this rainforest climate region. The results indicate a significant warming at the end of the 21st century and summer season with less rain. (June to August).

Central Highway Improvement

Intermoda Logistic Centre

International Highway Pucallpa-Cruzeiro do Sul



Ocean Port Callao, Lima

Principal Fluvial Port

Pucallpa Airport



Fig. 7 - Pucallpa's Articulation with the rest of the world
Source: Acuerdo de Cartagena: 2011

South American Integration Infrastructure projects (IIRSA)

The construction of the international road Pucallpa - Cruzeiro do Sul is an element that may disrupt the process of sustainability achievement by implementing the recommendations of these studies. It is essential to develop an impact assessment of this project that aims the exit facilitation to the Pacific Ocean of Brazil and to monitor the compliance of colonization that could generate.

Hydrological System of Ucayali River – Pucallpa sector

The confluence of the Ucayali River with Maranon River gives origin to the Amazon River



Fig. 8 Ucayali River – Pucallpa Sector. Afluents Pachitea and Aguaytía rivers. Source: Villa M, (Coord.) et al. INDECI-PNUD:

The Ucayali River is a meandric river, with a winding runway predominance above 1.5, and where the average slope of the river thalweg is 0.05 ‰. The presence of approximately 50 abrupt curves denotes this river´s sinuosity. The radius of curvature, R, has a relationship lower than 3 to the width of the runway, B, r/b, and an angle greater than 180 ° curve in many cases. The river path is not symmetrical, presenting greater depth to the side of the bank that is eroded.

The Ucayali River runs on an alluvial bed with little hydraulic gradient of about 8 km. wide presenting an average depth of 15 m. The width of the runway varies between 400 m and more than 1500 m. Relationship runway width and depth (w/h) in the time of floods is 40. The average speed of the river flow is 1.5 m/s.

Various academic and research institutions have studied morphology and flow changes along the Ucayali River and their impacts such as course changes and unpredictable floods: upstream ruptures, settlements isolation and earth-water balance destruction (Alvarado & Ettner: 2007; Hydrographic and Navigability Office of the Peruvian Navy & Directorate General of Water Transport of Ministry of Transport: 2008; Zarin 1999). There was a disadvantage of the lack of quantitative historical data for a proper analysis of the pattern changes in the river as only recently the Hydrographic and Navigation office of the Peruvian Navy recorded them upstream of Pucallpa, at Atalaya since 2007. Satellite imaging accompanied with hydrographic surveys, estimations using Hec-Ras program of small lakes minimum levels and information gathered from inhabitants and vessels owners were used to define the configuration characteristics of an easily eroded strata river bed.

The Ucayali River's sharp fluvial dynamic directly affects navigation. Extreme situations are nowadays becoming more frequent (REALU Peru Project Phase 1:2010). In the area of Pucallpa flow can increase up to 10 times (1984, 1985) as you can be seen in Fig. 9.

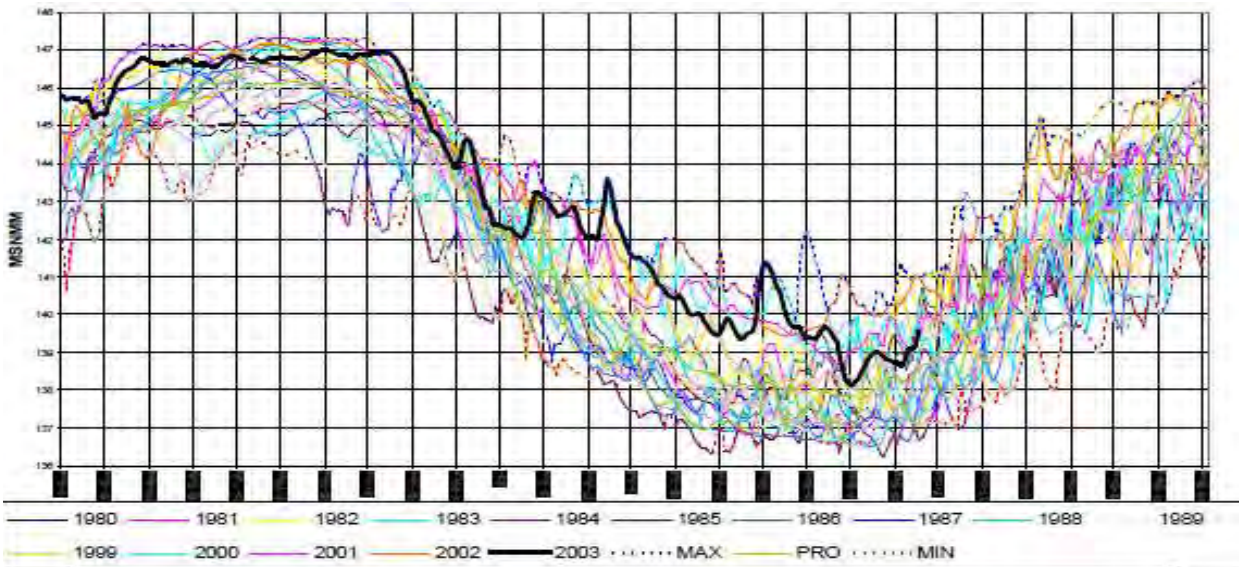


Fig. 9 Ucayali River Histograms levels near Pucallpa – 1980 - 2003
Source: Servicio de Hidrografía y Navegación de la Amazonia (SEHINAV) - Marina de Guerra del Perú

The Ucayali River in the rainy season tends to erode the margins of its concave sides and depositing materials in its convex sides forming river beaches in the migration towards the East of some sectors.

This process is responsible for the progressive abandon of the city of Pucallpa by the river since constant deposit of sediments continue shore formation and on the opposite bank erosion is permanent, since the banks of the Ucayali which is adjacent to the city is a meander. The fluvial dynamics of the Ucayali River channel from 1990 to 2003 in the area surrounding Pucallpa shows a clear proximity trend towards the city. Figure 10 graphics the different distances that went way off the river from the old terminal in 1985 until 1990 (4.34 km.).

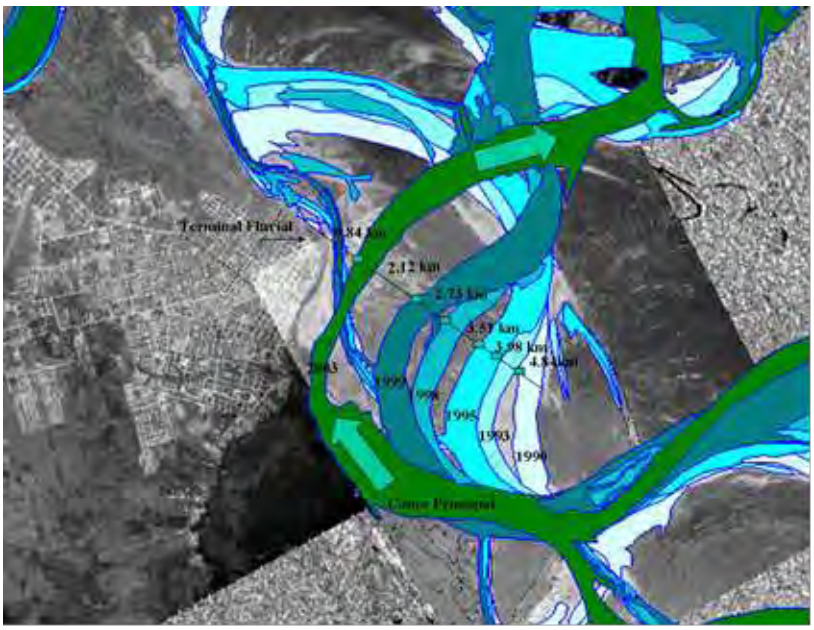


Fig. 10 Ucayali River Fluvial Dynamics 1990 – 2003 – Pucallpa Area – Study scope
Source: SEHINAV – Marina de Guerra del Perú

It is also observed an increasing level of 13 cm/year, with a break in the trend of 1998 values, probably due to natural factors (MTC-DGTA: 2005). A pattern of the cycle of digression of the runway in the alluvial bed is still not found, the distance that turned away since 1986 for 4 years, is being recovered in nearly 14 years (Fig. 10). According to assessments carried out in the area, straight areas on the are river banks have greater stability, the nearest being located approximately 25 km approximately upstream of Pucallpa. As we can observe on LANDSAT TM images, the runway of the Ucayali River more recently continues to vary. In Figure 11 the approximation in period 2002-2006 of the river towards Yarinacocha lagoon, immediately to the North-East point of Pucallpa, is note - the river for the year 2002 is shown in white, and blue for the year 2006. As shown in Figure 12, again its course has changed for 2013.



Fig. 11 Ucayali River Fluvial Dynamics 2002 – 2006 nearby Pucallpa. Source: Landsat



Fig. 12 – Ucayali River– Riverbed 2013 nearby Pucallpa. Source: Landsat 2013

Study Area



Fig. 13 Pucallpa's conurbation components.
Source: Villa M. (Coord.) et al INDECI- UN DP 2011

The components of Pucallpa city – conurbation – are the urban areas of Callería, Yarinacocha and Manantay districts of Coronel Portillo Province. The current population is approximately 325 000 inhabitants and its annual growing rate is 3.3%. The great conurbation has about 90% of Ucayali basin's population. The growth of the city contrasts with this sparsely populated region of the Amazon basin, including the province of which Pucallpa is capital, where a density of 9.06 inhabitants / km2 is observed.

Census Years	1940	1961	1972	1981	1993	2007	1940-61	1961-72	1972-81	1981-93	1993-2007
N° of inhabit.	2 363	26 391	57 993	95 864	172 286	272 616	-	-	-	-	-
Intercensal annual growing rate							12,2	7,5	5,0	5,6	3,3
Ranking related to Intercensal annual growing rate (national)							2°	4°	16°	3°	4°
Immigration					38,2%	30,3%	– percentage of Pucallpa's inhabitants				

Table 1.-Population growth of the urban conurbation of Pucallpa

Its role as a transport node articulating the Amazon jungle to the Peruvian Pacific coast and having the unique possibility for an important inland waterways to Brazil has empowered Pucallpa as the main attraction centre to the marginalized rural population of the central highlands of the country. We must not forget that nowadays the countries of Latin America have engaged the pervasive globalization of their principal cities located in many cases, as in Peru, in coastal areas. The appearance of small evidence of involvement of this new reality in the countries' interior cities is very recent in terms of joining the global flow of tourism for example. Aguaytía and Coronel Portillo are the only provinces of Ucayali-Maranon-Amazon River system of the Peruvian lowlands with direct access to regional and extra regional markets via the central highway. Pucallpa becomes the second river "port" of the Peru, but has the most dynamic population. In this decade, the explosive growth of Pucallpa has also been strengthened with the gas exploitation, hundreds of miles upstream of the Ucayali River, in the region of Cusco where still it is called Urubamba River.

Rhythms and forms of Pucallpa's site occupation

The plateau where Pucallpa is located lies 150 meters over sea level, on the western bank of the Ucayali River showing a soft and regular relief, crossed by Manantay, Yumantay and Tushmo creeks. This terrace, corresponds to the Ucayali formation, with medium and coarse grain sand interspersed with clay having certain resistance to erosion. It is very non-consolidated, susceptible to fluvial erosions as all surrounding areas to rivers or streams of pluvial type flooding is a typical characteristic.



Fig. 14 Ucayali River near Pucallpa
Source: INDECI-PNUD (2011)

Although Pucallpa originated on a site at the river's edge, its urban sprawl has first followed a north-westerly direction embracing Puerto Callao town (on Lake Yarinacocha shores) and in the last 30 years along the road which is part of the main central highway of the country.

This territorial sector is located on Quaternary deposits which are reliefs' erosion products of the Sub Andina cordillera and El Divisor mountain range to the west and East of the basin and lies on ancient fluvial deposits.

The landscape where Pucallpa is located is a complex characteristic of the region consisting of low terraces and flood areas (ravines, bajiales) small tributaries (caños, aguajales), wetlands and temporary water bodies. Hydrogeological characteristics of the soil of this location is a constraint for construction height and an orthogonal urban pattern.
However the urban structure components have not considered these limitations. The orthogonal plot continues to expand along the three districts that now make up the city, the existing water bodies being refilled, in the best of cases with soil, for urban land "construction".



Fig. 15. City's central Zone
Source: GOREU. 2008

Changes in the course of the River have left remnants of flood inundation beds and a legacy of marshy areas bordering the city. The aquifer level is influenced by the flow of the Ucayali River, whose waters at the time of growing spill over filling the adjacent small creeks that have been incorporated into the urban fabric. Many of these areas were invaded since the 1970s and being low-lying areas they are flooded practically every year, as shown in Fig. 16.



Fig. 16. Flooded area in Manantay district.
Source: Municipalidad de Manantay. (2010)

STUDY SUSTAINABLE CITIES - MAP OF HAZARDS, USES OF THE GROUND PLAN AND DISASTER MITIGATION MEASURES

Rapid urban growth of this territorial space was not attended with proper planning having as a result the location of population centres in high-risk areas. The attention of this problematic situation is considered a priority with the design and implementation of a Comprehensive Sustainable Development Plan, with territorial approach. The intensity of urban disaster depends on the interaction between the magnitude of the untoward event, the vulnerability by exposure and the resilience of the reception system since it is possible for example to recognize that human actions can significantly increase the risk of flooding.

The Peruvian National Institute of Civil Defence (INDECI) is fulfilling the goal of preventing human lives and infrastructure loss caused by emergencies and disasters anthropogenic and natural born. The National Information System is being built for Disasters Prevention and Attention, withstanding emergencies and disasters occurrence caused by natural phenomena.

To address the problems faced by riverine Amazonian cities like Pucallpa, Prevention and Disaster Reduction Programmes of UNDP (UNDP Prevention and Disasters Reduction Sustainable Cities Programme) and Peruvian INDECI's Sustainable Cities are being implemented. The objective of the programme is to create the necessary conditions for sustainable cities: safe, orderly, healthy, cultural and physically attractive, efficient in its operation and development and without affecting the environment or heritage (UNDP - INDECI, 1998-2014).

The proposal of a sustainable city model includes the systematization of information collected along with stakeholders and population representatives, then geo-referenced using the program ArcGIS, of impacts caused by potential hazards produced by recurring natural phenomena or anthropogenic sources and the geotechnical characteristics of the soils. This information is used to produce a risk map so as to analyse and systematize it with the application of an evaluation matrix of the hazard degree, showing the hazard degree of exposure of different areas of the city properly evaluated and classified. This map is combined

with the mapping of the environmental, physical, socio-economic and institutional vulnerability among others, producing the Risk Map. This map combined with economic and political activities leads to the identification of critical urban sectors and helps to develop priority projects to achieve a safer city.

EVALUATION and SYSTEMATIZATION OF MAJOR HAZARDS IN THE CITY of PUCALLPA (INDECI - Sustainable Cities Programme)

Technological Hazards: to modify or remove components of the ecosystem can bring new conditions to host vectors (and also the identification of the microenterprises activities that generate negative impacts to health, life, the economy and the ecology of populations settled in urban areas mainly).

It is the case that the dangers of biological origin: plagues, epidemics and epizootics sharpness by insufficient indoor water supply and pollution of waters due to inorganic and organic loads are dumped to the receptor without criteria or use of technology to reduce the polluting elements.

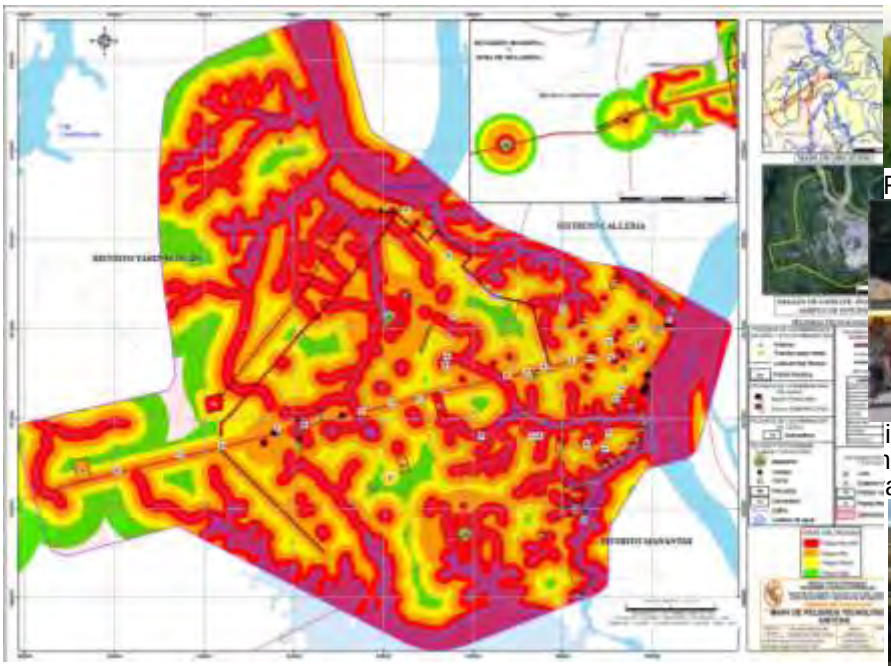


Fig.17 Technological Hazards Map. Pucallpa conurbation
Source Villa, M. (coord.) et al. -INDECI-UNDP, 2011



Fig.18 Tushmo Stream



ig.19 Prevalence of otorcycle taxis in public ansport



Fig.20 Sawmills and brick factories in the urban area

Natural hazards Evaluation

Natural phenomena as landslides and soil erosion, bank erosion and hydro morphism problems generate endogenous and exogenous processes that consistently the physical area of the city experiences. The activation or development of these processes, generate danger to a greater or lesser degree. According to the generation dangers as are: geotechnical, geological, climatic and geological - origin climate.

It has for example that, in relation to water phenomena, the degree of danger is:

Very high: areas threatened by flooding with large hydrodynamic force, speed and erosive power. The danger is activated to produce precipitation.

High: Sectors, which are awash at low speed and remain under water for several days, as they are the areas which are subject to wetlands and aguajales.

Medium: Very sporadic floods with low brace and speed. Water overruns are usually relatively calm and due to its periodicity may be laid down by the inhabitants of the place.

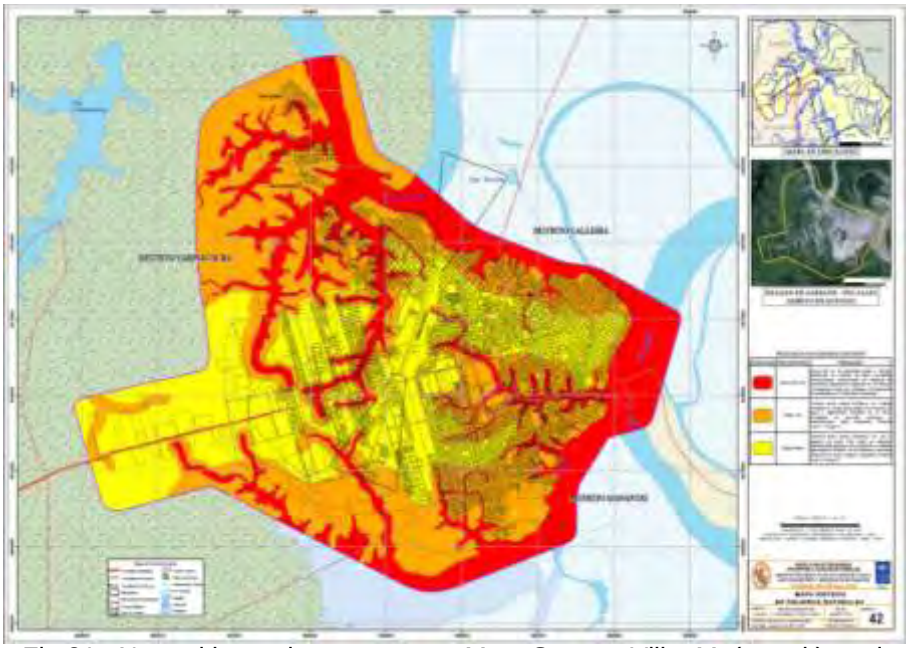


Fig.21 Natural hazards assessment Map. Source: Villa, M. (coord.) et al - INDECI-UNDP, 2011



Fig.22 Houses on old riverbed, La Hoyada area,

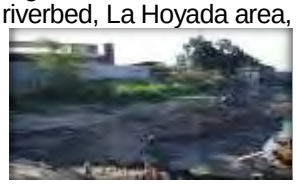


Fig.23 Side erosion. Ucayali River's margin.



Fig.24 Periodic Inundation

VULNERABILITY ASSESSMENT

Migrants apply construction and territory occupation techniques of their region of origin in a different ecological zone, resulting in an increased vulnerability of Pucallpa. There are historical and quasi-technical patterns used in the Sierra that may not be best suited even to the high Andean zones. Incremental growth of large riverine settlements as Pucallpa, where new inhabitants are unaware of the complex and fragile ecosystem of low terraces and flood plains of the Amazonian ecosystem in which it is located and therefore do not have the necessary knowledge to create a sustainable habitat. Quality of life is compromised.

The city of Pucallpa and its suburbs are environmentally vulnerable due to unregulated growth, houses precariously built in areas prone to flooding. They even have created new ways to gain ground, by filling ancient riverbeds ravines, wetlands and creeks with waste material from sawmills. New migrants to the area, not knowing the hydrography of the place, raise its buildings obstructing the natural pipes / plugging the drains, causing floods.

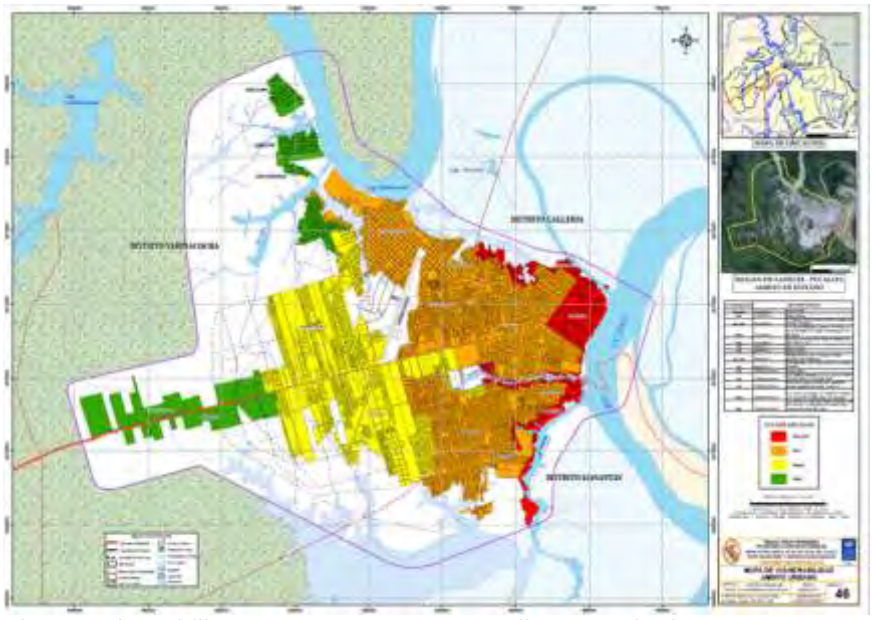


Fig.25 Vulnerability Assessment Map. Pucallpa conurbation
Source: Villa, M. (coord.) et al. - INDECI-UNDP, 2011



Fig. 26 Precarious and informal trade



Fig.26 Yumantay Stream during dry season



Fig. 27 Substandard housing built on inappropriate filling material

RISK EVALUATION AND CRITICAL URBAN SECTORS

A Risk Map combined with the location of zones with varying of vulnerability degrees leads to the identification of critical urban zones and helps develop actions and priority projects to achieve a safer city. According to the methodology of superposition of maps, those areas of highest risk are the result of the concurrence of areas with very high risk and very high vulnerability.

For the development of this map, workshops in the city of Pucallpa were done, where social actors and stakeholders took an active role, reaching concrete agreements between the different perceptions of danger and risk. Thus, critical areas that required punctual interventions as well as mitigation of the adverse impacts of the occurrence of natural hazards, where identified.

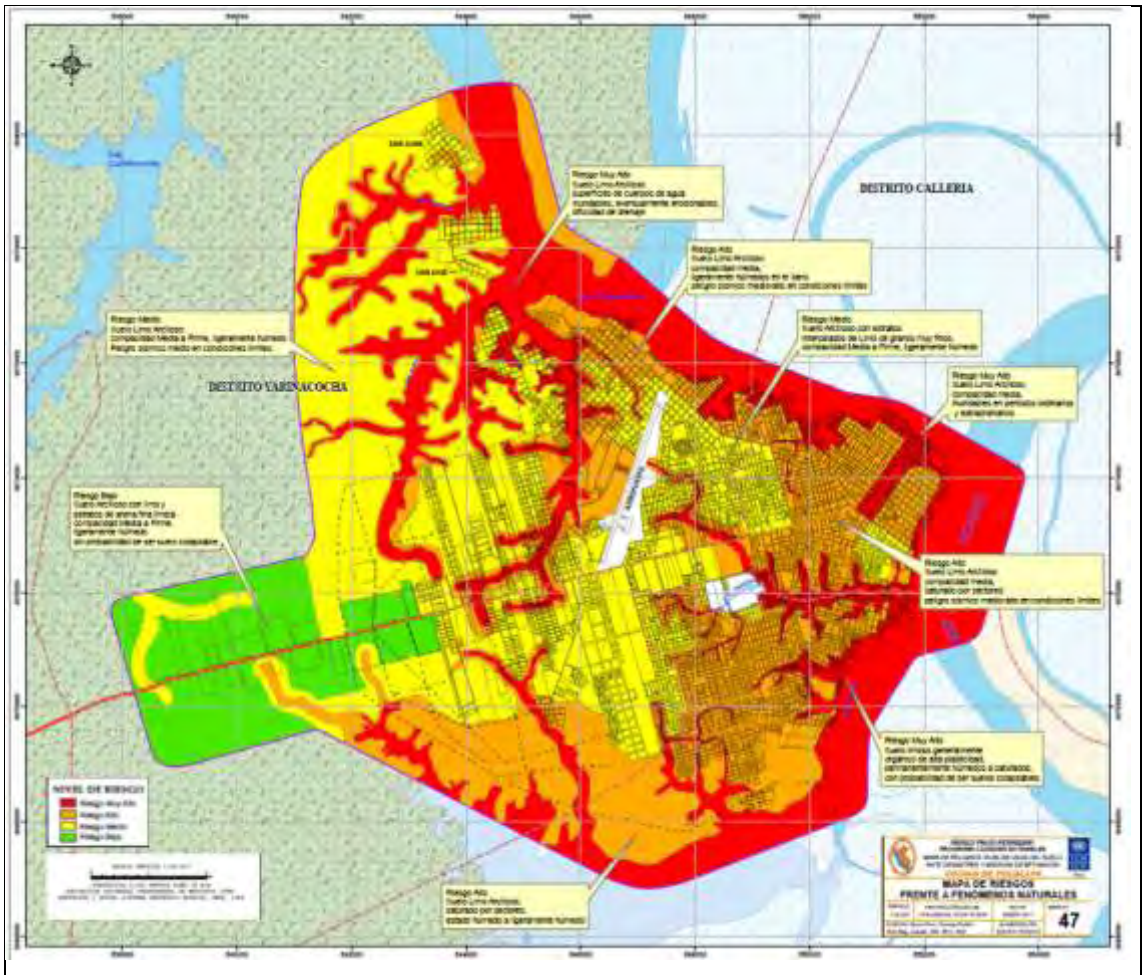


Fig. 28 Risk Map. Pucallpa conurbation
Source: Villa, M. (coord.) et al. -INDECI-UNDP, 2011

PREVENTION AND MITIGATION PROPOSAL IN URBAN AND PERI-URBAN AREA OF PUCALLPA AGGLOMERATION

Based on knowledge of Pucallpa´s land uses and its urban expansion trends added to the hazard, vulnerability and risk assessment in the urban and suburban area of Pucallpa risk management measures were proposed. An Environmental Model for sustainable urban development along with Prevention and Disaster Mitigation Measures and a Sustainable Land Use Plan to accommodate future growth and consolidation of the city in harmony with environmental conditions in a sustainable urban development.

1. *Components of the Sustainable Environmental Urban Development Model*:

   - Demographic and spatial urban growth should match a necessary balance between rural and urban populations' development levels, as a result of an appropriate implementation of measures for rural promotion development.

- Progressive implementation of urban planning for the currently critical sectors, reducing vulnerabilities and improving safety and habitability conditions.
- Organized urban development of the Pucallpa´s suburbs, through motor ways and transport diversification and improvement achieving easy access to the various urban facilities
- Improvement of the relationship green area urban/inhabitant, by the progressive change of use in urban areas (actual and possible) set on disadvantageous high risk areas to recreational uses.
- Urban equipment organization and location in areas with lower level of vulnerability.
- Efficient implementation of building systems and appropriate building materials use.
- Touristic development based on the area´s tourist resources.
- Strengthen of intermediate and small cities roles and functions by extending the offer of safe urban soils, provision of urban facilities and decentralized less vulnerable public services.
- Population, authorities and institutions committed to risk management, with the development and promotion of a culture of prevention.

2. Measures Considered for Disaster Prevention and Mitigation

Measures a. Political and institutional preventive measures
b. Environmental preventive measures
c. City planning and development preventive measures
d. Socio-economic and cultural preventive measures

- Refuge areas for post disaster' attention

3. Land Use Plan for Disaster Prevention and Mitigation

From the diagnosis conclusions and population growth hypothesis, the Plan proposed the following:

- Urban growth and Transportation,
- Classification of urban land by terms of general conditions of use for disasters' prevention and mitigation
- Techniques guidelines for existing and new urban housing allotments
- Building techniques and recommendations guidelines to reduce vulnerability of buildings
- Environmental health measures and techniques guidelines

The proposal for classification by general conditions of use for disasters' prevention and mitigation can be seen in Fig. 29

• Urban land without restrictions	Urban land unrestricted consolidation Urban land without restrictions in the process of consolidation Incipient urban land without restrictions
• Urban land with restrictions	Urban land with restrictions consolidation Urban land with restrictions in the process of consolidation Incipient urban land with restrictions Airstrip Urban land affected by flight cone
• Land to be urbanized	Urban expansion
• Soil not developable for urban purposes	Safety Strip - Ucayali River Bank Safety Strip - Tushmo and Yumantay Streams' banks Safety Strip - anthropic danger Urban fringe restricted, currently industrial use Streams' river-beds Ecological protection for streams fringes Ecological protection for lake fringes

	Eco recreational area - environmental buffer Existing Natural park
• Agricultural land and grasslands to maintain	Inundation banks (river's opposite margin)

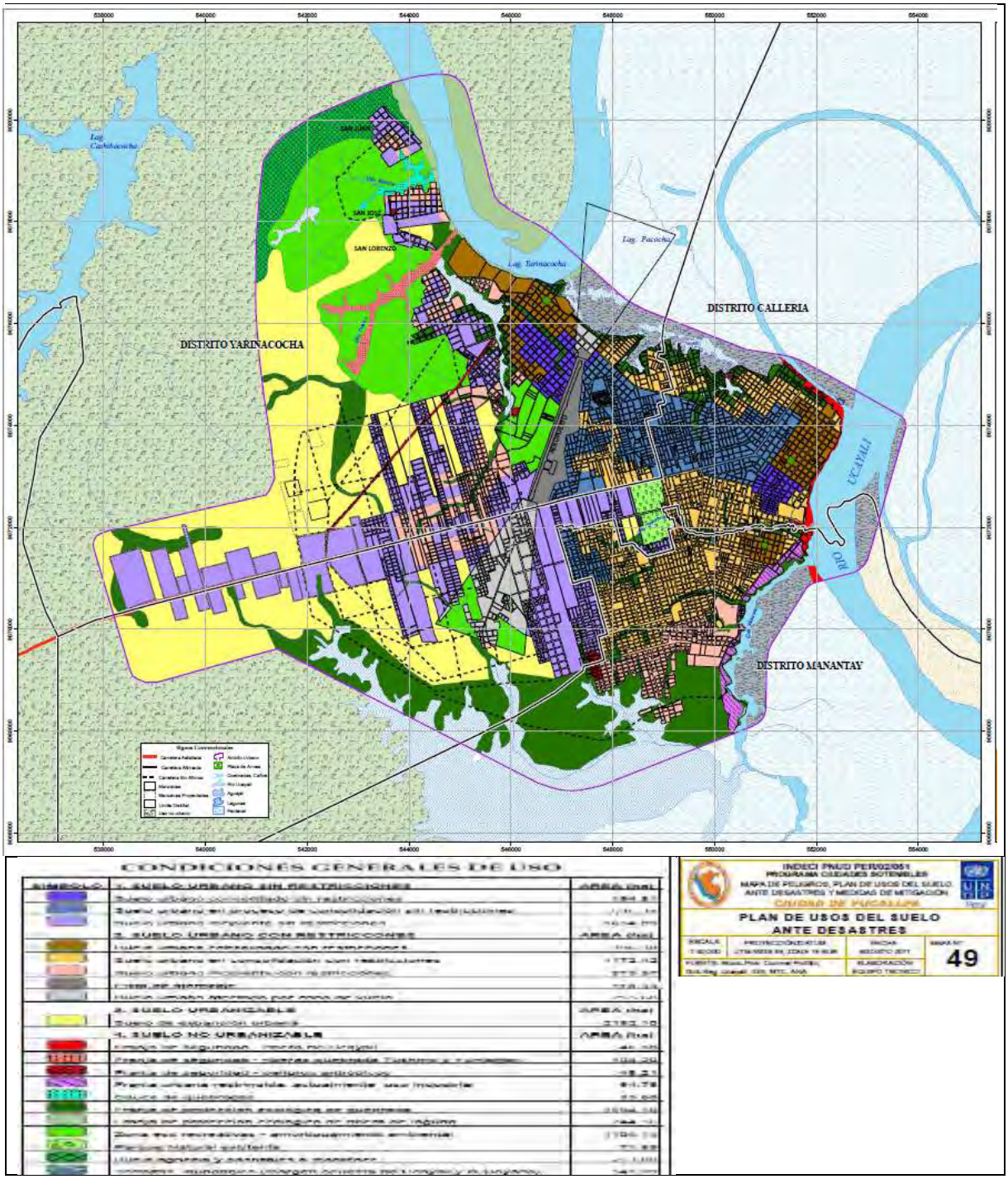


Fig. 29 General conditions of use for disasters' prevention and mitigation.
Source: Villa, M. (coord.) et al. -INDECI-UNDP, 2011

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Swiss Standards for Sustainable Development: A Juxtaposition – The Standard for "2000-Watt Sites" and the Swiss Standard for Sustainable Construction (SNBS)

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Synopsis

Due to global incentives, sustainability became an increasingly important factor in urban planning since the mid-1990s, but at that time there were no specific guidelines to go by in urban planning. Nowadays there are several standards and methods on the Swiss market. Cities like Basel and Zurich have been promoting the vision of a 2000-Watt Society with the aim of reducing the population's constant overall primary energy needs from about 6000 to 2000 watt. Apart from this new standards of sustainable urban development like Minergie Schweiz, Smeo and Nachhaltiges Bauen Schweiz SNBS (Swiss Standard for Sustainable Construction) have been promoted.

Standardization and sustainability assessments are tools for decision-making in projects having a relevant impact on sustainable development. Conflicts of objectives are nearly always involved, so a holistic assessment is necessary if the optimum solution is to be found. This case study focuses on the central theme of sustainability as an innovative factor providing a holistic view in the planning process. The main focus is on two methods of planning sustainable urban development: on one hand, the method of the 2000-Watt Society, developed by the Swiss Federal Institute of Technology, on the other hand, the method of the SNBS, the recently developed Swiss Standard for Sustainable Construction. The possibilities of implementing a new guideline in urban planning is explored in general by juxtaposing the two strategies, namely the 2000-Watt Society and the standard of SNBS with a SWOT analysis. Interviews with stakeholders such as Heinrich Gugerli, Project Leader of 2000-Watt Sites, Joe Luthiger, Head of the Network Standard for Sustainable Construction, Severin Lenel, CEO INTEP Integrated Planning Zurich and René Bäbler, environmental engineer, Losinger Marazzi AG provide a deep insight to the topic.

The standard SNBS covers a very broad user's area. Its strength lays in the comprehensive approach. The concept of the "2000-Watt Site", based on the concept of the 2000-Watt Society, is more specific, especially concerning energy needs. Both of the standards are tools based on quantitative and qualitative evaluation scales that allow the evaluation of a planning. The management of the standard SNBS is a voluntary commitment of the stakeholder; whereas the management of the "2000-Watt Sites" requires a binding framework between the stakeholders. It is remarkable that these two standards don't compete each other; they seem to be complementary.

1. The Position of Switzerland in a Global Context

Switzerland is one of the most highly globalized countries in the world, which is why challenges at the global level are becoming increasingly important. National challenges, too, must increasingly be addressed within an international context. Moreover, with the levels of production and consumption, Switzerland uses about three times the natural resources that are available in the country itself. Such a high level of interdependence of resources, import and export, entails a commensurate responsibility for global sustainable development.

1.1 The Need for Resources

Currently, 60 percent (or 3000 per capita watts) of Switzerland's energy needs are met by fossil fuels, principally oil and natural gas. Another 1000 watts come from nuclear power, and the

remaining 1,000 watts come from renewable resources, primarily hydropower. The Swiss plan calls for cutting the demand for fossil energy in half by 2050, a reduction rate of 10 percent per decade.

1.2 The Basic Concept of Sustainability

«Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs» (Brundtland Commission, 1987).
Sustainable development has become a widely accepted term since the Rio summit in 1992. Two key tenets are central to an understanding of sustainable development: the recognition that the essential needs of all humans must be satisfied, and the concept of the limited capacity of the global ecosystem.

Sustainable development is often depicted schematically using three circles for the target dimensions of the environment, economy and society, to which time and north-south dimensions are added.

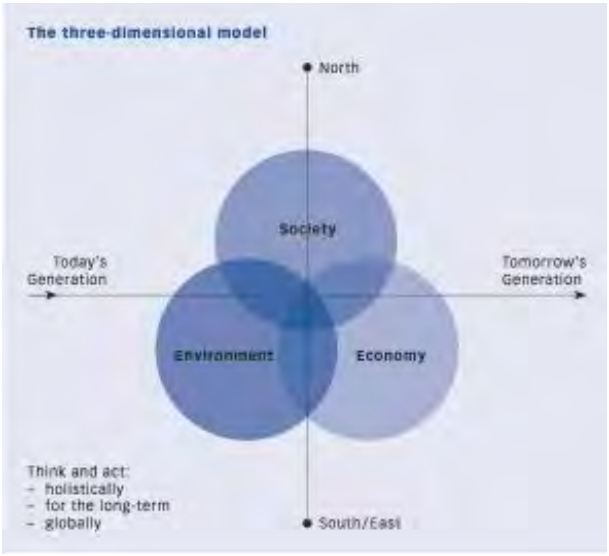


Figure 1: the three-dimensional model of sustainability

2. About Sustainability

The concept of the 2000-Watt Society was developed in 1998 by researchers at the Swiss Federal Institute of Technology (Eidgenössische Technische Hochschule Zurich, ETHZ) in Zurich. Global energy consumption is about a 17'000 kwh a year. This corresponds to a continuous power consumption of about 2000 watts for all activities such as living, working, transport, production etc. In Switzerland we consume about 6000 watts per person. Other countries, primarily in Asia and Africa, consume just a fraction of this amount, whilst some industrialised nations use much more. The idea of the 2000-Watt Society envisages a steadily reducing energy demand to 2000 watt, at the same time increasing it to this level in other countries, so that we use approximately the same amount of energy throughout the whole world and all people can enjoy a similar standard of comfort. In addition, three quarter of the energy will come from renewable resources. This objective should be attained as soon as possible in order to limit global warming. Yet, the 2000-Watt Society is not simply a program to save energy; it includes all the aspects, which must be considered for our future: social, ecologic and economic.

3. Indicator Systems: why do we need indicators?

If sustainability is to be pursued systematically, we need to take regular snapshots to track how things are moving forward. Where are we now, what progress has been made, and what is there still to do? This requires an appropriate set of metrics. Sustainability indicators fulfil a number of different purposes. They can:

- Measure the current status of sustainability, as well as indicate trends over time and identify areas for action (monitoring);
- Enable comparisons (benchmarking) and, as a result of the ensuing competition, motivate people to undertake efforts to achieve the goals with additional action;

- Initiate a debate between stakeholders in society about the goals and the direction of sustainable development;
- Inform the public and political decision-makers about relevant developments and thus, enable potential problems to be identified at an early stage.

3.1 The 2000-Watt Site certificate

Rising energy costs and concerns about climate change have led to growing demand for green buildings. While there exist numerous seals of approval and labels attesting the sustainability of individual buildings, so far there has not been a recognized certificate for larger building projects that takes into consideration density, mixed use and induced traffic.

The certificate for 2000-Watt Sites fills that gap. It is the first to allow developers to assess the added value of energy efficiency and climate protection and to specifically include sustainability into their portfolio strategy. Those pursuing a sustainable investment strategy set long term goals – and are a step ahead when it comes to energy efficiency and avoiding fossil fuels. The targets of the 2000-Watt Society are in line with the Swiss federal government's energy strategy 2050. By 2050, energy needs in the building trade are to be reduced to about half of present values, even though the total constructed area is set to continue expanding. And the building sector's greenhouse gas emissions are to fall by roughly 80%. The 2000-Watt Site certificate is proof that these ambitious targets have been met and that investment in energy efficiency and climate protection is future-proof.

The certificate was conceived as part of the federal SwissEnergy programme. The Swiss Federal Office of Energy (SFOE) thereby promotes implementation of national energy policy in the areas of energy efficiency and renewable energies. With the SwissEnergy programme for municipalities, the SFOE supports targeted projects at municipal level. The certificate for 2000-Watt Sites is based on the well-known «Energiestadt» ("Energy City") label for municipalities, the SIA (Swiss Society of Engineers and Architects) «energy efficiency path» and the Swiss standard for sustainable construction. The «Energiestadt» association is in charge of the certification.

3.2 The Swiss Standard for Sustainable Construction

The Swiss Standard for Sustainable Construction ("Standard Nachhaltiges Bauen Schweiz, SNBS") was launched on 13th June 2013 as national standard for sustainable buildings. It was developed together with representatives from the private and public sector and is supported by the Swiss Federal Office of Energy (BFE). The development of this new tool was very challenging, therefore experts from the fields of economy, society and ecology worked together on it. The tool, which is accessible at no cost, integrates proven Swiss tools and labels, and is adapted to the usual planning processes. The standard is applicable from early development stages on to the use phase.

The new standard sets out to integrate, as fully and equally as possible, all three dimensions of sustainability (society, economy and environment). The SNBS covers not only the properties of the building but also of the site and its neighbourhood. It is applicable for residential and office buildings. The tool covers the design, construction and operation processes. It thus addresses the entire life-cycle of the property. The standard goes beyond traditional criteria and takes its benefits for individuals and society, the economic potential of the building, and its contribution to the protection of the environment into account.

4. Stakeholder Interviews

- Heinrich Gugerli, Project Leader of 2000-Watt Sites
- Joe Luthiger, Head of the Network Standard for Sustainable Construction

The idea about the 2000-Watt Society has existed for more than 20 years. What is relatively

new is the fact that not only the whole building, but the area where this building stands is taken into consideration.

Heinrich Gugerli, you are in charge of the project management of the 2000-Watt Sites. Where would you put priorities regarding the implementation of the 2000-Watt Society and in particular regarding planning and constructing?

H.G.: I would like to get as much practical experience as possible to advance innovation in development, construction and operation of 2000-Watt Sites. For this purpose we need highly qualified and experienced 2000-Watt Site advisors.

The Standard for Sustainable Construction in Switzerland was found even though there have been other standards and labels: Why is this necessary? Where would you like to set priorities in this standard?

J.L.: The SNBS represents the first instrument, including the already existing Swiss norms, tools, methods and instruments, such as SIA, eco-bau, GEFMA, and others. The SNBS respects the very national and traditional Swiss construction culture that starts at the competition and design phase.
The main target is to offer one single instrument by making use of the common instruments in place, so the engineer/user does not need to invest too much time in learning new methods or tools.

What priority does the guideline or the implementation of the 2000-Watt Sites have for the implementation of the 2000-Watt Society?

H.G.: The guideline "Site development for the 2000-Watt Society" describes how the proof of 2000-Watt compatibility is performed and which are the most important parameters to reach the targets for energy resources and climate change. For the first time the rules for the 2000-Watt balance of entire sites consisting of several plots are defined.

To whom the guideline of the 2000-Watt site development is addressed and what is its main purpose?

H.G.: The guideline is addressed to investors and project developers. It describes the methods for the 2000-Watt balance of entire sites and the key influencing factors, as well as five case studies. The guideline is an important basis for the 2000-Watt Site certificate.

To whom is the Standard for Sustainable Construction in Switzerland addressed to and what is its main purpose?

J.L.: Building owners, investors and project developers are the key target for a standard or label for sustainability. Those can be private or public bodies. Furthermore, the standard offers an instrument to policy makers. Main markets are residential and non-residential buildings (offices). The SNBS can be applied to new buildings or renovations, but also existing buildings. It can be used for portfolio analysis and optimization strategies during planning.

What is the motor that has a positive effect on the development of an area regarding the goal of the 2000-Watt Society?

H.G.: A crucial parameter is the high density that allows in the city short distances. The energy for the operation of the site is typically under control, thanks to the far reaching regulations by the Swiss cantons. Bigger challenges include construction (embodied energy) and the site

induced mobility.

What is the motor that has a positive effect on the development of an area regarding the goal of the Standard for Sustainable Construction in Switzerland?

J.L. The SNBS is aiming at single buildings and their surroundings. Nevertheless, we are aware of some quarters using the SNBS already today in their design work.

What does the guideline to the Standard for Sustainable Construction in Switzerland consist of?

J.L..: The standard offers a possibility to measure a profound sustainability – society, economy, environment – individual buildings on a parcel including the surroundings (e.g. infrastructure, area supply). Currently, there is an investigation whether the standard will be supplemented with a label.

H.G. The guideline for site development and the according manual are designed for the evaluation of whole areas, which usually include several plots. However, only certain additional aspects of sustainability like density, life cycle costs, induced mobility or identity of an area are addressed besides the 2000-Watt indicators. A complete evaluation of sustainability indicators is considered as a positive contribution to reach the 2000-Watt Site certificate.

What position does the SNBS take regarding the goal of the 2000-Watt Society?

J.L: The instruments are complementary and serving similar targets.

What is the goal of the SNBS? Is there a measurement parameter?

J.L.: The SNBS is a standard, an instrument to be used on a voluntary basis. The user makes a self-declaration, which makes the difference to a label, in which a third party is involved and fixes limits to be reached at minimum. Nevertheless, a rating scheme is included in the SNBS ranking from 1 to 6, similar the Swiss school grades. As said, nobody is verifying the declarations and statements, it is the user's own responsibility. In the future, it might be possible to see a label based on the SNBS, giving clear guidance and making a sharp division between sustainable buildings and less sustainable ones.

It would have been possible to use the guideline of the 2000-Watt Sites as standard only: what are the criteria that were in favour of a certification?

H.G.: The quantitative and qualitative assessment may be employed without aiming at a certificate. However, then you miss the benefits of the Energy City exchange forum and quality assurance procedures, which many investors, builders und municipal authorities, have learned to appreciate.

It is possible to not turn the standard into a label: what are the criteria that are in favour or against a label?

J.L.: Besides the market size, a number of arguments are on the table giving pros and cons regarding a label. The network NNBS has taken up the market's needs and is working on a dual system that serves the market with a freely available standard SNBS and gives the opportunity to an interested market player developing a label. The discussion is running and no final decisions are made.

Final question: Which role does the life style of future inhabitants and users play?

H.G.: I am convinced that lifestyles are crucial when 2000-Watt Sites shall be certified in the operation phase. The regular evaluation offers the unique chance to measure the influence of life style along specific data and experience.

J.L.: Sustainable homes or quarters are anticipating future living styles, as we see in different projects coming up. Replacing automobile traffic by public transport, energy efficient constructions, renewables, intelligent designs using passive solar, sufficiency discussions resulting in less m2 per person, and so on. The future living, as anticipated today, is already influencing today's work and thinking processes more and more.

What are your final remarks and recommendations?

H.G.: The Energy City certificate "2000-Watt Sites" covers typically developments like brownfields with a large part of new construction. In order to reach the goals of the federal energy policy it will be crucial to have tools available, which may be applied also to existing neighbourhoods and their building stock. Preliminary investigations in this direction are under way.

J.L.: The Swiss society is on the good track to transform into a sustainable society. It has been recognized thatenergy efficiency is an important element and will remain such, but others must be added such as the embodied energy, mobility, user comfort.

5. What is the added value of Labels and Standards?

5.1 Sustainability assessments

Sustainability assessments are tools for decision-making and action in the case of projects having a relevant impact on more than one dimension of sustainable development. Conflicts of objectives and interests are nearly always involved, so a holistic assessment and balancing of the interests are necessary if the optimum solution is to be found. In particular, this is vitally important for projects with a long-term impact and significant financial consequences.

Regarding the implementation of assessments there are principally two methods:
Standards with quantitative and qualitative evaluation scales are tools for planners that allow them to evaluate a planning regarding autonomy. Awarding a certificate has to be done externally. Because of the process of certification this method becomes more sophisticated: there are minimal requirements and evidence has to be produced. Once the examination has been successful a certificate will be issued.

The certificate of the 2000-Watt Sites is awarded on two levels: «site being developed» and «operational site». The «site being developed» certificate is valid until more than 50% of the building area can be used for the new designated purpose. The site is then considered «operational». The two levels differ in the proof required and the tolerance range established for progress towards objectives.
By accepting the certificate, the site developers undertake to implement and use the required management system, to meet the targets set and to conduct an annual review by monitoring.

5.2 Stakeholder Interview with an expert for sustainability

- Severin Lenel, CEO INTEP Integrated Planning Zurich; Head of Minergie-ECO certification office, St. Gallen.

There exist a lot of different labels on the market now. What is the general benefit of standards and labels regarding sustainability?

S.L.: They're a guideline from a thematical point of view, a communication means and a quality controling instrument. Additionally, labels can lead to a better overall economy of a building and a healthier environment.

Do we need more than one Swiss label: Advantages and disadvantages?

S.L.: If there are too many labels, they are confusing the stakeholders; if there are too few, there's a lack of competition. What we really need are different levels of completeness regarding criteria of sustainability, so the applicants can choose how far they want to go.

Where would you locate the sustainability labels within the international norms?

S.L.: Swiss sustainability labels as Minergie-Eco and SNBS integrate the relevant Swiss norms. As far as Swiss norms reflect international norms, they're synchronised. But it's not planned to integrate international norms directly into Swiss labels or standards. Vice versa, there are attempts for developing European norms for sustainability labels, but I doubt that this will be successful in short terms because there are already many labels on the market.

5.3 Stakeholder Interview with an expert developer

- René Bäbler, environmental engineer, Losinger Marazzi AG

What is the value of standards and labels for project developers regarding sustainability?

R.B.: On the one hand, labels support the position of real estate within the market. This is exactly the reason for some investors to include a particular real estate into their portfolio because it suits their investment objective. On the other hand, there are also positive effects on the project development regarding the economy (compactness of a building, grey energy, reduced spoil). And a label guarantees to reach a defined standard in realization and operation.

Where do you as a developer see opportunities and risks regarding standards and labels such as, for example, 2000-Watt Sites or SNBS?

R.B.: It supports also light house projects regarding sustainable construction. This is a strategic concern of the enterprise, as well. In regard to forwarding it to investors the 2000-Watt Site label brings a certain obligation and effort to the project developer and the user as well because of the re-certification.

What is, according to your experience, the essential motor that has positive effects on sustainability regarding area developement ?

R.B.: Concerning the development of a site there is a range of diverse aspects such as grey energy, energy requirement, mobility, location, social and societal aspects, communication, participation, biodiversity, controlling and steering instruments and last but not least the commitment of the stakeholders important. Seen from the 2000-Watt Society mobility, density and compactness of the volume and the simplicity of a energy efficient front construction.

Which arguments are in favour of a certification and not of standards in your opinion?

R.B.: A certification is beeing supported a lot because it shows clear guidelines and frames for further development of a project and its adherence is observed and has to be proofed. The three first of a total of four areas in Switzerland have already been developed with the 2000-Watt Site certificate by Losinger Marazzi. From the perspective of project development a certification of projects on SNBS would also be supported. This encompasses areas of bigger dimensions as well.

6. Juxtaposition of the Standard SNBS respectively the Certificate "2000-Watt Site"

	2000-Watt Sites	*Standard SNBS*
Strength:	• The guideline is based on the SIA energy efficiency path (Swiss standard). • Compatibility of the aims of 2000-Watt Society and the strategy of Energy City. • Assessment method for sites with clear quantitative and qualitative criteria. • The certificate can be used for public effect before construction work begins «Site being developed».	• Use of existing Swiss methods, tools, norms; the standard follows the Swiss building approach and culture. • Relatively simple method in the application compared to labels such as LEED or DGNB. • Following the guidelines this supplies a full coverage of sustainability. • The method is applicable for small size projects and all design and construction stages.
Weaknesses	• Required investment in the development and maintenance of such instrument. • Needed time and resource investment for the user. • time-consuming certification process; needs legal framework respectively binding contracts with investors.	• Required investment in the development and maintenance of such instrument. • Less differentiation possibilities due to the wide sustainability approach.
Opportunities:	• Guideline for important decisions like type of construction, energy supply, transportation infrastructure etc.. • The 2000-Watt balance can be target at a very early stage of site development. • Challenge to have sufficient knowledge in all the subjects and processes for advisors. • Market position of the "2000-Watt Sites" for the in portfolios for sustainable development	• Positioning in the market as new standard of Swiss sustainability • Harmonization in the standard SNBS; less complex tool. • Market opportunities: An increasing number of projects are ready to be analysed • Working for big size projects, even a small office, when serving one expertise into a consortia • Applicable for small size projects. • The voluntary approach allows priorities to be set by the user and customer
Threats:	• Condition of the site • Big developer is required • Tremendous challenge in operation processes. • Legal transfer of the 2000-Watt provisions from land owner to investor	• Missing the running train due to ongoing market of labels for sustainability. • Move from voluntary to required, especially by public authorities

7. Summary

7.1 Management

The standard SNBS is a voluntary commitment of the stakeholders and in the user's own responsibility. The management of the "2000-Watt Sites" is more binding. The certificate is awarded after an agreement between developer and investor is reached on achievement of the goals. The certificate "2000-Watt Sites", especially to the point of «operational site», must be periodically renewed with an assessment of the current performance. Therefore, it guarantees the achievement of the targets for a "2000-Watt Site" in the long run.

7.2 Application

The approach of SNBS covers a broad view on sustainable development, whereas the standard for the certificate "2000-Watt Sites" is more focussed on energy, density, mixed use and induced mobility. The SNBS tool is applicable to new constructions, renovations and existing buildings; the standard for the certificate "2000-Watt Sites" is for new site developments including a share of renovations. Both standards are applicable to offices and residential buildings; whereas the standard "2000-Watt Sites" requires at least mixed use and a site of more than 10'000 m^2. Both standards include well-known and accepted Swiss standards, tools, labels and instruments (SIA efficiency path, Minergie etc.).

7.3 Method

The standard SNBS is a comprehensive approach; it is based on the three common pillars of sustainability. There are no exclusion criteria for its application; it therefore addresses a broad user's area. With the more specific approach of the concept of the 2000-Watt Society and the characteristics of the area for a certification process, this method is more exclusive than the standard SNBS. It covers a much smaller user's area.

7.4 The set of indicators

The set of indicators of the standard SNBS is more general and adaptable in any built environment; it also comprises the context of its neighbourhood in terms of the built environment and the social impact. The SNBS is a performance-oriented standard, that gives instruments and tools making the themes and indicators measurable. In difference to a label, the standard measures, but does not define a minimum level/ target values to be achieved. Indirectly this is given, as the achieved level is ranked between a scale of 1 to 6. The evaluation method has a tolerance.

However, the quantitative indicators of the "2000-Watt Site" are more specific and measurable (with guide and target values). The set of indicators of the "2000-Watt Sites" is, e.g. energy efficiency and renewable energy, more elaborated, but remains in other ones schematic. The qualitative assessment comprises few criteria and is based on a continuing improvement process according to ISO quality assessment procedures. However, it remains limited compared to the ISO environmental norm.

7.5 Process of evaluation and instrument

The application of the standard SNBS is user-friendly and manageable. The tool can be used with no cost. The quantitative and qualitative evaluation of the "2000-Watt Sites" is documented in a user-friendly manual. For the certification process however, expert know-how is needed and a consultant is required; this requires more resources in terms of time and cost, but provides an external view, as well.

The standard SNBS is applicable at any time from early development stages onwards to the use phase, which underlines its user-friendly application. The standard "2000-Watt Sites" can be achieved in the stage of a «site being developed» (more than 50% of the building area is realized) and «operational site», when the whole site is in operation, respectively built.

8. Conclusion

It is remarkable that the two herewith presented standards neither compete each other because they present different approaches, nor are they inconsistent with one another. They seem to be complementary and focus on different target markets. The standard SNBS is applicable to small size projects, covering a smaller area, whereas the standard "2000-Watt Site" requires a minimal size of the area and focuses on the site development as a whole. The standard SNBS is a relatively simple method in application and a guideline which covers full coverage of sustainability, but is less specific. Its strength lays in the comprehensive approach. The approach of the "2000-Watt Site", based on the concept of the 2000-Watt Society is more specific, especially concerning energy demands. The quantitative and qualitative evaluation of the "2000-Watt Sites" is more elaborated; it requires therefore a professional advisor. The binding framework for the certification of a site development might be complex, but guarantees the adherence to the objectives. The conditions for the certificate "2000-Watt Site" are crucial, from the characteristics of the area to the framework of the process; because of this the user's area is limited, mostly to big developers. This guarantee provides a clear position in the real estate market. The real estate development can therefore fit very clearly into strategic positions of a sustainable portfolio of an investor. This is a strong argument, which supports a broad and effective implementation in realization. Because of this, the actual efforts to extend the standard SNBS to a label scheme can only be supported.

References:

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- Sustainable development in Switzerland: A guide: Interdepartmental Sustainable Development Committee (ISDC), April 2012
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Reference Projects:

2000-Watt Site:

- Site development Greencity, Zurich
- Site development Erlenmatt West, Basel
- Site development Im Lenz, Lenzburg
- Site development Schweighofpark, Kriens

Swiss Standard for Sustainable Construction (SNBS):

- Site development Tscharnergut, Bern
- New office building, Zurich
- New mixed use building, Horw

9. Appendix

9.1 Brief Manual Swiss Standard for Sustainable Construction (SNBS)



The Swiss Standard for Sustainable Construction SNBS is based on the three well-known pillars of the sustainability concept with economy, society and environment. For each of the pillars four objectives had been formulated. Most of the objectives are measured by two criteria, summarizing a specific theme. The criteria can be rated in six levels from 1-6. The tool is applicable for new or existing buildings, without any restriction of size. For more information see: http://www.nnbs.ch/standard-snbs/

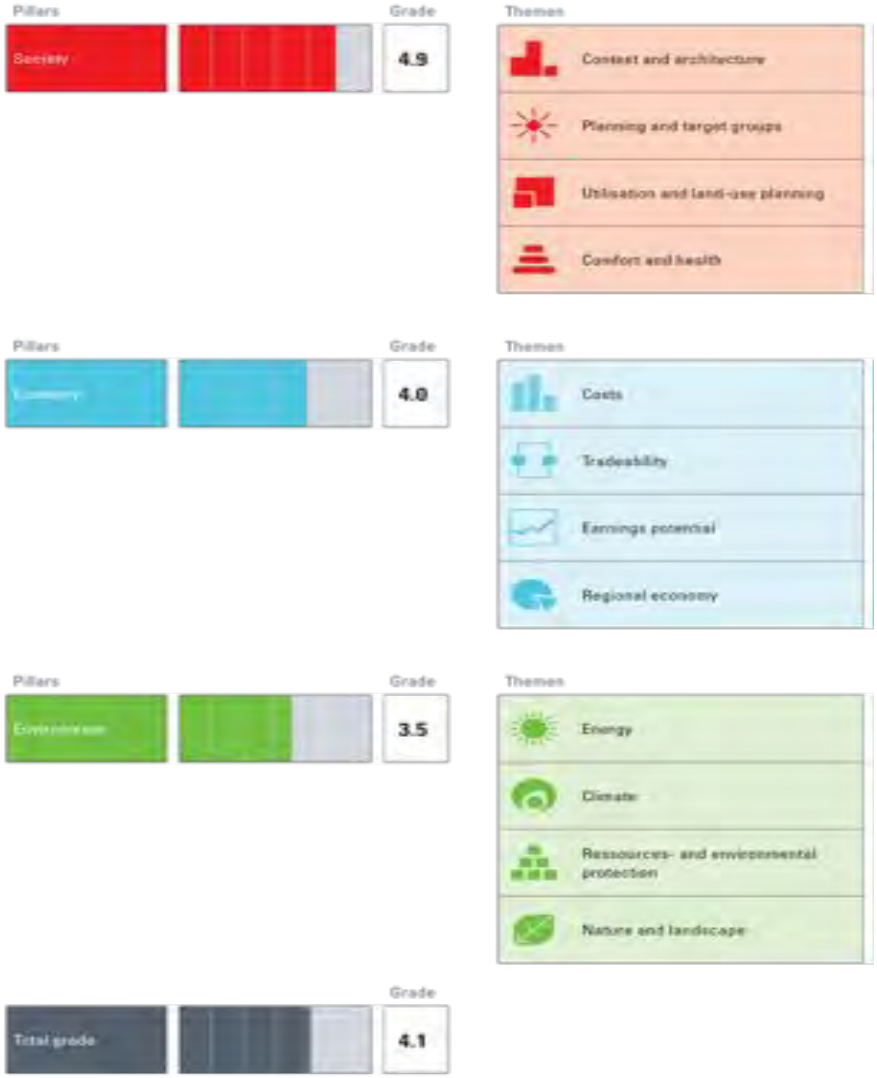


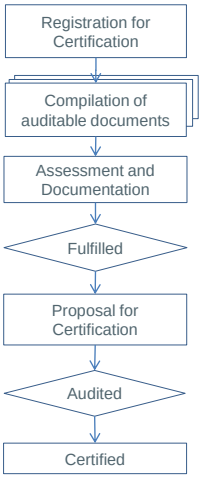
Figure 2: example of evaluation

9.2 Brief Manual Swiss Certification «2000-Watt Site»

www.2000watt.ch
www.swissenergy.ch
2000-Watt Gesellschaft
EnergieSchweiz für Gemeinden

Certification

The «2000-Watt Site» certificate is awarded to settlement areas with surface area more than 10,000 square metres, that make resource efficiency a priority – from construction to operation, including building renovation. The certificate is awarded at two levels: «site being developed» (more than 50% of the building area is realized) and «operational site». The certificate for 2000-Watt Sites is fixed-term. It must periodically be renewed with a current performance assessment.



Project phase		Development	Realization	Operation
	Certificate	"Development"		"Operation"
Quantitative	Target value	Evaluation with "Calculation tool" (Adviser)		
Quantitative	Proof	Evaluation with "Calculation tool" (Adviser)	Calculation of project values: – Construction – Operation – Mobility	Monitoring of operation values: – Energy & water – Mobility performance – Amount of waste
Quantitative	Tolerance range	+/-20%	+/-10%	+/-10%
Qualitative	Requirements	Criteria catalogue "2000-Watt District" with five domains		
Qualitative	Proof	Proof	Proof	Proof
Qualitative	Degree of fulfilment	At least 50% of the points mentioned in the five domains		

Figure 3: Certification processes «site being developed» (blue) and «operational site».

Indicator System

The project is validated using a twofold approach that comprises quantitative evidence and qualitative assessment. The targets for primary energy and greenhouse gas emissions depend on the zoning and use plans and are set individually for each site. For more information see: http://www.2000watt.ch

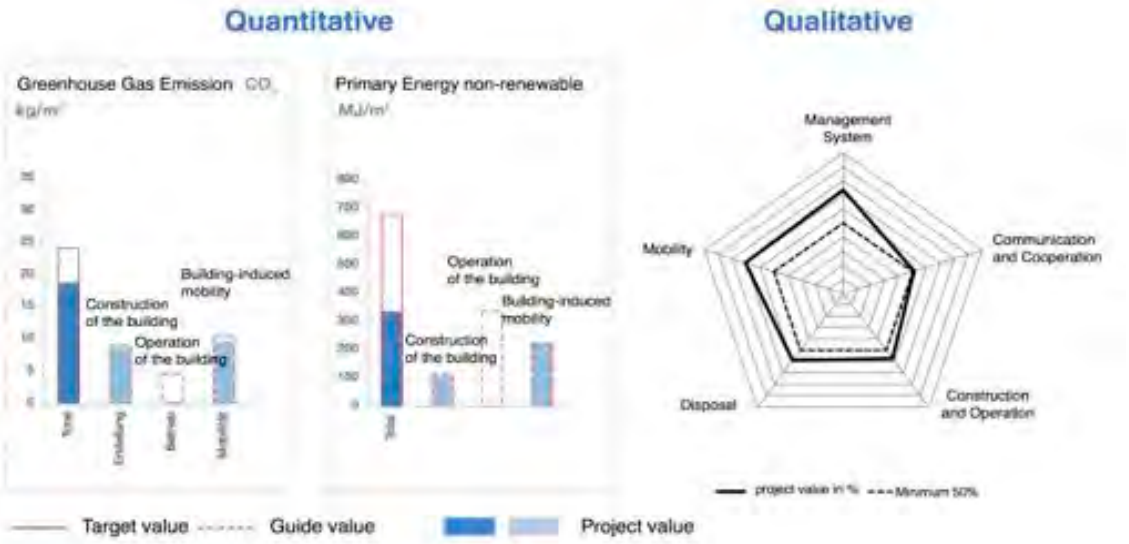


Figure 4: quantitative and qualitative indicator system

Restoration of Urban Scenic Fringe Areas in Water Town: Strategies and Approaches to Slender West Lake

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Synopsis

Under the effect of uncontrolled urbanization, urban scenic area is becoming one kind of the most pervasive scenic areas in China. Surrounded by urban patterns, urban scenic fringe areas are playing an important role in coordinating the relationship between city development and scenic resources protection and utilization. To support co-evolutionary development and positive interactions between urban land and urban scenic area in water town, landscape approaches for managing fringe areas within their broader water ecosystem and urban context have been put forward, by considering the interrelationships of their physical forms, natural features, and urban ecosystem restoration. An actual project of Slender West Lake, a famous urban scenic area in Yangzhou, China, has been proposed as an evidence of the strategies.

1. Background and proposition

Under the effect of urban sprawl, many scenic areas which used to be far away from the urban area are gradually surrounded by it and even become part of the city. The close relationship between urban scenic area and city has brought both advantages and disadvantages to the two different sides. For scenic area, its close relationship with city has advantaged it with high accessibility, diversified choices of travel modes, shared city service facilities while brought about problems such as limited space for future expansion, too-high population density in the scenic spots, continuous deterioration of water environment, etc. For urban area, scenic areas serve as ecological patterns in the city, providing recreational space for surrounding residents. Besides, tourists attracted from scenic spots boost local popularity and economy.

The interaction process between scenic areas and city development has proved that the two will be complementary to each other when they are in a harmonious state. In particular, a proper protection over city scenic spots will create a distinct city landscape style and an identical city landscape spatial pattern. When coordinating and planning urban scenic spots, therefore, it is necessary to deal with the relationship between the fringe areas and the city so as to reflect local cultural, historic and environmental characteristics and highlight the features of integration among cultural landscapes, natural water context and the city.

As stated above, urban scenic fringe area is playing an important role in the co-evolutionary development of both sides. To propose the strategies of dealing with such kinds of fringe areas in water city, an actual project of Slender West Lake in Yangzhou is proposed. As the cradle of the Grand Canal, Yangzhou was an important port of ‘Marine Silk Road’ in ancient China. Owing to its developed water system, it had become the largest metropolis in Southeast China and one of the four greatest trade ports in the Tang Dynasty. Slender West Lake is located in such a typical water town, and as one of China’s most representative urban scenic area, it is experiencing an explosive increase in terms of both its tourist number and tourist production value. With uncontrolled urbanization, however, the original city layout, water system and elegant city landscapes of Slender West Lake which embody the characteristics and styles of water town in China, is exposed to great pressure from spatial fragmentation, market exploitation and mass tourism. It is a matter of great urgency to determine strategies and tools in support of sustainable co-evolutionary development in fringe areas of urban scenic area.

This paper, therefore, is intended to discuss how to bring the distinct “landscapes in city and city in landscapes” advantage of urban scenic areas into practical action while avoiding various contradictions resulted from the too many interweaving spatial and geographical relations among urban scenic fringe areas through exploring the planning method.

2. Problems and cruxes

2.1 Inappropriate protection of ancient town ruins and water system

The evolution of the ancient town and its water system is shown in figure 1. As a water town with a history of about 2500 years, Yangzhou was built in the Spring and Autumn period in B.C. 486, so the city has gone through three prosperous periods during Western Han and Eastern Han dynasties, Sui and Tang dynasties and Qing dynasty. The location changes of Yangzhou from Tang dynasty to Ming and Qing dynasties and its city construction are closely related to the Grand Canal. Nowadays, surrounded by the city construction area, the urban scenic fringes which involve the precious ancient city ruins, area faced with great pressure of over-development.

Besides, with the development of sea transportation, the traditional canal transportation has been gradually replaced. The ancient water system in the town was blocked and broke up gradually. For now, the water habitat is under the pressure of the rise in tourism exploitation. The water resource of Slender West Lake largely depends on municipal water supply due to its segregation from surrounding water systems. Rainwater cannot be well collected and reused. The water quality also deteriorates once municipal water pipe stops working, which leads to an unsustainable water circulation in Yangzhou water system.

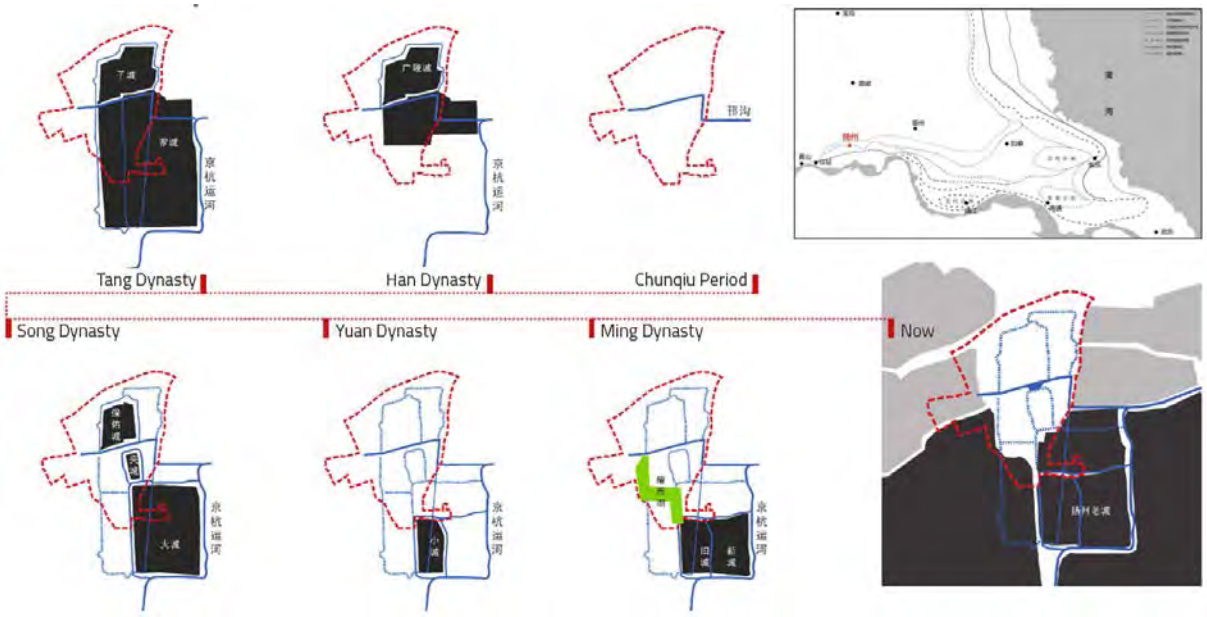


Figure 1: Evolution of the town and its water system
Source: Author’s self-drawn

2.2 Spatial and ecological segregation between scenic space and urban space

Figure 2 shows the expansion of the urban area around Slender West Lake in past three decades. As the Tianjin-Pukou railway was opened for traffic, the city has been expanded continuously towards directions of east and south and the Shugang-Slender West Lake Scenic Area where there are relics of past dynasties is in a state of being marginalized.

Also, under the ‘invasion’ of city sprawl, the nature resources and historic scenic areas in the interface area were gradually developed as city construction lands due to unlimited or illegal development. In the aspects of regional ecology, shrinking green buffer is not wide enough to support the original rich biodiversity along rivers and lakes. Local species are threatened by the mass development and increasing number of visitors. Furthermore, many eco-habitats are no longer large enough to serve as an ecological node or corridor connected with boarder greenway system in city scale. How to realize the ecology protection and biological diversification restoration of the scenic area through fringe areas promotion still remains a question.



Figure 2: Expansion of the urban area
Source: Author’s self-drawn

2.3 Complicated land use situation in fringe areas

As shown in figure 3, nowadays the scenic areas in water town have been gradually surrounded by residential areas, factories, enterprises, etc. The complicated land use situation resulted in development dilemmas for the urban scenic fringe areas in the following four points.

(1) The private land of public institutions and schools are located in the fringe areas, which result to a closed interface between scenic area and city

(2) There is a large proportion of Industrial land left around the urban scenic area due to the past economy-oriented development, which became the pollution sources to the nature resources along riverside.

(3) Several land plots are going to be leased to real estate developer to make profits, which largely invades the urban scenic fringe areas and furthermore blocks the possibilities of urban scenic area’s future expansion and development.

(4) Lack of tourism and public facilities makes fringe areas much less attractive then the core scenic spots. Also, current public service system cannot support rising amounts of tourists in the near future.

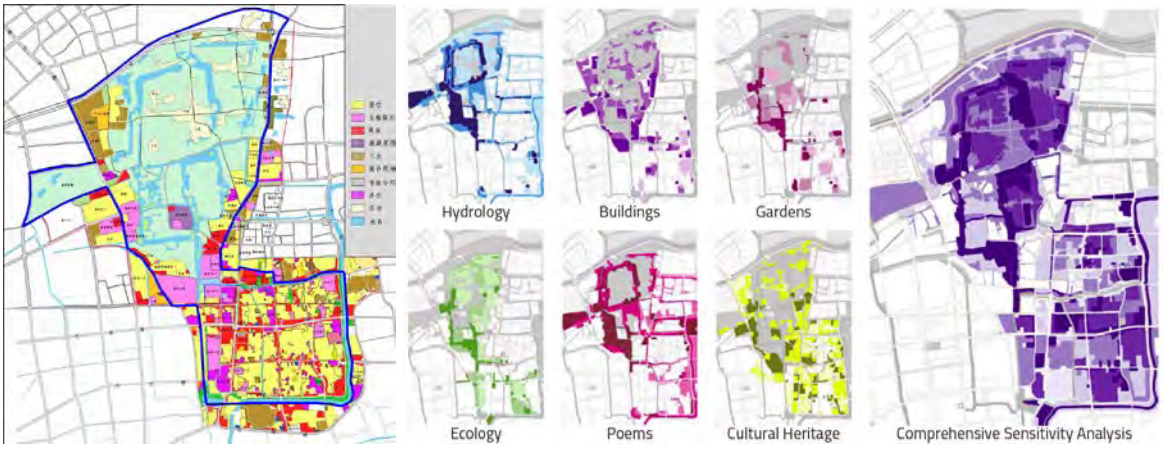


Figure 3: Current land use and sensitivity analysis in urban scenic fringe areas
Data Source: Shanghai Tongji Urban Planning & Design Institute

3. Strategies and methods

To reach a balance between preservation and development, landscape approaches for managing fringe areas within their broader water ecosystem and urban context have been put forward, by considering the interrelationships of their physical forms, their natural features and settings, and urban ecosystem restoration.

3.1 Ecological system recovery and water system reconnection

Since city scenic spots are likely to be separated from their surrounding environments in the process of city development, it is necessary to resort ecological patterns between cities and scenic spots from macro, meso and micro perspectives when coordinating and planning city scenic spots so as to form landscapes that integrate cities and green lands.(Figure 4)



Figure 4: Green Corridor Planning

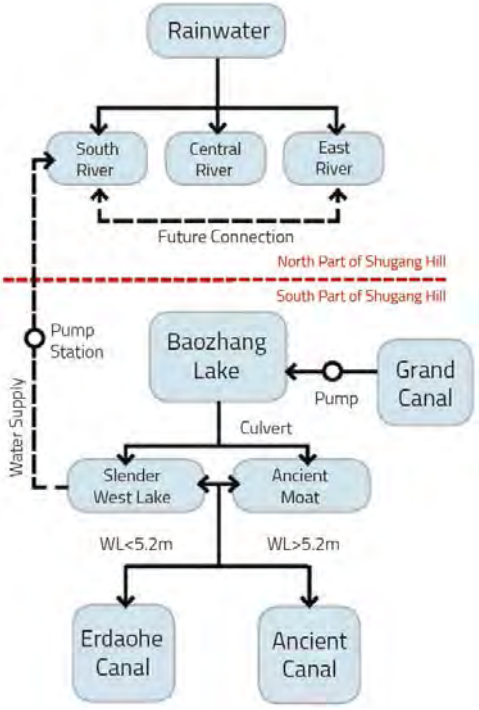


Figure 5: Water System Planning

Source: Author's self-drawn

In macro level, Shu Gang-Slender West Lake Scenic Area and Yangzijin Scenic Area in Yangzhou are two major important ecological cores of the city. Yangzhou is relying on its water space for establishing green corridors, but the scenic spots are separated from green lands in north-south direction. Therefore, it is suggested to ecologically connect Tangzi city, Songjia city and Slender West Lake Scenic Area so as to form a water-side ecological corridor that goes through the site, connecting itself to the ancient canal and getting through the south-to-north city green corridor in the downtown area of Yangzhou city. Moreover, Slender West Lake was supplied by natural water sources in the past, but it is currently supplied and changed by water from aqueducts of the Grand Canal from Beijing to Hangzhou. Therefore, it is suggested to dredge water system of the city when planning so as to fundamentally change the current "transfusion-type" water exchanging and better mix and integrate the city system and nature system. Damaged wetlands in urban context should be recovered, linking its high ecological, aesthetic and recreational value with historic urban

areas. Besides, reconnection and dredge engineering of original water system could be carried out so as to improve the eco-environment. (Figure 5)

In meso level, divide downtown areas and scenic areas in a comparatively definite way and divide scenic areas into several areas that are independent from and connected to each other; moreover, tear down and reconstruct some buildings that are sheltering landscape patterns, gradually recover spatial visual corridors and form alternations with reasonable densities within the areas through weaving traffic axes, parks, green lands and road protection green lands vertically and horizontally.

In micro level, realize ‘density in spacing’ through setting article buildings in entity environment with local features and ‘spacing in density’ through setting some small-scaled green lands in entity space of buildings. In this way, density and spacing are interweaved with and complementary to each other and form a typical contrast that goes through the whole spatial environment of the city while being mutual connected and influencing to constitute a city space environment with characteristics.

3.2 Scattered cultural clusters and resources integration

Though Slender West Lake is rich in historical and cultural resources, the cultural relics have been invaded and there is an absence of historical atmosphere due to the rapid development of a great deal of infrastructure construction, community construction and other projects in urban scenic fringe areas. Being directly exposed to the surrounding environment, the historic values and cultural completeness of these clusters are being threatened and the spatial relations between the distinct relics are lost. The historical urban relic clusters are gradually broken into cultural fragments.



Figure 6: Touring routes classified by cultural connotation
Source: Author’s self-drawn

When planning the layout of urban scenic areas in water city, it is necessary to fully discover their inherent cultural relevance, promote space integration, organize spatial routes according to historical context and focus on regional joint development from the perspective of city-landscape integration. For example, the joint development between Yangzhou and Shu Gang-Slender West Lake Scenic Area includes two major levels: first, the joint development of Shu Gang-Slender West Lake Scenic Area and old city of Yangzhou; second, the integration and joint development of the Grand Canal cultural system.

Complex layering of those distinct but scattered ecological and heritage clusters could be integrated and connected through vehicle-free embankments, further interpreting the city as a continuum in time and space. As shown in figure 6, through interpreting and recognizing scenic resources of Shu Gang-Slender West Lake Scenic Area and the old city of Yangzhou, a series of touring items and routes has been determined and classified by their distinct and rich cultural connotation and landscape resources.

3.3 Local residents and tourism development

As to the distribution of residents, commercial housing estates on the boundary areas have broken up the relations between urban landscapes and the city. Daily life of the residents living in the villages inside the scenic spots has caused adverse influence on the development of scenic areas. On the other hand, the residential areas within urban scenic boundary areas are not related to the aim of urban scenic areas protection and development at all, which has resulted in the mutual restrictions between the life of residents and development of the scenic areas. Such problem is particularly severe in the village areas in the Tangzi city and Songbao city relics: the archaeological development and preservation of cultural relics are being threatened while the local industrial plants have caused pollution to the ecological environment.

However, the residential areas in urban landscapes are also the outcomes of long-term historical development and they have become part of the historic scenic areas. The 'one-size-fits-all' planning will not only cause disadvantages to future management, but also destroy the completeness of scenic resources. In the process of development, therefore, it is necessary to adhere to the principle of prior participation of residents in the historic scenic areas and limited participation from outside workers, which means providing residents in the historic scenic areas with opportunities of priority so that they can participate in tourism development and relevant benefit distribution. Moreover, planners should focus on exploring distinct traditional industries of the residents and society so as to turn the residential areas into a kind of tourism resources and achieve an integration between the residential areas and urban scenic areas; meanwhile, encourage the residents to play an active role in the construction, management and operation of the urban landscapes especially in the perspective of mutual development in fringe areas.



Figure 7: Fringe area residents relocation plan(2012-2030)
Source: Author's self-drawn

3.4 Land use and function planning

For now, most of the land plots around urban city scenic spots are for construction. So it is necessary to arrange the layout according to objective requirements of various construction units so as to share city infrastructures and municipal facilities.

It is not difficult for us to discover that the impact on urban landscapes in the aspects of their functional structure, spatial layout, ecological environment and even city characteristics with the expansion of city scale. When many current factors are undetermined, the coordination and planning of urban scenic fringes should obey the following several principles: (1) reserve enough resilient space for the future sustainable development of urban scenic areas; (2) avoid any invasion upon core protection areas in future from city construction; (3) focus on requirements for future development when planning and strictly control the unconstructed districts.

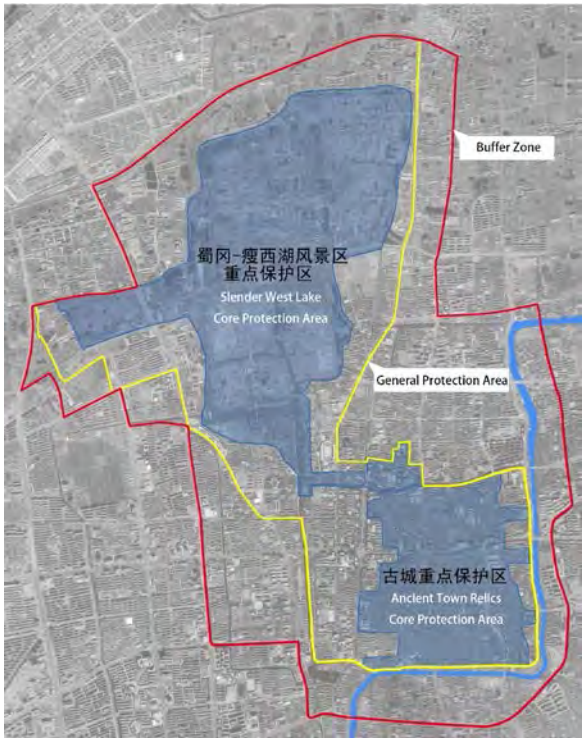


Figure 8: Protection boundaries
Source: Author's self-drawn

Furthermore, detailed legislative and regulatory measures aimed at the conservation and management of the tangible and intangible attributes of ecosystem in urban areas should take into account the existing built environment, ecological and cultural diversity, and environmental factors. Thus the double-win orientation on the fringe of urban scenic area in water town could be achieved and promoted to other cities of this kind. In order to implement the principles in the real planning process, three layers of protection boundaries have been put forward to guarantee the positive relationship between Slender West Lake and its surrounding spaces. (Figure 8)

(1) In the core protection area, the historic cultural relics and original water system will be strictly protected. Newly construction project is forbidden in any case in these areas. Furthermore, all existing buildings and constructions should be highly coordinated with local landscapes and surrounding environment. Wetlands and rivers should be recovered while the historic buildings should be renovated as it used to be.

(2) In the general protection area, construction projects should mostly be used for public facilities or tourism facilities. The height and the function of the buildings are also limited according to the guideline in order to make the closed or gated scenery open to public again. Also, the color and style of building facade or roof should be similar to its surroundings.

(3) In the buffer zone, green buffer and habitat recovery should be taken into action to restore the ecology situation of urban scenic space. More public spaces are recommended to be built here, providing the recreational space to both the local

residents and tourists while relieving the population pressure inside the core protection area.

4. Conclusions and revelations

Urban scenic areas are keeping a complicated relationship with cities. Problems should be attached great importance to in the process of fringe areas planning and restoration, including how to effectively protect the environment of scenic resources, how to promote the integration of natural and cultural fragments, how to optimize the positive influence of scenic areas on city living environment and how to coordinate the contradictions between city and landscapes so as to make scenic areas a driving force rather than a burden of city development.

For water town like Yangzhou, the original water system has made great contributions to the economic, political and cultural development of Chinese feudal society. Strategies and approaches to the restoration of urban scenic fringe areas largely depend on the revitalization of waterfront areas because these spaces are of high historical and recreational values. To support co-evolutionary development and positive interactions between urban land and urban scenic area in water town, landscape approaches for managing fringe areas within their broader water ecosystem and urban context have been put forward. Since urbanization is unavoidable, it is necessary to face city development in an objective attitude when planning urban scenic areas; meanwhile, besides meeting the needs of nature protection and public entertainment, comprehensive consideration should be given to the ecological layout, cultural fragments and their integration, residential life and tourism, land use and function, and many other factors so as to realize the sustainable protection and development over the urban scenic fringe areas.

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Construction of greenway network based on ecological restoration of the old course of Yellow River in economically underdeveloped region of China

Yao Guipeng, Wu Yi, Zhang Yu, Yin Haiwei

Synopsis: To improve the ecological and landscape features along the old course of Yellow River in north of Jiangsu Province, the project plan is committed to construct a regional greenway net-work with multiple functions to enhance the ecological and recreational connection of cities in economically underdeveloped region.

Greenway has more than 30years history as an official concept from the United States. In Europe, a similar concept which is called "ecological net-work" acts as an important role in environment protection from the 1990's till now. Either greenway or ecological net-work focuses on how to serve for the nature, such as how to protect the habitat for planting and animals, and to protect the quality of water body and etc, and they may support moderate recreation activity to human as well. Greenway firstly came in to China in 2009, the government of Guangdong Province published the master plan of the greenway net-work of Pearl River Delta, and thousands kilometers greenway has being built till now. As public facilities have been built, greenway in China concerns more about the recreation function to connect the scenic areas and tourism resources serving for people, and it's still rare to see research about how to cope with ecological problems in a typical landscape scale by greenways.

1. Challenges and opportunities which the old course of Yellow River in Jiangsu Province of China is facing

Based on the public policy requirements of the "urban system planning in Jiangsu Province" which was published in 2012 by the government of Jiangsu Province, the core function of the greenway network is to serve the ecological need of conserving the precious natural landscape with local characteristics.

When we focus on this river, we find several key characters which make it quite unique from other rivers. These conclude both challenges and opportunities to create a greenway net-work serving for both the nature and human beings.



Figure 1: Location of the old course of Yellow River in Jiangsu Province
Source: The author's own study

1.1 Created by manmade flood

It was formed by manmade overflow to stop the enemy in 1128 of Song Dynasty, the flood created great disaster to the people nearby. For example, there are three separated cities from the ground level to the underground in Xuzhou City. The two ancient cities were flooded by the Yellow River in Ming Dynasty and Qing Dynasty. People rebuilt the city twice on top of the former one due to the flood. Similar examples could be found in other places. "City underneath city" is really a rare wonder and also an evidence of the disaster.

1.2 The perched river without water source from upstream

From 1855 in Qing Dynasty, the Yellow River went back to north to the Bohai Sea. From then, the old course lost the water supply from the upstream. With the redundant sediment brought by the Yellow River for hundred years, the old course became a perched river which is 5-8 meters higher than the ground level nearby. Also as an unfortunately result, it cut the original watershed into two separated parts and made the river system quite disorder during a long time.

1.3 Weak ecological conditions on both sides

Due to the redundant sediment, desertification as a typical phenomenon appears in the soil on both sides of the river. It becomes even worse when monsoon comes and causes big problems for agriculture and forestry. Salinization of soil also happens in some places especially besides the sea. Economic development has been setting back and people are still living a relative poor life within the region.

1.4 A sinuous river with natural and cultural resources

Compared with other rivers canalized by mankind within the region, the old course has a sinuous route created by natural water flow. This is quite match to the local topography and provides various habitats for birds and fishes. There are three natural conservation areas mainly for birds, which can proved the positive effect caused by the sinuous river. Four cities connected by the river all have a long history of more than a thousand years, there are many cultural heritages with ancient stories.

2 Define the greenway along the old course to overcome different ecological problems

The greenway along the old course must respond to the local ecological problems. So the first step is to define the route and boundary of it. We should recognize the different areas in which the ecological factors have problems. The key factors we focus on are soil species and problems, water quality, the land use type along the old course, and the endangered bird species, such as Egretta eulophotes.

2.1 Greenway to improve the soil quality



Figure 2: Analysis for soil species
Source: The author's own study

Through the analysis towards the soil along the old course, we find out there are mainly five types, which are Cambisols soil, semi leached soil, semi hydromorphic soil, anthropic soil and saline-alkali soi. The soil which have negative ecological effect on local condition are two of them, the Cambisols soil and the saline-alkali soi. The area which contain these two types of soil are defined as part of the green way.

To improve the Cambisols soil along the old course, we must cooperate the greenway corridor with agriculture. Relevant experiment shows that local Populus trees can prevent soil desertification, and it's possible to protect farmland from the monsoon. So corridors organized by local Populus trees with farmland among them could be one type of typical landscape to be compatible with both soil improvement and agriculture. Another approach is to use different local plantings which are also suitable for the Cambisols soil to creat forest landscape rather than agriculture. This way seems more wisdom when there are some areas which are abandoned, the key point is to blend planting with deep root and horizontal root to retain the sand within the soil. Other strategies to improve soil are shown in Table 1.

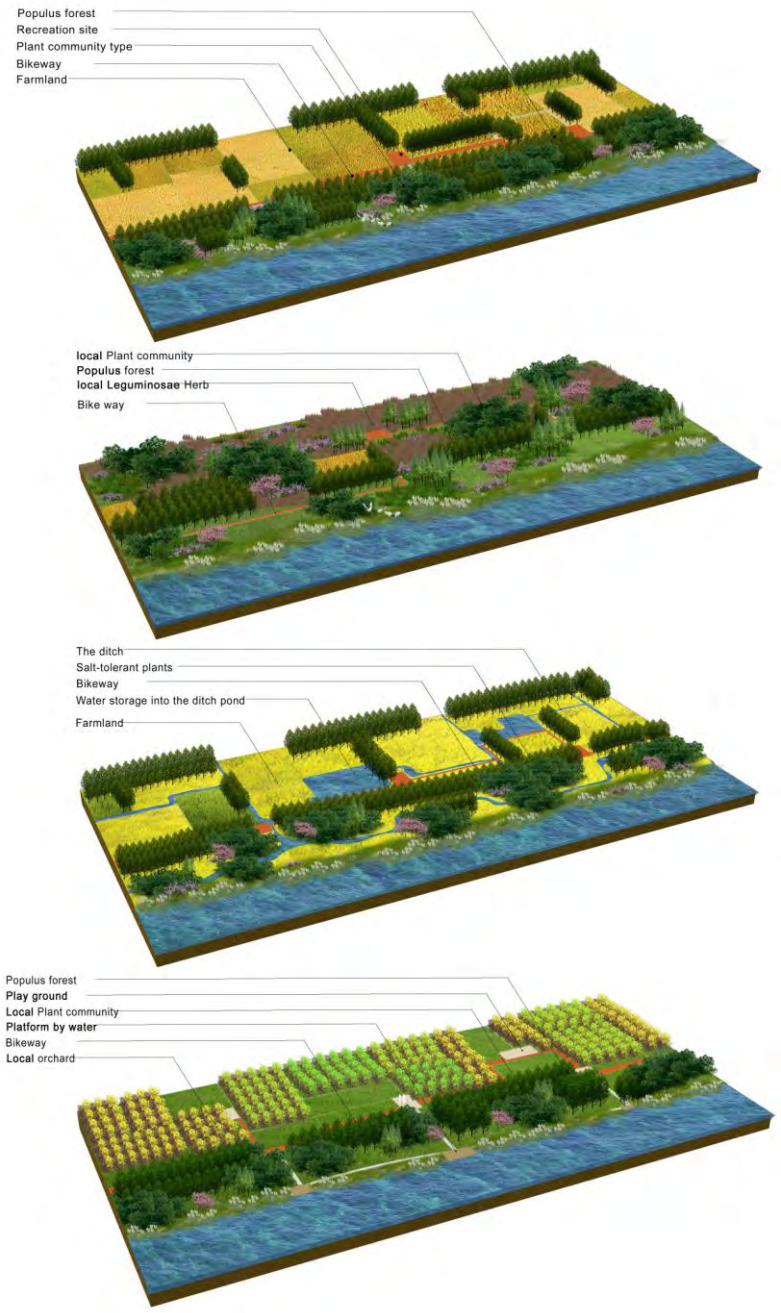


Figure 3: Possible greenway type to improve soil quality
Source: The author's own study

2.2 Greenway to protect the water quality

There are little industry along the old course, the quality of water is relative good compared with other rivers within the region. There are some water sources for the nearby cities, and some parts of the river are used to transfer clean water for human. These places and segments are sensitive for water quality and need green corridor widely enough to prevent possible sediment, nutrition and contaminant from the land nearby.

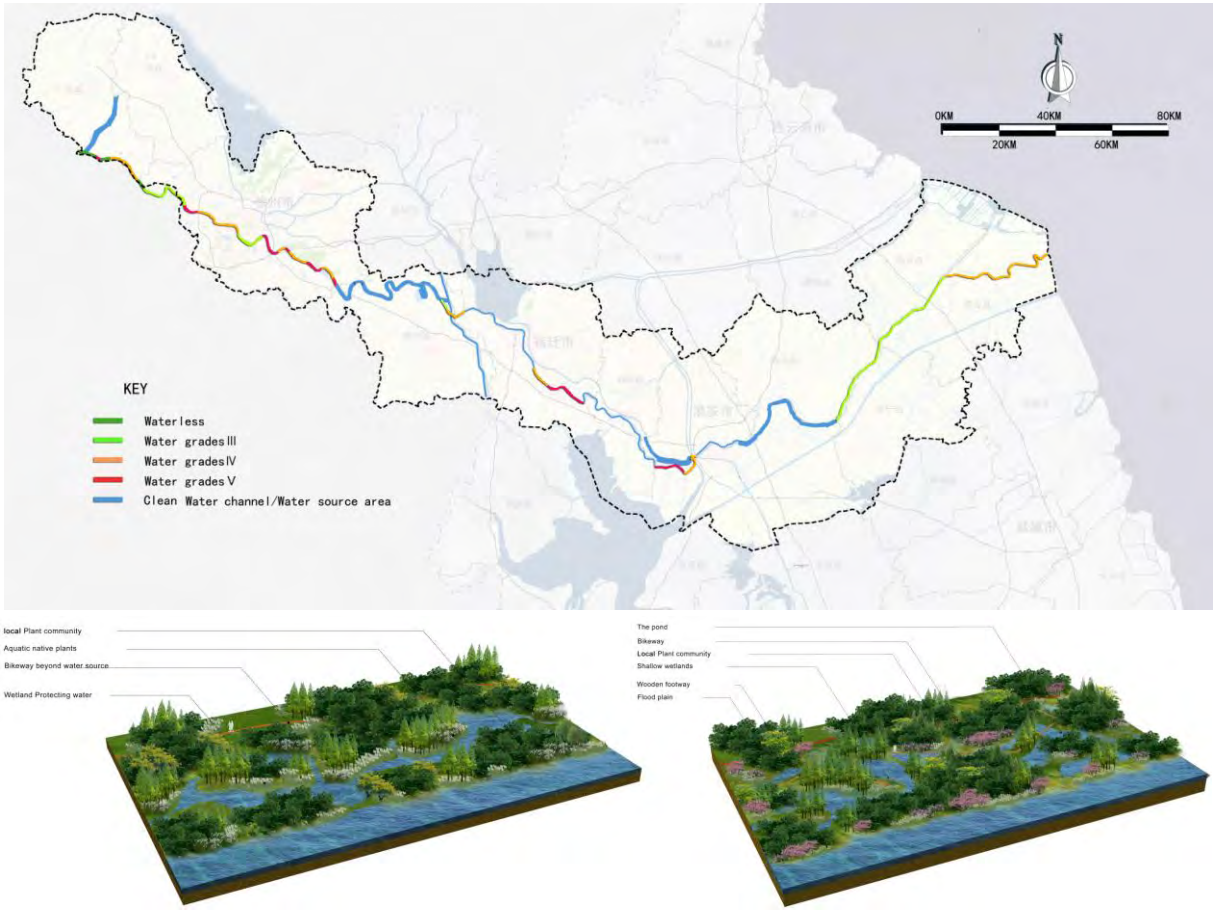


Figure 4: Water quality analysis and greenway to protect water quality
Source: The author's own study

2.3 Greenway to connect the potential habitats

The existing land use along the river is also important for defining the greenway corridor. From the remote sensing image, we get the information of land use type. Normal farmland, farmland with ecological oriented agriculture, urban area and other human settlements, water body, wetland and forest are the main land use along the river. Greenway corridor should connect the land with more natural value as much as possible, including forests, water bodies, wetland and even farmland with ecological oriented agriculture, which is always preferred to have vegetables and fruit trees suitable to the Cambisols soil. They are all good to improve the coverage rate of forest and to conserve the water and soil.

There are two kinds of wetlands along the river. The first is wetland within urban areas and always sit besides big water body, the water level is usually controlled by dam or other water conservancy facilities. So they are mainly for entertainment. While the other kind is always far away from urban areas, much more like natural wetlands with different water level in different seasons, they are more important to keep the corridor continuous and maintain the diversity of species.

It is also quite valuable to concern about the protection of the endangered bird species along the river, such as Egretta eulophotes. There are two natural conservation areas for their habitats, other three wetlands along the river also have the habitats suitable for them. They are migratory birds, during the end of March to the beginning of April, they come here to breed, and fly to the Philippines at October each year. The greenway corridor should provide more habitats and opportunities to diffuse for foraging and other needs for them.

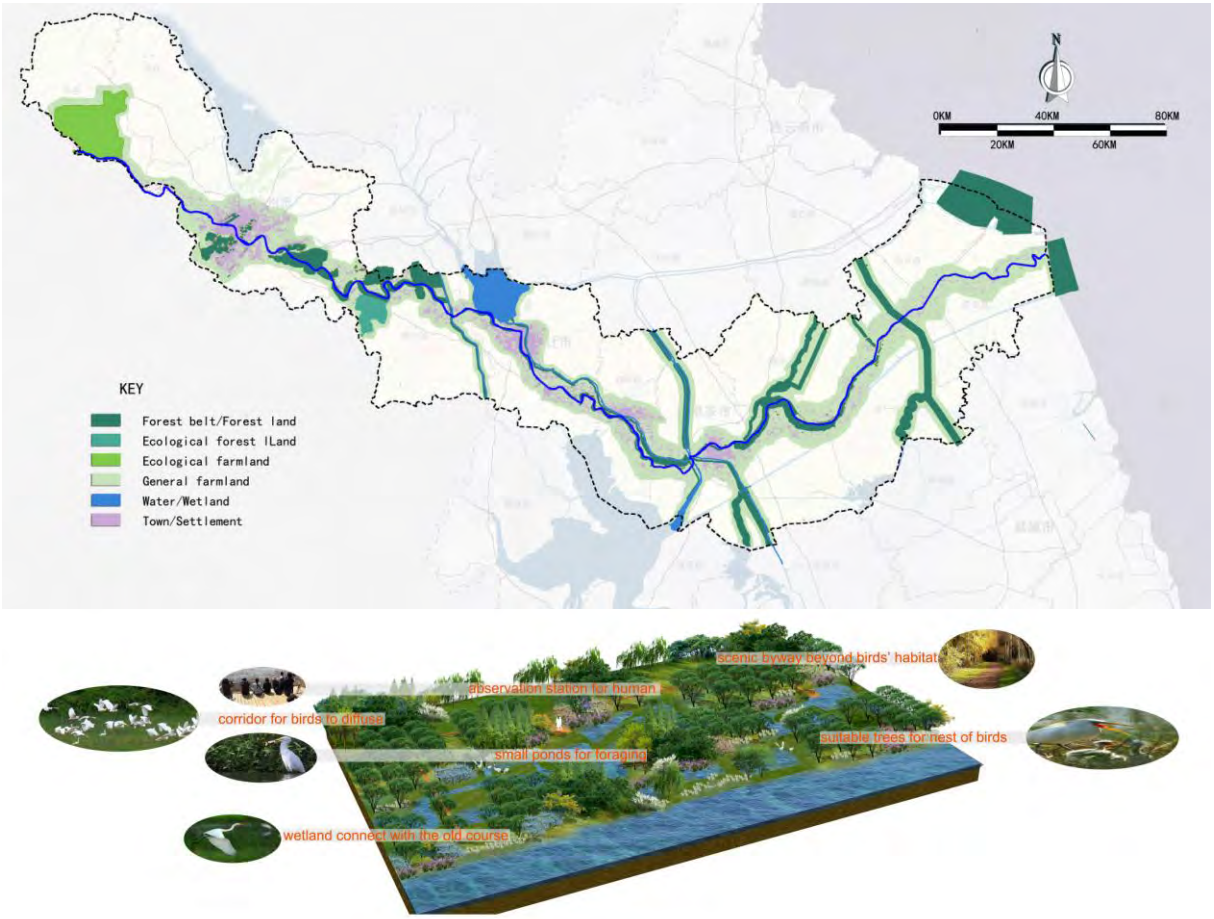


Figure 5: Potential habitat analysis along the old course and greenway to protect endangered birds
Source: The author's own study

2.4 Greenway combined with multiple functions including recreation

Different needs of ecological factors represent different range and corridor composition. If we overlay the separated ranges of different layers, we could define the range of the greenway corridor with multiple ecological functions. It is convenient and more clearly to analysis different factors one by one, but actual conditions must be more complex. We summarize the six typical types of greenway corridors to be guidelines in practice.

Greenway types		Functions and form	Possible recreation for human
Greenway to improve soil quality	Desertification prevention	Be combined with agriculture and forestry, local Populus to prevent wind. Local Orchards and Leguminosae herb to conserve the water and soil. Local plant community consist of deep root and Inclined root to fix the soil.	Scenic byway along the Populus corridor and river within great open farmland. Unique landscape

	Salinization improvement	Discharge the redundant salt through swale and ponds system. Local plant community consist of haloduric and xerophytic planting. Special planting like apocynum to create economic value and unique landscape.	for special planting like apocynum. Fruits and vegetables picked. Popularization of science within landcape.
Greenway to protect water quality		Decrease the erosion, sediment and redundant nutrient. Wipe off the pollution within the runoff and air.	Recreation at the edge of the greenway and be far away from the water source.
Greenway to protect endangered bird species		Create additional habitat for endangered birds within greenway. Plant community consists of mulberry, locust and cypress trees for birds to make nest. Create corridor with variety of habitats combined with forest, wetland and small island for birds to diffuse. Improve the Monitoring mechanism.	Recreation beyond the possible habitat of birds. observation point for visitors Popularization of science for birds protection.
Greenway with wetland		Recover the natural variation of water level within wetland controlled by dam. Preserve the flood plain with suitable planting	Wetland experience by bike. Popularization of science for wetland protection.
Greenway as urban open space		Utilize and expand the existing open space along the river within urban areas	Cultural and history heritage experience like "city underneath city".
Greenway serving for the villages		Wipe off the redundant nutrient from farmland Provide small habitat and water source for small wildlife species. Provide recreation corridor for farmers and visitors	Rural tourism for farming experience. Inspirational education for children. Fruits and vegetables picked.

tables 1: Greenway type summarization for the old course of Yellow River
Source: The author's own study

Recreation and tourism must be concerned according to the government request. So the question is which segments are attractive for people to visit. We create a system with several factors to evaluate the attraction of the river itself. The factors include the width and water quality of the river, density of natural and cultural sources and others. Due to the analysis, we

give priority for the scenic byway and entertainment facilities in the high level attraction segments.

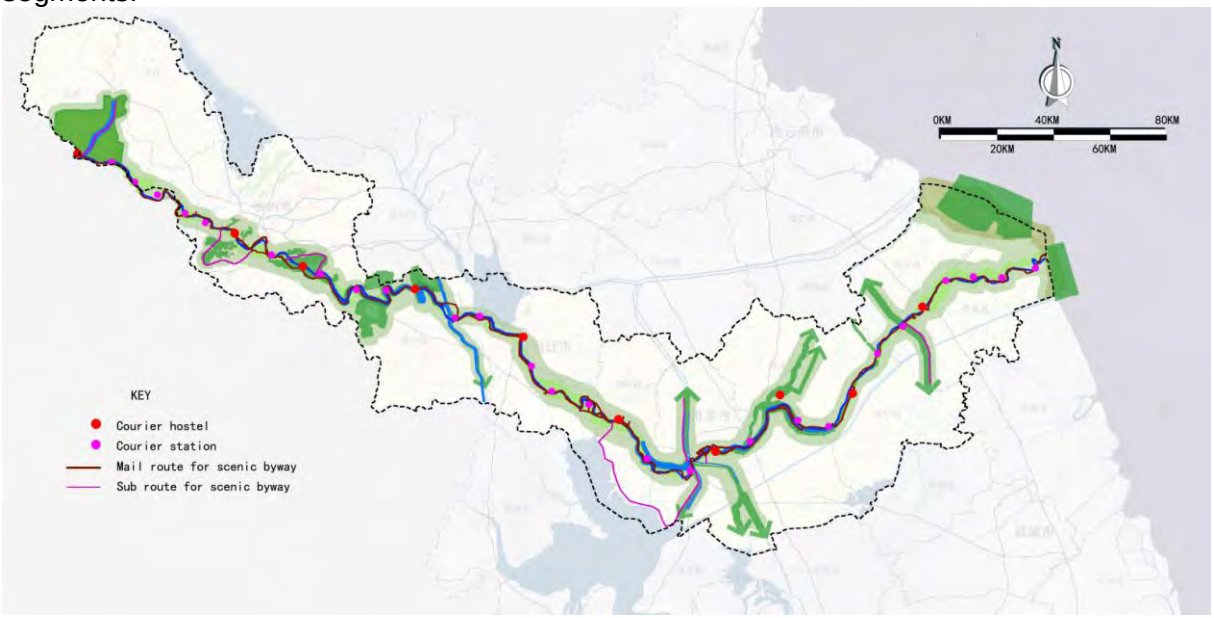


Figure 6: Possible tourism route according to the greenway
Source: The author's own study

3 Ecological greenway net work contribute to the region

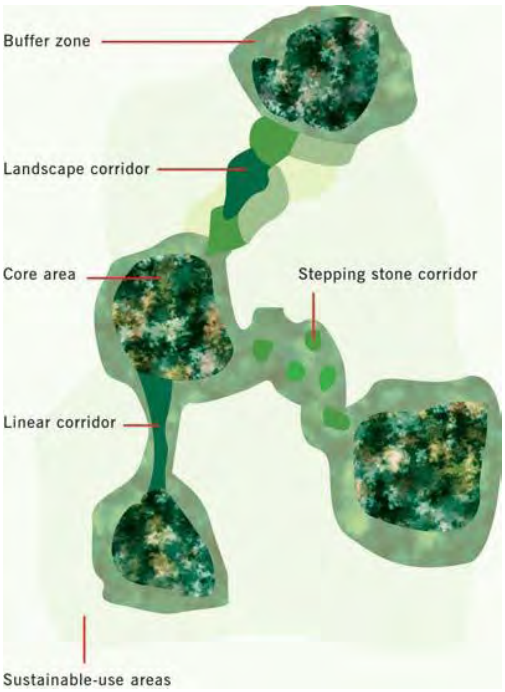


Figure 7: Principle of ecological net work
Source:
http://countdown2010.net/archive/paneuropean.html

It's undoubted that this greenway corridor could be help to the river itself and the land on both sides. Furthermore, if we enlarge our scope to the region, there are several natural or seminatural area separately along the region which the river goes across. There are also several rivers go through, including the Grand Canal of China. By the greenway of the old course, We may create an ecological greenway net-work beyond the river itself to connect the precious natural heritage. This net work can also provide a tourism system for the people within and out of the region.

Research about "ecological net-work" has more than ten years in Europe. It is based on two theories which are "Island Biogeography theory" by MacArchur and Wilson, and "Metapopulation theory" by Levins. It is mainly used to protect the diversity of natural species. The key principle is to make enough and proper connections among the natural landscape patches to avoid the habitats fragmentation, rather than to create natural conservation areas quite separately.

According to the principle of "ecological net-work", different kinds of corridors could be the key elements to connect the landscape patches and habitats. Since we have already defined the greenway corridor along the old course of Yellow River, we would like to see where and how to connect.

3.1 Land use analysis within the region

We enlarge the research range at the south-west of the old course out of the administration area of Jiangsu Province to get ecological analysis result. The land use map is based on TM remote sensing image (30m resolution), aerial photo (0.5m resolution) and GIS map (1:50000). Farmland is the matrix within the region, the area percentage is 78.62%, built up urban areas take 10.14% percent. While water body takes 4.7% and forest only takes 2.11% percent. The forest area is mainly on the upland and hills around Xuzhou City. Two big lakes sit on the north and south of the old course. They are formed by those rivers which were blocked by the old course in history. Now the lakes provide water source to the old course when it is dried and also accept the possible flood from rivers include the old course when it is rainy. The Grand Canal comes from the north and connects with the old course in Huai An City on the middle east.

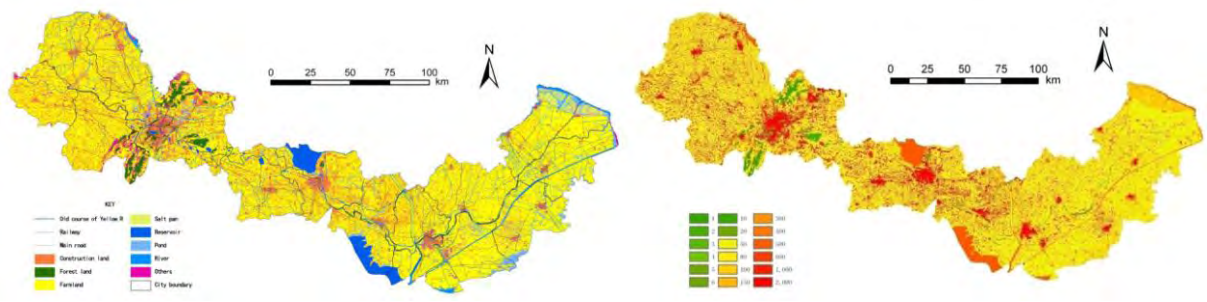


Figure 8: Land use and resistance analysis for the region
Source: The author's own study

3.2 Effective net work for the upland and wetland patches

Totally twenty four landscape patches are recognized to be "ecological sources", the principles include the size of the patches, diversity degree of the species and coverage rate of forest and etc. For a certain kind of species, different kinds of land have certain resistance to overcome for their diffusion. But be restricted to the limitation of information about local species, we could generally say that for most of the animals on uplands to diffuse, forest, small stream and wetland are easy for them to migrate, diffuse and be temporary habitat. While built up urban areas, roads, expressway and big water bodies have relatively bigger resistance for them to use. The potential corridors will connect "sources" with stronger gravitation by the routes which have resistance as weak as possible.

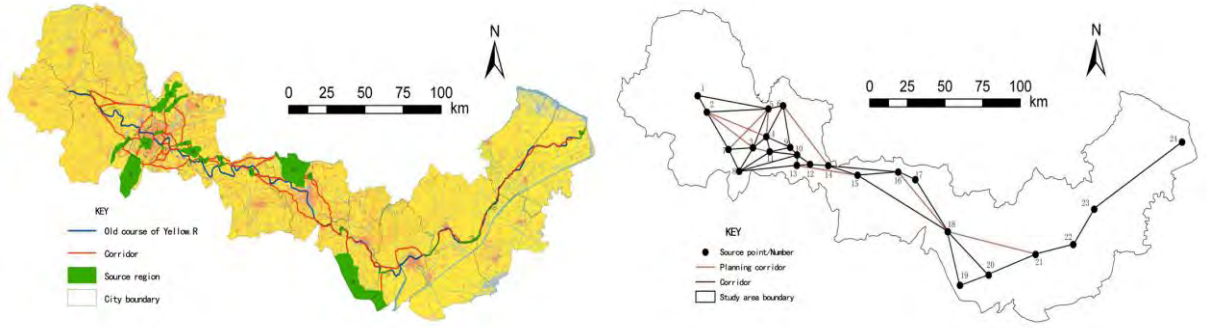


Figure 9: Potential corridor and ecological network analysis and improvement
Source: The author's own study

Base on GIS, by "The lowest cost path" and "Gravity Model" analysis, we get a potential ecological net-work for upland and wetland patches. Base on Graph Theory, we can evaluate the quality of the net-work by closure degree, the connectivity inside. We could then obtain

the guidelines for the routes of green corridors to connect with the old course within the region by this analysis.

3.3 Effective net work for the birds

Birds have quite different habits and living habit from animals living on upland. Since there are several endangered birds within the region, greenway net-work aim at them will be quite different. We focus on Egretta eulophotes as the representative species. Their habitat is usually near big lakes, rivers or swamp. Fishes, shrimp and frogs are their favorite food.

According to the data about them and the investigation, five big patches and other seventeen suitable patches are recognized to be the habitat sources. Farmland, forest and water body have less resistance for them to diffuse and provide places for rest and foraging. By analysis with similar principles, we get an effective net-work for them. Among the five main sources, we suggest clear migration corridors for them. Among the other seventeen potential habitats, we suggest possible green corridors to connect with each other.

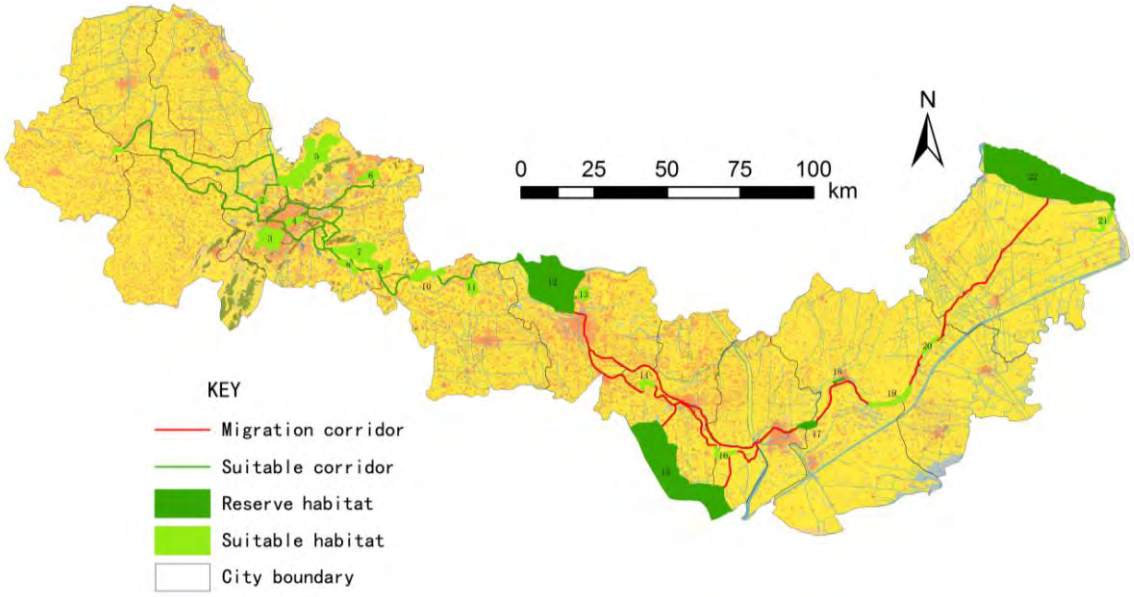


Figure 10: Potential corridor and ecological network analysis to protect endangered bird species
Source: The author's own study

3.4 Possible tourism and recreation system within the net work

Different aims will lead to different results, these two net-works represent needs of the nature from different aspects. We overlay them as different layers to create a multiple net-work, as a good result, we find out that most of the cultural heritage are near by the network, so it can provide opportunities to organize a recreation and tourism system for people. Density for the Non-motorized transportation and entertainment facilities and the schedule for carrying out are determined by the economic level of different areas and accessibility of the net-work itself.

4 Conclusion

All in all, "greenway" has already become a common concept to China, but always known as routes to connect with scenic areas. The evaluation standard about greenway is always whether it is beautiful or not. What we try to do in this project is to use greenway to resolve different ecological problems in different landscape scales. During this process, we find the most difficult thing is to get precise information about the various ecological factors. Be restricted to this limitation, the result need to be improved in many aspects. What we have done is only a cautious attempt for the nature of China.

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The Ecological Sensitivity Analysis in Ecological Urban Planning: A Case Study of Shanghang County, Fujian Province

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Abstract:

In the background of industrial pollution increase, ozone hole expansion, green house gases increase, etc. global ecological risk becomes more obvious, making human living environment confront with a severe challenge. Eco-city is actually a form of harmony of human beings and nature, unification of human construction and natural development. And how to build an eco-city is always a key problem. Eco-city planning is an important part of the eco-city construction, which is an effective measure to realize the dynamic balance of the ecological system of city and regulate the relationship between human and environment.

Based on the eco-city planning of Shanghang County, this paper does research on the ecological sensitivity analysis. In the analysis, this paper firstly selects eight factors. Then using single factor analysis and superposition algorithm, it gets comprehensive sensitivity regionalization map and classifies the area into five different grades: extremely high sensitivity region, high sensitivity region, medium sensitivity region and weaker sensitivity region. Finally, according to different features in each regions, different regions are classified into three areas: construction prohibited area, construction limited areas, construction appropriate areas.

As the core of ecological urban planning, ecological sensitivity analysis focuses on urban planning from natural ecology aspect. Through identifying the sensitive areas, protection planning can be made to protect, preserve and recover these areas. And it can guarantee urban natural foundation from destroyed and promote urban sustainable development.

1. Eco-city introduction

1.1 Concept

In the background of industrial pollution increase, biological species extinction, ozone hole expansion, green house gases increase, etc. global ecological risk becomes more obvious, making human living environment confront with a severe challenge (DONG,2002). Richard Register first put forward the term "eco-city" in his 1987 book, Ecocity Berkeley: Building Cities for a Healthy Future. Then the concept of eco-city has drawn wide attention.

The foundation of eco-city theory is ecological selection theory. Natural selection can be divided into three types: biological selection, physical selection and ecological selection (WU, 2000). The first two types are the base of the latter one's existence, that is to say, the latter one is the extension of the first two types in a higher level. Ecological selection is a conditioning selection, occurring between biology and physical environment. That is, it is the oriented and localized process between biology and physical environment in multi-dimension (SHEN, 2004).

1.2 Connotation

An eco-city should meet the needs of the present without sacrificing the ability of future generations to meet their own needs. Human should keep a balance with biology and environment, rather than being dominant in such eco-city.

Eco-city is actually a form of harmony of human beings and nature, unification of human construction and natural development. It regards natural conditions as a basic component in a city, and its developing object includes human as well as biology and environment. In an eco-city, human, biology and environment is interdependent and irreplaceable. The developing goal of eco-city is to create a living pattern with ecological economics, ecological services and ecological culture.

2 Fundamental principles of ecological urban planning

Though it has not been a long time since the concept of ecological urban planning was put forward, academic discussion on ecological urban planning has a long history. Ideas on ecological urban planning in real sense occurred 10 years ago, mainly represented by Western European and American scholars. Former Soviet ecologist O.Yanistky (1981) once divided eco-city design and practice into three knowledge levels and five activity phases. (Table 1)

Levels and Phases	*Basic Research(I)*	*Applied Research(II)*	*Urban Design(III)*	*Construction Process(IV)*	*Formation of Urban Organic Structure(V)*
Culture-Consciousness Level	√				√
Society-Function Level		√			√
Time-Space Level			√	√	

Table 1 Design and practice matrix of eco-city

O.Yanistky considers the first level as physical geography level, which is a spontaneous level for human activity. It is a process of urban niches extension and competition balance, realizing comprehensive usage in the end (WANG, 1988). As human activities grow, contradiction between city and nature becomes more obvious. It arises human to improve urban relationship and strengthen system functions. And this is exactly what the second level studies. The concept of eco-city is put forward on the third level, and aims to study human's ecological consciousness and turn it into a self-motivated activity. Therefore, ecological urban planning should develop from the first level into the second, third level, combine sociology, economics, ecology, geography, etc. into urban planning, and turn into a comprehensive planning (SHEN,2000; SHEN,1998; WANG, ZHU,1998).

In the book Green Cities published by D.Gordeb in 1990, a series of approaches to make urban space ecological have been discussed. It includes: 1) green city is the most harmonious reflection of biological materials and cultural resources; 2) it possesses survive ability in nature with a balance of input and output; 3) protect natural resources and recycle waste that has to be produced inevitably; 4) possess open space and other species coexisting with human; 5) emphasize on human health and encourage green food; 6) each urban component should be planned on the basis of ecological esthetics; 7) provide comprehensive cultural development; 8) final outcome of scientific urban planning and community planning.

C.B.qisijiakewa(1991) concluded Russian urban planning department work and proposed principles and strategies in ecological urban planning: 1) proportion of planning layout and technology in solving nature reserve issues; 2) urban geology, ecology boundary, population planning, and functional relation with its surroundings; 3) urban ecological zones; 4) landuse and spatial organization for solving environmental risks; 5) infrastructure meeting ecological demand; 6) reasonable proportion of architecture space and green space; 7) rebuilt of residential and industrial areas; 8) ecological esthetics in urban architecture spatial organization.

When J.Smyth made Sustainable Development Planning in Ventura County, USA, he put forward eight principles in ecological planning: 1) protection, preservation and recovery of natural environment; 2)constructing actual price system as economical activity foundation; 3)support for local agriculture, commerce and service industry; 4) developing ecological communities with multi-function and pedestrian system; 5) utilization of advanced transportation and communication system; 6) developing renewable resources; 7) set recycle program and reusable material industry; 8)support for mass management education.

Based on above analyses, we realize that ecological urban planning is an important component of eco-city construction, a planning approach considering each urban ecological factor in a comprehensive way, and an effective way to realize urban ecological system dynamic equilibrium. Under the guidance of sustainable development theory, we should apply knowledge from various subjects to understand each ecological relationship in eco-city, and identify the degree that resources development and utilization. In this way, human and environment can be developed in a well-coordinated manner.

3 Ecological Sensitivity Analysis in Shanghang County

3.1 Brief introduction of Shanghang County

Shanghang County is located in the southwest of Western Taiwan Strait economic region, bordered in the south by Zhu Jiang delta region and in the west by Southern Jiangxi region. Thus, Shanghang County plays an important role in the western development axis of Western Taiwan Strait economic region. Relying on its location advantages, Shanghang County can undertake industries transferred by Zhu Jing delta region and Western Taiwan Strait economic region, forming the significant gateway in the southeast areas.

The hilly areas accounts for 79.9% of the total areas, arable land accounts for 8.9%, and the remains are water areas and others. The terrain slopes from northeast to southwest with typical characteristics. The forest coverage in Shanghang County is 78%, forming an excellent ecological environment. Meanwhile, it also makes it environmentally fragile and high sensitivity with less construction land.



Figure 1 Location of Shanghang County

3.2 Ecological Sensitivity Analysis

3.2.1 Concept of Ecological Sensitivity

Ecological sensitivity refers to adaptability of ecological factors in external forces or changes in the context of not reducing environmental quality. Ecological sensitivity regionalization is to analyze regional ecological environment's sensitivity to human activity and ecosystem's recovery ability. To achieve sustainable development, we should firstly make ecological planning and analyze ecological sensitivity before landuse planning. In this way, we could avoid "construction destruction" and create good regional environment.

3.2.2 Selection of ecological factors

There are numerous factors influencing regional ecological sensitivity, such as elevation, gradient, vegetation, hydrology, etc. Based on the analysis of Shanghang County present conditions, this paper selects eight factors with obvious influences on landuse. That is, elevation, gradient, hydrology, forest, farmland, soil erosion, nature reserve and urban area. Among these, the last one can be classified as artificial factor and the others are classified as natural factors.

(1) Evaluation of natural factors

To make it more quantitative, some factors are divided into sub-factors with each sub-factor mapped to one layer in ArcGIS. Then identify each factor's value. (The evaluation value has been classified into five degrees with 9,7,5,3,1 respectively.) According to spatial analysis in ArcGIS, superposition algorithm operates on seven natural factors. Then it assigns value (9,7,5,3,1) to each factor and classified into five degrees, that is, extremely high sensitivity region, high sensitivity region, medium sensitivity region, weaker sensitivity region, non-sensitivity region.

Factor	*Classification*	*Evaluation Value*
Elevation	*> 100m*	*9*
	75-100m	*7*
	50-75m	*5*
	25-50m	*3*

		< 25m	*1*
Gradient		*> 25°*	*9*
		15°-25°	*7*
		8°-15°	*5*
		2°-8°	*3*
		< 2°	*1*
Hydrology	*Lake and Main River System*	*Site that River Located*	*9*
		Buffer < 50m	*7*
		Buffer 50-120m	*5*
		Buffer 120-200m	*3*
		Buffer > 200m	*1*
	Minor River and Its Branches	*6m Site that River Located and Buffering 6m*	*9*
		Buffer < 50m	*7*
		Buffer 50-80m	*5*
		Buffer 80-120m	*3*
		Buffer > 120m	*1*
Forest		*Primary Dense Forest Land*	*9*
		Secondary Dense Forest Land	*7*
		Open Forest Land	*5*
Farmland		*Basic Farmland*	*9*
		General Farmland	*7*
Water Source Protection Zone		*First-grade protection zone*	*9*
		Second-grade protection zone	*7*
		Would-be protection zone	*5*
Nature Reserve		*Needed to be protected*	*9*
		Buffer 200m	*7*
Urban Area		*Extremely Low Sensitivity*	*1*

Table 2 Selection of ecological factors

(2) Evaluation of artificial factors

The superposition algorithm on urban area is actually the process of identifying non-sensitivity region. Urban area factor is an artificial factor with sensitivity value of 1, and urban area is non-sensitivity region itself. If superposed with natural factors according to the rules of choosing maximum, urban area factor will be deserted. Thus, in the process of evaluation, we superpose urban area factor with the outcome of superposition algorithm on natural factors.

The outcome of superposition algorithm on natural factors is merely 9,7,5,3. Thus, when superposing urban area, it assign urban area's value as 1 and assign other areas as 0. We will get following matrix after superposing all the factors.

Value	*9*	*7*	*5*	*3*
1	*10*	*8*	*6*	*4*
0	*9*	*7*	*5*	*3*

Table 3 Superposition Matrix

The areas having outcome of 4,6,8,10 will be classified as non-sensitivity region, while the areas having outcome of 9,7,5,3 will be classified as extremely high sensitivity region, high sensitivity region, medium sensitivity region and weaker sensitivity region.

3.2.3 Analyses of each factor

(1) Elevation factor

The landscape mainly comprehends hilly areas in Shanghang County, thus, elevation factor has a direct relationship with its natural skeleton. The higher the elevation is, the higher the sensitivity is. This paper takes the elevation of town location as datum elevation, and uses relative elevation to discuss elevation's contribution to ecological sensitivity.

(2) Gradient factor

Gradient factor plays a significant role in maintaining ecosystem balance and preventing soil erosion. Meantime, construction activities are limited according to different gradient. The higher the gradient is, the more possibility of soil erosion occurs and the higher the sensitivity is.



Figure 2 Elevation factor analysis

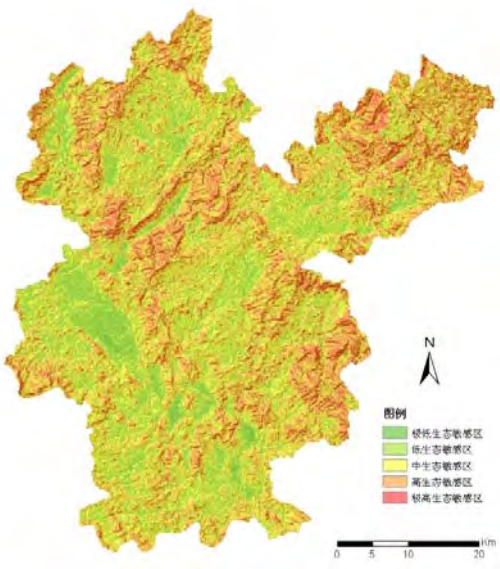


Figure 3 Gradient factor analysis

(3) Hydrology factor

Shanghang County has a large water catchment area with numerous lakes and rivers. Reasonable usage of hydrology has an important role in protecting ecosystem stability and promoting socioeconomic sustainable development. This paper only selects planar factor (such as lake, reservoir) and primary linear factor (such as river).

(4) Forest factor

Forest factor plays a role of modulation and feedback in this compound ecosystem. From regional scale, forest has an effect of microclimatic modification. Particularly, with high sensitivity, primary dense forest land promotes biological diversity protection and super

ecological environment. Secondary dense forest land provides beautiful scenery and fresh air to cities. And open forest land has a medium ecological sensitivity.

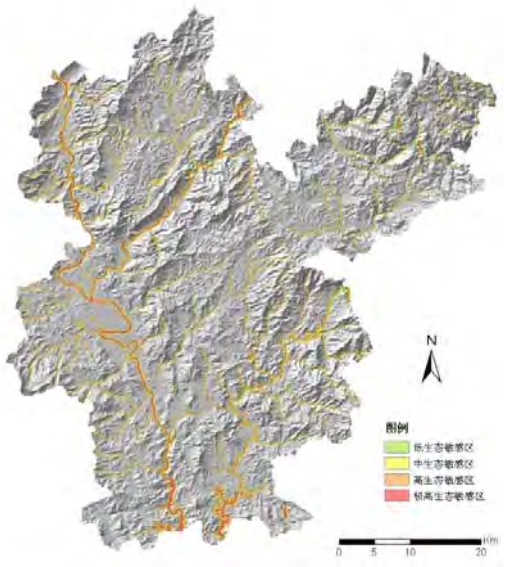


Figure 4 Hydrology factor analysis

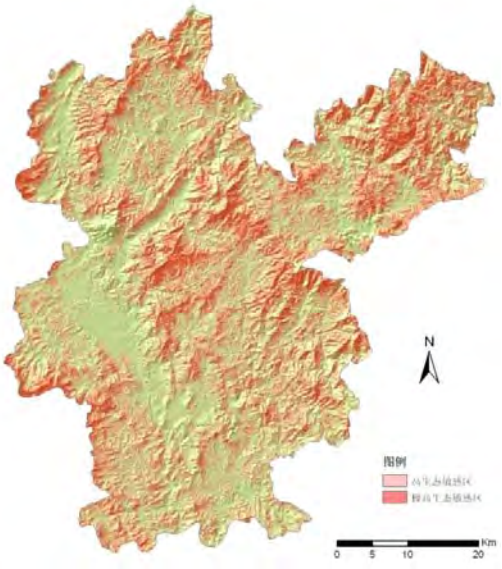


Figure 5 Forest factor analysis

(5) Farmland factor

Agriculture is the foundation of Shanghang County. Farmland can not only provide food and raw materials of industry, but also play an active role in improving ecological environment. Based on farmland factor, area that can be used as construction region (non-sensitivity region) is 97 square kilometers, merely accounting for 3.36% of total area in Shanghang County.

(6) Water source protection zone factor

Water resource is the necessary resource in social production and daily life, thus, water source protection is absolutely critical. The upper river where the water source locates is the high sensitivity region. So first-grade protection zone and second-grade protection zone have been set up, and these areas with surroundings have a high sensitivity.

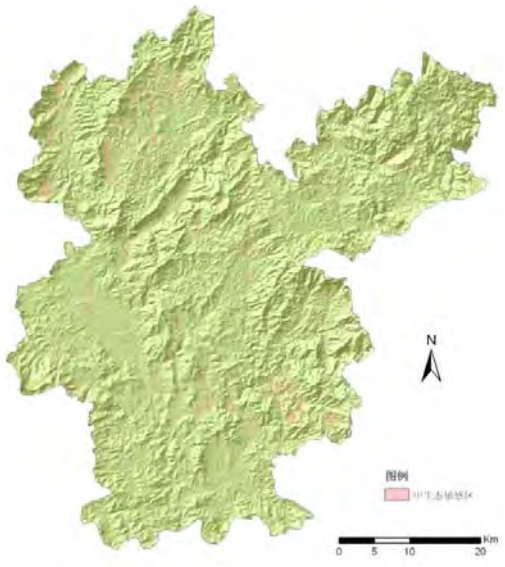


Figure 6 Farmland factor analysis

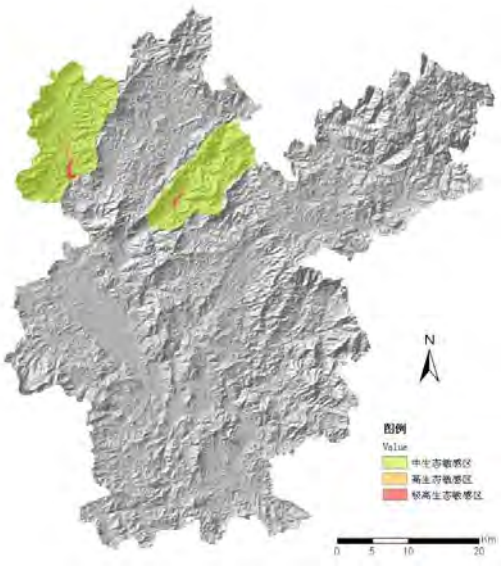


Figure 7 Water source protection zone factor analysis

(7) Nature reserve factor

There are abundant wildlife resources in South China Tiger Park of Plum Mountain (National nature reserve), Chinese Yew Ecological Park (National nature reserve), West Putuo Tourist Attraction (National Forest Park). Thus, nature reserve has a significant role in rare species protection and ecological environment improvement.

(8) Urban area factor

As the only artificial factor, urban area refers to the areas that have already been constructed, including urban and rural construction land. And urban area is classified as non-sensitivity region. The non-sensitivity region areas in Shanghang County is 160 square kilometers, accounting for 5.5% of total area.

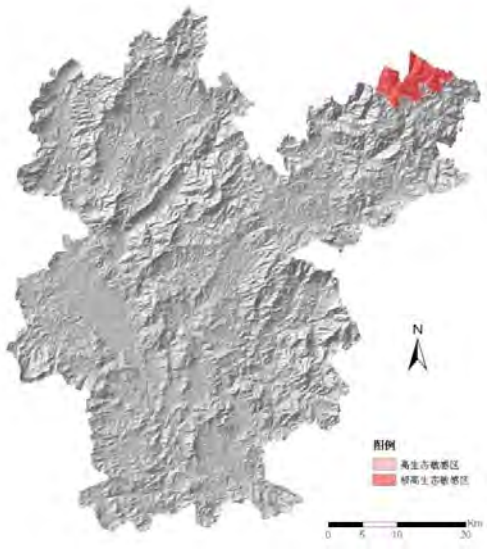


Figure 8 Nature reserve factor analysis

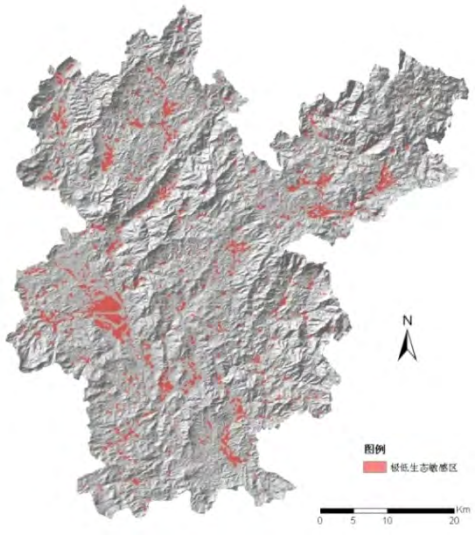


Figure 9 Urban area factor analysis

3.3 Analyses of ecological sensitivity outcome

According to superposition algorithm rules, we can get the comprehensive sensitivity regionalization map of Shanghang County. It is used to describe spatial distribution characteristics and differences of ecological sensitivity, and provide reference and foundation for further regional planning.

According to Tab.3.3 and Tab.3.4, the ecological sensitivity in Shanghang County is generally high. The area of extremely high sensitivity region and high sensitivity region is 2389 square kilometers, accounting for 78.4% of total area with most forest and water area. The area of medium sensitivity region is 315 square kilometers, accounting for 10.34% with most farmland. The area of weaker sensitivity region is 244 square kilometers, accounting for 4.83% with urban area surroundings. And the area of non-sensitivity region is 339 square kilometers, accounting for 5.89% with urban area.

Sensitivity Value	*Area*	*Elevation*	*Gradient*	*Primary Hydrology*	*Secondary Hydrology*	*Forest*	*Farmland*	*Water Source Protection Zone*	*Nature Reserve*	*Urban area*
Non-sensitivity	*339*	*1112*	*85*	*0*	*0*	*0*	*0*	*0*	*0*	*160*
Weaker Sensitivity	*244*	*269*	*669*	*58*	*40*	*0*	*0*	*0*	*0*	*0*

Medium Sensitivity	*315*	*258*	*940*	*44*	*36*	*626*	*97*	*281*	*0*	*0*
High Sensitivity	*944*	*205*	*911*	*64*	*27*	*727*	*0*	*3*	*5*	*0*
Extremely High Sensitivity	*1445*	*1060*	*298*	*9*	*36*	*299*	*0*	*3*	*40*	*0*

Table 4 Area of each sensitivity region(square kilometer)

Sensitivity Value	*Percentage*	*Elevation*	*Gradient*	*Primary Hydrology*	*Secondary Hydrology*	*Forest*	*Farmland*	*Water Source Protection Zone*	*Nature Reserve*	*Urban area*
Non-sensitivity	*5.89%*	*38.28 %*	*2.94%*							*5.50 %*
Weaker Sensitivity	*4.83%*	*9.27%*	*23.05 %*	*2.01%*	*1.37%*					
Medium Sensitivity	*10.34%*	*8.88%*	*32.36 %*	*1.50%*	*1.25%*	*21.55 %*	*3.36%*	*9.66%*		
High Sensitivity	*30.99%*	*7.06%*	*31.37 %*	*2.19%*	*0.93%*	*25.03 %*		*0.09%*	*0.16 %*	
Extremely High Sensitivity	*47.45%*	*36.51 %*	*10.27 %*	*0.30%*	*1.24%*	*10.30 %*		*0.09%*	*1.38 %*	

Table 5 Percentage of each sensitivity region(%)

Extremely high sensitivity region and high sensitivity region belong to environmentally fragile areas which can be easily destructed. And once destructed, it is hard to recover. So these two areas should be classified as construction prohibited area. Medium sensitivity region and weaker sensitivity region belong to relatively fragile areas and can be easily disturbed. So they should be classified as construction limited areas, and moderate construction should be under guidance. Non-sensitivity region has a less influence on ecosystem and should be classified as construction appropriate areas with intensive development.

Based on the analyses above, the area of construction appropriate areas is 339 square kilometers, accounting for 5.89% of total area. The area of construction limited areas is 559 square kilometers, accounting for 15.17% of total area. The area of construction prohibited areas is 2389 square kilometers, accounting for 78.4% of total area.

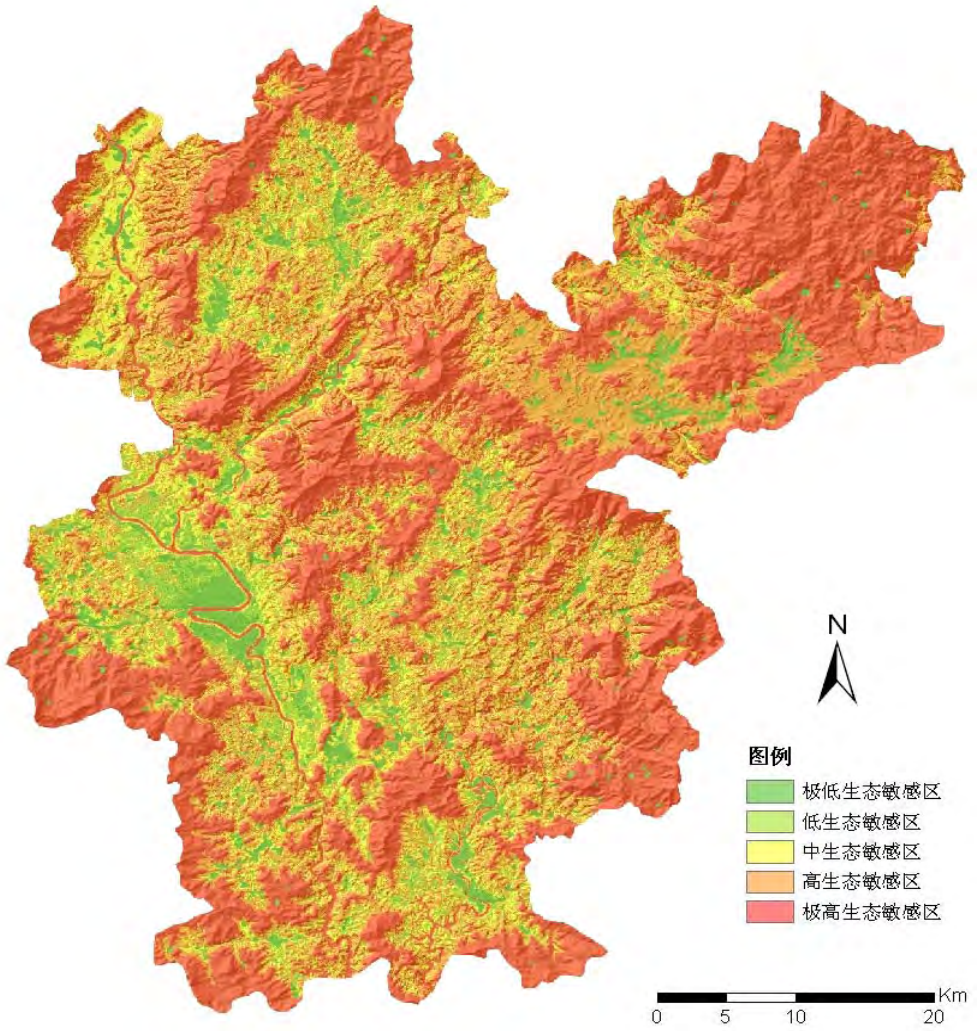


Figure 10 Comprehensive sensitivity regionalization map

4 Conclusion

This paper takes ecological urban planning in Shanghang County as a case, and studies the approaches of ecological sensitivity analysis. In the analysis, this paper selects eight factors: elevation, gradient, hydrology, forest, farmland, soil erosion, nature reserve and urban area. Then it gets comprehensive sensitivity regionalization map by superposition algorithm.

As the core of ecological urban planning, ecological sensitivity analysis focuses on urban planning from natural ecology aspect. Through identifying the sensitive areas, protection planning can be made to protect, preserve and recover these areas. And it can guarantee urban natural foundation from destroyed and promote urban sustainable development. Especially for water parameter, ecological urban planning could make better plans to reasonably save water parameter, resulting in using less water to create better environment.

Ecological sensitivity analysis in this paper is from natural and artificial aspects and selects eight factors based on Shanghang County present conditions. Then it analyzes each factor and presents through each figure. Finally it chooses the intersection to get the comprehensive sensitivity regionalization map. Due to intersection selection, the outcome possesses comprehensive consideration. Meantime, the classification of sensitivity is based on urban planning, biology, environmentology, etc. which is scientific and objective.

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An Analysis of the Characteristics of Sandu'ao's Raft Settlements In Fujian Province, China

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Abstract: Fishing and aquaculture are the traditional modes of production in the southeast coast of China. Sandu'ao, a bay in the north of Fujian Province, has become a concentrated breeding base of Croceine croaker and other seafood since the early 1990s because of its unique natural and geographical characteristics. A large number of fishermen began a long-term residence in floating rafts in the bay, therefore unity settlements with productive and residential functions have established. These settlements, with huge scale and distinctive spatial forms, reflect the special needs of this lifestyle excellently, and were perfectly integrated into the natural environment surrounding the bay. This unique human settlement system shows significant geographical features and the perfect fusion of human beings and nature.

Influenced by the increasing serious economic, environmental and social problems including the decline of the regional fishery and the degeneration of water quality, it is imperative to transform the traditional fisheries and reform fishing rafts. Through the investigation on the spot and the analysis of typical cases, this paper summarizes the layout features, elements and spatial characteristics of the traditional rafts in Sandu'ao. Then, this paper analyzes the threats which the fishing raft settlements encountered in the sustainable development in recent years, such as marine environmental pollution, decline of fisheries, and disintegration of social structures in the traditional fishing villages. To achieve the ecological sustainable development of raft settlements, this paper puts forward a composite industrial mode which could integrate the fisheries and eco-cultural tourism together.

Keywords: Raft settlements, Spatial characteristics, Layout features, Elements, Sustainable development

1 Introduction

Fishing and aquaculture are the traditional modes of production in the southeast coast of China. For thousands of years, the production methods of fishing are experiencing a constant evolution. In recent years, to avoid the risk of sea fishing and improve the stability of outputs, it became more widespread to build fish rafts in the offshore gulf region to carry out massive aquaculture. Lots of fishermen started to settle in fishing rafts perennially. These raft settlements, with considerable scale and unique spatial characteristics, fully reflect the needs of living and production and are integrated into surrounding environment well. It became a noteworthy regional phenomenon of human settlement.

Sandu'ao, in Ningde Fujian province, has the largest Fish Breeding Rafts at sea in China. Sandu'ao cage culture area is continuous on the sea, stretching over dozens of square kilometres (Figure 1). There are about 20,000 fishermen, mostly fed Croceine croaker (Pseudosciaena crocea). Sandu'ao fish rafts are not only larger, but also well developed with modern facilities including community agencies, police stations, stores, restaurants and entertainment facilities. The raft settlements are almost the same as the villages on land. The amazing scale of Sandu'ao fish rafts is mainly because of Sandu'ao special natural environment, as well as its development history.

Such special form of these settlements is the embodiment of the harmonious and friendly relationship of fishermen and sea. And it reflects the fishermen's dependence on the sea, the changes of production and life style, as well as the characteristics of fishery culture of China. However, because of environmental, economic, social and other aspects of threats, it is necessary and essential to strengthen the research of Sandu'ao raft settlements.



Figure 1 Aerial view of Sandu'ao raft settlements（Source:by author）

2 Natural characteristics and its development history

2.1 Location and topography

Sandu'ao is situated in Ningde Coast, northeast of Fujian province, and north of the Taiwan Strait. Geographical coordinates is 26 ° 18 ' ~ 27 ° 40 ' north latitude, 118 ° 32 '~120 ° 44 ' east longitude. It is located in the middle section of the coastlines of China (Figure 2).



Figure2 Regional Plan of Sandu'ao(Source:by author)

Sandu'ao consists of 5 single islands including Sandu, Qingshan, Doumao , Baipao, Rooster hill, one peninsula named Cheng'ao, 14 islets, 17 reefs, 5 tidal lands , Guanjing Yang and Fuding Yang (both are waters). The total water area is 714 square kilometres.

The natural geographical condition of Sandu'ao is superior and rare. Sandu'ao is a marine Lake surrounded by mountains. There is only one sea gate named Dongchong in the southeast, which is about 3 kilometers wide. Sandu'ao is located in the estuary of Huotong Creek, Qidu Creek and Saisan River, and in the northwest of the undersea fault zone of Pucheng-Ningde. The islands outside the sea gate, developed by fault zone, stop the wave. These conditions make the sea of Sandu'ao deep, open and calm, therefore it is the one of main habitats of Croceine croakers(Wang,F. and Wang,E.2009).

2.2 Climate

Sandu'ao belongs to the subtropical maritime climate. The annual average temperature is 13.8~19.3℃. The annual average rainfall is 1616~2143mm. The climate is humid, with the characteristics of maritime monsoon climate. Typhoons and rainstorms are frequent in Sandu'ao, which result in large flow of rivers. A large amount of nutrients are taken into estuaries for the growth of the fish in the estuary(Wang,F. and Wang,E.2009).

2.3 From living in the ship to settling in the sea

Guanjing Yang in Sandu'ao is the well-known natural growing region of Croceine croakers in China. Sandu'ao is the bedrock coast with curved shore line, steep cliffs, and deep seawater. Those features make Sandu'ao the convenient place for Croceine croakers' migrating and spawning(Wang,F. and Wang,E.2009). According to the statistics, gross amount of fishing of Ningde city was 1214 tons until 1949. Since then, the fishing industry developed rapidly, and the amount of fishing increased year by year. Gross fishing amount reached more than 3,000 tons in 1970's.

Over fishing has bought Croceine croakers to a death end. As a result, the government issued orders to limit or ban fishing in order to ensure continuation of Croceine croakers. Because of the deep, open and calm sea area of Sandu'ao, it is suitable for the growth of Croceine croakers. And it provides the conditions for developing large scale of fishery aquaculture. Moreover, due to the history of Sandu'ao, port development is at standstill. It offers plenty of space for the development of fish rafts. Since the middle of 1990's, artificial propagation of Croceine croakers and cage culture has succeeded in Sandu'ao, and widespread soon. In order to meet the change from fishing to aquaculture, some simple cabins built by fishermen on fish rafts were gradually emerged in Sandu'ao. Today, most of fishermen in Sandu'ao make a living by culturing Croceine croakers, and they also aquaculture abalone, turbot and other aquatic products according to the seasons.

During the time of underdeveloped aquaculture and sea fishing, fishermen lived in their fishing boats. Along with the development of fishery and widespread of cage culture, fishermen began to settle down in the sea. They are working and living in fish rafts, which forms a unique "raft settlements on the sea".

3 Layout features and its elements of fish rafts

3.1 Layout features

3.1.1 Site selection

The location and layout of the fish rafts are closely linked with fish growth and the service time of fish rafts. The layout of Sandu'ao fish rafts is relatively concentrated, usually along the coastline or island edge. As seen from the satellite photo, most fish rafts are located in the

south of mountains and islands. For example, there are lots of fish rafts located in south of Dahu hill, Sandu Island, Qingshan Island and Dongan Island. The sea between Qingshan Island and Dongan Island is covered with a large number of fish rafts. Some fish rafts are also located on the both sides of the Dongchong sea gate (Figure 3).

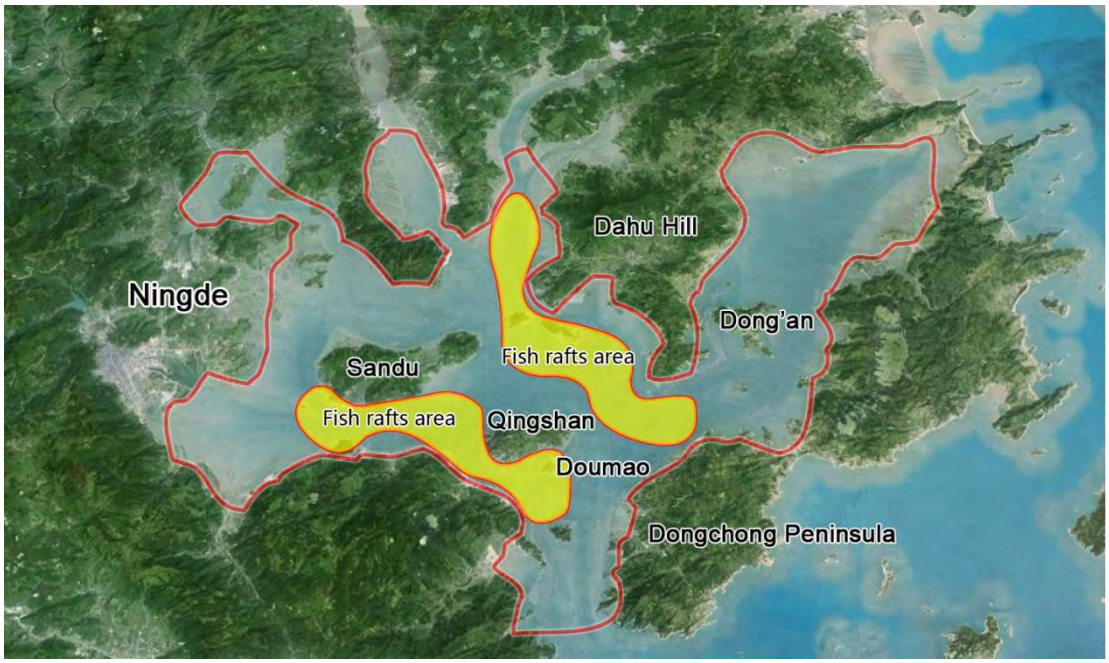


Figure 3 Layouts of fish rafts in Sandu'ao(Source:by author)

Many reasons are contributed to this kind of layout. Firstly, fishermen can manage fish rafts and get supplies conveniently near shore. Secondly, near-shore water exchange capability is weak, so fish rafts and aquaculture cages in this area are more stable than other place. Weak water exchange may also retard the diffusion of feed and prevent feed from being taken away by the currents too fast, then reduce the impact of growth of cultured fish. Lastly, the south of island is sunny, and the water is warmer, which are benefit for the survival of cultured fish.

3.1.2 Spatial Characteristic

The spatial characteristic of fish rafts is usually a regular rectangle, because the cells to form a raft are 4*4 meters wooden boxes. Due to the shape of the shoreline, some fish rafts are irregular polygons. The size of the fish rafts are mostly 70*100 meters. According to fisherman's management scale, fish rafts area may be greater. But these larger rafts are not expanded along the shoreline, but radial continuous in a direction perpendicular to the shoreline (Figure 4). There are channels with about 10 meters wide between the fish rafts for

ships passing.

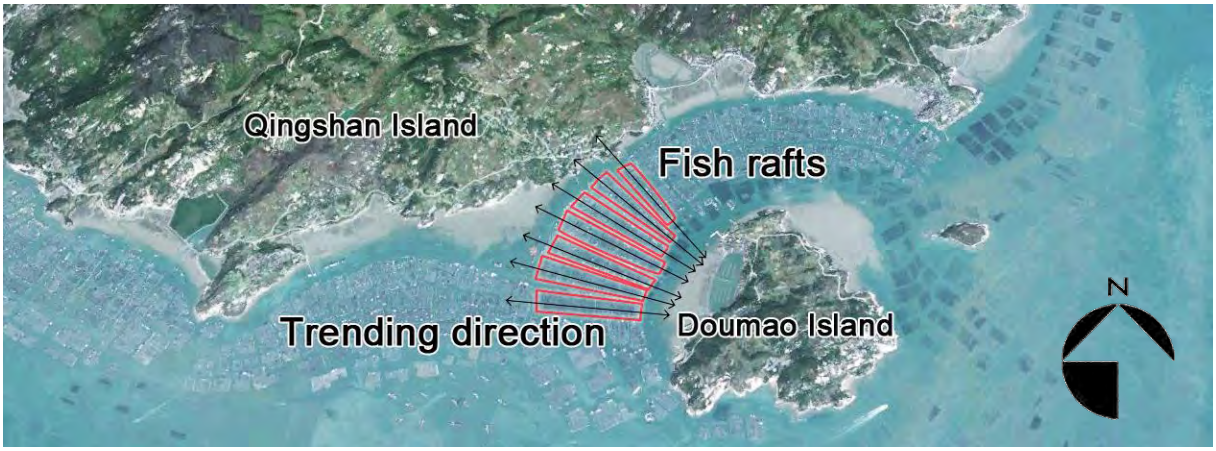


Figure 4 The distribution of fish rafts(Source:by author)

3.2 Elements of fish rafts

3.2.1 Production unit

- *The aquaculture cage*

The aquaculture cage consists of woods and plastic float balls. The basic framework of the aquaculture cage is made with 9 wooden boxes. The wooden board is usually 12 cm long, 7 cm thick and 28-30cm wide. These boards are fixed by screws. The material of float balls under the boards is usually polystyrene plastics. The buoyancy force of each float ball is about 150 kg. Each box has 8 balls. Fishermen may increase the number of float ball in areas with larger water current velocity(Gao,C. 2011). The fishing nets are hung up on each wooden box to feed the fish. The depth of these nets is usually 3 meters, 6 meters or 9 meters (Figure 5).

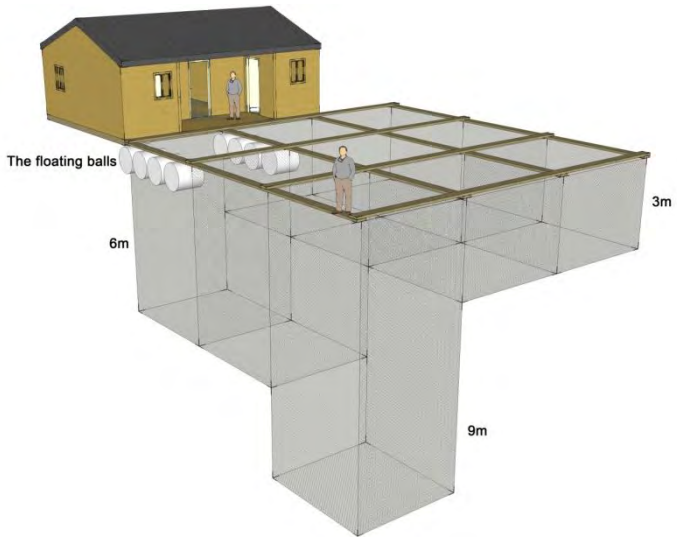


Figure 5 The basic framework of fish rafts(Source:by author)

■ *The workbench*

Every fish raft will have at least one workbench (Figure 6). The workbench is usually located in the outboard of fish rafts and close to the main channel. It is convenient for fishermen to receive the feed carried by fishing vessels. The workbench tends to be more simple and crude. It is a shed opening on all sides with a fees slurry machine. Fishermen put the feed in the workbench and making mixed fodder to feed the fish.



Figure 6 The workbench（Source:by author）

3.2.2 Residential unit

Due to working in the fish rafts for a long time, fishermen build residential cabins in the rafts. The cabin is usually built far away from the main channel to reduce the influence to the cabin from the waves caused by the passing fishing boats. Electricity is transmitted to fish rafts by the wire. Freshwater needs to be purchased from the villages on the shore.

Sandu'ao fishermen's cabin usually is 1 storey. some rich fishermen may build 2-storey cabins with adequate facilities. The building plane of cabin is usually square or rectangular. There are many small windows distributed regularly in the wall for ventilation. Living room is the largest room, sometimes combined with semi-outdoor platform, with the main function of eating,

resting and recreation. On both sides of the living room are small bedrooms which can only accommodate only one bed. A toilet and a kitchen are located in two sides of platform respectively. The toilet facilities are very primitive (Figure 7).

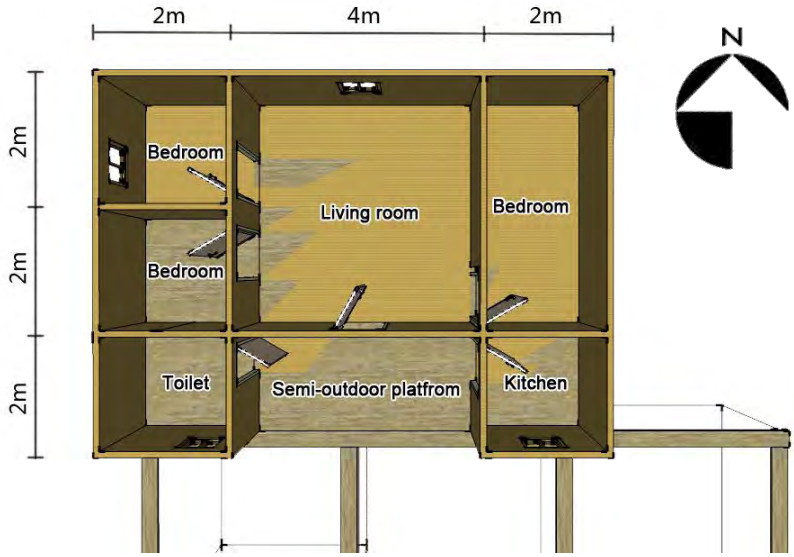


Figure 7 The building plane of cabin in fish rafts(Source:by author)

3.2.3 Other functional facilities

Other function facilities in Sandu'ao fish rafts are fully equipped, almost the same as the villages on land. Sandu'ao fish rafts are floating villages on the sea. There are streets, door numbers, community management agencies (Figure 9), police stations (Figure 10), clinics (Figure 11), churches (Figure 12), supermarkets, restaurants, karaokes, mobile business halls, sea buses, and so on.





Figure 9 Community management agency(Source:by author)Figure 10 Police station(Source:by author）



Figure 11 Clinic（Source:by author）



Figure 12 Church（Source:by author）

4 The current problems and influential factors of fish rafts

Environmental, economic and social problems come along with the continuously development and maturation of fish rafts in Sandu'ao. For instance, Seawater pollution threats the environment that aquaculture relying on. The high incidence of fish diseases and fluctuations of seafood market lead unstable income of fishermen who are only making a living of fisheries. The poor infrastructures at fish rafts make fishermen living uncomfortable and dull. With the improvement of farms living conditions in shore, living on sea is becoming unattractive. Government proposed new position and direction for Sandu'ao... These problems resulted in decay of fish rafts in Sandu'ao—— aquaculture staffs are reducing, fish rafts are becoming smaller or abandoned directly. Sandu'ao fish rafts are facing severing threats at present.

4.1 Environmental issues and influential factors

Sandu'ao is an unusual bay because of the narrow sea gate and deep seawater. There are lots of islands in the sea area and the water is not active, which benefit for the siltation. The exchange of near-shore water is poor, which slowed the spread of pollutants to some extent (Lin,Y.2007).

In recent years, the pollutants of industrial pollution, domestic pollution, agriculture pollution, aquaculture pollution, ports pollution, and ship-source pollution are discharged into coastal seawaters through rivers transporting, port ship (direct or mixed) emissions, sewage discharge, sea water aquaculture, and so on. Based on relative investigation and analysis, the water quality of Sandu'ao has been obviously deteriorating. The water quality of Sandu'ao in 2003 belongs to Level IV(In China, the sea water quality is divided into 4 levels according to Chinese Sea Water Quality Standards. The quality is decreasing from Level I to Level IV.). In 2004, the water quality in Tanwan and Jiaotou area is worse than Level IV, Guan Jing Yang is

Level III, which all belong to severe pollution level. In 2005, sea water quality of Sandu'ao is Level IV. Although the water quality is recovered to a certain extent, it still can't meet the functional requirements yet. The main pollutants are inorganic nitrogen and active phosphate, and eutrophication of sea water is serious(Xue,L.and Lei,Y.2006).

Water pollution is directly related to the viability and living environment of farmed fish and shellfish, and the quality of aquatic products as well. Water pollution can also result in the decline of living conditions of rafts settlements and the decreasing of, the areas of fish rafts and the number of fishermen.

4.2 Economic issues and influential factors

Sandu'so fishermen's income are almost all relying on fishery aquaculture, but the high incidence of fish disease and fluctuations of market lead to serious economic losses, then more and more are giving up fish rafts aquaculture.

Since 2000, Sandu'ao witnessed mass death of Croceine croakers every year. According to the statistics from the fisheries sector, the death of fish resulted from diseases annually occupied 20% of the entire output of Croceine croakers . At least 10,000 to 20,000 baskets of large Croceine croakers had to be sold in advance for fish diseases. Fish disease brought about 200 to 300 million yuan economic losses each year.

Influenced by the international financial crisis, the economic situation of Korea, the major target country of aquatic products export, was grim. As a result, export orders declined sharply, which brought a big hit to Sandu'ao aquaculture. Meanwhile, many fishermen's economic damage came from the copycat culture. It might lead to oversupply of aquatic products in the market.

4.3 Social issue and influential factors

In recent years, along with the rapid social development in China, the towns nearby Sandu'ao are experiencing fast development, and living conditions are superior to fish rafts at sea. Living in fish rafts becomes less and less attractive.

The life of Sandu'ao fishermen is boring, lonely and risky. They eat and live almost all on fish rafts, and repeat their life day after day, including feeds trade, and fish feeding, etc. At night the only entertainment is watching TV or playing cards. Occasionally, their family visit fish rafts, but leave soon for shakable house and foul smell at sea and no longer willing to live in the sea.

Moreover, the biggest threat to sea life is Typhoon. It may destroy the fish rafts. Though the revenue of aquaculture is high, the risk is higher.

Since living at sea for fishermen is unattractive, many fishermen choose to be back to shore farming or working in city to earn a living instead of operating fish rafts. The reductions of fishermen and fish rafts make a great impact to such a special production and life style of fish rafts in Sandu'ao.

In 2008, the Government of Ningde issued a development planning for Sandu'ao. Until 2020, Sandu'ao will focus on the development of modern logistics and port industries. There are two reasons to choose these two industries. The first reason is the growing demand for port traffic from the surrounding areas. Deep-water and large scale development of world water transport will change the pattern of coastal ports in China. The development of Sandu'ao deep-water port resources can remedy the insufficient unloading capacity of ports the Yangtze River Delta and along Yangtze River. The second reason owns to the aggregation trend of heavy industry to deepwater port. The further dependence on foreign countries of energy and mineral resources of China and the further integration of heavy industries will accelerate the transfer of heavy industry to coastal areas. Deep water shoreline has been the important resource of port industries and logistics industry. The resources of deep-water port shoreline in Sandu'ao are rich and mostly undeveloped, which has a high potential and value in Southeastern Coast China. This is the advantage to develop port industry with large scale.

However, the development of modern logistics and port industries will break the existing industrial structure in Sandu'ao. The status of fishery will fall dramatically. Meanwhile, with the construction of logistics port, fish rafts will step down for the port, and the area of fish rafts may reduce significantly. Port industries are mostly heavy industries. The impact on marine living environment and conditions of fishermen is inevitable. These changes are a big shock for the development and continuation of raft settlements in Sandu'ao.

5 Conclusions

Sandu'ao fish rafts are large in scale and developed well. Their significant feature is to make full use of local superior natural environment for marine aquaculture, and to combine production with life. It forms a distinctive "settlement on the sea".

However, the drawbacks of simple aquaculture industry in Sandu'ao are well known now. It is not conducive to the protection of the environment and sustainable development. So, industrial transformation is necessary and essential for Sandu'ao to obtain longer vitality . Government and the fishermen should combine tourism with aquaculture, and develop experiential leisure fishery. The leisure fishery, including sea fishing and fishermen life experience, can not only richen Sandu'ao tourism, enhance marine tourism level, but also spur the development of ship fishing, resorts, entertainment places, hotels, catering and other related services. It can also increase employment and promote fishermen's job transfer (Chen,J.2010). Meanwhile, it can optimize the traditional methods of aquaculture, and advance the development of complex marine aquaculture industry. Intercropping of fish, shellfish, algae and shrimp can achieve high yields, and reduce marine pollution as well.

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Track 6: Ports, Transportation and Infrastructures

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Morphologic Assessment of Istanbul Beyoğlu Peninsula In the Process of Reproducing the Urban Waterfront.

Melih Birik, Kırklareli University, Turkey

1. Integration of Beyoğlu Waterfront with Existing Urban Morphology.

"Water", the main signifier of Istanbul had different meanings for the city specifically starting from Haliç (also known as the Golden Horn) to the Bosphorus. During the long period of urbanization, Haliç became the backbone of integrated historical sites that encounters different morphologic characteristics. Despite deep cultural, social and geographical roots integrating its identity with the water, today Istanbul's city centre is under the risk of turning its back on the waterfront because of currently planned spatial interventions. Lack of connections and flows are separating this vibrant city centre from the coastline. In this assessment, the spatial qualifications of the waterfront of Beyoğlu Peninsula will be examined according to morphologic values in order to re-associate it with its hinterland.

During the 1950s and 60s, a modernizing ideology of new production methods guiding the spatial planning policies had transformed the waterfront of Istanbul, creating barriers between the city centre and the water. Especially, along the Beyoğlu Peninsula following the coastline from Besiktaţ to the Haliç shipyard the barriers have a massive effect. While the new urban planning ideology of the 80s was predicting the decentralization program for waterfront, the city centre have had a new chance to create the potential for the use of spatial voids within the solid structure of the old urban fabric. Unfortunately, during the last decade, these potential public areas, consisting of warehouses, shipyards, industrial plants and customhouses of mostly industrial heritage buildings were enclosed in privatization programs under the guidance of a real estate market based on certain urban transformation policies. İstanbul's waterfront; without any spatial or social context of a holistic plan, is needed to be understood as a part of an existing urban morphology and assessed as potential public area where city meets the water again.

For Istanbulies, reaching the Bosphorus and touching the water not only reflects the desire for public space as envisioned by western culture but also the way of living and the meaning of being part of Istanbul. Hence, these potential areas of transformation are not expected to serve just the need for parks, open spaces, jogging paths, picnic areas or culture centres and museums, they are important to reconnect the city to the water because of their importance for local identity.

This assessment is aimed at determining how to integrate the waterfront into urban morphology through using the basic information obtained from spatial questioning and examining the mappings of urban corridors and the desire of flows.

2. Integrated Urban Morphology of Central Istanbul



Figure 1: Istanbul Water Corridors

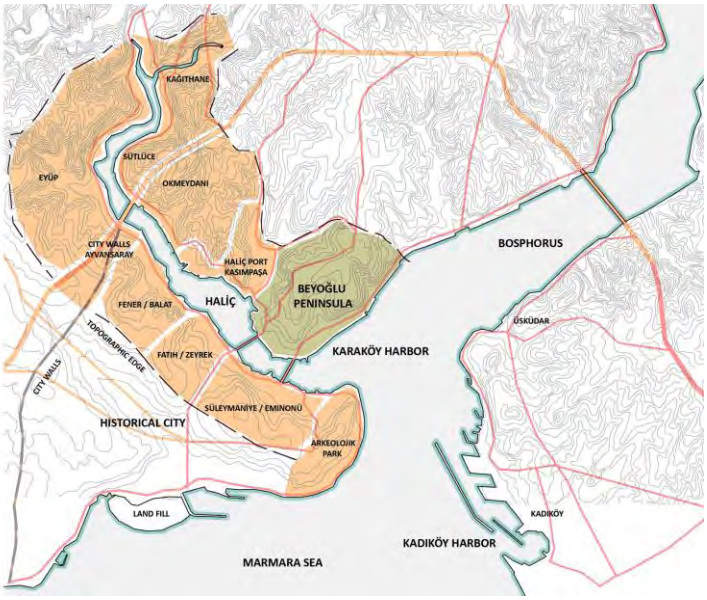


Figure 2: Haliç, Integrated Urban Network

Central Istanbul's spatial development has a strong relation to its coastlines. The Bosphorus, Haliç and Kadıköy coasts line three major water corridors connecting the urban structure. The Beyoğlu Peninsula as the centre of these corridors has a strategic importance for these systems. The Haliç corridor has been playing an important role in the development of the city through time because of its location facing the old city centre and as the inner harbour. Over the centuries of its urbanization period the Beyoğlu Peninsula has been the key to Istanbul's connection with the world outside. Karaköy Harbour still serves as a cruise port and carries the mission of international linkage. To the north, the Bosphorus corridor connects the city centre with former coastal villages and serves as a public transport route. At the beginning of 20th century, piers, small harbours and docks along the Bosphorus have been used as the stepping stones for urban development until road networks connected these settlements across the land. The Kadıköy coast has not only connected Istanbul to the world with its container port, but links the Asian side of the city to the historical centre.

The Haliç corridor diverges from the other water corridors when considering the assessment of the area as a whole. This natural harbour served as a backbone network to stimulate central urban development at each historical period and hosted the contemporary needs that eventually transformed the city. From this point of view the Haliç corridor can be considered as an incubator for urban development in control of the Beyoğlu Peninsula. Haliç-born transformations had holistic effect on urban structure and left traces of exciting urban morphology on the citiy's architectural, historical and cultural urban heritage. Today's "urban voids" along the coastline are the traces of this heritage awaiting new urban transformation.

It is still possible to observe the integrated structure of different subzones and districts along the both sides of Haliç as Süleymaniye, Eminönü, Zeyrek, Fatih, Fener Balat, Eyüp, Okmeydanı, Kasımpaşa and Beyoğlu.

Throughout their history, the urban morphology of the historical peninsula and Pera, at the tip of Beyoğlu, was driven by events and facts dependant on water. Although the settlements along the Bosphorus were developed to take advantage of waterline transportation, the urban pattern of Beyoğlu Peninsula was developed according to different urban dynamics (Kuban, 2010). Beyond the walled city of old Galata, the 16th century urban morphology of

the Beyoğlu Peninsula started to develop on the hilltop due to the construction of consulate buildings. This urban pattern expanded to the waterfront, following the development of Pera, and fed from the coast through piers and docks located at Karaköy and Tophane.

The Tophane distiric, with a suitable topography for open public spaces has been a focal point for social integration. The Kılıç Ali Paşa Mosque and Ottoman public buildings - bath, school, and fountains - defined the area during 16th century (Müller-Wiener, 1977). In the following periods, this area has been used for military and industrial purposes due to logistic and strategic reasons. The Ottoman modern army and artillery compound gave an identity to Tophane. The existing docks of Galataport have been built during the transformation period of the modern Turkish Republic. The Haliç shipyard, since 15th century, has been the industrial innovation spot and engineering bay for reforming Ottoman Empire and has been used for civil purposes until recent time. Throughout history, the small ports and piers connecting the historical city centre across Haliç have created a picturesque effect of Istanbul perceived. Beyoğlu watching the old Istanbul is what makes it meaningful.

The case of this assessment of today's waterfront of the Beyoğlu Peninsula, starts from the Halic shipyard, continues through Perşembe Pazarı, Karaköy Square, Karaköy Port and warehouses, Mimar Sinan Fine Arts University, Findikli Park and the Kabataş Transfer Station. The total length of the waterfront is 3.8 km. long.

3. Planning, Investments and Desires

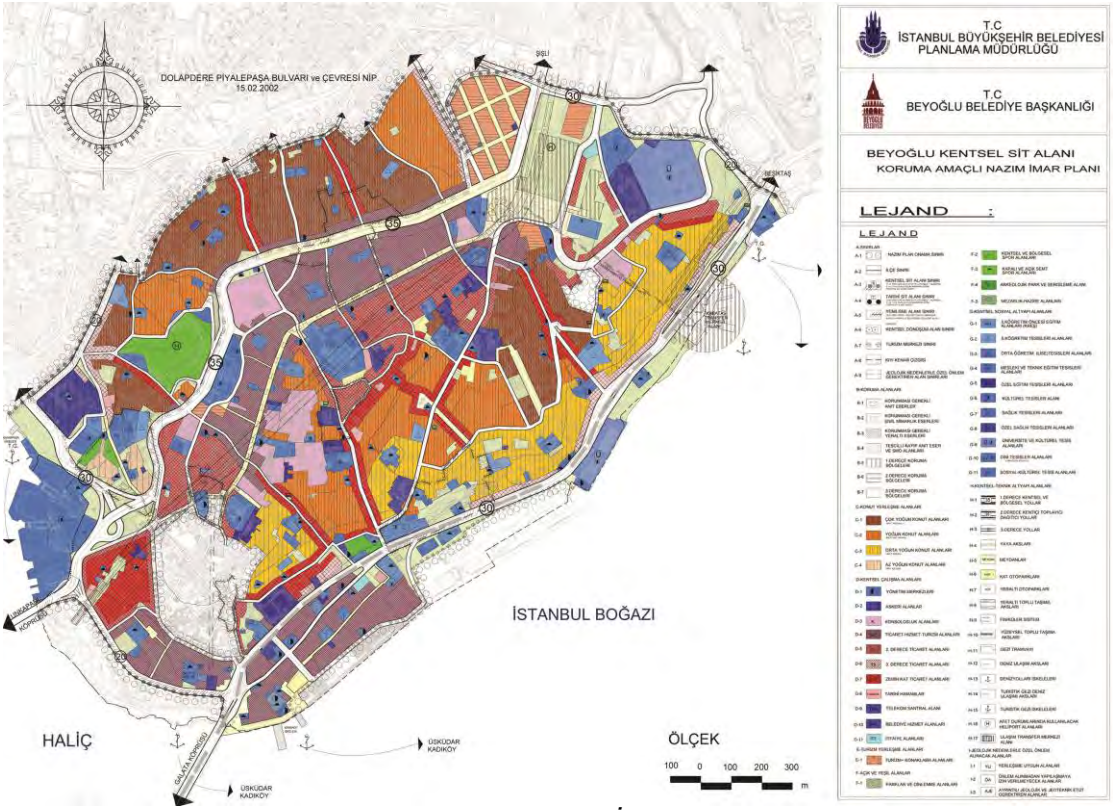


Figure 3: Beyoğlu Urban Conservation Plan (İstanbul Greater Municipality, 2010)

Planning process of this unique historical and cultural side became the bone of contention during last 5 years. Finally, The Beyoğlu Urban Conservation Plans (2010) have been taken to administrative court and were cancelled due to not being compliant with upper scale plan decisions and not consisting of participatory planning models (10th Administrative Court, İstanbul. Decision Number: 2013/1665, Issue: 2011/1094). Also, the partial approach of the plans has been criticized. Unclear decisions in the plan revealed it to be a tool for investors rather than a plan for conservation.

In addition to unique historical settlements like Galata and Pera there are also important spots like the Haliç Dockyard, Persembe Pazarı, Karakoy Port and Galata Port which are currently under discussion for urban transformation. Despite their importance, the urban space of Persembe Pazarı and Karaköy coastline are being shown as urban voids in the plan. In fact, this is the waterfront of the Beyoğlu peninsula and also of its potential public spaces. In addition to that, part of Galata district, one of the vital and productive spots of the city was defined as touristic area and again shown as an urban void in the plan.

It possible to see that, the plan was prepared to protect the interests of the investors, not having any participatory tools and aiming at a specific target. One of the crucial items of the plan is to base the approval of the projects on principles defined by the investors and the architect.

Another item is to open the current urban voids between the building blocks to public use as parks, gardens and parking lines. This approach would also create a deformation in the existing urban pattern and destroy the characteristics of Beyoğlu. One of the important characteristics of Beyoğlu is the relationship of the road pattern with natural morphology. The connection of narrow roads with stairways, hills and roads defines the lifestyle of the area. It is visible in the plan that major interactions are planned for this area like transforming some stairways to roads. These interactions will cause deformation in neighbourhood characteristics.

The Turkish Privatization Administration opened the Galata Port Project to private investment in 2005. Tendering has been realized after two attempts in 2013 and operating rights given to private investor for 30 years as a part of build – operate - transfer model. Different architectural concept projects and programs were designed and declared to the public without any participatory process. It is possible to understand how it approached the design process by looking at one of the project reports; *"the study addressed strategic planning, market analysis, zoning analysis, concept development, program definition and options appraisal for redevelopment of this site. The team also prepared a master plan and urban design strategy which would unlock the development potential of this site."* (Visionnaire Development Consulting Ltd., 2014). Master planning and urban design issues for such a unique environment should not be the project of an individual architect but in fact, in the absence of a holistic and participatory planning strategy, projects create their own approach for the city. This willingly preferred upside down strategy is a useful tool for the investor and the government to maximize the income at the cost of losing the urban identity and creating a false vision for the city.



Figure 4: One of the Architectural Proposals for Galataport (Concept Design Proposal of Visionnaire Development Consulting Ltd., London)

4. The Need for Urban Morphology Analysis

As it was described at the former passages, the Beyoğlu peninsula waterfront has become a new frontier for Istanbul, full of opportunities and risks. It is also the new battleground for public and private interests. Urban planning experience has no satisfactory outcome to guide contemporary tendencies for the new development of the waterfront as a whole. Partial projects based on architectural solutions are being encouraged to reach a fast, pragmatic implementation but it is easy to say that they don't come near to answer the public needs and desires.

Within these complex circumstances, the existing urban morphology is the key to be recalled to understanding the facts and the needs for the Beyoğlu peninsula. It is necessary to perceive the area as the part of an integrated urban structure and the backbone network. This network cannot only be defined through physical urban components of streets, squares, paths or natural qualifications of hills and waterfronts. Desires flowing through urban paths and corridors transferring the physical structures to a vibrant network are important components of the system. These horizontal relations define the culture of Istanbul and create the meaning of place rather than what predefined mega projects try to impose. Deleuze (Sutton; Martin-Jones, 2008) explains such a composition of multiple information combined to gather in rhizomatic networks. Without flows of desires in public space, physical components become theatrical decorations for touristic events. It is clear that decentralization of existing multilayered functions and creating pseudo environment without considering the existing networks can not employ the needs of this vibrant city centre. As Dowey stated (2005)," The spatial network or field is material condition rather than a discursive or symbolic practice. However, spatial structure has a key linkage to such issues in that it frames and mediates access to certain forms of place experience". In the case of the Beyoğlu peninsula where the heart of the city is located, principally the first design criterion of an architectural project should be to give the answer to the question of how to be connected and be a part of the existing urban networks.

Therefore, analyzing urban morphology is needed to predict existing flows and desires and to guide the planning process and determine the linkages for further implementation projects.

4.1 Relation of Urban Fabric and Topography



Figure 5: Relation of Urban Fabric and Topography

It is clear to see the diverging urban patterns lined up at the upper hill between 70 to 50 meters level though out the peninsula. Galata – and its old urban pattern of narrow streets where the social interaction is increased - is followed by the Tünel and Şişhane districts. The touch of modernity is visible in Şişhane in the straight lines of 19th century roads and the traffic junction of 1982. Tunel, Galatasary and Taksim districts occupy the plains of the hilltop. Below the hilltop at 60 to 40 meters the Cihangir district and building blocks are located where neighbourhood characteristics exist. The Tophane area is located at the lower level where the topography is mostly flat and exhibits a mixture of different urban patterns. These opposing characteristics identify the use of the public space. In spite of this rich dense urban fabric, there are only two accesses which exist at waterfront to connect with the Bosphorus. They are Karaköy Square and the Fındıklı Park. The rest of %78 of the waterfront is not open to public use.

4.2 Existing Urban Flows and Corridors

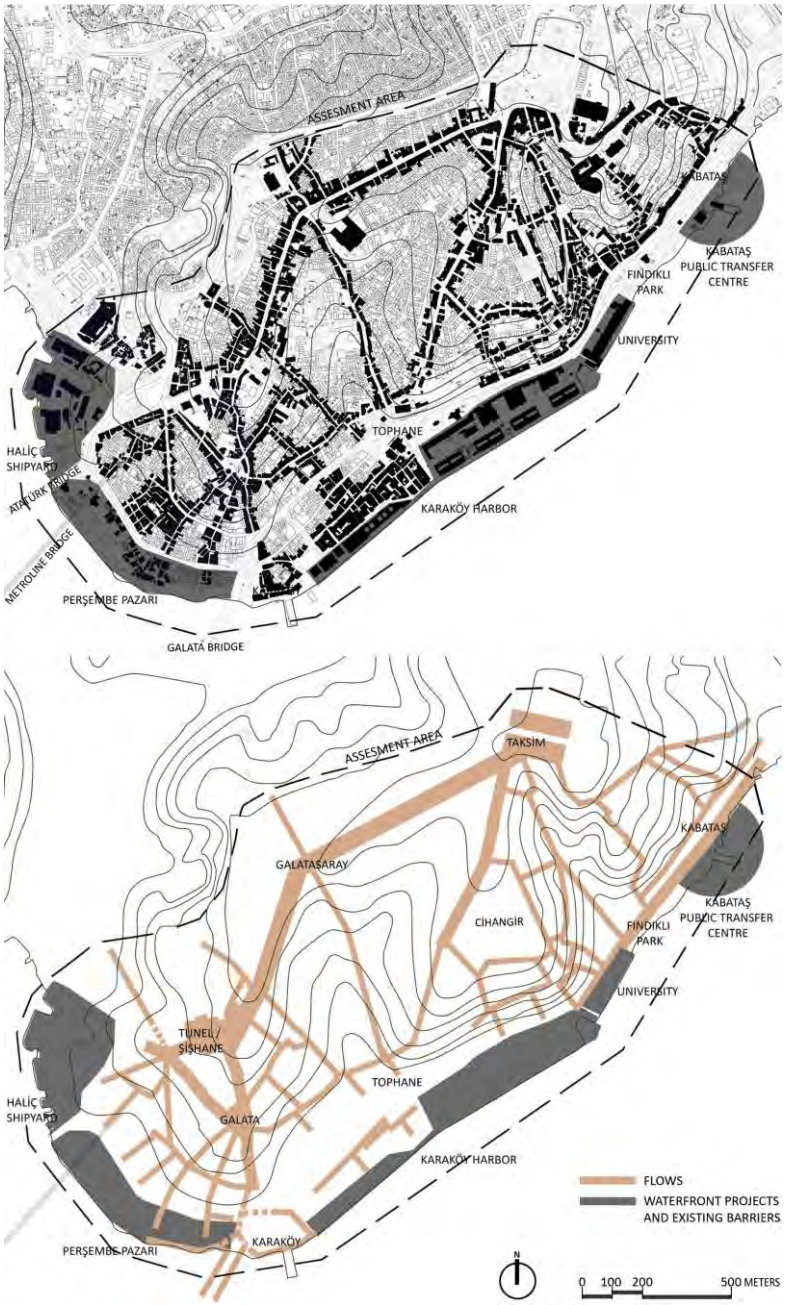


Figure 6: Existing Corridors and Flows

The main pedestrian movement of the assessment area occurs between Taksim and the Tünel Central Business District. The vibrant İstiklâl Street guides the dense flow through Galata where multilayered urban functions define the public space. This flow dissolves in the urban texture and only has a chance to reach the waterfront via Karaköy Square. Activities behind the Karaköy Harbour have a limited connection to attract this flow to the area although potential public space is promising. The Tophane district is the only corridor connecting the centre of İstiklâl Street to the coastline but there is a limited access to the waterfront through the security gate of Modern Art Museum and yet it is not possible to reach to the water because of the customhouse and the port. Taksim Square has two major connections to waterfront. These are also fading into Tophane and Cihangir neighbourhoods. The only only access to the waterfront is the Fındıklı Park. This area is also under the risk of losing its uniqueness because of the planned public transfer centre at Kabataş. It is clear to observe the lack of linkage between the hinterlands and the waterfront.

5. Hinterlands

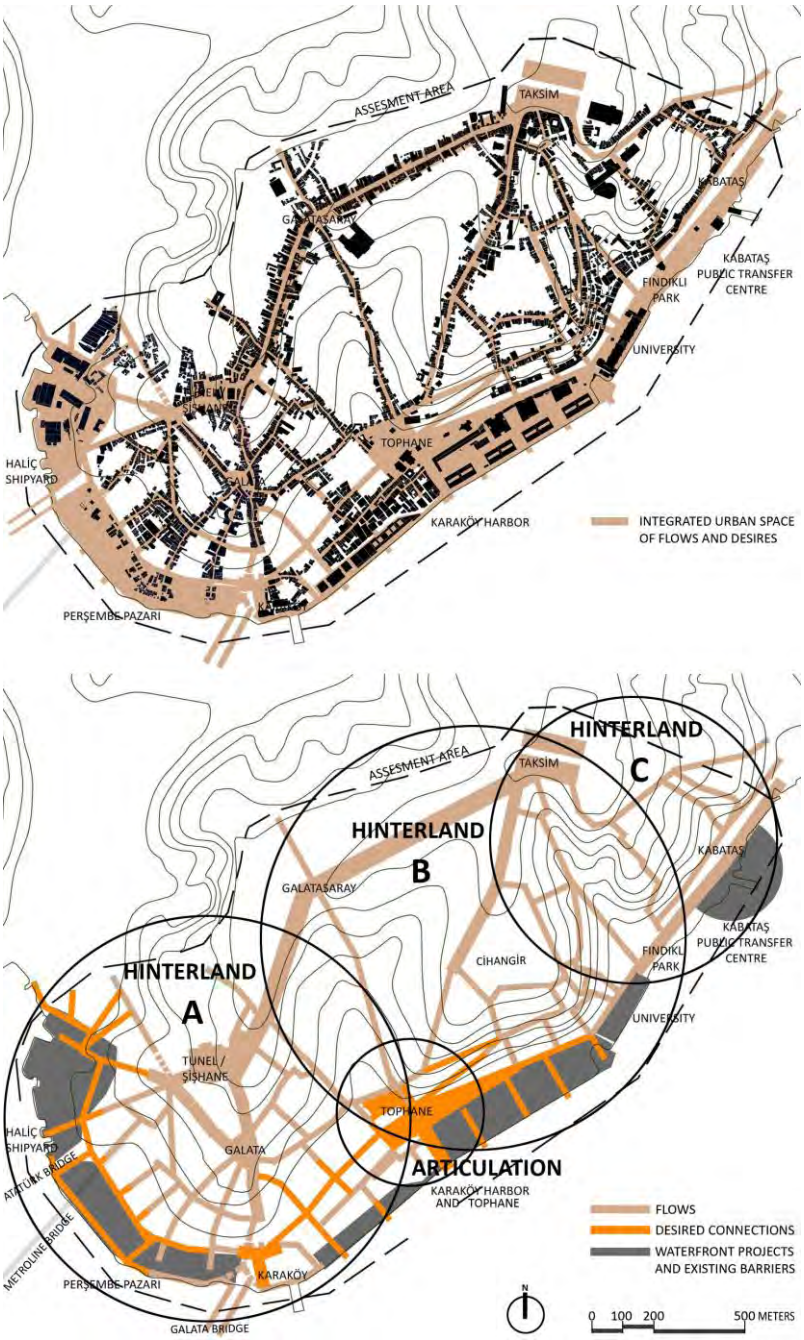


Figure 7: Prospective Linkages, Potential Public Spaces and Hinterlands

According to determined existing urban flows and corridors, it is possible to classify the study area in to three hinterland zones. Each zone relates to the topographic qualifications and the orientation of the Peninsula.

Hinterland A: Şişhane, Tunnel and Galata districs.

Haliç port is along the coast line of the Şişhane district that has no connection to the hillside. This industrial heritage zone is an important potential public space needs to be linked to Şişhane and Kasımpaşa to guide the dense flow of the business district to reach Haliç waterfront. Şişhane Square needs to be redeveloped as a whole with its connections and not only be used as a vista point or a park. This important urban space should be regained as a

social hub to distribute the flow from İstiklâl Street and Tunel to Haliç waterfront. Şişhane has individual projects as Theatre Centre achieved by architectural design competition but these projects needs to be integrated.

There are connections in the urban fabric to connect Galata and Tunnel area to the Persembe Pazarı waterfront. The area is the front line facing historical peninsula. Most of the buildings have been demolished 20 years ago during the urban renewal program and existing the disintegrated urban structure of Persembe Pazarı is too weak to carry the flow down to the waterfront but there is enough open space to host the flow of Galata to meet with water. The program of this urban space should be designed together with Galata District.

Karaköy Square is the main connection with Galata's upper hill via Yüksek Kaldırım Street but this flow ends with a traffic junction. The Bankalar Street coming down from Şişhane is also ends in this traffic junction too. The square is supposed to link the flow to historical peninsula across the Galata Bridge.The square needs to be redefined as a linkage together Perşembe Pazarı, Galata and Karaköy Port. Karaköy Port has the potential of reusable spaces of customhouses and has a strong relation with the urban structure behind it.

Hinterland B: Galatasaray, Taksim and Istiklal Street

The main corridor of pedestrian movement has the chance to reach the water front through the Tophane District. There are three main flows reaching to Tophane area. This area also has a spatial importance to collect the flows from Galata District. Hence, it is possible to recognize Tophane as a potential articulation zone to guide the flows from all parts of the peninsula. With the support of this articulation Galataport has the chance to connect Galata, Taksim and Istiklal Street.

Hinterland C: Taksim, Cihangir and Gumüşsuyu

Kazancı Yokuşu is one of the dense linkages routes connecting Taksim Square to the waterfront. Cihangir and Gümüşsuyu neighbourhoods use this corridor as the main artery for transportation but also to preserve their privacy and neighbourhood characteristics with inner courtyards and street life. Small streets and stairways connect the neighbourhood settled at the upper hill to the coast. This morphologic characteristic gives a unique identity to the Cihangir area and needs to be revaluated. Fındıklı Park is the only active park connected to its hinterland at the waterfront. Still, it needs to be redeveloped together with Cihangir and the Taksim area to meet the flow from its hinterland. Kabataş is already serving as a transfer area but the spatial limitation is not allowing it to establish itself as a sufficient transfer centre. The risks of land fill bring along the changing of the character of the waterfront. This area has to be associated with Gumuşsuyu, Cihangir and Taksim districts and redeveloped according to local needs as well.

6. Outcome of the Assessment

A new transformation process has already begun for the Beyoğlu peninsula but there is still no sufficient, participatory, integrated urban plan created for this important part of Istanbul. Individual architectural projects and tourism based on partial conservation plans are to be used for the transformation of the waterfront. As a result of this upside down process, the chance to integrate the dense urban land use and its flows to the waterfront are at risk.

It should be taken in to consideration that each project area is the part of an urban network of physical and social morphology, just as the Beyoğlu peninsula as a part of the Haliç Urban Network. The waterfront of the Beyoğlu peninsula is needed to be related with its hinterlands and to be planned as a whole. Existing potential links should be utilized in the urban structure to lead the flow to the waterfront and bring with it, the vitality of the city.

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Challenges and conflicts in achieving the sustainable waterfront development in Izmit Bay; the case of Evyap Port

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Abstract

Izmit Bay is in the Marmara Region which is the most developed & modern part of Turkey. Izmit Bay is the area near Istanbul City where the most of the private ports are agglomerated. Beginning in the late 1980s; central government, metropolitan municipality, district municipalities, industrial companies, port authorities and high court are the key actors to create a process for transforming waterfront in Izmit Bay. Recent port developments illuminate the relationship between decision makers and the capital flows. Economic challenges for waterfront planning enhance the land use competition among port areas, industrial areas and housing areas. It raises the question of how to integrate the port with the city. The decision-making tradition emphasizes a highly intertwined waterfront planning process with international, national and local stakeholders. No developments in Izmit Bay can be isolated from Istanbul's spatial development strategies. It has a strong relationship between new port investments in Izmit Bay with industrial decentralization process of Istanbul Metropolitan Area.

In this paper, the most recent port developments of Izmit Bay are evaluated in the context of sustainable development strategies, metropolitan plans, and broader economic trends, legislative and institutional frameworks. This study based on a technical research report that is prepared for directorate of circulating capital of the university. The focus of the research case is Evyap Port enlargement. Evyap Port is directly adjacent to the urban neighbourhood of Izmit. On the border between the industrial harbour area and the housing areas, logistics and other commercial land uses are situated. This area is proposed for further industrial development within the Development Plans, Regional and Metropolitan Plans, because a high demand for space for new logistics and distribution facilities are expected. During the relocation of ports and logistics, a strong opposition of residents can usually be observed. Creating port functions and land uses will re-image the city and have effects on the local labour market, transportation facilities, and cause challenges to communities in the new location. As a result, port projects in Izmit Bay support regional and urban economic development activities. Nevertheless, port is not just an economic function. More importantly, the port areas should be considered as a part of the urban planning agenda.

Keywords: City and port relations, Waterfront planning, Sustainable development

1 The Concept of Port City Relations

The case of water was always decisive in the selection, organization and the regulation of residential areas. City-states of antiquity, the medieval trading cities, 19th century industrial cities and the information society cities after the industrial revolution have been in a great interaction with their harbours. The accumulation of production in certain centres and transformation of it into a collective movement due to various human needs have given rise to the need for greater

ports within the framework of technological advances, increase of the possibilities of communication, capital flows, easy movement of goods and services. In this case, the meaning and the place of the ports, which were once sheltered and were without the hinterland and the chance to grow, have begun to change (Tümertekin, 1987). While, on the one hand, ports are leaving their part to the old city, on the other hand they demand space from the city for container traffic in recent years particularly (Schubert, 2008). The organizational, institutional, social and geographical contexts are important for port activity, in its formatting the city (Hall and Jacobs, 2010). In terms of formatting of the city by the port in general; realm of influence spread, strong and integrated transportation system in realm of influence, presence of economic development increasing products in the realm of influence, hosting capacity of the port for ships, infrastructure and superstructure conditions, capability of adapting to progressions in naval technologies, presence of qualified labour forces, creation of value-added and local economic development (United Nations, 2002, World Bank, 2001, Daamen, 2007). Factors active in the changes in the city-port interface and transformation are; changing urban policies especially with technology, regulations used in their implementation, environmental and economic issues (Hoyle and Pinder, 1992, Hoyle, 2000). Today's modern harbour areas is characterized as seaports with mostly container traffic and as cruise ports for organized touristic tours; and have been identified as the units for safe anchorage containing docks, piers, harbour services building.

Nowadays the term “port” used for harbour area has been described as units regulating docks, piers, basins as well as a place for safe anchorage. In addition, they have great effect on cargo loading-unloading and inland transportation. It shows the partner relationships of commercial and transportation systems that could satisfy all the needs of transport and trade initiatives (Ramin, 1999). The primary purpose of the “port” concept, which allows various products and commercial interference, is to transport passengers and cargo from sea to land. The location of the port is usually connected to the existing physical environment. Therefore, it can be located on a river in conjunction with the open sea in the form of an inner harbour or located on the shore in the form of an external harbour. Historically, many of the old harbour are located in the inner harbour providing protection for sailing in stormy weather. Ships are small and the harbour is deep enough to meet marine traffic. Depending on the recent containerization, however railways, highways, waterways, facilities in the transportation from ports to the hinterland are integrated thanks to the changes in ship typology, modern port operating systems, handling, storage, supply chain management. Besides port are gaining new meanings as a "hub" to manage cargo and transportation traffic (Aversa, Botter, Haralambidies and Yoshizaki, 2005).

The relationship between the port and the city is the basis of socio-economic structure of the city, in this context, the renewal of the port city is regarded as one of the most important factors affecting character of the port city (Chaline, 1995). For the port and city relations, the benefits arising out of the port activities and employment opportunities should be kept in mind. Local, national and transnational economic and political forces of the port authorities, terminal operators and logistics companies must be considered in the process (World Bank, 2001).The meaning of the interface between the port and the city is the factor that changes the use of the port radically. Ports are transformed into a gate for the passage of goods and people due to increasing container traffic. The formation of a customs area provides facilities that changes the definition of the interface established between the port and the city. Now, the combining elements between modern container port and the city are highway, railway, and waterway and airway infrastructure in terms of the spatial and functional features. Therefore, ports should not only be considered as an area in which economic factors rule only but also as a part of the city (Rosselli, 2005). Depending on maritime policies of countries and waterfront land use regulations, a quite homogeneous evolutionary scenario is mentioned especially in European cities in terms of the physical evolution of the city-port interface (Hoyle, 2000, Vigariu, 1995,

Vallega and Smith, 1991). Port activities should be the areas in which the factors in urban areas in which it locates and expands such as political environment, legal and administrative framework, technical and social infrastructure facilities, spatial suitability and competence, integrated transport networks, services domain, environmental issues, water depth, technological innovation, economic development, employment structure, the distance between the central city and region and their relationships and urban services are assessed and positioned (Erbaş, 2007). The relationship between the city and the port can be turned into "cooperation" if it is defined by suitable planning tools specific to the "place". However; if relationship is not held in accordance, this interface may turn into a realm of "conflict". Changing urban policies especially with technology, regulations concerning the implementation of these policies, environmental and economic issues can be listed as factors active in changes and conversion in the city-port interface (Hoyle, 1998 and 2000).

2 Ports and Logistics Sector in Turkey

The neoliberal discourse observed after 1980 emphasised the gradual withdrawal of the government from the economy and the liberalisation of capital movements. In this respect, cities and regions composed of cities have started to become the areas where global capital movements are experienced in the most intense manner. The facility in capital fluidity that globalisation has brought about has created competition among cities and regions that want to attract investment. In this respect, cities "competitive advantages" are discussed and they even attempt to be ranked in a "league of cities". Strategic factors that stem from both their physical and human geography are important in determining the competitive advantages of cities and regions. The ports and logistics sector, basically known as the transportation and carrying sector, has become a vital aspect of the economy after great transformations experienced in cities, metropolises and urban areas, which are production and consumption centres.

The logistics sector in Turkey rapidly developed in parallel with the great transformation experienced in the country after 1980. In a period in which capital flow was dense, production and consumption increased, social welfare level improved and urbanisation and industrialisation rates grew, the logistics sector undertook new meanings and responsibilities. The changes that will be experienced in Turkey in almost all areas in the following years will deeply influence the logistics sector. The most important factor that will create these changes is its relations with the EU. EU integration, especially in the field of logistics, will bring important issues in terms of ports, airports, highways and railways to the urban agenda in Turkey.

3 The Dynamics of Maritime Trade in Turkey

Turkey is a significant gateway to the markets of EU, Central Asia and the Middle East. Nowadays as global economy to gain momentum across countries and goods and services flow to increase, the tradable goods are increasingly diversified depending on the competition based on a rapidly changing economic conditions and transport times and transport costs are becoming important. As known, maritime transport offers several important advantages compared to other types in terms of transportation costs Therefore, a very large part of international trade-related transport takes place by way of the sea in almost all of the countries with maritime transport facilities. Today as about 90% portion of Turkey's international trade was made by sea, for the reduction of transportation cost and time, on the one hand, measures are taken for lowering handling time in port, on the other hand types of ships are being developed with less stay and transit time and intermodal transport stands out. Along with the prominence of combined transport, the need of port for container transportation, in which diversified goods can

be carried together and which reduces packaging and storage costs significantly and enables transfer between different types of transportation easily such as sea, rail, road, and air, is increasing day by day.

3.1 Projected Future Demand for Container Transport

There are numerous studies indicating that ports are expected to arise in the future in relation to the transportation demands some of these studies are implemented to estimate the demand for transport in relation to a particular region or port and some covers demand across the country.

In "Vision 2023, Report on the Turkish Port Management Sector" prepared in 2007 by Port Operators Association of Turkey (POAT) in cooperation with the Dokuz Eylul University; projections for container traffic in Turkish ports prescribed for handling in the future are included. As of the date of this report, to begin from 2007, three different scenarios were created for the estimates at a period extending until 2023.

In the figure below, the container handling between 2000 and 2013 and container traffic forecasts provided for three different scenarios for the period between 2008 and 2023 in Report on Turkish Port Management Sector have been shown together.

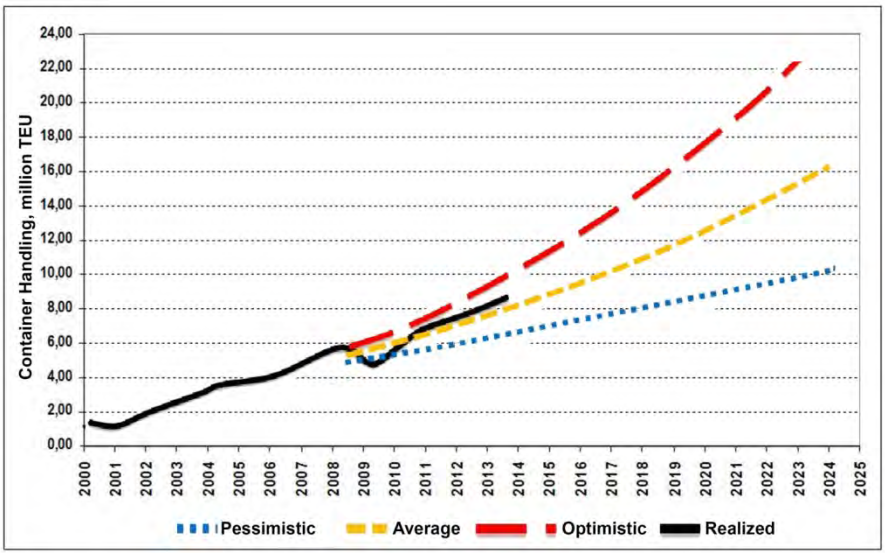


Figure 1: Projected and Actual handling of containers in Turkey

Source: POAT (2007)

As can be seen in Figure 1, handling volume that took place between the years from 2007 to 2013, when a reduction in 2009 due to the economic crisis is ignored, is approximately 5% above of the average scenario. In other words, the average estimated container traffic scenario, took place in a very large proportion. In this case, within the next ten years, it would not be misleading to predict that the amount of containers handled at ports in Turkey will double. According to this result, especially in the Marmara Region, new container handling capacity at ports should be created for the prevention of container handling capacity shortages at present and in the future.

4 Maritime Transport and Ports of Istanbul and Kocaeli

In the global economic order, increasing the kinds and quantities of goods with a quick and inexpensive method of transportation, has become one of the main factors determining the

competition with respect to foreign trade transportation distances. Maritime transport, the transportation cost is known to be 3.5 times cheaper than railroad, 7 times cheaper than highway and 22 times cheaper than airline. Today as transportation distances reach intercontinental size, the importance of maritime transport, which allows most of rational and economical use of resources, is increasing. Depending on these developments, waterborne loads are increasing significantly each year in Turkey. Transport, Maritime Affairs and Communications Ministry, according to data from the Directorate General of Merchant Marine in 1999, total carriage of around 170 million tons increases 2.26-fold in the intervening 14 years and reached 385 million tons.

The transport infrastructure diversity in the area, access to facilities, capacities and standards is extremely important in the distribution of load to regions and as well as the impact of the range of ports and the industrial enterprises around ports. Indeed, in shipments by sea, loads are carried by another type of transport (road, rail, pipeline or conveyor) from the starting point to the port or from the port to the destination point by a large majority. Thus, the domain of the port facilities also varies depending on the transport infrastructure in the region. In "Coastal Structures Master Plan Study" prepared by Joint Initiative of Ministry of Transport, Maritime Affairs and Communications, General Directorate of Railways, Ports and Airports Construction , Yüksel Project International Inc. - Belde Projects and Consultancy Ltd.Co, port domains in different regions are determined by taking into account Turkey's road network. In the mentioned study, Istanbul and Izmit Bay Ports are evaluated together and were identified as having the largest hinterland or domain when compared with other regions in Turkey (Figure 2).

When this part is taken into consideration as the most developed region of Marmara Region in terms of the social and economic factors with that domain determined geographically, the capacity of ports in this area and the importance of transport infrastructure facilities will be better understood.

On Coastal Structures Master Plan Study Final Report, it is also indicated that the hinterland of Istanbul, Izmit Bay ports and the port of Gemlik Bay is quite different from theoretical hinterlands determined by "Gravity Model". In the report in which it is mentioned that it is natural for the hinterlands to overlap due to the fact that Istanbul and Izmit Bay Port have almost the same transport system; although Gemlik ports are not developed as other two regions in terms of transport links, it is emphasized that it has attracted cargo due to the development and industrialization of its close environment and its domain has expanded due to bottlenecks experienced in Istanbul and Izmit Ports' especially in container transportation. In other words, containers from the ports of Istanbul and the Izmit need to be moved from Gemlik port from time to time due to capacity constraints. Naturally, this situation has led to significant losses in terms of both industrial organizations and the economy.

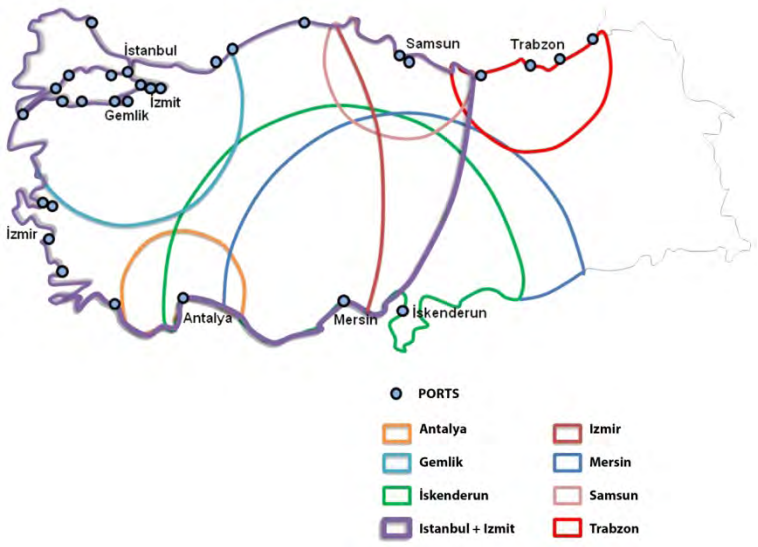


Figure 2: Domains of Turkish Ports

Source: MTMAC (2010)

According to data by the Maritime Trade General Directorate, Ministry of Transport, Maritime Affairs and Communications, total shipments reached from the level of 28 million tons in 1999 to 61 million tons in the intervening 14 years in port located in Kocaeli Region. In other words, the total amount of handling in ports situated in Kocaeli Region increase 2,14 times during the years between 1999 and 2013.

5 Combined Transport and Port of Kocaeli Region

Container transport as the main element of combined transportation that allows fast, secure, undamaged and economical transport by using different types of transport from point of production to the place of consumption of goods is growing and gaining more importance. Indeed, while the growth in the global maritime trade during the period of 1990 - 2008 only doubled, in the same period, growth in containerized cargo is average 9.8% annually and five times in container movements.

In line with global developments, container transport in Turkey has gained a large momentum in recent years. In 1999, about 1 million TEU containers were handled in our ports and this amount has increased to 7.9 million TEU in 2013 (Figure 3). Given the the increase in total maritime freight transport was 2.26 times in the same period, the importance of maritime container traffic growth reaching up to 8 times will be better understood.

Figure 4 was prepared with the purpose of determining the distribution of container traffic to ports from data by Transport, Ministry of Maritime Affairs and Communications, the Directorate General of Marine Merchant. As can be seen from the figure that Ambarlı Port has the largest share (42%) of container handling in Turkey in 2013.The total share of the port Located in the Kocaeli region is 10.2%.

Years	Shipping			Landing			Total Container Handling	Transit	Grand Total
	Cabotage	Exports	Total	Cabotage	Imports	Total			
1999	22.061	497.149	519.210	33.937	467.731	501.668	**1.020.878**	365	1.021.243
2000	27.200	547.315	574.515	29.606	534.406	564.012	**1.138.527**	88	1.138.615
2001	30.586	491.806	522.392	32.909	368.819	401.728	**924.120**	36	924.156
2002	46.330	942.643	988.973	35.984	928.257	964.241	**1.953.214**	0	1.953.214
2003	58.766	1.174.016	1.232.782	39.072	1.110.670	1.149.742	**2.382.524**	110.226	2.492.750
2004	20.682	1.490.066	1.510.748	13.334	1.409.945	1.423.279	**2.934.027**	176.271	3.110.298
2005	6.579	1.598.450	1.605.029	8.167	1.577.932	1.586.099	**3.191.128**	173.138	3.364.266
2006	14.008	1.809.433	1.823.441	6.913	1.840.649	1.847.562	**3.671.003**	184.921	3.855.924
2007	34.005	2.152.014	2.186.019	27.128	2.224.653	2.251.781	**4.437.800**	120.427	4.558.227
2008	86.867	2.429.820	2.516.687	82.934	2.474.773	2.557.707	**5.074.394**	117.353	5.191.747
2009	70.329	2.132.113	2.202.442	71.696	2.117.762	2.189.458	**4.391.900**	12.542	4.404.442
2010	104.278	2.306.587	2.410.865	104.047	2.354.303	2.458.350	**4.869.216**	874.239	5.743.455
2011	154.338	2.690.889	2.845.227	150.918	2.770.190	2.921.108	**5.766.334**	757.171	6.523.506
2012	236.905	2.879.122	3.116.027	235.440	2.942.562	3.178.002	**6.294.028**	898.368	7.192.396
2013	274.690	3.163.662	3.438.353	270.015	3.199.452	3.469.466	**6.907.819**	989.816	7.897.634

Figure 3: Maritime Container Transportation in Turkey (TEU)

Source: MTMAC (2013)

Quantities of containers handled from ports located in the Kocaeli region in the period between 2004 and 2013 is given in Figure 5. As seen, container traffic in Kocaeli ports has increased by a huge momentum in the period in question. In other words, while ports in Kocaeli region have a share of only 1.3% in Turkey's container handling in 2004, its container traffic was up to 10.3% share in nine years.

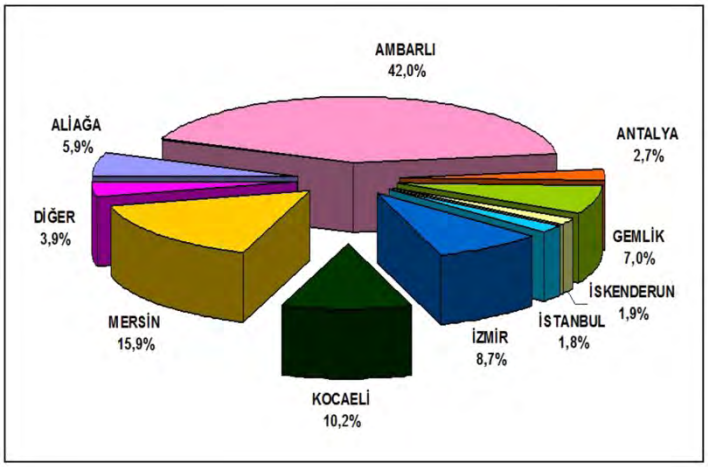


Figure 4: Distribution of Container Transport to Ports (Year 2013)

Source: MTMAC (2013)

Years	Shipping			Landing			Total Container Handling	Transit	Grand Total
	Cabotage	Exports	Total	Cabotage	Imports	Total			
2004	1.101	18.603	19.704	99	19.612	19.711	**39.415**	2.503	41.918
2005	471	23.106	23.577	135	23.646	23.781	**47.358**	2.719	50.077
2006	190	30.267	30.457	60	30.142	30.202	**60.659**	1.978	62.637
2007	603	69.197	69.800	662	60.791	61.453	**131.253**	1.310	132.563
2008	3.266	125.733	128.999	1.711	121.828	123.539	**252.538**	137	252.675
2009	1.168	144.452	145.620	4.594	126.118	130.712	**276.332**	3.997	280.329
2010	5.060	211.211	216.271	2.188	193.940	196.128	**412.398**	3.546	415.944
2011	13.401	244.495	257.896	4.327	245.610	249.937	**507.833**	4	507.837
2012	22.612	296.266	318.878	14.501	296.774	311.275	**630.153**	0	630.153
2013	16.605	386.632	403.238	28.303	375.291	403.594	**806.832**	925	807.757

Figure 5: Kocaeli Port Container Transport (TEU)

Source: MTMAC (2013)

6 Evyap Port; Location and Surroundings Relations

Evyap Port, serves in the town of Kirazlıyalı with an area of about 29 hectare and within the borders of Kocaeli province, about 80 km east of Bosporus, Istanbul and 10 km west of Izmit City Centre. Istanbul and environs have always been the focus point on international and regional transportation activities. Global markets, different locations of raw material and industry, increasing in consumption, level of development in industrial and trade sectors in Istanbul and environs increased the load activities (Figure 6).

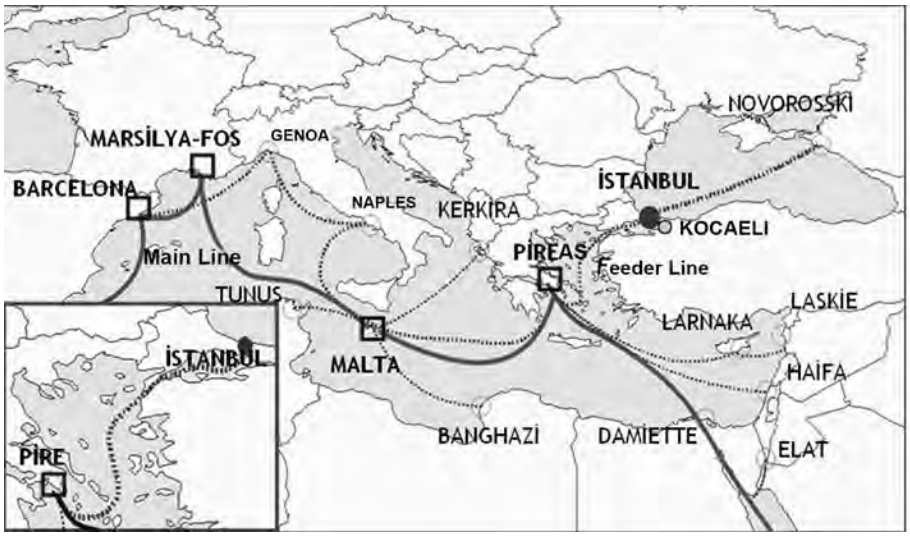


Figure 6: Location of Istanbul and Kocaeli in International Container Shipping Lines

Source: Canci, 2009

Evyap Port, which was established in 2003 as a business arm for logistics support to store and transfer the liquid raw material of the group companies, began container handling operations in 2004 increasing the capacity up to the present and has become an important port that meets the needs of the country's industry. Still, hinterland of the port with its container and tank terminals includes provinces such as Yalova, Bursa, Düzce, Bolu, Bursa, Eskişehir, Kütahya, Ankara and industrial zones, automobile factories, chemical industry centres such as Gebze, Tuzla, IMES as well as Kocaeli and Adapazarı provinces.

Construction status of the area in the western and eastern part of Evyapport within approximately 1 km limit is shown on the aerial photograph in Figure 7.

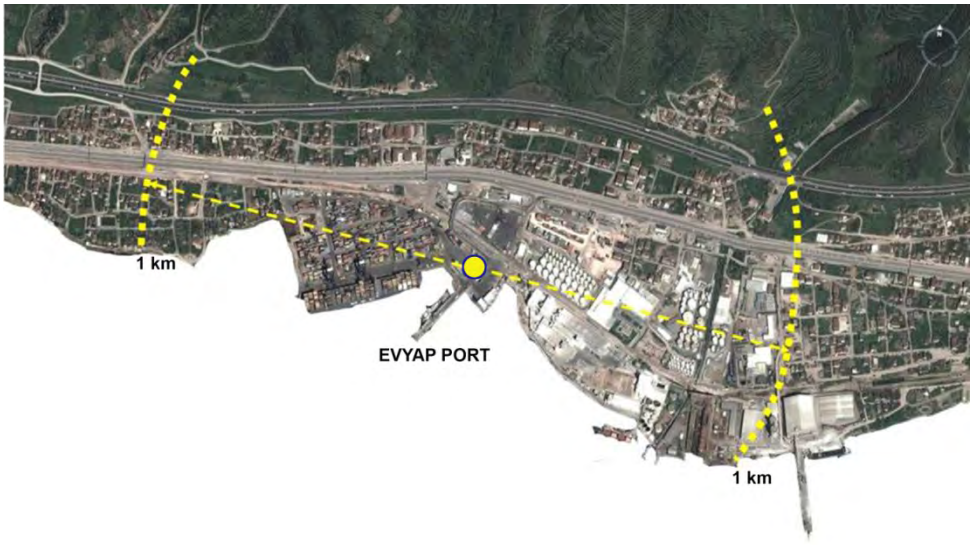


Figure 7: Aerial photo of Evyap Port and close surrounding

The basic use in a circle of 1 km radius with port locating in the centre can be specified as follows;

Evyap Port's western neighbour plots are located within the boundaries of the Kirazlıyalı neighbourhood built-up area that continues parallel to the shore between Cumhuriyet Avenue and Şerif Canga Street. Mainly consists of 2-3 story residential structure. North estate is divided into several parts firstly with D100 road and then with the TEM highway. In the northern part of D100 road, Cetin Emeç, Mustafa Kemal Süleyman Demirel, Bahriye Üçok Streets are located and there is the built-up area parallel to the coastal area. The eastern part of Evyap Port is subject to services such as industry, shipyard and storage especially in Port of Gubretas. Accordingly, the western part of Evyap Port is composed of mainly residential area; the eastern part is of the industrial and port area.

As is known, due Istanbul Haydarpaşa Port is not responding to growing container and freight traffic adequately, many other ports in the region including the Derince Port is working to meet the needs. As such, a number of landfills for port functions are seen in facilities such as Gubretas Port and Rota Port including Evyap Port in recent years. However, it is also known that arrangements for a major container port in the western part of Tupras are being made. Apart from these Evyap Port is located about 5 km away from Tupras Refinery in the east, 10 km from the port of Izmit, 15 km from Dilovasi to the west, 25 km from Gebze Organized Industrial Zone. When evaluated as such, its proximity to the industrial centres such as Istanbul, Kocaeli that play a key role in the economy of Turkey is remarkable.

6.1 Port Capacity and Transport Loads

The tank terminal at the port created in 2003, serves with instant storage capacity of 115,000 m^3 and a total of 44 tanks volumes ranging from 910 m^3 and 4300 m^3 today. If the terminal's handling capacity to absorb tank is 1 Million Ton / Year level and only fats and oils are handled at the port. Port container terminal, which was added in 2004, recently reached the handling capacity of 600,000 TEU / year level. In the Evyap Port area, although there is a not significant

increase in liquid cargo traffic since 2006. Container traffic has increased about 32-times in the eight-year period between the years from 2005 to 2013. As mentioned in the previous section, the area has a significant demand for container transportation.

In order to compare the growth in Evyap Port container traffic and the total seaborne container transportation in Turkey and Kocaeli Region, total cargo tonnage handled in Turkey and Kocaeli ports and Evyap Port is calculated as index showing 2005 as 100 the increase in container traffic for each port group is shown in Figure 8. It will not be misleading to say that this rapid development, as mentioned earlier; is a result of steady increase in flow of goods and services between countries depending on the development of global economy, and the intensive increase in demand in container transport as a result of diversified tradable goods due to the competition based on the rapidly changing economic conditions.

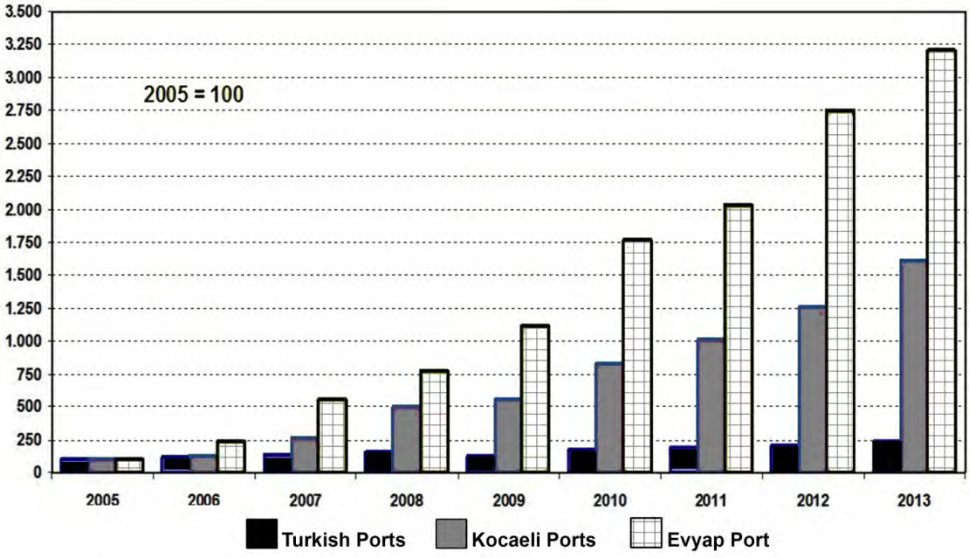


Figure 8: Container Handling Index in Turkey-Kocaeli Ports and in Evyap Port

Source: MTMAC (2013)

7 Evyap Port In terms of planning Relations

7.1 IX. Development Plan (2007-2013) Report of the Special Commission on Maritime Transport

As upper scale planning efforts, the Maritime Transport Special Commission Report prepared for IX. Development Plan was primarily examined. First, the current situation analysis is made in the report and is drawn to the importance of maritime transport. Approximately 7.5 million TEU container transport capacity is determined in national level. For this to occur, establishment of the port-rail-road combined transport network and creation of transport corridors are required. In order to be competitive with other transportation corridors, the main port is expected to be created including northern Marmara and Derince regions. In the report, Maritime Transport-related parts are also considered within the adaptation process for full membership in the EU. Investment decisions on the development of less costly maritime transport planning with EU member countries are highlighted. It is known that there is regular freight between the ports of Northern European-North American (NENM), Hamburg-Antwerp-Beirut-Latakia-Kumport-Evyap-Izmir and Evyap Port example located on the estate in question. Piraeus port shown as the port of significant competition in the region in the Commission's report is not included in this

itinerary. Thus, as seen in this example, regular container transport developed with the EU countries in this way provides investments that may turn Turkey's geopolitical position into a major advantage and at the same time obtains "competitive advantage" among "hub" ports such as Port of Piraeus (Figure 6).

7.2 Evyap Port in Kocaeli Metropoliten Plan

1/50000 scale Metropolitan Plan was adopted with Kocaeli Municipality. It is indicated in the report that Izmit Bay is a natural harbour and allows for transit transportation because it is close to a major trading centre as Istanbul. It is reported that planning area is divided into four sub-regions; the central region including the estate in question covers Izmit, Derince and Korfez districts. This region has the characteristics of an area in which the presentation, promotion, marketing and real estate activities are frequently made along with finished goods, raw material storage services due to industrial activity and its geographical location. The harbour area under examination remains in the Urban Settlement Area legend.

7.3 Approved Master Plan and Evyap Port

1/25000 scale Zoning Plan was adopted by a decision of the Kocaeli BMK dated 18.07.2007 and No. 379. The harbour area under examination in this plan is to stay in port function with storage space. When 1/25.000 scale Master Plan Report is analyzed; port operations in the Korfez Region including the estate in question are expected to continue in parallel with the current use. In addition, it is stated by the relevant authorities of plan provisions contained in Article 18.3 that the approved development plan stipulated by the laws and regulations of verse 3194 is valid until the date this plan is approved. Thus, it is understood that there were port area enlargement plans before 2007 approved on different dates since 1998 the area including the estate in question and provisions of this plan is protected by 18.03 plan notes.

1/5000 scale Master Plan was adopted by a decision of the Kocaeli BMK dated 15.10.2008 and No. 459. The estate in question is to stay in port function with storage space in this plan. It is seen that coastal part of the fill area is drawn however shoreline on the sea side is excluded from boundary of the planning area. It is indicated in the plan provisions that the area approved by planning authority by specific laws in Article 1.3 is excluded from approval plan. Pier Master Plans previously approved for Evyap Port are as follows;

25.11.1998 – Pier Master Plan
26.04.2000 – Pier Master Plan
07.06.2002 - Pier Master Plan
15.09.2003 - Port Master Plan Revision
01/04/2005 - Kirazlıyalı Pier Application Plan
01/07/2005 – Port Extension Plan
04/06/2007 - Port Extension Plan
14/11/2008 - Port Extension Plan
20.04.2011 - Port Extension Plan

As can be understood from the above plans, the coastline of Evyap Port area is constantly transforming due to the growing container traffic starting from 1998 up to the present (Figure 9).

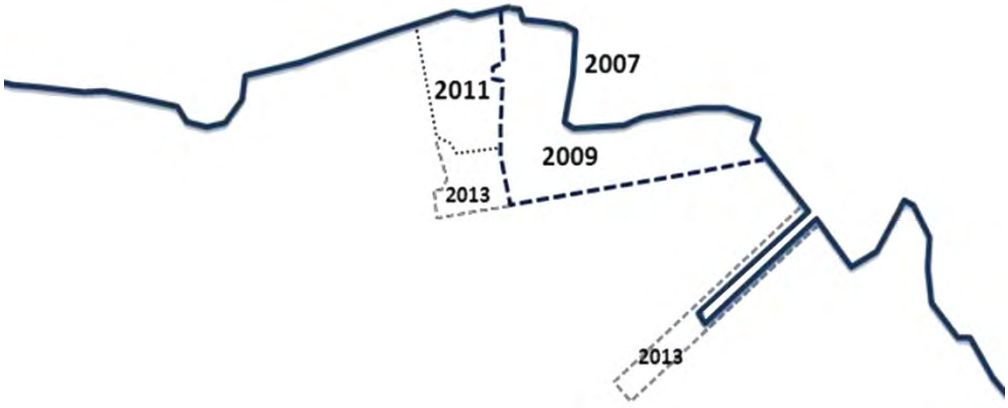


Figure 9: Transformation in Evyap Port Area, 2007-2013

It is understood from Plan's Report that the port is extended in order to meet the growing needs and this issue consists of arranging docks and piers appropriate for today's large-tonnage container ships.

7.4 Evyap Port Enlargement and Socio-Economic Challenges

Evyap Port Area is one of the fastest-growing private ports located in the Izmit Bay. One of the major factors in the increase in capacity is the pier and dock area obtained by landfills. However, there are many challenges in terms of possibilities of extension in both western and eastern part of the Port (Figure 10).

Evyap Port is buying residential areas in the process of extension. However, administrative proceedings were opened against the enlargement process by the residential property owners located around the port. Evyap Port have sought to deal with owners to expand the in the western part of the port and the deal has been made. However, housing prices have become extremely high, as there is no regulation on purchasing. At this point, the first challenge is in determining the value of real property. Another issue is the regeneration of residential areas located between Gubretas Port and Evyap Port. The residential area situated on the edge of Kirazlıyalı Quarter and Atalar Quarter remained in-between in the enlargement process of both Gubretas Port and Evyap Port.

In the context of these developments, there was no possibility to carry out their functions as housing. There is a rapid transformation in the area from the residential to the port. As is seen, the enlargement process may contain important challenges for both Evyap Port and the surrounding residential areas. Mismatches between urban plans and pier master plans cause to social and economic challenges in Evyap Port Waterfront. The lack of an integrated and participatory planning approach, sustainable development is impeded. As a result port extension issues in Evyap Port Area, rather than a collaboration between the port and the environment is creating a conflict environment.

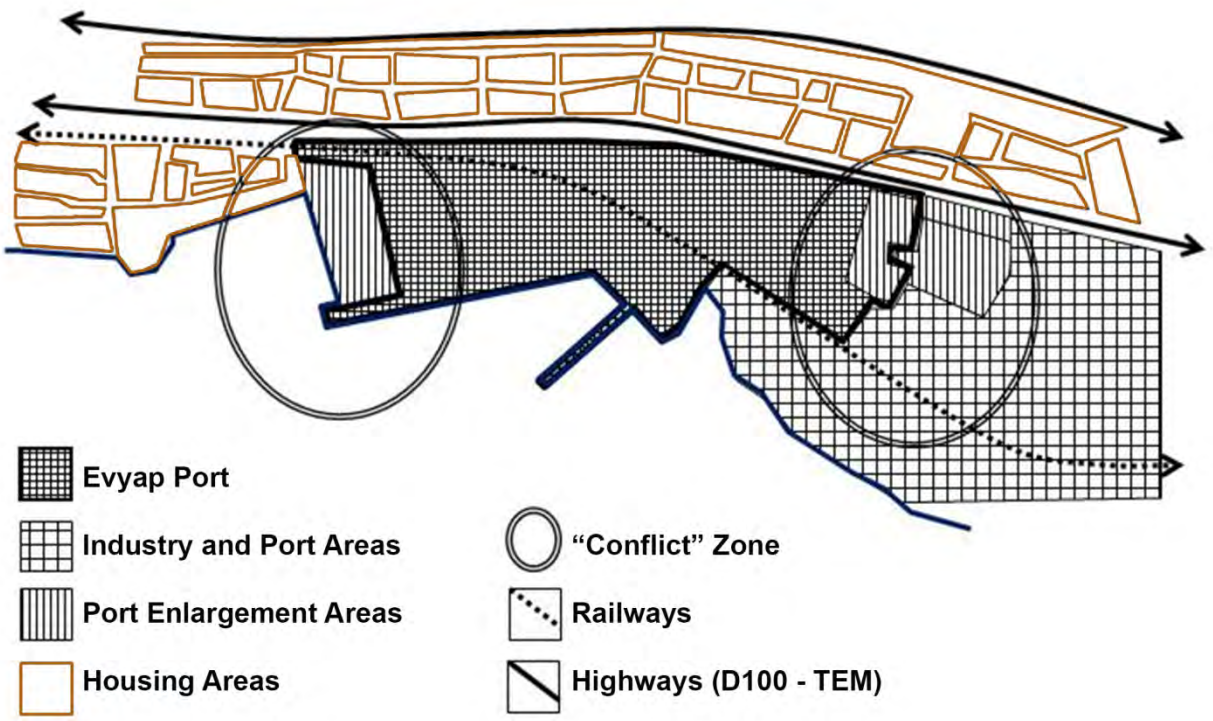


Figure 10: Evyap Port Enlargement and Conflict Zones

8 Findings and Discussion

Within the framework of the basic approach described above, key findings highlighted as a result of the enlargement of the Evyap Port as the port area of the neighbourhood are as follows;

a. Competitive advantages of Evyap Port due to its location in the country's most developed region of Turkey in which more than half of industrial products are manufactured,

b. The existence of deficiencies in terms of capacity in the port area of Izmit Bay, the offer of the new ship berths and container terminal areas to strengthen the metropolitan area's logistics infrastructure,

c. Evyap Port's contribution to economy by employment opportunities and add value created by its projecting to continue its activities in the fill area,

d. The fulfilment of the level of international standards for existing port infrastructure and superstructure investments needs required for maritime transport activities and taking into account the need to pursue the rail and road links in accordance with the completion of the new port requirements for site selection and project planning activities,

e. Meeting of the region's growing need for container transportation and the requirement to enlarge the size of berths and wharves to comply with scale of the ship technologically,

f. Disputes in waterfront planning arising from the authority of Ministry of Environment and Urbanization in the regulation of shore on the seaside and the authority of municipalities in the regulation of land side according to the Shoreline Law,

g. The increase in economic, social and political challenges in the process of Evyap Port's extension due to the lack of any legal sanctions,

h. However, the increase of the land value formed by port enlargement on the surrounding residential areas causing conflict in the region and move of all transactions to the administrative jurisdiction due to the approved pier master plans,

9 Results

Various departments of judiciary have interpreted the coast in different ways. While 7th Law Office has given judgment "Coastal social content is in the public domain", 4th Law Office has given judgment "Coast is an economic resource". When determining how society use these resources and how they are assessed; coastal urban built-up area and its connection with its location, to take advantage of the infrastructure needed quality, accessibility, geo-morphological structure, the environment's ecological structure are guiding in the evaluation of the coast as a social or economic resource. This assessment must be addressed in terms of social and economic parameters according to sustainable development planning approach. In this framework, the "Sustainable and Integrated Waterfront Development Plan" which determines use of the coast of the Izmit Bay and forms of evaluation including Evyap Port area and the surroundings is needed. To ensure a sustainable and integrated waterfront development project, it is essential that the experts from different fields of study work together to deliver a holistic plan. This planning approach is expected to deliver a spatial planning framework based on region's economic growth and the sustainable development strategy to perform the transformation on social, economic and environmental issues. Otherwise, the relationship between the port and the city will continue to be the scene of rather a "conflict" than “cooperation".

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Development of public spaces as a part of urban waterfront regeneration strategies – a critical approach

Marek IZYDOR, Poland

1. Introduction

Public spaces are very important in the process of modern city's creation because they serve the engagement in essential activities vital for the local community. Well-planned public spaces affect people's desire to spend their time and socialize there. This supports the development of city-forming roles. Public spaces situated on the waterside are particularly attractive because of their open landscape, so valuable in high-density development of the city centre, and water as a factor shaping high quality city structures.

The aim of this study is the verification of the concepts of city public areas systems as the basis of the development and transformation of the waterside and the analysis of risks and chances that may follow these processes. The development of waterfronts is one of the most difficult tasks that urban planners face these days. In spite of the fact that these spaces have different features and structures, their transformation focuses on the best exploitation of their potential. The waterside areas are considered a very special part of natural resources and one of the most important factors in the creation of a port city; yet, difficulties with the development and determination of the roles of public areas often occur.

This paper attempts to explain the process of changes in urban waterside areas based on the example of the City of Gdynia. The study will determine whether public spaces may add new values to the development of Gdynia's waterside and whether they have a positive influence on the metropolitan role of this sea-open city.

2. Forming the system of public spaces in Gdynia before World War II

Forming the centre of Gdynia in the twenties and thirties of XX century was constantly related to the process of creation of integrated and well-planned spaces open to bay waters. These areas answered the needs of inhabitants who lived there at that time. Attempts were made to plan the system of streets, subdivision into city blocks, their layout and mutual relations between areas serving different purposes by applying the rule of functional zoning with a relation to the coastline.

From 1925 to 1926, initial urban plans including the central part were drawn up in The Outline Development Plan for the City of Gdynia. The system of communication was based on existing streets: Świętojańska, 10 Lutego, Śląska and Morska. The centre of the system was Plac Konstytucji (Constitution Square) with a view axis pointing towards the port and Wybrzeże Francuskie (French Quay), (where a marine station was built later), and the main compositional view axis pointing towards east-west direction (now Wójta Jana Radtkego Street) running from the square in front of the station to the waterside square. The main north-south axis was supposed to be located on Władysława IV Street, and Marszałka Piłsudskiego Street opened the southern part of the centre to the sea. (Figure 1)

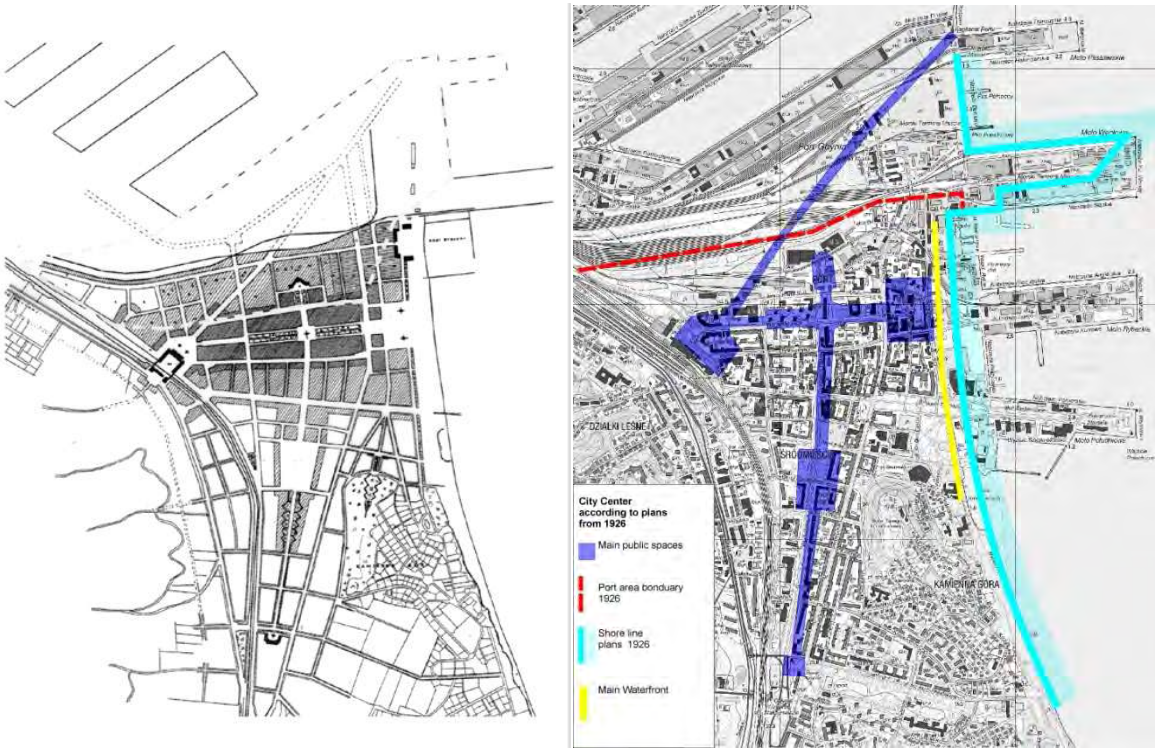


Figure 1: The Outline Development Plan for the City of Gdynia from 1926 (Sołtysik, 1993) and the analysis of the system of public areas on the current map of Gdynia (own elaboration).

The outline became outdated as early as in 1927 when a considerable part of the northern side of the centre was dedicated to a quickly growing port. Because of a significant move of the border of the designed district, the main compositional axis lost its function, and the planner Adam Kuncewicz decided to move the axis towards the south on 10 Lutego Street, which ended with an elongated square (Skwer Kościuszki). The initial plan of building the maritime forum was given up as a result of cutting-off of the city centre from the sea by dock basins. Also, the area of waterside boulevard was reduced from initial 1 100 m to 300 m. (Figure 2)

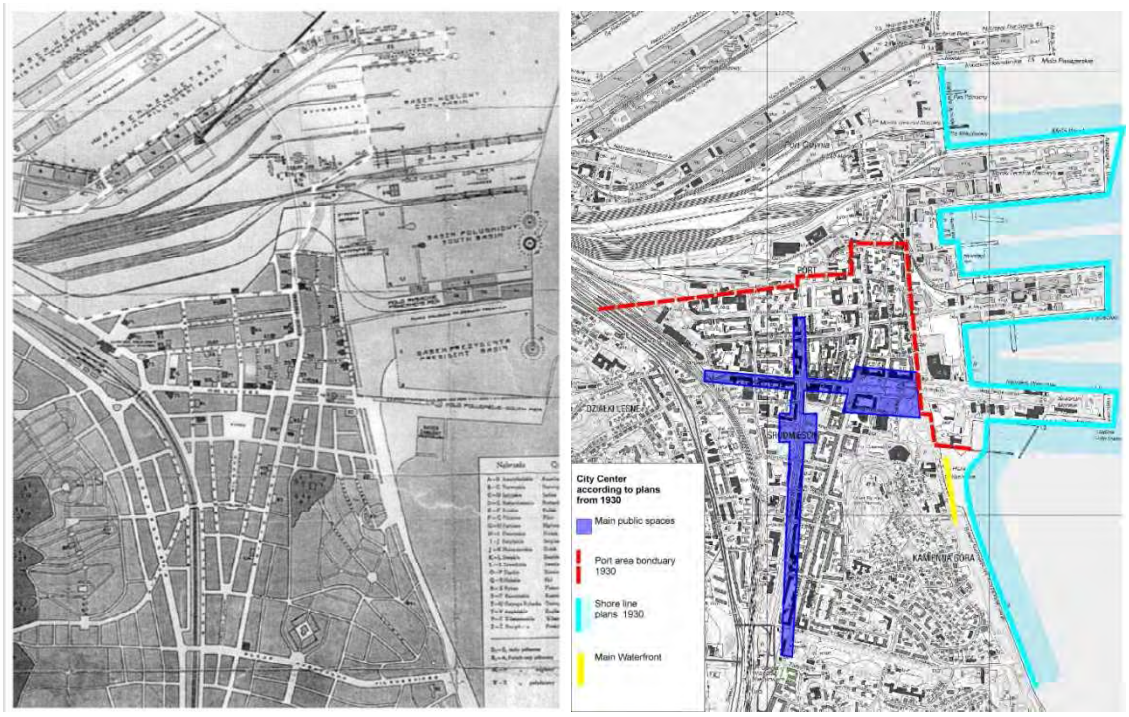


Figure 2: The Second Master Plan for the City of Gdynia, 1928-1930 (Sołtysik, 1993) and the analysis of the system of public areas on the current map of Gdynia (own elaboration)

The thirties of the interwar period enforced other changes in urban plans mainly because of the location of ship transport services and a yacht marina on Molo Południowe (Southern Pier). This enabled better integration of this part of space with the structure of the centre. At the base of the pier, a system of squares was planned. These squares were supposed to, along with adjacent city blocks, become the most presentable part of the city and at the same time to symbolise the openness to the sea (Figure 3). In 1936 a design contest for this area was announced. Taking into consideration contest entries, worked out concepts and a discussion held the project of a multifunctional space that directly meets the waters of Gdańsk Bay was drawn up. (Figure 4)

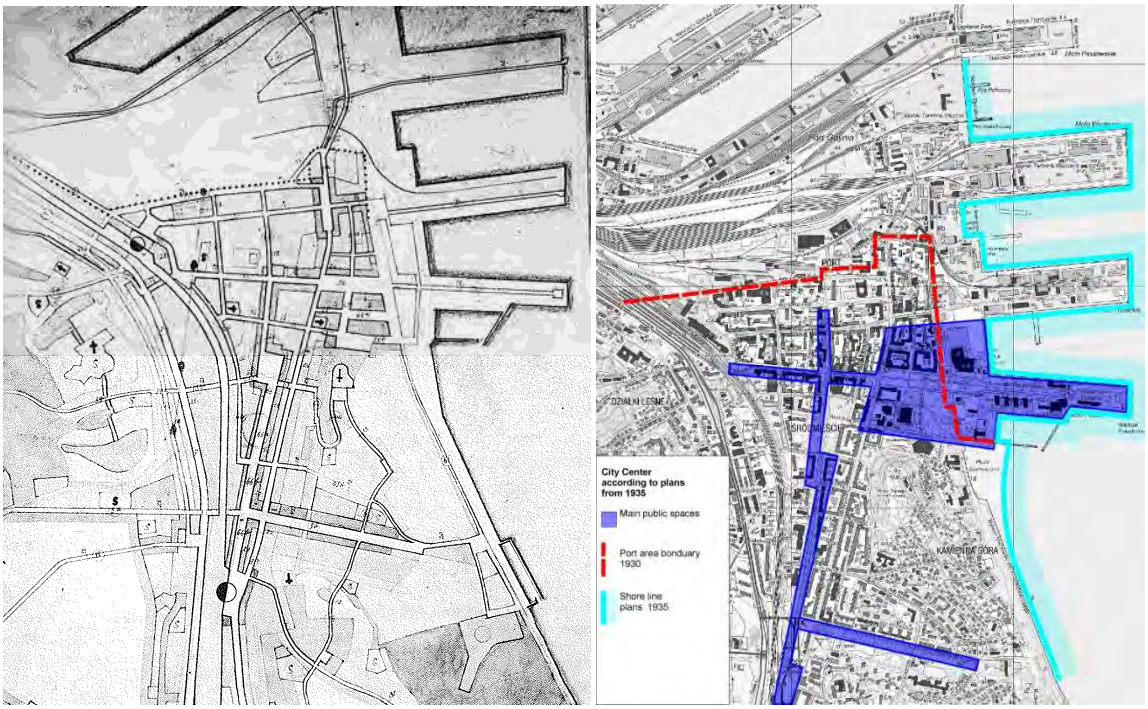


Figure 3: The Outline Development Plan for the City of Gdynia from 1935 (Sołtysik, 1993) and the analysis of the system of public areas on the current map of Gdynia (own elaboration)

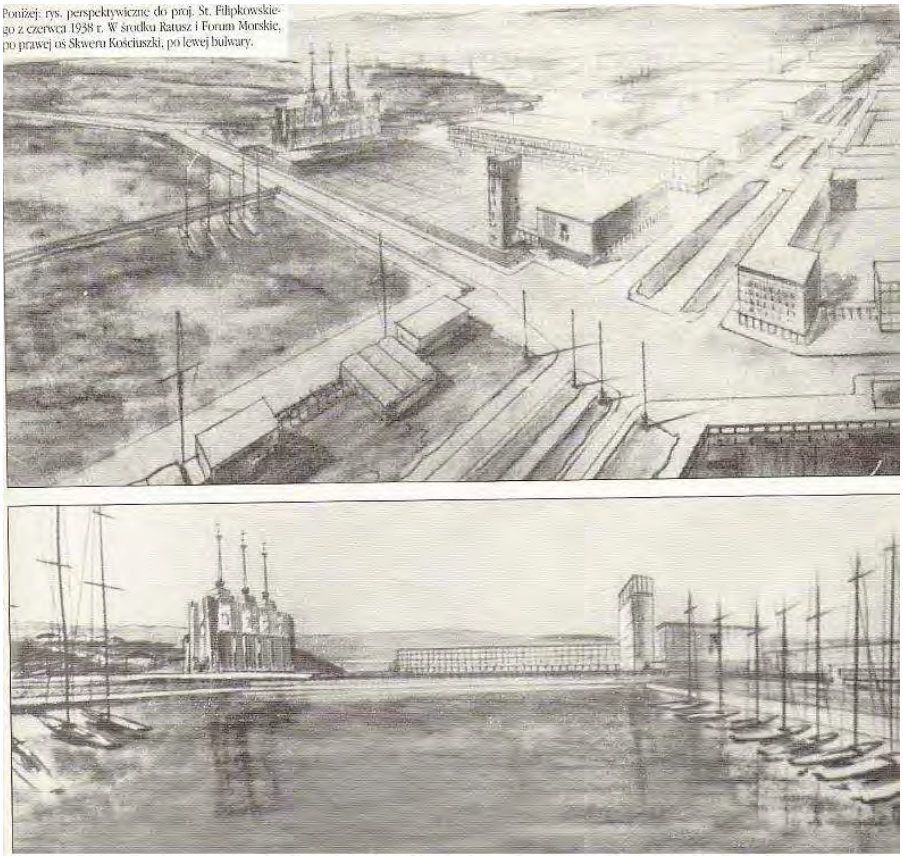


Figure 4: Stefan Filipkowski - The plan of Marina Forum (Forum Morskie), 1938 (Sołtysik, 1993)

Furthermore, a commercial square was planned on Władysława IV Street and a square in front of Wzgórze Świętego Maksymiliana Station, from where a southern boulevard toward the sea was built, according to initial plans.

The urban works carried out on a spectacular scale stopped when War World II broke out; however, all plans, despite all changes, were based on a historical background and were of a far-reaching character. Some of the plans were not carried out because of changing needs of the port, the structure of land ownership and the prospects of building investments; however, at the time of The Second Republic of Poland modern urban fabric was successfully developed. After all, the core of the composition of the presentable city centre was located by Plac Konstytucji (Constitution Square), 10 Lutego Street elongated with Skwer Kościuszki (Kościuszko Square) and Molo Południowe, Bulwar Nadmorski (Sea Boulevard), Starowiejska Street, Świętojańska Street, (the commercial character of Władysława IV Street was not gained). The complete modern system of the city centre is clearly based on these axes and opens to the port and the sea (Figure 5).

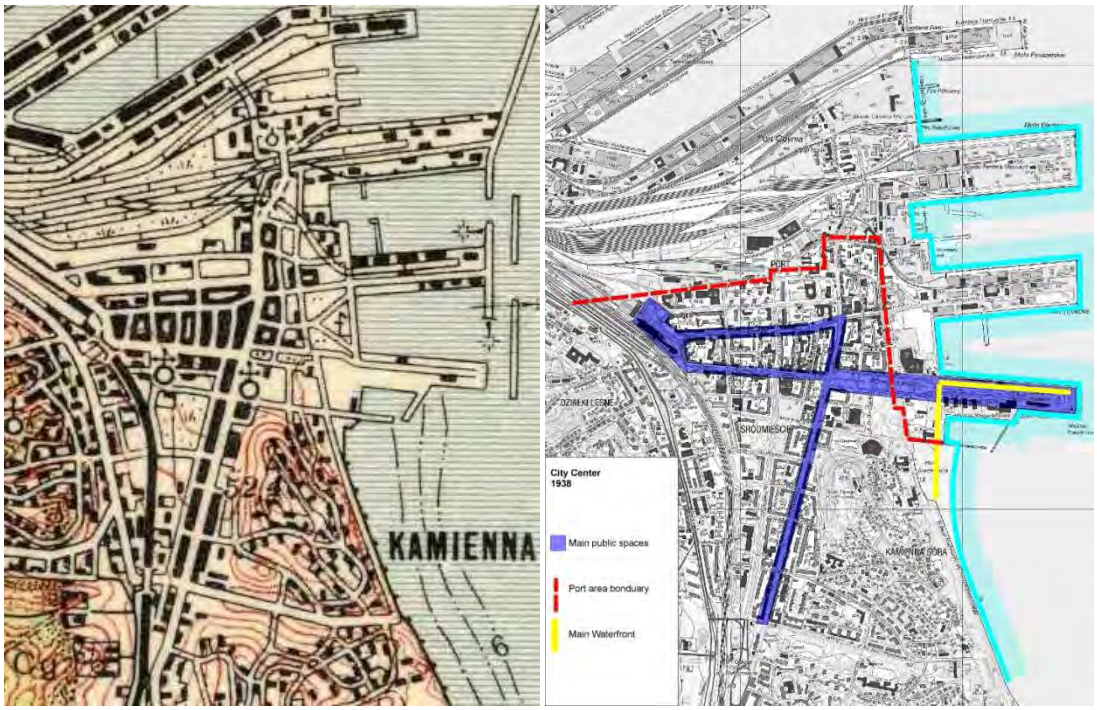


Figure 5: Gdynia City Centre Map from 1938 (Wojskowy Instytut Geograficzny Archive) and the analysis of the system of public areas on the current map of Gdynia (own elaboration)

There were few changes in the spatial layout of the centre in the post-war period. First of all, the communicative character of Władysława IV Street and the recreational character of Armii Krajowej Street and the Bulwar Nadmorski were maintained. Gdynia Hotel and Music Theatre in Gdynia were built near Forum Morskie (Maritime Forum). This redefined the character of the area. In addition, many new housing estates were built and the population of Gdynia reached 250 thousand.

3. Recent changes in the spatial arrangement of Gdynia City Centre.

Political changes after 1989 modified the approach towards the organization of public space, and new opportunities that could answer needs in this scope appeared. Political and economical transformation followed by cultural and social changes affected Gdynia too. When planning the urbanised space of the City Centre, the authorities had to take into consideration new problems: negative migration balance (mainly to nearby rural communes), glorification of property ownership and an unstable situation on the real estate market.

One among many successful actions carried by the authorities was the redevelopment of Bulwar Nadmorski and the city beach. Sanitary facilities and amenities for lifeguards were built, a new paving laid and backlit umbrellas installed. This created an attractive public area, and the project was awarded with “The Marshal of Pomorskie Voivodeship Award for the Best Public Space in Pomorskie Voivodeship 2009”.

The most prestigious private investments are also made along Waterfront. This includes multifunctional Sea Towers, Waterfront Kompleks or Transatlantyk and Moderna tenement houses.

The waterfront in Gdynia became the most popular public area in the city. It is 2.5 km long and goes from Polana Redłowska through Bulwar Nowowiejskiego, the city beach, Marina to Skwer Kościuszki and Molo Południowe. Its length generates pedestrian traffic because distances between each tourist attractions are not long. It takes about a half an hour to move from one point to another. The area of Waterfront varies in terms of space development and functions. The boulevard is not only a traditional walking route but also a place to rollerblade or cycle. Under the cliff, there is a fitness trail with fitness equipment, and at its end there are playgrounds for children. Despite the fact that in general the architecture of the boulevard is not very sophisticated, it always attracts crowds. On the route also Naval Museum and the City of Gdynia Museum are also located. The city beach is also a special city square, which becomes a bustling place on warm days and evenings. Just next to the beach, there is a yacht marina, and closer to the land there are Park Rady Europy (The Park of the Council of Europe) and Music Theatre. At the base of Molo Południowe Skwer Kościuszki is located. This is the most presentable place in Gdynia. The pier (Molo Południowe) is one of the most attractive points of the city. It is a place where tourist ships and the water taxi stop, and museum ships such as Dar Pomorza and ORP Błyskawica moor. On the pier, also Gdynia Aquarium and facilities of Maritime Academy of Gdynia are situated (Figure 6)

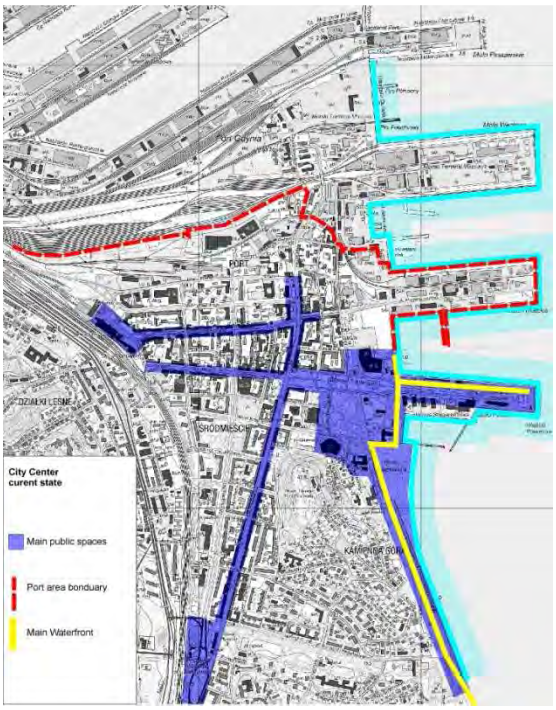


Figure 6: Current spatial arrangement of Gdynia City Centre (own elaboration)

4. Development plans of the waterside part of the centre

According to the Development Strategy for Gdynia, the main priority enabling long-term development is space. A great deal of attention is paid to the revitalisation and raising the standards of the city centre as well as the creation of a presentable district open to Gdańsk Bay.

Two crucial projects answer the aims of the Strategy: “City Centre Development Zone” and “Maritime Urban Prestige Zone”. It is a noteworthy fact that the works have been conducted since the nineties, and the development plan was drawn up in 1998.

Initial plans embrace the area between Jana z Kolna Street, Nabrzeże Polskie (Polish Quay) and Nabrzeże Duńskie (Danish Quay). “Maritime Urban Prestige Zone” project is designed for the area directly open to the sea including Basen Prezydenta (President’s Basin), Nabrzeże Kaszubskie (Cassubian Quay) and Nabrzeże Kutrowe (Boat Quay), Bulwar Nadmorski enclosed with Kępa Redłowska on the south. It is proposed that a prestigious area that has all city functions is created (especially along the President’s Basin) (Figure 7)

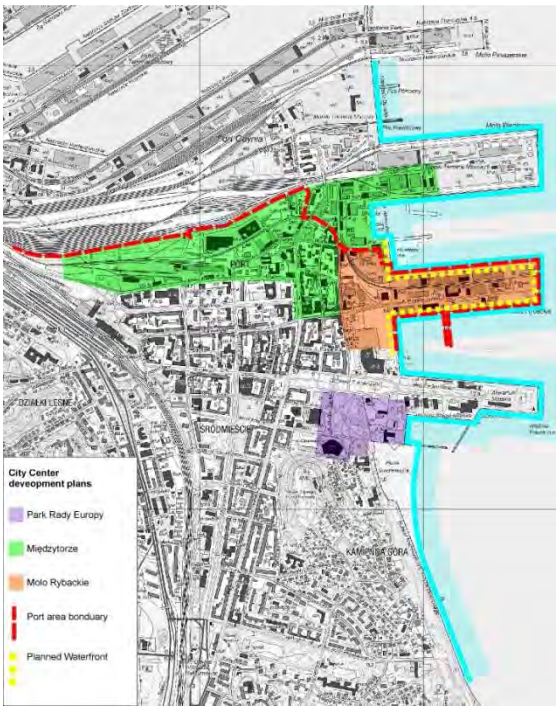


Figure 7: Gdynia City Centre development zones (own elaboration)

Other city regulations are subject to the necessity of complex spatial rearrangements. The Study of Conditions and Directions of Spatial Development mentions the city centre as the area of main interest. The works on the Local Plans of Spatial Development are also advanced, (for the whole area, the plans either are being drawn up or are being conducted).

The plans of building Centrum Kultury (Cultural Centre) and arranging Council of Europe Park are strongly related to the pre-war plans of creating Forum Morskie. This aims at creating the most prestigious, multifunctional city block with public utility facilities. Fiszer Atelier architectural studio was the winner of the development plan contest announced in 2008. The project contains the erection of a public media library, modern art gallery near the existing Music Theatre, the City of Gdynia Museum and Naval Museum. The centre of the project is a clearly defined square where outdoor events may be organised (Figure 8).



Figure 8: The plan of future Gdynia Maritime Forum (http://www.fiszeratelier41.pl)

Another area planned to be arranged to serve civic purposes is the space of the total area of 120 ha called Międzytorze between the port and the very centre of the city enclosed with Jana z Kolna Street. For the time being, it does not play any important role in the city. According to the project drawn up by Trigranit company in 2007 a few new functions should be added: communicative function (vicinity of Gdynia Train Station), a multifunctional city zone with a predominant commercial function, an official and administrative centre and a housing area. The core of this composition and at the same time an important public space is planned to be designed around a pathway running from the station to Molo Rybackie (Fishing Pier).

The spatial arrangement of Molo Rybackie, which is a natural elongation of the Gdynia Waterfront, is still in the preparation phase. Currently, there are only degraded port areas. The development of the area embraces sale and services, official, touristic and housing functions. The system of public areas will include a pathway around Molo Rybackie and three squares: at the beginning, in the middle and at the end of the pier along with a dense grid of orthogonal streets. Such a system creates an opportunity to generate various forms of social activities in the city (Figure 9)



Figure 9: The plan of Molo Rybackie spatial arrangement (Polski Holding Nieruchomości S.A. elaboration)

5. The effects of waterside public areas on the development of Gdynia.

The attractive waterside public space in Gdynia determines the character not only of the centre but also of the entire city. This helps building the prestige of the city. Because of this a highly lucrative industry branches, financial and insurance services, professional services, real estate and corporate services, hotels and restaurants are located. This boosts the consumption and attracts domestic and international investors. Consequently, the values of nearby real estate increase.

These areas intensify activity of inhabitants and tourists. Tourist movement is considered to activate international flow of information and innovations. Attractiveness of the city centre encourages newcomers and supports the migration flow. This contributes to an increase in the number of young, creative and prosperous members of the society.

The conduction of the projects of development of waterside public areas will result in higher standards of this port city. This, with the above factors, will eventually lead to the reinforcement of Gdynia's metropolitan roles.

6. Summary

Openness to the sea was a basic urban aim from the very beginning of planning the spatial arrangement in Gdynia. Simultaneously, the waterfront was supposed to be a prestigious public areas system. This has been curbed for many years by the development of the port. When the following parts of the coastline were gained, the authorities have persistently built the system of public spaces. Thanks to the sea, these spaces seem to be authentic and are the most attractive parts of the city. Also, they represent the unique character of the city and attract inhabitants and tourists. The city is also very attractive for investors. Along the coast in Gdynia, a multifunctional urban fabric is created and it is a sign of the city's strength, and affects the entire Tricity metropolis.

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Integrating Cycling with Urban Riverfront Revitalization in Motorizing Cities: a Case of Kunming, China

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ABSTRACT

In motorizing Chinese cities, car traffic keeps taking increasing amount of economic, social and environmental resources, whereas bicycle use is shrinking significantly. In addition to political preference for cars, the lack of cycling data at the project level has often led to biased and short-sighted decisions, shaping urban projects more car-oriented at the cost of deteriorating non-motorized traffic environment. This paper develops a systematic and operational method to count and analyze bicycle data, and illustrates its application and value in an urban riverfront revitalization project in Kunming, China. We find that the time-spatial pattern of cycling is similar to walking, but the volume of cycling is 40-70% more, and the bicycle flow along the north-south river corridor increases dramatically as approaching to the city center. However, the problem of continuity, connectivity along the riverfront route and of the quality of public space has undermined the potential of the riverfront being as a cycling and public life corridor. Based on the analysis, we develop the overall retrofit vision and key recommendations for the project.

Keywords: Cycling, Riverfront, Revitalization, Kunming

1. INTRODUCTION

In motorizing Chinese cities, car traffic keeps taking increasing amount of economic, social and environmental resources. Traffic congestion grows in intensity in recent years that severely influences urban form and citizen's everyday life choice. Recent research shows that one step on the brake pedal equals to 0.25-0.5 Yuan RMB in China. Cars occupy much space in cities, making them crowded, congested, sprawling, and more importantly, inconvenient and dangerous to pedestrians and cyclists. From 2000 to 2006, Shanghai suffered from the death of 769 pedestrian and cyclists in car accidents, and 5127 injuries(1), among which 75% of the pedestrians and 71% of the cyclists were innocent(2,3).

Promoting cycling is desirable, as it can help alleviate traffic congestion, reduce air pollution and carbon emissions and improve people's health through daily physical exercises on bike. However, cycling use has dropped significantly in Chinese cities. Beijing's bicycle mode share dropped from 58% in 1995 to 30% in 2005, and further 15% in 2011(4). While practitioners and researchers are making tremendous efforts to study car flows aiming at relieving congestion, little attention has yet been given to the accumulation of survey data or systematic analysis/research on walking and biking, leading to biased and short-sighted decisions, shaping urban projects more car-oriented at the cost of deteriorating non-motorized traffic environment. The desirability of complementing data on bicycle use cannot be underestimated. This paper aims to:

1) Develop a systematic method to collect and analyze cycling data;

2) Illustrate its application and value through a riverfront bicycle project in Kunming, China.

The rest of this paper is structured as follows. The next section discusses previous research on bicycle facilities and surveys. Then the project and survey methodology is introduced, followed by the survey results as well as implications to design strategies being illustrated. The paper concludes with lessons and potential improvement areas of the method application.

2. LITERATURE ON CYCLING RESEARCH

To our knowledge, there is no research explicitly focusing on the integration of cycling and urban riverfront, although in past decades increasing attention has been put on cycling in the field of transportation and urban design. In general, research could be grouped into three categories. The first category conducts survey through questionnaire to research on whether a cycling route itself is good or not. They are successful in evaluating the qualities of alternative route types based on cyclists' preference in general. However research tends to simplify the differences of bicycle routes with a single type factor, for instance on road or off road (5), yet fails to differentiate the impact of individual design elements on the cyclists' preference.

The second category of research explores the empirical relationship between cycle route design and observed bicycle use. Studies in this category generally analyze data collected by questionnaires or sensors with scientific method such as well-established comprehensive audit tools or algorithms (6-8). Thorough examination on path-level (e.g., travel time) and/or route-level (e.g., pavement quality) factors are well developed. For instance, cyclists are willing to travel up to 20 minutes more to switch from an unmarked on-road facility with side parking to an off-road bicycle trail, with smaller changes associated with less dramatic improvements(9). And cities with higher levels of bicycle infrastructure (lanes and paths) are associated with higher levels of bicycle commuting (10,11). The literature of this kind is valuable to policy makers and planners in promoting cycling in their cities in general.

The third type of literature focuses on the safety of cyclists. Zhang, et al studied the relationship between road network and pedestrian-cyclist accidents in Alameda County, California, and found that higher block, intersection and street density could reduce the pedestrian-cyclist accident rate (12). Hourdos, et al studied roundabouts in the Twin Cities of Minneapolis and St. Paul, and concluded that roundabout crossing improved the safety of both cyclists and drivers (13).

Most previous studies are conducted under American and European context, which make the conclusion not transferable to those motorizing developing countries. In addition, the methodologies presented in the literature are infrastructure-oriented, not project-specific. While figuring out determinants of cycling trips and route choices, there is a strong need for utilizing survey data at the project level to develop proper design principles and solutions for cyclists, which is the case this paper presents.

3. PROJECT CASE AND METHODOLOGY

3.1 Project Case

This paper is developed upon an urban riverfront revitalization project in Kunming. Kunming, known as the “City of Eternal Spring”, is the capital of Yunnan province in Southwest China. The city has a fine-grained old city centre, and is covered with blossoms and lush vegetation all-year round. Yet similar to other cities in China, the share of bicycle trips in Kunming has dropped significantly from 54% (1995) to 25% (2011), whereas 1,000 new cars are being added every day. The north-south Panlong River is the mother river of city, and lies as a structural backbone in Kunming (Fig. 1). The river runs from the mountains in the north and to the Lake Dian in the south of city, connecting the city center with a range of urban neighborhoods and new town development at outskirts.



FIGURE1. The Panlong River in the context of the transport network and land use of Kunming

The riverfront project was launched in 2011, as part of the overall city strategy implementation, which focused on creating a high-quality pedestrian, bicycle and public transportation network for a greener and more sustainable Kunming, highlighting the city's character and spatial qualities. The project goal is to revitalize the riverfront space into a green transportation corridor with high-quality public space, so as to enhance the non-motorized mobility and the livability of urban environment.

3.2 Methodology

Our survey methodology was adapted from the Public Life Public Space (PLPS hereinafter) survey, which was developed by Prof. Jan Gehl in Copenhagen, Demark in 1968. The PLPS survey has a primary focus on the status quo of walking and cycling patterns in cities, with the purpose of guiding the design of public urban space and to support project evaluation and decision making (14). PLPS includes two major components, the public life survey and the public space survey. The first examines the pedestrian and cycling movement on certain road segments (Fig.2) and stationary activities at certain places, whereas the second evaluates the quality of public space. Specifically, in the public life survey, the surveyor will count the flow numbers of pedestrian and cycling respectively for 10 minutes every hour from 8am to 10pm on a typical weekday and a typical weekend with good weather. The counting points will be provided to surveyors in advance by the design team. A post-survey is expected to be conducted after the project implementation. By comparing before and after data we could analyze the "true" influence of a project in a quantitative way.

In the Panlong riverfront revitalization project, we conducted PLPS survey on 25 June (Saturday) and 5 July 2011 (Tuesday), in order to examine people's behavior patterns on both workdays and weekends. The weathers were good on those days. In addition, we conducted the following task-force surveys:

1. Bicycle crossing behavior. The number of both jay-walking and legal crossing by bicycles and pedestrians were counted at major crossing places for 10 minutes.

2. Cycling speed. We did an experiment survey with 3 surveyors, one riding along the Panlong River, the second riding along an adjacent parallel arterial (Qingnian Rd) and the third driving along the same road. The experiment on the three options started from the same place at the same time in the peak hour of a typical weekday. Surveyors were asked to record the exact time when they reached each crossing place. The outcome will be different tempo-spatial patterns for the whole stretch by different modes.

3. Furthermore, we collected conventional vehicle use data (e.g., vehicle flows on east-west arterials cutting off the Panlong river corridor, parking on the riverfront lanes, etc) in order to perform comparative analysis together with cycling data.



FIGURE2. An example of the public life survey map

4. SURVEY RESULTS AND IMPLICATIONS

4.1 The general pattern of use

Fig 3 shows the general pattern of use along the riverfront corridor today. First, cyclists are more than pedestrians in most places and time, in the magnitude of 40-70%. This suggests that cycling is a very important component of the corridor function. Second, the average bicycle volume on weekend drops only 7% compared to workday, suggesting that bicycles on the riverfront are used not only for commuting, but also for other purposes such as recreational activities. Third, in terms of daily use pattern, the peak hour effect on cycling is stronger in the afternoon then the morning. Day and evening data comparison illustrates that cyclists prefer day-time trip more than the evening. Among nineteen counting points, all but one is associated with the total day-time volume (9:00-17:00) exceeding the evening-time volume (17:00-22:00). The only exception appears to be on a corridor segment used mainly for recreational activities.

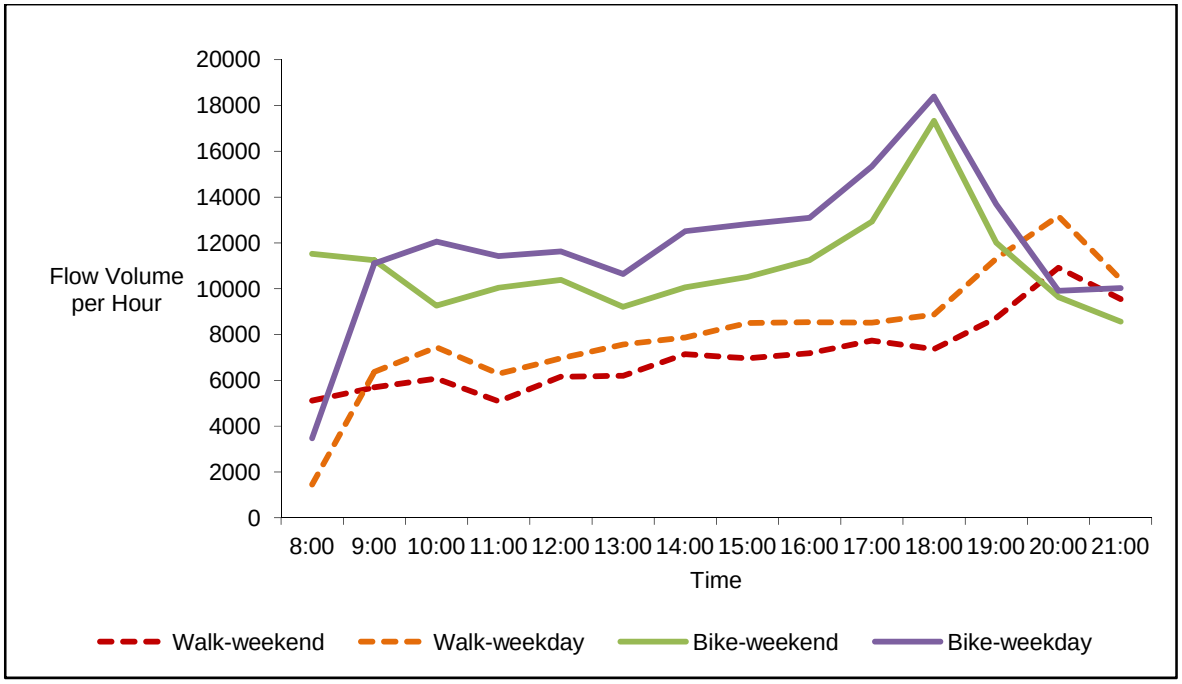
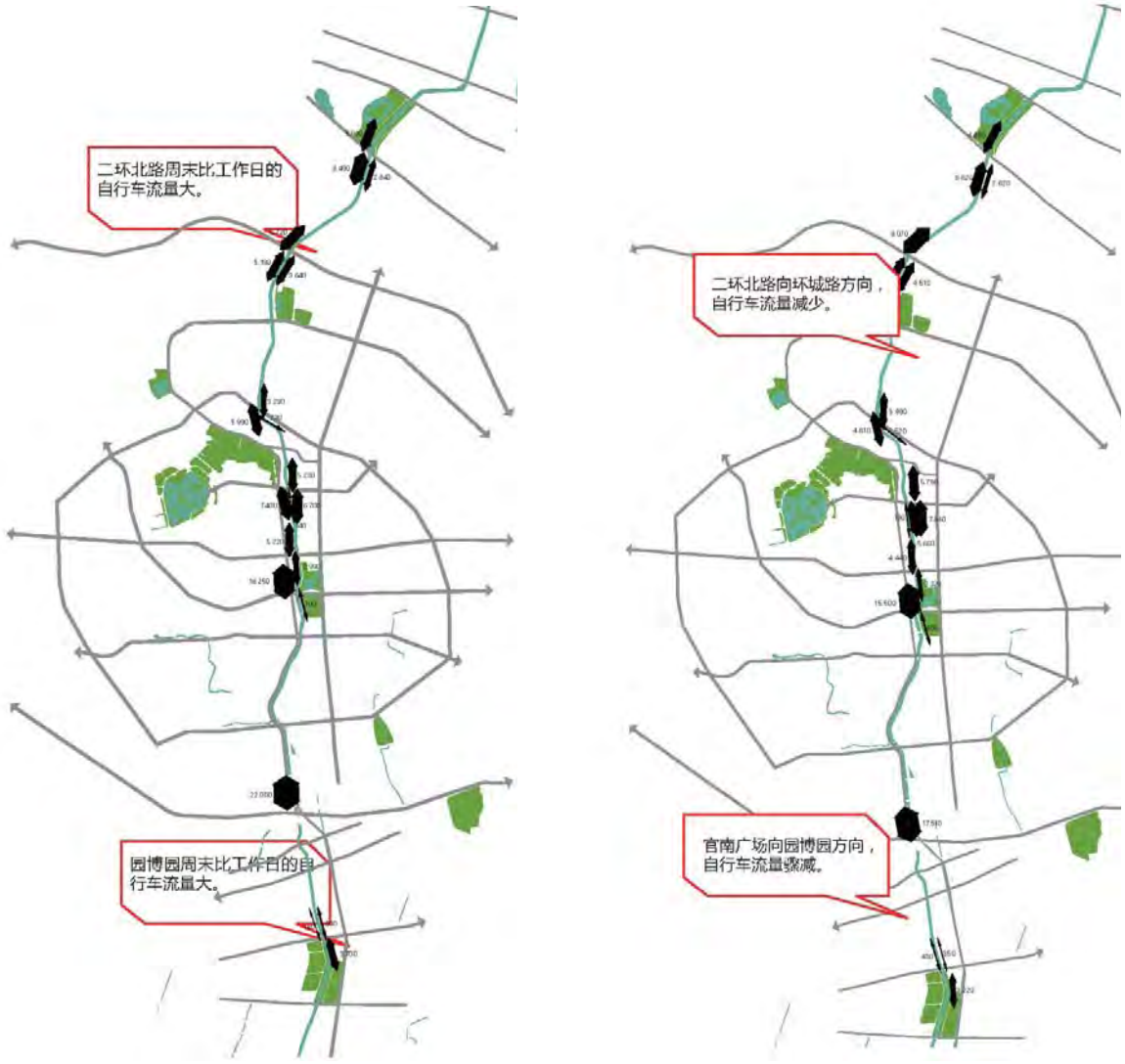


FIGURE3. Average walking and cycling flow volume along the river

Regarding the variance of cycling flows across different locations along the river, we find that more bicycle trips are currently used more at place where there is more commercial space, well designed public space and better access to adjacent neighborhoods,. Bicycle use along the river corridor increases dramatically as approaching to the commercial center and city parks whereas the rush-hour effect diminishes there. The cycling volume remains a relatively satisfying and stable level around well-designed and maintained public space. For instance, at the Dongfeng Square near the commercial centre, and at the Taoyuan square near the Yuantong Mountain and the Cuihu Lake, the weekday cycling volume can be as high as 20,000 people (Fig.4). Since commercial centers and public spaces attract more trips in general, it is worth putting a lot of efforts to improve connections to them.



FIGUR4. Day-time cycling volume on a typical weekday (left) and weekend (right)

4.2 Continuity and connectivity along the route

The north-south riverfront corridor is broken into small segments by east-west crossing arterials. At the crossing points between the corridor and arterials, there is almost no bicycle and pedestrian priority, making traveling along the riverfront by bicycle or foot at risk and very inconvenient. At some points the arterials even block the continuity of the north-south movement along the river, forcing people to take large and again inconvenient detours. This finding is supported by the fact that the cycling volume along the riverfront drops dramatically from one side of some wide arterials to the other (Fig.4). The problem is also highlighted by the jaywalking/cycling data. As shown in Fig.5, in several locations with no or poor crossing facilities, most people will do jaywalking/cycling anyway to continue their trip along the river, rather than taking a too long detour or waiting for more than 45 seconds for a short green-light phase. However, this can endanger pedestrians and cyclists using the river corridor, because car drivers would not be expecting people's crossing at those places.

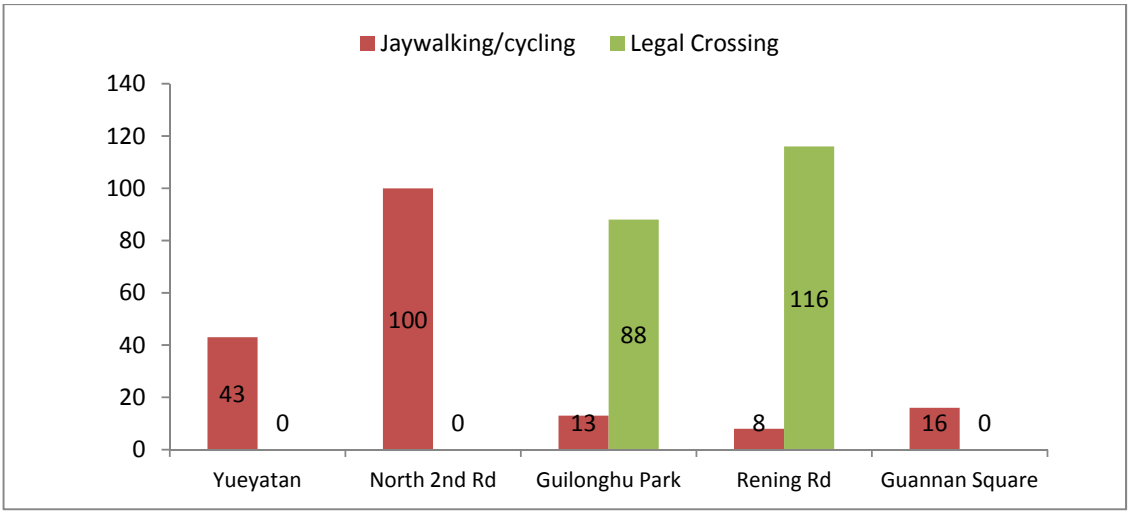


FIGURE5. Jaywalking/cycling versus legal crossing

While the high volume of east-west car traffic is often emphasized by traffic engineers, the total demand of north-south crossing from bicycles and pedestrians is even higher. The task-force survey of counting cars on the river-cutting arterials as well as the number of cyclists and pedestrians close to the crossing points (as a proxy of number of people who desire crossing) where conducted at seven places. The comparison shows that at six points out of seven, the number of cyclists and pedestrians who need crossing exceeds east-west car volume in a day, as shown in Fig.6. This suggests that good crossing facilities are deserved on those arterials. It can effectively improve the continuity of cycling along the river corridor, making the route more convenient and attractive to daily users.

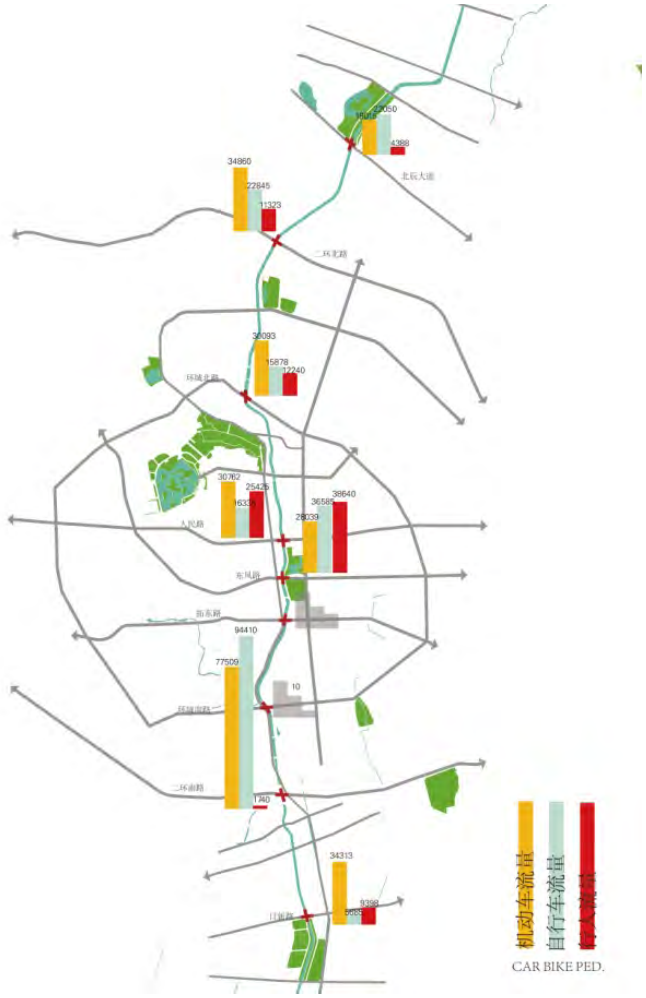


FIGURE6. East-west car flows versus north-south pedestrian and cycling flows

4.3 Quality of Public Space

On several segments, the bicycle flow drops severely, given long walls and passive façade along the route, indicating possible challenges of accessibility from major roads and adjacent neighborhoods. Only 200-meter south to the intensively used Dongfeng square, the street façade is inactive and uninteresting (Fig.7, left), where the bicycle number drops to 1,180 bicycles per day. Previous studies have shown that an increase of number of people and stationary activities is observed when the street façade is opened up and active. For example, a street façade with 35-40% glass and window, 75% of people passing by would look into the window and 25% would step in the steps. On the other hand, if 10-20% of street facade is open and transparent, 21% of people would look into it and merely 1-2% step in (15). Therefore, it is important to open up the riverfront cycling route to the city to attract more travel. Green spaces in new development areas at outskirts are either inaccessible or without programming, or both. There are many plants and grass, but only a few places offer opportunity for sitting and playing (Fig 7, right). Sometimes it even prohibits entering. Another problem is a lack of programming, which applies to public spaces in both the suburban and central city areas.



FIGURE7. Inactive street facade and green space at some segments along the river

4.4 Potential for a cycling and public life corridor

In spite of the challenge of continuity and connectivity mentioned in section 4.1, cycling along river is proven to be faster than cycling along the parallel arterial as well as car driving at the city center in rush hours. As shown in Fig 8, the average speed of car driving on Qingnian road (next to the river) is 17km/h, whereas the cycling speed is 12.5 km/h along the river and 10.1km/h on the Qingnian road. If looking at the numbers in the downtown area, car speed drops to about 6-9 km/h, slower than the current cycling and much slower than the normal cycling speed, which is 15-20 km/h. We believe that by creating a cycling corridor along the riverfront space, cyclists without unnecessary detours will spend least time on commuting among all modes. This together with appealing riverfront environment will provide a very attractive option for commuters, thus stimulating mode shift from car driving to cycling, which is good not only for safety, efficiency and healthy, but also for alleviating traffic congestion.

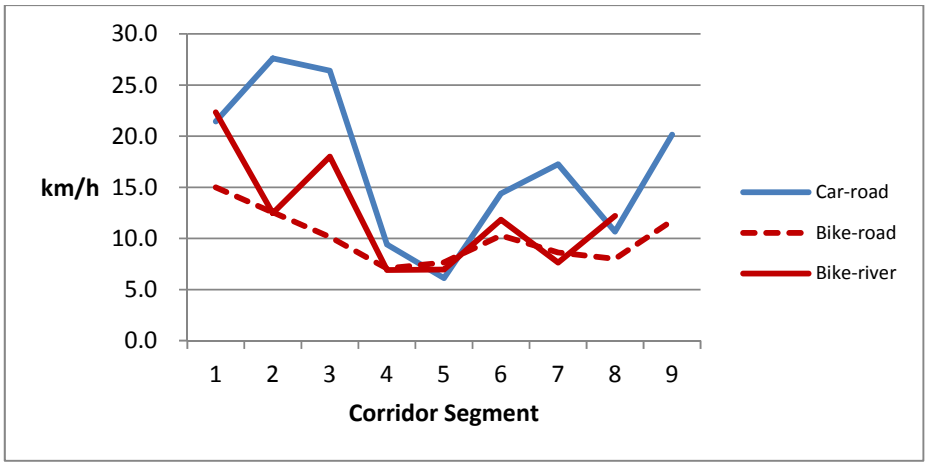


FIGURE8. Comparison of travel speed among cycling along the Panlong River and along the parallel arterial Qingnian Rd (cycling vs. driving)

On the recreational side, the stationary data were divided into 2 categories of activities, passive and optional. It shows that optional activities already take 2/3 of overall activities, which suggests that people are very much attracted to the riverfront for playing, dancing and social activities (Fig 9). By providing more diverse spaces with for various programs, more people will be attracted to participate.



FIGURE9. Stationary activities on weekends (25 June, 2011)

5. RECOMMENDATIONS

Based on the analysis and findings above, we developed a more concrete and clear vision for the riverfront revitalization project in Kunming, China. The vision is to make the riverfront an integrated part of the overall city network for cyclists and pedestrians. It should function both as a convenient cycling route as well as a recreational linear park containing different destinations, functions and activities linking to the adjacent city neighborhoods and functions. Key policy recommendations include (16):

1) Make a recognizable riverfront route. It is important to work with simple design solutions for the traffic system with a layout that does not shift too much but is changeable according to the possibilities in the different areas of the route (Fig 10). Working with recognizable design elements such as signs, paving, lamp post and furniture is a simple way of guiding the users. The diversity of the surrounding city neighborhoods can also be reflected in the design of the riverfront. Together with establishing high quality and visible access routes to and from the riverfront to the surrounding urban areas and functions, integration of the Panlong Riverfront Park in the local context can be ensured.

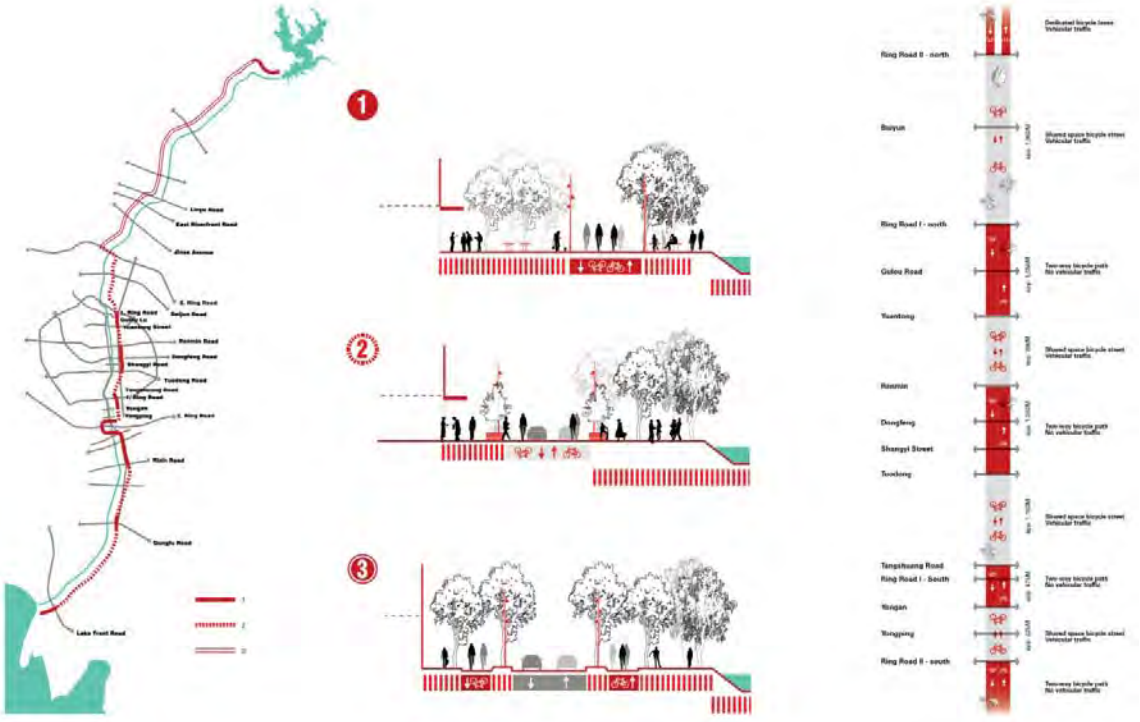


FIGURE10. Cycling path typologies proposed along the riverfront route

2) Improve crossing along the riverfront route. In most cases when meeting east-west arterials, zebra crossings with stop lights and bicycle crossing lanes should be preferred (Fig 11). Integration with transit stops and bicycle parking facilities is also preferred. In places where a zebra crossing is not possible, a pedestrian/bike bridge or an underpass should be considered and it is of great importance to ensure a feeling of safety both day and night and make convenient access to road level for both pedestrians and cyclists.



FIGURE11. Crossing design proposed on the Dongfeng East Rd.

3) Reconnect the riverfront to city for better connectivity. It is suggested to break down barriers between the buildings and the riverfront, to open up gated area, and to ensure direct access to the riverfront route from gated housing areas. In terms of wayfinding, signs or marking in the paving on the routes should be placed, showing travel distance to different destinations, where you are on the routes and access to public transport and functions.

4) Create active public space along river route. We suggest activate dull and closed off ground floor frontages along the riverfront route and open up towards the riverfront wherever possible. New street furniture or facilities should be introduced to existing public space to invite people and facilitate activities for all ages both day and evening for everyday life (Fig 12). Green spaces along the riverfront should invite for a more diverse use and open up for access to existing parks and lawns. For the new development areas, housing units should be facing towards the riverfront, so as to ensure natural surveillance and a more safe experience along the riverfront.



FIGURE12. Retrofit design to activate existing street facade

6. CONCLUSIONS

In a motorizing countries like China today, promoting cycling in cities can be a challenging but rewarding task. Taking the riverfront revitalization project in Kunming as a case study, this paper demonstrates that analysis with cycling data at the project level can be quite useful in helping investigate status quo of the use pattern and problems with cycling environment in a structured and quantitative way. It also facilitates development of pertinent strategies and solutions during the design phase of projects. Though not possible to illustrate through this case, complementing another survey when the project is fully implemented could enable before-after comparison to verify real project benefits, which is critical to create political momentums and lesson taking for further phases of the project. Improvement areas for the project survey methodology include:

1) Differentiating commute bicycle trips with recreational bicycle trips more explicitly,

2) Emphasizing the integration with public transportation system, and

3) Distinguishing among motorcycles, electric bicycles and ordinary bicycles.

It is worth noting that collecting and using cycling data is not a panacea by itself to the success of a riverfront revitalization project or any type. To ensure a successful implementation, many other critical obstacles, such as lack of political championship, conflict with current design codes, and inadequate technical capacity at the local city level, need to be overcome. We hope that cycling data collection and analysis can serve not only as a short-lived weapon for specific urban projects, but also as a catalyst triggering the pattern change of thinking and acting towards bicycle urbanism and low-carbon cities in China in the long future.

ACKNOWLEDGEMENT

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Where does the container terminal really end?

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Abstract

Container terminals, nowadays, are crucial elements of a global logistics network, due to the fact, that a large part of the diversified cargo is currently transported in containers. The biggest container terminals are usually located in port cities, although some of them might be situated in the hinterland. Container terminals are also of the highest importance for distribution of goods to a city or metropolitan region. Together, with the related functional objects, container terminals are a part of the logistics infrastructure of port cities, and are a necessary spatial component of the settlement network. Their spatial elements are spread all over a metropolitan region. Understanding rules governing their spatial distribution would be of a great help in the process of management of the metropolitan area.

However, in the practice of spatial planning, the port and the transport and industrial areas are usually treated with neglect. Being typically closed to the public, they are most often marked on land-use plans as large, uniform spots. Due to their technological complexity, planners very rarely analyse their internal structure, nor their functional and spatial connections to the city. This issue is also not in the mainstream of scientific research. There are a number of publications concerning the technical aspects of development and operation of the container terminals (Agershou, 2004), (Boese, 2011). There are also interesting articles dedicated to terminal - region relationship (Rodrigue, Notteboom, 2005, 2010, 2013), (Berquist, Wilmsmeyer, Cullinane, 2013), (Biskup, 2010), (Monios, Wilmsmeyer, 2012), Roso, Woxenius, Lumsden, 2009). At the same time there is a noticeable lack of works related to the influence of container terminals on a spatial structure of a city or metropolitan area.

This article explain some relationships between the development of container terminals and the structure of port metropolis.

Container terminals as an element of the port structure

Within borders of a one port, there is usually a group of container terminals. Generally each of them belongs to and is managed by a different body (financial group, ship-owner, etc.), and has its own supply and distribution channels. As container terminals are competitive in many aspects, they have to be equipped with independent systems of infrastructure within and around a terminal. This would require, that the spatial elements of the outer transport and logistics zones of each terminal must be planned independently (fig. 1). Only the public infrastructure, such as roads and railways, is commonly used, although by different operators.

Terminals, having similar turnover and the size structure of calling ships, will also have similar infrastructural needs from a water side. Large terminals, serving such a big container vessels as 12.000 TEU (Emma class), or 18.000 TEU (Triple E class) require an easy access from open waters, depths at quay at least 16,5 m, a sufficient pier length to accommodate 400,0 m long ships, as well as an adequate storage space. Due to these reasons, new container terminals are usually located close to the port entrance, on newly constructed land (ex. Deep Water Container Terminal in Gdańsk, Delta Terminals in Maasvlakte).

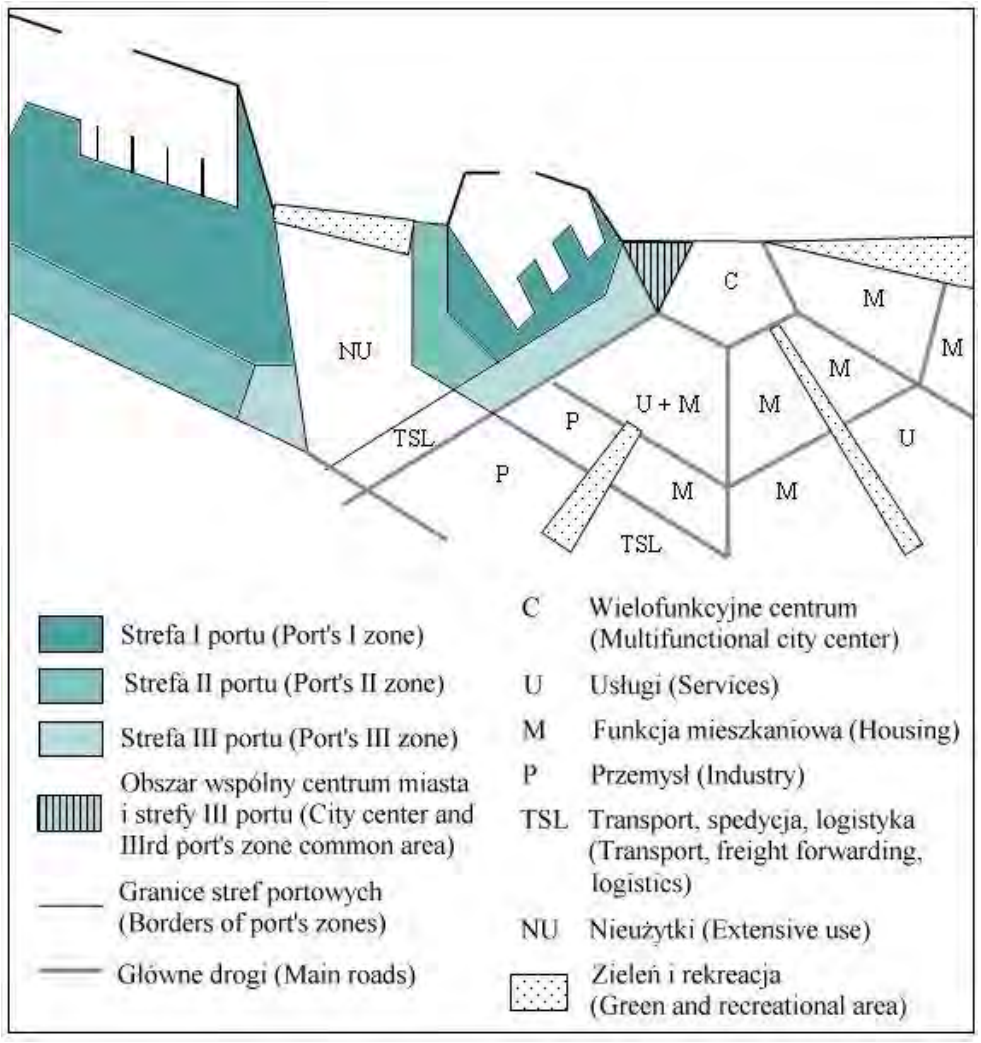


Fig.1. A typical distribution of port functions in port city. (Krośnicka, 2013, p. 26)

The spatial model of a European port city was well described by Ducruet and Lee (2006), based on analysis of spatial structure of the port Le Havre and Southampton. Ducruet's and Lee's model shows the level of throughputs growing in the direction of the port entrance, as well as dynamic processes ongoing in port cities. Examples of this include the "urban shift" (redevelopment of derelict port areas), and the "port shift" (migration of new port investments towards the sea).

The sea ports are normally constructed from three major functional zones parallel to the berthing space (fig. 2).

The first zone consist of terminals having a diverse spectrum of cargo (container, ro-ro, general cargo, bulk, oil, etc.), and a unique operational processes. Due to similar draughts of ships, container terminals are frequently situated next to oil and bulk terminals. However similarities in cargo characteristics might suggest locating the container terminals in the vicinity of terminals handling general cargo, or roll on – roll terminals.

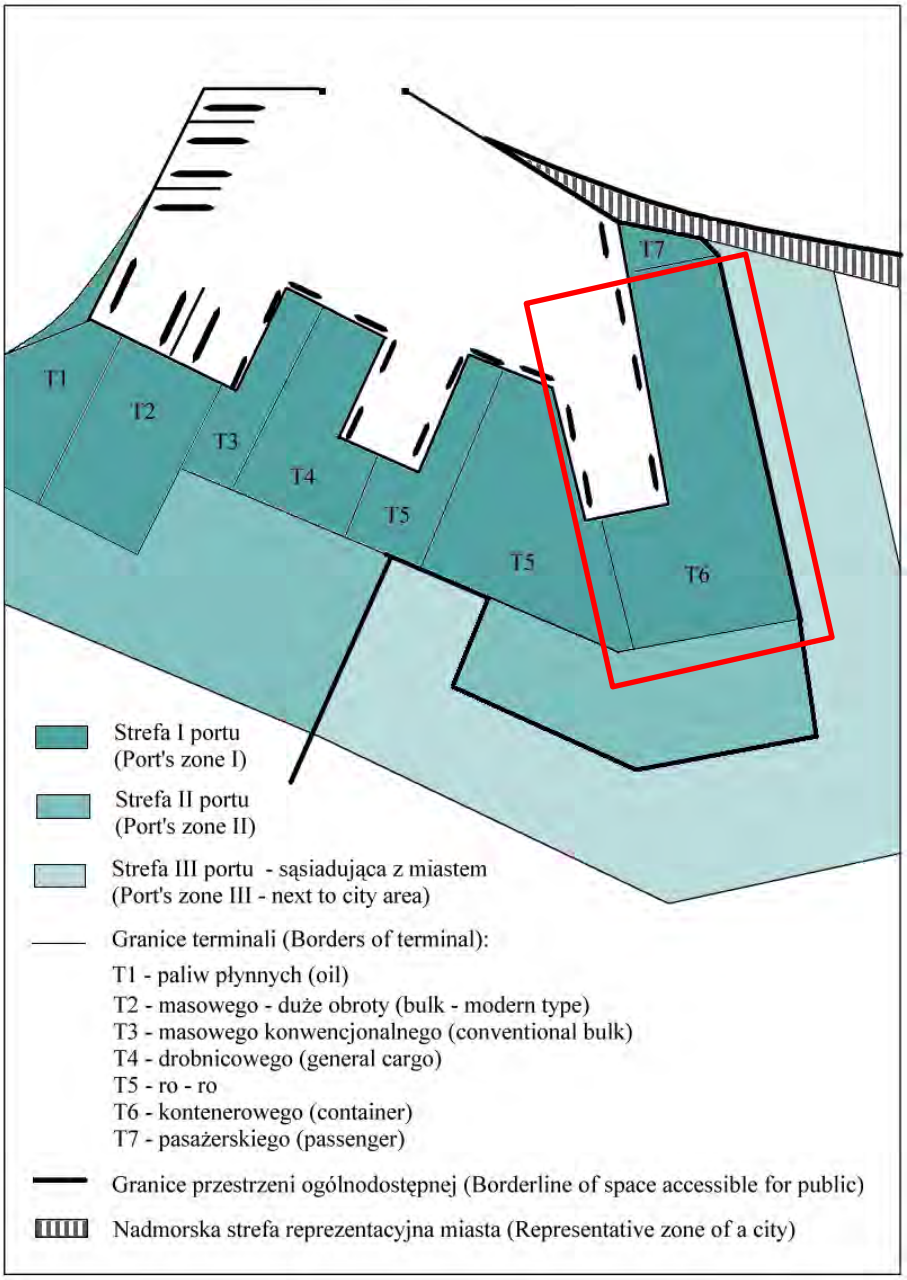


Fig.2. A typical port's layout (Krośnicka, 2013, p. 25)

The second zone would encompass an infrastructural and industrial component of the port, as well as logistics facilities serving the zone of terminals. This would contain: distribution centers, warehouses, railway sidings, parks for lorries, container depots, as well as companies producing goods and services for cargo. Additionally the second zone is

frequently crossed by routes leading to terminals' entrance gates. The first two zones (I and II) are areas having no public access.

The third zone consist usually of port's services and companies serving the maritime industry, such as: ship chandlers, freight forwarders, maritime administration, etc. The third zone is usually functionally merged into the urban fabric, and is available to city dwellers.

Definition of a container terminal and typology of its spatial elements

Container terminals are technologically advanced spatial structures, built to handle containers and their transportation. Therefore the standardized 20 foot long box, called twenty foot equivalent unit (TEU) is the design standard, and at the same time a measure of efficiency and size of container terminals. The handling capacity (turnover) of container terminals may vary from about 10.000 TEUs (small terminals) up to 5 and more million TEUs per year (big terminals). Thus, each of the terminals represents a different evolutionary stage of spatial and organizational development. Generally, the larger the yearly turnover of the terminal is, the more advance the technology is implemented in its operations, resulting in a more complicated spatial structure.

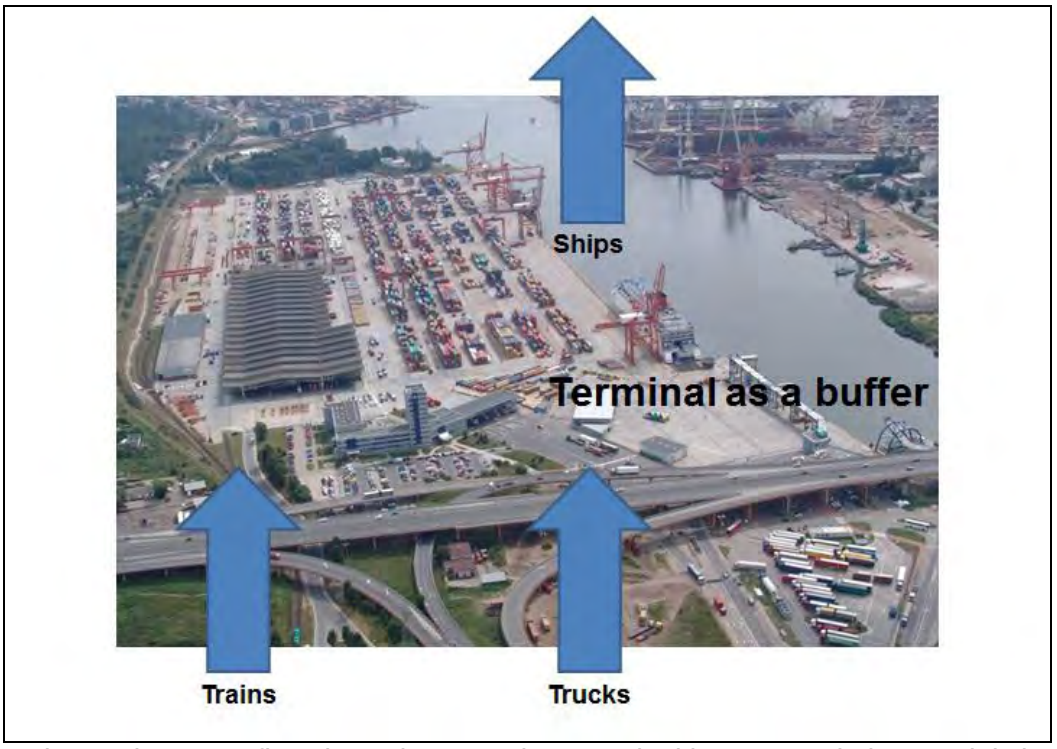


Fig. 3. The cargo flow through a container terminal in export relation. Aerial view of Baltic Container Terminal in Gdynia.

The primary role of the container terminal is to buffer the cargo passing primarily from land to sea (fig. 3). The growing dimensions of ships and increasing volume of cargo are enforcing constant enlarging of the buffer’s retention and evoking spatial and technological challenges for the container terminal.

Areas, that are a part of the container terminal, or supporting them, can be found within all the three previously mentioned zones, as well as in the other parts of port city, or metropolitan region. Contemporary container terminals consist of three basic spatial elements:

- the terminal itself,

- the outer transport and logistics zone,

- the constellation of distributed transport and logistics objects related to the terminal.

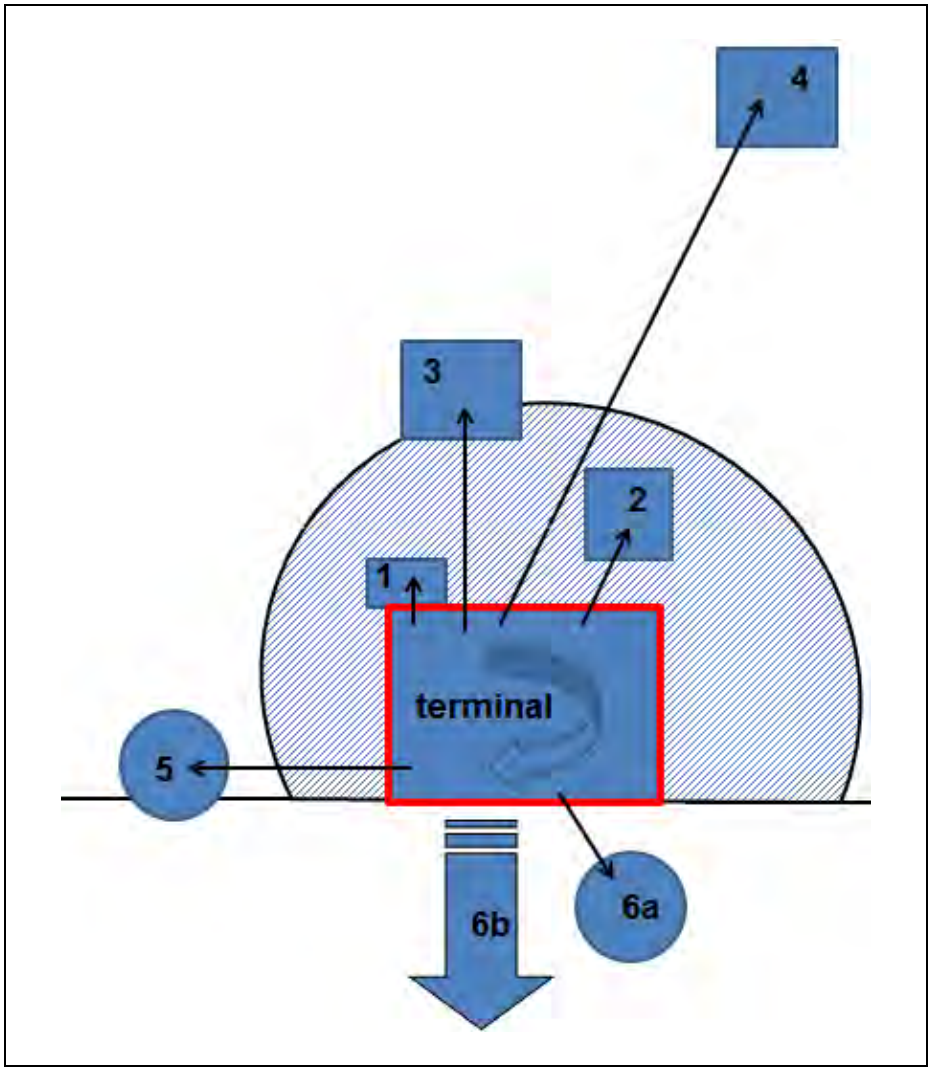


Fig. 4. Development possibilities of container terminals. Explanations in text.

The technical and spatial solutions enabling development of container terminals can be implemented in a variety of ways, depending on the evolutionary stage of a container terminal. The following solutions may be mentioned here (fig. 4):

- technical and operational solutions within the boundaries of the existing terminal,
- solutions that require locating some components of a terminal beyond the outline of its boundaries:
    1. on the area immediately adjacent to the terminal,

2. on the area situated close to a terminal,
3. on the area located on the outskirts of the port metropolis,
4. on the area located in the distant hinterland of the port,
5. on the area around another port,
6. in the foreground of a port, such as a transshipment hub (6a), or shor sea shipping line (6b).

Development within the boundaries of the existing container terminal

The easiest way of increasing the capacity of a terminal, or speeding up its cargo flow, is to reorganize a terminal within existing boundaries. This method is sometimes the only choice when there is lack of available land in the neighborhood on which a terminal might expand. Reorganization might include the use of “software” solutions, enabling optimization of both operational and handling procedures. The “hardware" solutions may include replacing the terminal equipment with updated and more efficient versions, increasing the terminal’s capacity (for example by replacing straddle carriers with rubber tyred gantry cranes). This upgrades undoubtedly lead to spatial changes within terminal borders. “Hardware” changes can result in a complete change of a functional system and a spatial rearrangement of a terminal (e. g. container terminal Burchardkai in Hamburg).

Development outside the boundaries of the existing container terminal

Another development possibility for container terminals is expansion on areas directly adjacent to them. Adjoining new land allows the expansion of the existing storage space (e.g. DCT terminal in Gdańsk), as well as moving some auxiliary functions outside a terminal (technological zones, container depots). Land neighboring with container terminal is very often used to improve entrance gate’s capacity by lengthening the inbound traffic lanes, construction of alternative access routes, enlarging the parking zone, or finally organizing a pre-gate parking. The last solution is particularly interesting. It plays a role of an external buffer by increasing efficiency of traffic flow through a terminal. Pre-gate parking allows trucks to appear at the declared time at the main gate of a terminal, in the order determined by calls of ships.

Some functions associated with container terminals may be located on the areas situated in the close vicinity of a terminal. Logistics or distribution centers, container depots demand an efficient transport access to terminals, but do not need the direct contact with the terminal. These functions concentrate mostly within the second port zone, although they are increasingly appearing at the port city outskirts.

Due to a large number of trucks passing through a container terminal everyday most of the bigger terminals possess “strategic parking”, that is located at the boundaries of the city or metropolitan region, and directly connected via a highway or an expressway leading to a port. Some of the “strategic parking” areas can be equipped with advance technologies to fill the role of the remote gateway terminal, and they are called “extended pre-gate”. Extended pre-gate allows trucks to appear at the main gate of a terminal "just in time", in the order determined by calling ships. The use of extended pre-gate is possible, provided that there is no chronic congestion on public roads leading to the terminal, and the intelligent traffic control systems are used on the way to a port. An additional complex solution is an intermodal satellite land terminal called a "dry port", with an associating transport corridor. Short-range dry ports are shunting yards, situated on the edge of metropolitan region to serve trains carrying containers to and from the port terminals. The most well-known short range dry ports are among others: Railport Scandinavia in Gothenburg, Rotterdam’s dry

ports. A distant "dry port" is theoretically a functional extension of the container terminal, but there is no direct spatial connection between them.

It is rare, that the functional component of the container terminal is built in another port. It might be caused by a need of creation a transport corridor, whose existence would speed up the transfer of containers from the hub terminal (e. g. Altenwerder in Hamburg). A popular solution is construction of a deep-water "intermediate hub", described in works of Rodrigue and Notteboom (2005, 2010). These terminals of a transit type, such as Gioio Tauro (Italy), or Pelepas (Malaysia), are usually built on islands, to collect the cargo from many different terminals, before loading it on ultra large container vessels. This phenomenon Rodrigue and Notteboom (2010) call and characterize "Foreland based regionalization".

Conclusions

So, where do container terminals finally end? Frequently their functional border reaches far beyond the terminal's fence. Any operating container terminal would be able to function without well-designed entrance and parking zones, container depots and an associated technological zone. These objects are usually spread all over the port city, although most of them are grouped within the second port's zone. In a case of larger container terminals these solutions are not sufficient any more. Terminals with yearly turnover of 1.5 – 2 millions of TEUs need to seek for external solutions, such as extended pre-gates, dry ports, and transshipment hubs. And these functions are usually situated at the outskirts of a port city.

What that means for the metropolitan region? The distribution of components of the container terminals, spread out through the port metropolis, enforces a coherent spatial policy, that works across the local administrative borders. The spatial policy should define special zones, such as having a very good transport accessibility and a sufficient land. Such a policy should be established together by both city, port, and terminal authorities.

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Water As An Urban Element (The Case of Galata, Istanbul)

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1. Introduction

Three main elements of life are always crucial for human: air, soil and water. In a settlement water only takes positon on riverine and coastal landscapes. At this point being in a relationship with water is always a privilege for a city. In this article, Galata(one of the first settlements of Istanbul) is chosen to research water relations of an urban settlement. Galata is an old Mediterranean harbour city in Istanbul. Since the first settlement, the region took its power from water. But today despite its natural conditions and historical background, the region has an isolated lifestyle from water. Also due to some political and economical developments recently, the region is in a circumstance of a rapid gentrification.

In the historical background, Galata was one of the worldwide trade centers in middle ages such as Venice, Amsterdam, Genova. The first stroke to this Mediterranean harbour city was the Industrial Revolution as Fernand Braudel describes in his book:'Mediterranean.' Since than this impact spread out from regional scale to urban design scale.

Since seven years there is many political and economic arguments about Galata. 'One of the main aim of the Municipality is to renovate this area and revitalize it with new functions.'[1] But it is going to transform the area into hotels, shopping centers and elite places. This act will cause loss of daily urban life, cultural background and local life in the area. But on the other hand 'passing through a new era marked by a range of initiatives to re-profile the city and give it a more competitive edge in the international arena, Istanbul is no exception to these general trends that permeate quite a number of cities with global aspirations'.[2] From that point, in this proposal, it is aimed to make more powerfull the relationship between water - city - locals.

As a research method; network mapping is chosen to research new possibilities and create new strategies for area. In this context some typical features defined for Galata: Small business, education, culture, trade, green characteristics. With network mapping it is aimed to gain the 'harbour city characteristic' back that used to before.

2. Evolution of Galata

Harbour and topographical conditions are designated borders in urban pattern in Galata. In historical background area known as a trade center as a Byzantion Coloni, Constantinopolis and Ottoman Istanbul. It is possible to analyse relationship with water in

three period: Before and after the Conquest and Turkish Republic in 1980's.

There was two main elements defining urban pattern before in Byzantian time: Sea trade and defensive wall systems to protect trade values.[3] First urban features constructed by Byzantines at this time. Those features were: A defensive wall system, a theatre, St. Irene church, roads and gates.



Figure 1: The spatial development process of Galata between 1422 - 1965

Among this period, especially Genoeses were quite effective about area's having Mediterranean urban characteristics. After Byzantian constructions, area surrounded with defensive walls. All the walls, gates and main axis were directly connected to harbour and wharfs. There was straight-narrow stairs and roads up to the sea which is typical characteristics of Galata as a Mediterranean Harbour City. Area was having dynamic, colonial wharfs with high potential before the Conquest. The region was a universal harbour and trade center.

After the Conquest, according to importance of trade, defence and protection of region, military settlement was too important to protect and defense the city. Also there was muslim components stressing sea silhouette. But being a harbour city needed an independent urban structure of Byzantian or Ottoman effection. So urban pattern of Galata is not formed of religions, it is military and trade structured.



Figure 2: Today, Galata

In 20th century, fill areas created along the coast and. Due to some urban constructions, there had been demolishments. Also vehicle and pedestrian traffic started among the coastline. Main axis opening to sea broadened for traffic. And among this period there was wharfs for boats. Till 1980's there was a strong relationship with water and sense of place as a harbour city.

From 80's till today, in the triangle of economy, politics and globalization, area had many changes, especially social changes effecting structure and urban life of area. Today, the harbour is working passively. In daily life, relationship with water is almost finished. There is only boat wharfs and fishermen using an active water experience.

The reason is world trends. All this broken situation comes from change of global dynamics. Today's dynamics are defined by a more dynamic capitalism than liberal western dynamics. An organized and spreaded capitalism possibled with ruling a space. In this context, cities are the fortresses of capitalism as fictioned places. As a result economy is an important component to be admit as a dynamic of Galata today. But this dynamic causes loss of locality and this directly effects water – urban relations.

3. Dynamics of Water – Urban – Localism in Galata

Dynamics of Galata are directly feeding from water as its nature needed. But today, it is hard to say that there is a harbour city life. Because nature of the area is not a concern for today's life conditions. People prefers another criterias such as showy and money priority lifestyle. At that point, the real needs of living in a place as human being is not important. The reflection of this situation to Galata, being in such ways: Houses are selling and transforming to hotels, living on a coastline is not a criteria for people.

At present, there is three dynamics for the area: Local people, trade and harbour. In the expansion of these criterias, it is possible to observe that local people are living in an isolated and limited district and can not connect to the coast directly. Also there is many business places but nearly none of them are related with sea trade business. There is one or two sea trade firm in the region recently. Harbour is working for only big cruise ships, as symbolicly.

Beside main characteristics of area there is important components about daily urban life at present: Schools as an educational dynamic, health services and many cultural historical buildings giving value to the area. In spite of all these potential, components can not link with water. Instead of them, parking cars and walls among the coast are in a relationship with water, ironically.

It is obvious that, each of these are powerful characteristics for urban life. But there is a serious network problem between layers of Galata and water. With network mapping, layers of the area can be analized and it will be possible to fix ideas to unify local and global dynamics to connect with water. Components for mapping are: Historical buildings, green areas, schools, religious buildings, sea trade centers, art, hospitals, and in between spaces.

Galata's network components:

Historical	Trade
Green	Art
Education	Health
Religion	In – Between Spaces

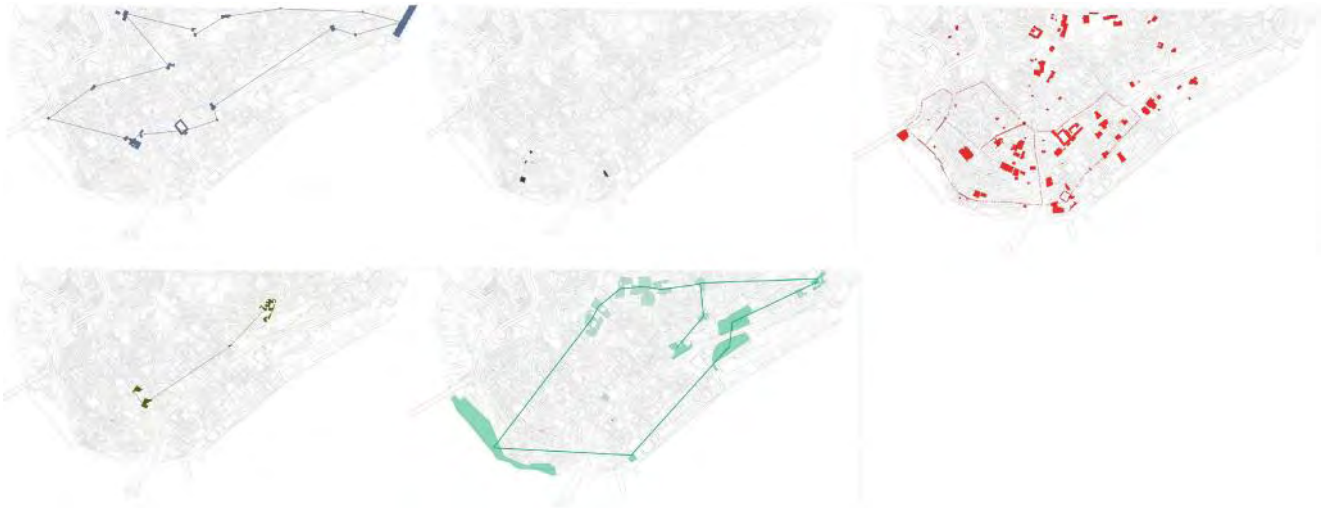


Figure 3: Networks of Galata and environment in the relationship with water; from the top educational network, sea trade, cultural history, health services, green places and courtyards

According to analyses, it can be observed that some of the components are strong and some are weak. There is a strong historical network connecting with water easily. Schools are in a good relationship with each other but can not relate with water effectively. Trade centers has a weak network and also they're about sea trade which is an identifical characteristic for the area that must gained back. Green system has a changing potential in the area needed a more effective relationship with locals and water. Also car park areas among the coast line and closed areas which are opening to the sea between buildings are important reasons about broken relationship with water.



Figure 4 : Urban Networks of Galata, 2013 – 2014 Fall, Urban Design Studio, ITU, Küblü Y, Saka Ö, Afridoon S.

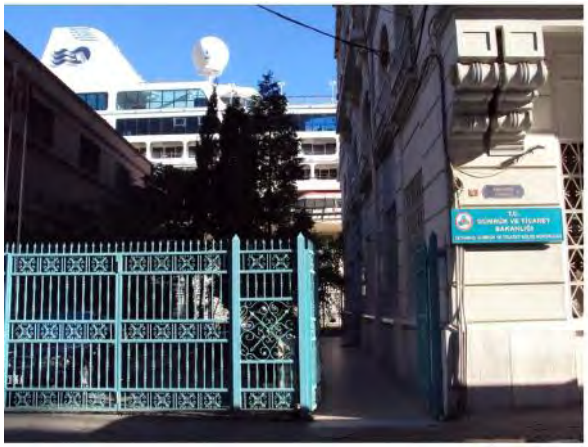


Figure 5 : Closed areas on the coastline



Figure 6: A passage from street to the sea

4. Evaluation

As a result of network analyses it is possible to make some inferences. In association with network maps, it is possible to make some inferences relationship with water of Galata.

Despite having many potentials connecting with water today, Galata has a surprisingly broken urban life from water. It is obviously important to gain back all this characteristics in global aspects, but more important thing is continuity. To provide it, every component in Galata must be linked with water. It can be named as a water centered urban life.

To be successful, some parts of closed areas between buildings on the coastline, must be opened to the sea to gain coast – street relationship. Beside, this is especially crucial for locals as they are living an isolated life from water which is their right actually. Also, there is a possibility for buildings among the coastline to be functioned for sea trade and cultural activites. It is important to continue the identity of sea trade area with developing and by increasing functions, the use of locals will be increase also. Giving leisure functions to carparks also contribute the relationship with water. With the concept of permeability, wall effect among the street can be lifted. Other important potential is having a huge potential for in between spaces connecting to water with arcades. With increase of daily and night usage of locals and tourists, rise of sea trade business and productive use of small business, inadequacy of coast – urban relationship, it will be possible to find solutions in the area. And creating an educational function on the coastline which is also connecting with art museums in the area will give a water based transformation responding today's needs at the same time. Matching all characteristics with modern urban dynamics is a crucial point. As a final view, it is obviously important to gain back all this characteristics in global aspects, but more important thing is providing continuity.

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Analysis of Maritime Infrastructure in Seaport City in Indonesian Using Fuzzy-Logic Cognitive Mapping

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1. Introduction

With 17,504 islands, Indonesia is the largest archipelago in the world. So, Indonesia has a lot of seaport (a town or city with a harbor for seagoing ships) where the people earn a living from the sea sector. Marine Fisheries Statistics in 2011 states that sixty-five percent of the total 467 districts/cities in Indonesia are in the coastal region. In 2010, Indonesia's population reached more than 237 million people, of which more than 80% live in coastal areas.

Ministry of Public Works stated that since 2004 to 2009 the percentage of the number of activities directly related to marine coastal areas such as the transport sector and the fishing port is only about 3 - 3.5% of total GDP. This condition illustrates the shift in the main activity in the coastal cities of Indonesia, which is supposed to be the main sectors of the economy, from the traditional period (beginning of the history of the archipelago) up to today's modern times. Side effects of the release of a community's coastal city by the sea is a shift value from the view of the coastal area as a 'porch' into the coastal area as a 'undeveloped area'. The paradigm shift led to the development of infrastructure in coastal areas (harbor city) abandoned.

However, the more problematic of maritime infrastructure threatens both the city development of seaport and the people's live. At the macro level, the problems of maritime infrastructure very affected shipping traffic among the islands, equitable regional development, and national economic growth. At the micro level, the threat to loss of seaport's live and work of local people is becoming a reality. The irony, in addressing the problem of transportation in archipelago, it should use the view that the water (sea) for means of linking the island, not to separate the island.

One of the main problems that led to the poor condition of water transportation in Indonesia is poor infrastructure that supports the marine sector activity. The number of ports in Indonesia are declining, and the condition of the seaport city and the port became worse. The lack of infrastructure development alignments in the maritime sector is one of the keys on this issue. Furthermore, infrastructure problems has become very complex because of the many interrelated factors, such as aspects of land use, economic, technical, national and regional planning, government policy to community paradigm. Determination of the root of the problem and the relation between sectors to determine the appropriate solution for this problem.

This paper discusses on the analysis of the main causes that led to the worse condition of seaport infrastructure in Indonesia. This analysis uses Fuzzy-logic Cognitive Mapping (FCM). FCM analysis methods conducted as a modeling technique based on fuzzy logic and theory to find the root of the problem so that decision (solution) can be made with the scheme of structure decisions in the form of a cognitive map. The outcome of this paper is how the interaction among the elements that make up the poor condition of infrastructure and which elements are very important and should be a focus on building infrastructure in the seaport in Indonesia.

2. Infrastructure in Seaport City

According to Bassett and Hoare in 1996, There are three components that shows the relationship between the city and the harbor; that is synergy between the harbor and the role of seaport city, irrelevance growing intensity of the harbor as a driver of growth in the city because the process of urbanization that caused the government just pay attention to the development of the capital city, and the coastal city as a center of production of goods and services has been shifted to the city as consumption centers.

The linkage between the seaport city with the harbor very large impact to determine development priorities port city. Activity of the harbor determine how the characteristics and role of the port city. Associated with linkage seaport city with the harbor, there are some aspects of the port city development ie:

- Security and disaster management. Regions seaport city in Indonesia have a higher vulnerability to floods, tsunamis and tidal waves. From 41 seaport cities in Indonesia, there are 32 cities that are vulnerable to flooding, 29 cities are vulnerable to tsunamis, and 15 cities are vulnerable to tidal waves (BNPB, 2010). Based on these conditions, the seaport city infrastructure development should consider the concept of understanding, spatial planning, and infrastructure development that is sensitive to the vulnerability of disaster.
- Comfort in the city hall. The demands of convenience by the people appearing on the component housing, recreation component, and cultural areas (Bassett and Hoare, 1996). The demands of convenience is not only for the facilities housing units themselves, but also include environmental quality, social quality and community cohesion. In addition, people also need a cultural attachment which became the prevailing values within the community. The restoration and maintenance of cultural areas through the provision of infrastructure and facilities to foster emotional attachment to the citizens with the city and its culture values.
- Productivity seaport city that is filled by job opportunities. The demands of society will create jobs in various sectors, from the construction sector to trade and services sectors. The effectiveness of these employment needs to be balanced with the development of human resource capacity to meet that demand. Community participation is key to the structuring of the seaport city.
- Environmental quality. The provision of infrastructure development and law enforcement for violations that threaten environmental sustainability is a major component in improving the quality of the environment. It also needs to be supported through community awareness and responsibility in environmental management. The primary key of the understanding establishment and and social responsibility in maintaining the environmental sustainability of the coastal city is through a process of regular and intensive education by empower the non-governmental organizations and active participation of the community.

Resilience to climate change. Climate change in the world has a huge impact for a city related to the threat of cyclones, sea level rise, flood, and drought. So it is necessary to anticipate through the approach of technical aspects (retaining the ocean waves, water treatment, reservoir dams), the policy aspect (spatial planning, coastal zoning regulation, disaster risk management, mangrove forests and water catchment areas), and the establishment of people's behavior that noticed the issue of climate change.

Based on the above considerations, the approach in the provision of seaport city infrastructure in coastal areas should be based on sustainability concepts of spatial planning in the coastal areas. Provision of infrastructure needs to conducted in an integrated manner across sectors. In the implementation, infrastructure development related to the system of

the government regulation, infrastructure quality standards, as well as economics and business.

The role of regulators, who are ultimately responsible to Parliament, is to regulate business decisions and promote the public good. Regulation can be divided into three areas, there are economic that aimed at controlling the abuse of monopoly power, public goods and external effects such as environmental and safety regulation, social such as pensions and benefits.

Standards are at the hub of the quality infrastructure, facilitating the other areas by supporting or replacing regulations, providing the basis for trade policy negotiations, leading to mutual acceptance and recognition of accreditation, certification and audit or test results giving weight to individual firms' design specification activities, including their intellectual property rights conformity assessment and accreditation.

Economic and business ultimately bear the cost of standards development, conformity assessment (certification, tests, audits) and attestation (mandatory marking, 'quality marks', licenses, etc.). It needed a strategic planning, management disciplines (marketing and finance, training and people development), quality-related disciplines (process reengineering, management systems), areas of the quality infrastructure (standardisation, certification, regulatory and voluntary compliance). The quality infrastructure provides benefits to consumers, through a competitive market and the goods and service they purchased.

3. Fuzzy-logic Cognitive Mapping

A problem in a town sometimes need to get an alternative solution that blends between science and society. Decision-making on the problems of a city can be translated scientifically. Axelrod (1976) showed how political decisions are made to political decision structure scheme in the form of cognitive maps (cognitive maps). The models were Widely used for political analysis and decision making, negotiation, and crisis management.

Cognitive map is a schema that describes the relationship between the variables that make up a problem. Cognitive map is meant here is the abstraction problems encountered by the observer (observer) that then can be described in the model maps the causal diagrams (causal loop diagram).

A fuzzy cognitive map is a form of observation of a problem that is described in the model diagram map, based on fuzzy logic. Map diagram illustrates how the elements (actors) of the forming an event related to each other and how "impact strength" of the each of these factors.

The introduction of fuzzy logic that represents deliver new capabilities for the the CM and lead to the development of Fuzzy Cognitive Maps by Kosko (1984). Allows the use of fuzzy logic representation of both types (positive and negative) of the causal relationships that exist between concepts of the the model but also the level of causal relationships. In general, Fuzzy cognitive maps (FCMs) shows how the concepts (events, values, moods, trends or objectives) causally influence each other to some degree.

The following FCM inference algorithm is:

Step 1: Definition of the initial vector A that corresponds to the elements-concepts identified by experts' suggestions and available knowledge.

Step 2: Multiply the initial vector A with the matrix W defined by experts.

Step 3: The resultant vector A at time step k is updated using function threshold ' f '.

Step 4: This new vector is considered as an initial vector in the next iteration.

Step 5: Steps 2–4 are repeated until epsilon (where epsilon is a residual, describing the minimum error difference among the subsequent concepts).

For example, we will construct a model of to causal relationships as follows:

- Because of C_1 then occur C_2.
- Because of C_2 then occur C_3 and C_4.
- Because of C_3 then occur C_4.
- Because of C_4 then occur C_1.

Each node in the FCM Represents a concept. Each arc (Ci, Cj) is as well as a weighted directed, and Represents a causal link between concepts, showing how concept concept Ci causes Cj.

This is illustrated in Figure 1.

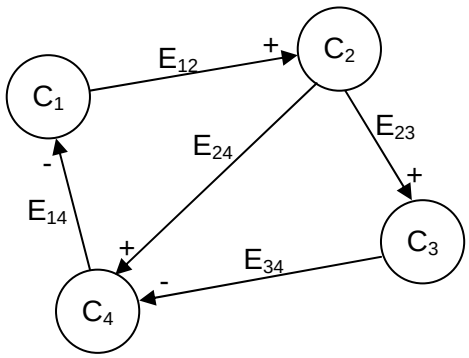


Figure 1: The Concept of FCM Model

Causal relationship between each point in the FCM (C_1 and C_2, etc) can be related straight, usually marked with "+1" or "+" alone. This means that if the quality of the the concept C1 C2 enlarges the concept of quality is also enlarged, otherwise if the quality of the concept C1 C2 narrowed the concept of quality is decreasing. On the other hand, this causal relationship can be the opposite, usually only marked use "-1" or "-".

Each relationship consists of the two points, ie points C_1 and C_2, has three possible edge weights (eij), that is:

- e_{ij} >0, it means that both concepts have positive causality (related straight) that is growing and shrinking value C_i quality will result in swelling and shrinking value C_j quality as well.
- e_{ij} <0, it means that two concepts have the causality negative (opposite) that is growing and shrinking value C_i quality will lead to shrinking and swelling values C_j quality as well.
- e_{ij} =0, it means that both concepts do not have a direct causal relationship.

Thus, through the weight of edge (eij), the relationship basically can be converted into a connectivity matrix of FCM that we define as:

$$M = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & -1 \\ -1 & 0 & 0 & 0 \end{bmatrix}$$

Each point representing a particular concept is also represented to a state vector C, which shows the value of each concept (the concept of the number n) and matrices over the edge, that is M. Each value of the C is calculated as:

$$C_{t+1} = f\left(\sum_{j=1, j\neq i}^{n} C_t W_{ji}\right)$$

In this equation, The value of W_{ji} is the value of the weight of the C_j to C_i and the function f is a function that transforms the result of the the multiplication in the interval [0,1] that became the value of the each concept. This equation in a more general form can be written as:

$$C_{baru} = C_{lama} \times F$$

that C is the result matrix vector multiplication of the the value of the old C to the edge of the matrix F.

This value can be obtained of the the opinion of the experts combined. So the result of the this merger would be simulated for the see how the description of the the experts are then sought alternative solutions and policies that may be taken.

4. Mengurai Permasalahan Infrastructure Using FCM

The use of FCM analysis for the some problems has been popularized by Kosko since 1994, particularly in view for the outlining the social problems in the community. Infrastructure problems in the port city has major implications for society and social life. Analysis outlines maritime infrastructure problems in the city that are currently getting worse.

4.1 FCM Model

There are many ways to parse the problem using FCM. In this study, a description of the the problem using literature analysis Indonesian Ministry of Public Works. Priority issues using other analysis of the Indonesian Presidential Candidate Work Programme 2014. Currently, Indonesia is holding presidential elections. Exposure presidential candidate programs using analysis expert team consisting of the experts and scientific experts of the universities and expert practitioners. Associated to infrastructure, they mentioned work program also describes that the infrastructure be focused in their work plan for the build the country in the next 5 years. This proves that the infrastructure is one of the vital aspects in development and should be addressed.

A description of the infrastructure in Chapter 2 elaborated and adjusted by a factor that prioritized. In the FCM implementation, priorities and relationships between factors defined to step a direct or inverse relation between two factors is-identified; it is marked with an arrow pointing the direction of the relation. Then, the strength of the relation is described, using linguistic (qualitative) weights, there are: "strong", "medium", and "weak". The symbol "+" (positive) indicate a causal relationship where the first factor led to the emergence of the second factor and the symbol "-" (negative) suggests otherwise.

+ + +	Strong	1.00	Positive influence (induce)
+ +	Moderately strong	0.67	
+	Weak	0.33	
-	Weak	-0.33	Negative influence (reduce)
- -	Moderately strong	-0.67	
- - -	Strong	-1.00	

Figure 2: Fuzzy Linguistic weights

There are 24 factors that were involved in the development of infrastructure in a city. In the port city, things to note is that most of the marine industry community life of the marine and fisheries activities. In addition, the culture and customs of the local people that know each other and have a strong community cohesion should be a factor considered. The models comprises twenty four factors i.e.:

1. Infrastructure
2. Safety
3. Housing
4. Recreational
5. Cultural
6. Employment
7. Living and environment
8. Social
9. Community cohesion
10. Participation
11. Human resources development
12. Education and technologies
13. Community awareness
14. Technical
15. Marine sector production
16. Government Tax
17. Climate issues
18. Good governance
19. Economic (investment and business)
20. Strategic planning
21. Land use
22. Regulation and law
23. Corruption
24. Industry

For the factors including the following models of causal relations between them have been identified:

- Infrastructure has positive influence over Housing, Safety, Recreational, Cultural, and Employment.
- Safety has positive influence over Living and environment.
- Housing has positive influence over Living and environment, Social, Community cohesion, and has negative influence over Climate issues.
- Recreational has positive influence over Social and has negative influence over Climate issues.
- Cultural has positive influence over Participation, Marine sector production, and has negative influence over Corruption.
- Employment has positive influence over Participation and Human resources development.
- Living and environment has positive influence over Marine sector production and Climate issues.
- Community cohesion has positive influence over Cultural and Social.
- Participation has positive influence over Living and environment, Community awareness, and has negative influence over Corruption.
- Human resources development has positive influence over Education and technologies, and Community awareness.
- Education and technologies has positive influence over Community awareness, Technical, and Industry.
- Community awareness has positive influence over Cultural, Living ad environment, Climate issues, and Regulation and Law.
- Technical has positive influence over Climate issues.
- Marine sector production has positive influence over Government tax and Industry.
- Government tax has positive influence over Good governance and has negative influence over Investment and business.
- Climate issues has positive influence over Infrastructure.
- Good government has positive influence over Investment and business, Strategic planning, and Regulation and law.
- Investment and business has positive influence over Strategic planning and Industry.
- Strategic planning has positive influence over Infrastructure, Marine sector production, and Land use.
- Land use has positive influence over Infrastructure.
- Regulation and law has positive influence over Safety, Land use, and has negative influence over Corruption.
- Corruption has negative influence over Good governance and Investment and business.

- Industry has positive influence over Marine sector production, Government tax, and has negative influence over Cultural, Living and environment, Climate issues, and Land use.

Based on the identified causal relationships the weighted matrix associated to the model was defined:

Maritim Infrastructure	Infrastructure	Safety Aspect	Housing	Recreational	Cultural	Employment	Living and environment	Sosial	Community cohesion	Partication	Human resources development	Education and technologies	Community awareness	Technical	Marine sector production	Government Tax	Climate issues	Good governance	Investment and business	Strategic planning	Land use	Regulation and law	Corruption	Industry
Infrastructure	0.00	1.00	1.00	0.67	0.33	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Safety Aspect	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Housing	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Recreational	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cultural	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.67	0.00
Employment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Living and environment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Social	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Community cohesion	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Participation	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	0.00
Human resources development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education and technologies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Community awareness	0.00	0.00	0.00	0.00	0.67	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	1.00	0.00	0.00
Technical	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marine sector production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Government Tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	-0.33	0.00	0.00	0.00	0.00	0.00
Climate issues	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Good governance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	0.00
Investment and business)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	1.00
Strategic planning	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
Land use	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Regulation and law	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.67	0.00	-1.00	0.00
Corruption	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.00	-0.67	0.00	0.00	0.00	0.00	0.00
Industry	0.00	0.00	0.00	0.00	-0.33	0.00	-0.67	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.67	-1.00	0.00	0.00	0.00	-0.67	0.00	0.00	0.00

Figure 3: The Weighted Matrix

The matrix should visualize to the FCM Model. For a better visualization of the FCM model, there is Mental Modeler software. That is free software that could be visualize the model with the fuzzy linguistic weight. Gambar dibawah ini menunjukkan FCM model dari hasil analisis di atas.

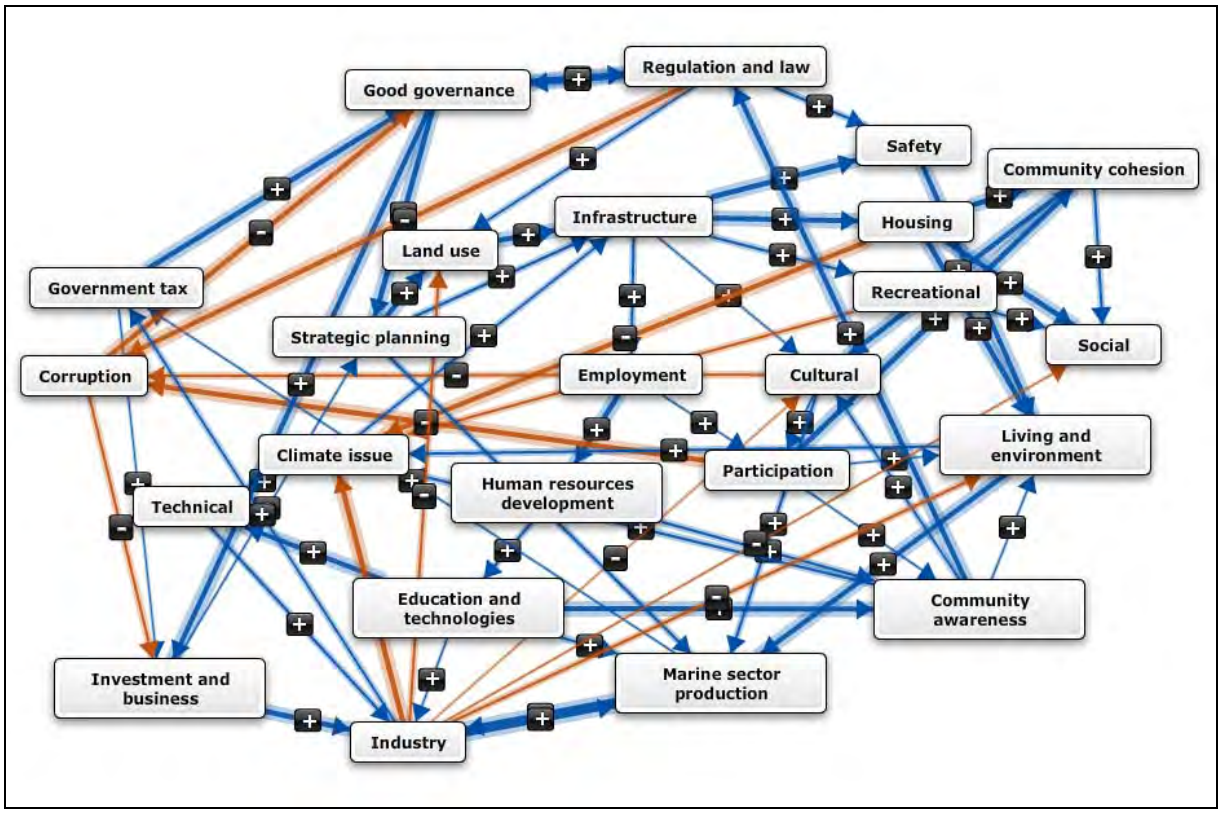


Figure 4: The FCM Model

From the results of FCM model above, we can know some of the factors that a central activity complexity. These factors are shown in the figure below.

1	Industry	7.00	13	Education and technologies	3.67
2	Infrastructure	6.01	14	Land use	3.34
3	Good governance	6.00	15	Investment and business	3.33
4	Regulation and law	5.34	16	Safety Aspect	2.67
5	Marine sector production	5.34	17	Social	2.67
6	Climate issues	5.01	18	Community cohesion	2.67
7	Housing	5.00	19	Human resources development	2.34
8	Living and environment	5.00	20	Government Tax	2.33
9	Community awareness	4.67	21	Participation	2.32
10	Corruption	4.34	22	Recreational	2.01
11	Cultural	4.00	23	Employment	2.00
12	Strategic planning	3.67	24	Technical	1.33

Figure 5: Centrality Factors

4.2 Analysis of FCM Model and Two Scenarios

Based on the initial state of the system is represented by a set of values of its constituent concepts (such as initial values for the weights in neural networks), FCM may develop from time to time until a state of equilibrium, until it reaches steady state. Steady state can be used to make predictions or different scenarios. Two scenarios are prepared using the programs 'two candidates leader' in the case study areas, with the priority on 7 major factor.

Modification of one or several factors in the equilibrium state the system will generate a different behavior. The scenario envisioned in our model is to increase the seven factors considered decisive by each candidate. These factors have increased in value by 30%,

according to the average rate of economic growth per year for 5 years, with the maximum number is 1.000.

Concepts	Results - No Changes	Results - Scene 1	Results - Scene 2
Infrastructure	0.701	0.911	0.911
Safety Aspect	0.776	0.813	0.829
Housing	0.668	0.869	0.713
Recreational	0.615	0.648	0.648
Cultural	0.756	0.771	0.765
Employment	0.615	0.648	0.648
Living and environment	0.791	0.815	0.793
Social	0.776	1.000	0.780
Community cohesion	0.661	0.704	0.671
Participation	0.611	0.615	0.615
Human resources development	0.649	0.844	0.657
Education and technologies	0.607	0.638	0.789
Community awareness	0.776	0.803	0.807
Technical	0.647	0.654	0.688
Marine sector production	0.954	0.963	1.000
Government Tax	0.708	0.729	0.731
Climate issues	0.283	0.268	0.300
Good governance	0.641	0.833	0.833
Investment and business)	0.580	0.754	0.627
Strategic planning	0.697	0.747	0.739
Land use	0.661	0.654	0.859
Regulation and law	0.805	0.837	1.000
Corruption	0.128	0.123	0.106
Industry	0.850	1.000	1.000

Figure 6: Change Factor for Two Scenarios

Analysis of the FCM matrix model using FC Mapper software. Calculations based on two scenarios, then compared between the two. The results of the analysis can be shown in the figure below.

Scenario 1	% of Variables Changed			Scenario 2	% of Variables Changed		
	68				68		
Positive Changes	**Strength (pos)**	**Negative Changes**	**Strength (neg)**	**Positive Changes**	**Strength (pos)**	**Negative Changes**	**Strength (neg)**
Safety Aspect	1	Climate issues	1	Safety Aspect	1	Corruption	1
Recreational	1	Land use	2	Housing	1		
Cultural	1	Corruption	2	Recreational	1		
Employment	1			Cultural	2		
Living and environme	1			Employment	1		
Community cohesion	1			Living and environme	2		
Participation	2			Social	2		
Education and techno	1			Community cohesion	2		
Community awarene	1			Participation	2		
Technical	2			Human resources de	2		
Marine sector produc	2			Community awarene	1		
Government Tax	1			Technical	1		
Strategic planning	1			Government Tax	1		
Regulation and law	1			Climate issues	1		
				Investment and busin	1		
				Strategic planning	1		
1=strong change; 2=medium change; 3=weak change; 4=very weak change.							

Figure 7: The Results Analysis of Two Scenarios

From the analysis results of the Scenario 1, we can draw the conclusion that with the priority to the seven factors, it will have an impact as follows:

- Overall change of 68%.
- There are major positive changes on 11 factors (Safety, Recreational, Cultural, Employment, Living and environment, Community cohesion, Education and technologies, Community awareness, Goverrntment tax, Strategic planning, and Regulation and law); and medium changes on 3 factors (Participation, Technical, Marine sector production).
- There is the risk of strong negative changes in the 3 factors (Climate issues, Land use, and Corruption). However, negative changes of corruption as a bad factors means a good condition in order to reduce the number of corruption.

Also, from the analysis results of the Scenario 2, we can draw the conclusion that with the priority to the seven factors, it will have an impact as follows:

- Overall change of 68%.
- There are major positive changes on 10 factors (Safety, Housing, Recreational, Employment, Community awareness, , Technical, Goverrntment tax, Climate issues, Investment and business, and Strategic planning); and medium changes on 6 factors (Cultural, Living and environment, Social, Community cohesion, Participation, Human resources development).
- There is the risk of strong negative changes only in the 1 factors (Corruption), that means a good condition in order to reduce the number of corruption.

5. Conclusion

The development of infrastructure in the seaport city is crucial to be supported by the Government. Good governance, regulation, and law enforcement are main key element in shaping the Government that has integrity, so the decline in corruption will happen by itself. Developing of the maritime industry should also be the focus in the city development. So, the economic condition of the city will be improved and will have a positive impact on society.

Understanding as above is very useful to be able to model the priority which should be taken in order to build infrastructure in the port city. The situation of the city and the people who change from time to time is an interesting thing because it can lead to greater divisions of the problems occurred. By developing FCM model, this approach seeks to understand how the situation occurred and highlights the reasons that lead to such behavior so that appropriate solutions can be found to solve the problem.

FCM model has identified the main factors that influence the development priorities in the port city. Two scenarios were analyzed to determine which is most appropriate scenario and more of a positive impact on society. In general, it can help the FCM model analyzes how the calculations could help the social problems that exist in society.

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Water views, affluence and concern for sustainable transport: the case of Sydney, Australia

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1. Abstract

Located on a beautiful harbor, Australia's premier City Sydney is one of the prettiest in the world. In recent times, the harbor and river side suburbs have seen much faster property value growths than other parts of the city. As a matter of fact distance from water and from city center is the most significant determinant of the property values. Indeed affluent communities with their beautiful views and high quality schools are all located at or close to the water edge and the city Centre. These communities also have much higher levels of concern for the environment. This paper presents an in depth discussion on relationship among water views, affluence and concern for sustainability in Sydney Metro. It also presents the case of one such Sydney community that joined forces with planning students from the University of Western Sydney to study ways to improve sustainability of its transportation.

The leafy suburb of North Epping in northwestern Sydney is served by a State Transit operated bus service which is a loop through the suburb of North Epping taking passengers to the Epping train station. The service then continues beyond the station to its eventual destination at the Macquarie Centre/University. It is argued that the bus service has low patronage and serves to reinforce the car-based lifestyle of North Epping.

Transition Epping is a community based action group working within the Transition Towns initiative that is focuses on relocalisation of food, cleaner energy and water consumption, strengthening the local economy and collectively reducing the carbon footprint of the area. The community group with the help of transport planning students at the University of Western Sydney conducted an elaborate study to discover ways of increasing bus patronage and reducing reliance on car for transport.

A number of hypotheses were made about various aspects of the bus service (bus size, bus route, bus timetable) for improvements in its patronage. These hypotheses were then tested. The method employed to conduct the study included: a survey of local community on their preferences for the bus size, route and timetable; a bus patronage study; and an interview with transport economist to understand financial implications of any proposed changes to the bus route. All the findings were synthesized into a plan of action for the bus service improvement. This paper presents a summary of the findings of the study and sets it in the broader context described above.

2. Studying 295 Bus Service in North Epping

Sydney is a beautiful harbor-side city. Properties with views of water are however beyond affordability for most. Proximity to water, CBD, and good schools (important factors in modern lifestyle) fetches much higher property prices than the rest of the metro. In recent years the property price gap has marked increased between Eastern part of metro i.e. closer to water, CBD and good schools (in particular in the northeast) and the western part that is away from natural and cultural amenities. The affluent are also very environmental aware. North Epping is one such affluent suburb on the Eastern side of the Metro Sydney. Transition

Epping, a local community organization, asked the author and his students to conduct a study of local public transport service. The objective of the study was to find ways to improve the service and increase patronage.

Patronising public transport is one way that we can reduce our dependency on private vehicles and thus reduce our need for a declining and increasingly expensive non-renewable resource – oil. In this way we can contribute to a more sustainable future for North Epping (and surrounds), a key aim of Transition Epping. The 295 bus provides a valuable service for many North Epping residents but for how many? And how can we get more people using it? To that end, what improvements can we suggest to the bus providers? It was these and similar questions that prompted us to work with Transition Epping to find the answers.

I would like to thank my students in the course Transport, Equity and Access, for undertaking the various tasks involved in the project. The students appreciated the experience of studying a real-life issue.

This paper is divided into three parts:

1. Community survey
2. Bus patronage survey
3. Economic analysis

Whilst sections 1 and 2 came up with different conclusions, section 3 describes the complexities of changing bus routes due to the upfront surveys and analyses required and political realities. That said, the sections of the paper make interesting reading. The conclusions that were presented to Transition Epping for improvement in 295 bus service include:

- reinstating a North Epping loop service during peak hour at least to decrease unreliability and increase the frequency of service which should encourage increased bus patronage. This is feasible as there are plenty of bus services from Epping station to Macquarie Centre/Uni that bus commuters from North Epping can link with at peak times.
- starting bus services 20 to 30 minutes earlier in the morning peak to allow for an extra service before 9am and putting on an extra school bus in the afternoon to satisfy demand.
- keeping the Macquarie Centre service between 10am and 3pm and after 6:30pm, that is, in off-peak times to cater for shoppers.
- keeping the larger buses as smaller buses would not cope with peak hour traffic, require retraining of drivers and eliminate economies of scale currently available with the City Buses fleet.
- keeping the same route, even though it does not pass the shops, as many more people get on the bus on the current route than would warrant a change. (The Bendigo Bank community bus provides a service to the North Epping shops for elderly residents once a week).

3. Part 1 - Community Survey

The public survey conducted on May 21st 2011 was a huge success, with more than 70 surveys completed. At around 9:30am three groups set out and presented residents at the local North Epping shops with the small questionnaire. Over the course of around 3 hours, residents were very helpful and mostly enjoyed seeing young students engaging in community activity that will hopefully benefit the residents of North Epping.

Right now the 295 North Epping Bus is on a route that is experience less than acceptable patronage. The route starts at Epping Station, as seen as letter A on figure 1, continues to North Epping, letter B, which loops around North Epping and back to Epping Station, A. After this the bus continues down the main road towards the Macquarie Centre, letter C on figure 1.



Figure 1: Present Bus 295 Route

There are a number of proposed changes to this Bus, that include:

- Shortening of the bus route to ONLY the North Epping Loop (figure 2).
- A more frequent bus service, running without timetable.
- Use of smaller buses.
- Re-routing the bus (eg. to North Epping shops).



Figure 2: Proposed change to route (purple indicator).

As shown above, the re-routing can also incorporate a more frequent service, catering for the loop only. This may reduce common complaints of buses being infrequent and unreliable.

The small survey was made beforehand in order to engage in learning activities that have real life implications. The attached excel document has the collected data from the 72 surveys completed. Part 2 of this journal/report will allude to patterns that emerged, while showing important data relevant to changes that can be implemented, which will be explained further in Part 3. Part 4 will then conclude on the best possible solution and will also comment on the validity of the exercise coupled with limitations and highlighting community involvement as a valid assessment tool.

3.1 Survey Results

The most important result from the survey is how often a resident uses public transport in the area. Public transport as a necessity is indicated by a 'Heavy User' (numbers 8-10), followed by 'Medium Users' (numbers 4-7) and lastly 'Light Users' (numbers 0-3). The survey had a line from 1 to 10, and asked residents to indicate their reliance level. I then put these into the 3 distinct categories described above. Figure 3 shows the distribution of these categories.

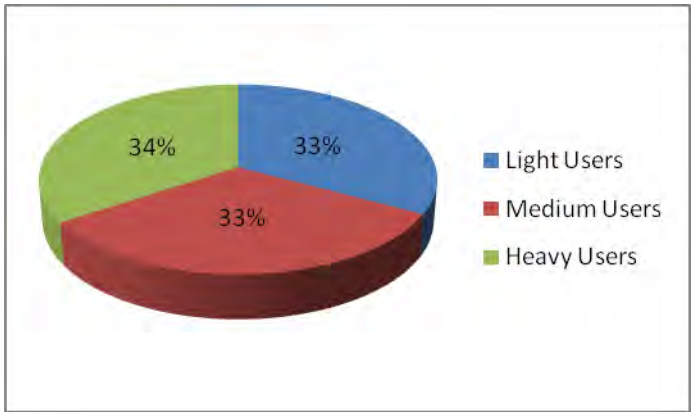


Figure 3: Distribution of reliance on public transport.

From the graph we can see that the distribution is quite evenly set. This result can often mean that there will be a variety of comments or complaints with the current situation. The variety of users makes it difficult to make all three categories satisfied. It is also important to see that there is a great deal of residents who use public transport with almost 70% needing it at a 'medium' rate. Without a train station, this leaves the bus network at the sole public transportation mode.

Age is another important result of the survey, as age can often give us an idea of the types of people in the area and how they use public transport. Figure 4 shows the age distribution of residents that completed the survey.

From figure 4 we can see that the dominant age group was the 55 and over range. This can show us that a lot of residents may need public transport out of necessity (medium or heavy users in figure 3). Another important result is that almost 8% of people indicated that the bus should be re-routed. Out of these residents 100% indicated that the bus should go past the North Epping local shops. The bus currently drops passengers off 250-300 metres down the road. If we look at figure 4 again, people 55 and over may not be able to walk this distance without some sort of discomfort, making the rerouting of the bus more important (discussed further in Part 3).

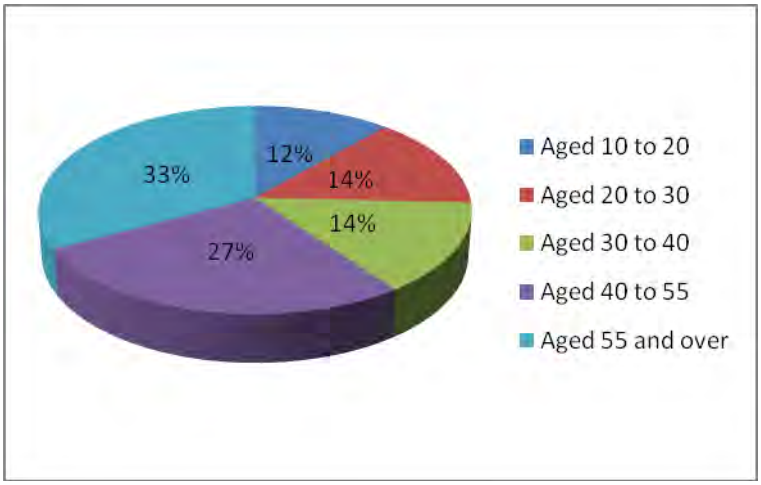


Figure 4: Age distribution amongst residents.

The problems with the bus have been varied, but they can all fall into 6 categories asked within the survey. Figure 5 shows the distribution of problems, if any, that allows us to examine just what is wrong with Bus 295.

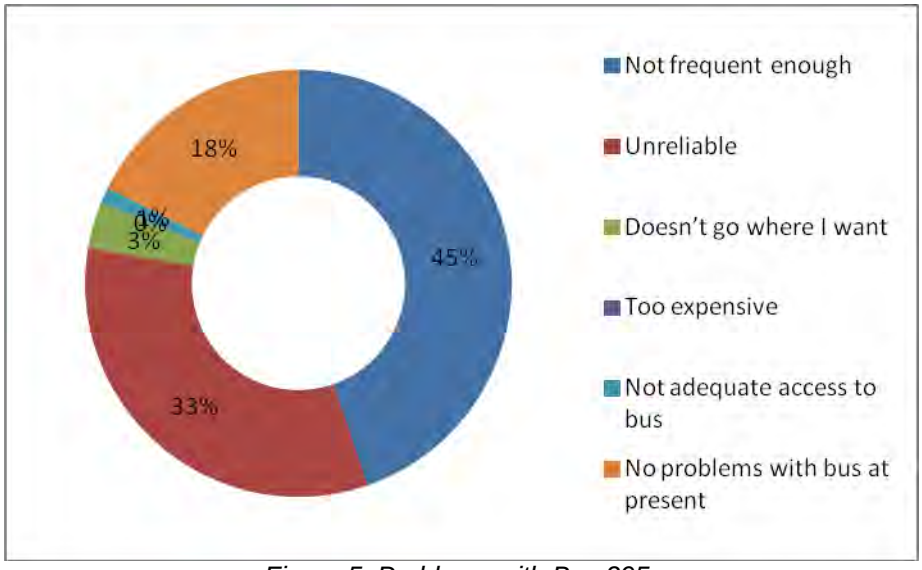


Figure 5: Problems with Bus 295.

From the data presented above, over 75% of the problems lie within the frequency of the Bus, coupled with its unreliability. This data can help propose changes to the service, for example:

- Making service more frequent.
- Sticking to timetable.

A particular problem noted by participants of the survey said that the bus didn't stick to its timetable, often skipping bus stops if there were no passengers. While the bus was earlier, the driver fails to realise that a lot (most likely all) of passengers rely on the timetable presented by the bus company, and not adhering to that can often lead to stress, anxiety and ultimately less patronage.

Another particular note is that almost 20% do not see a problem with the current bus network, but with 32% of people stating they do not catch the bus at present, this statistic may have inaccuracies as they may not even use the network. It is also important to realise that not one resident stated that the bus is too expensive, so cost is not an issue at all in the area.

Before implementing changes, it is important to examine just when passengers use the bus. After this we can get an idea of the time of day changes need to be made, and how much the bus is in demand. Figure 6 shows the time of day when residents use the bus.

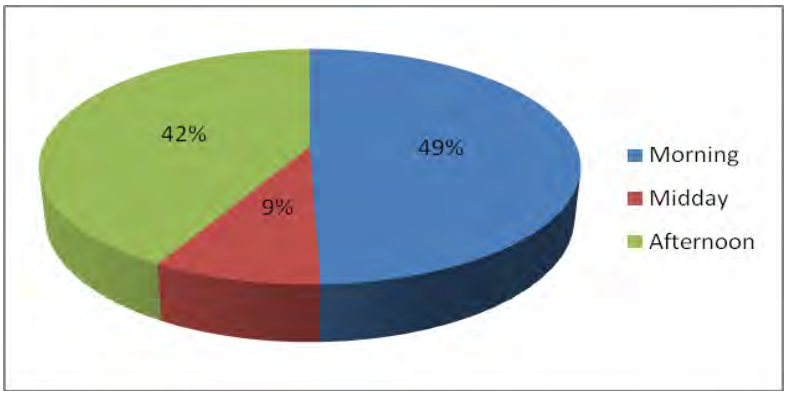


Figure 6: The times of day passengers use Bus 295.

Looking at this data, there is a clear indication that use during the day is limited, which may be the reason for the reliability issues during this time as the bus might not come for one hour. Also, with morning and afternoon acocunting for 92% of use, we can deduce that many of this use is for school or work related events, as many of the residents indicated BOTH morning and afternoon use.

The last important piece of data to look at is where passengers get off, or what the bus is used for. This will give us a strong indication of whether or not the dropping of Macquarie link is necessary or if it will better serve the community if it was kept. Figure 7 shows the range of destinations.

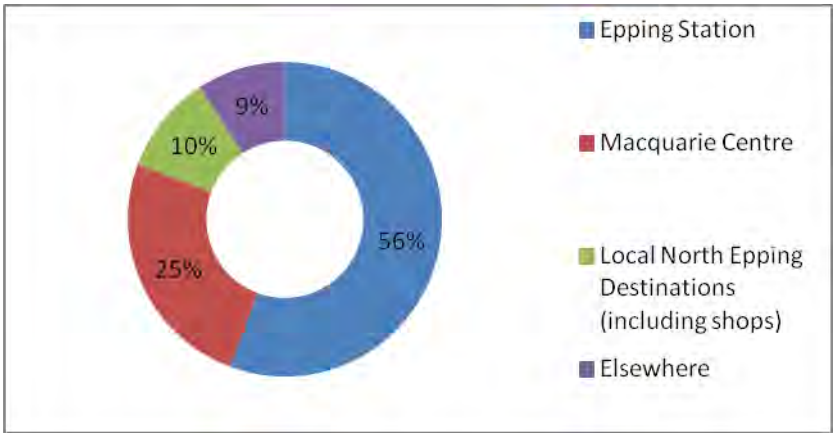


Figure 7: Primary destinations for passengers.

Figure 2.5 clearly shows that a majority (56%) use the bus service for the use of trains at Epping Station, reiterating the importance of the bus, as many are trying to organise their trips to coincide with train arrivals, eliminating waiting times. With this 56% coupled with the 33% of people saying the bus is unreliable, we can begin to imagine just how much of a problem this can be, and how much this may affect patronage. Also just as important is the Macquarie Centre link, with 25% of people using the link, the proposed dropping of this link may prove to be detrimental to patronage.

3.2 Potential amendments

There were 3 proposed changes that were given as examples to residents who completed the survey, with varying results. Figures 8, 9, 10 show us the feedback of current or potential passengers.

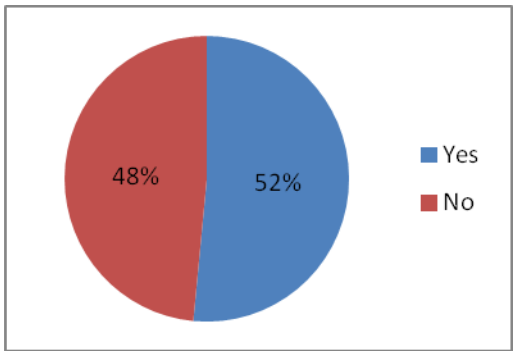


Figure 8: Drop the Macquarie Link, using only the North Epping Loop

From figure 8 we can see that the residents are divided on this issue, which would make the dropping of the loop altogether impose a significantly negative effect on passengers.

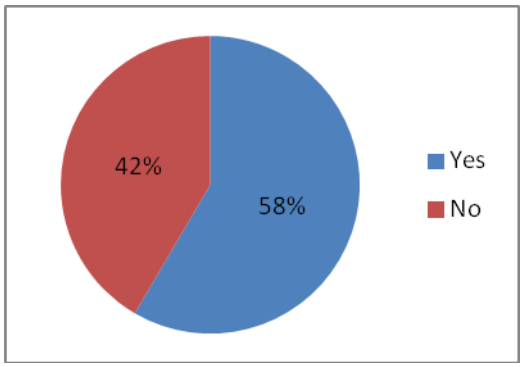


Figure 9: Would a more frequent service, catering the North Epping loop only, be better than having a timetabled service.

From 9 we can see more of a defined result, with almost 60% indicating that a more frequent service, without timetables would be much better, which would alleviate problems of unreliability. If people see the bus more, they are more likely to plan their trips knowing the bus is more frequent.

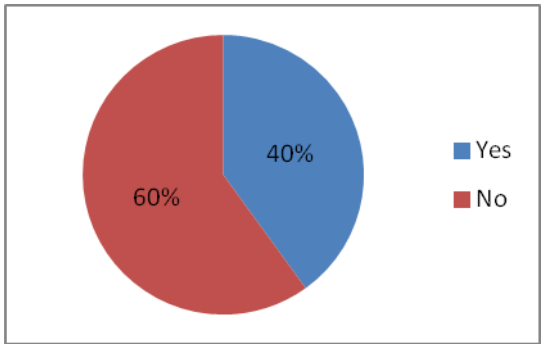


Figure 10: Making the bus smaller and re-branding so that it resembles an RSL bus.

Figure 10 shows us that re-branding of the bus would not be ideal, and residents would most likely not take notice of such a change. I feel this statistic is closely related to figure 11, showing that while most want more frequency, they also want smaller buses.

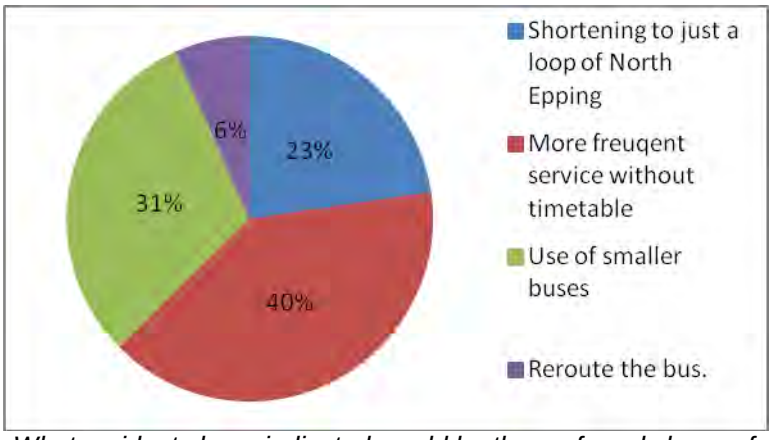


Figure 11: What residents have indicated would be the preferred change for Bus 295

As explained earlier, a small portion of residents would like a rerouting of the bus service, with all participants stating that the bus doesn't go to the local shops. From the figure above we can also see that almost half want a more frequent service while over 30% want smaller buses.

3.3 Conclusions from Survey

After an extensive look at the data collected, the survey has varied results, and as with many public concerns, the goal of satisfying every individual is practically impossible. The survey was conducted only once, and during the time of day when most younger persons are not present at a local shopping location. This coupled with the three hours of time spent may provide inaccuracies, as mentioned throughout parts 2 and 3. Upon looking at all data from the survey the ultimate solution would be to have Bus 295 run a non-timetabled service from the hours of 7:00am-10:00am and also 3:00pm-6:30pm, that has increased frequency and does not include the Macquarie Link. At that time of the morning and afternoon/evening it seems to be only school students and workers trying to get to and from the station.

A more frequent service may limit waiting times at Epping Station and make the service more reliable. During the day, after 10:00am until 3:00pm and also after 6:30pm, the Macquarie Link can be made for shoppers and University students. Most of the participants who were over 55 that used the Macquarie link, did so during the middle parts of the day. One additional feature is to have the service pass through the local shops of North Epping, eliminating the resounding complaints that the service stops too far from the shops, which is undesirable for elderly passengers. This rerouting should be available throughout peak and non-peak times.

4. Part 2 - Bus Patronage Survey

After community concern relating to the Sydney Buses route 295 and its effectiveness in transporting people as well as its reliability, a patronage survey was organised and conducted to provide clear spatial details on patrons and capacity levels of the service. With this information an informed recommendation can be made as to whether the service route should be changed, the service timetable altered, the bus size reduced or that the service remain the same.

4.1 Observations:

Our observations began at Epping Station (6) at 6.34am; already the bus was running three minutes late. However we were the only passengers on the bus as it headed into North Epping. On this loop through North Epping eight passengers boarded the bus, with seven exiting at Epping Station. A reoccurring problem occurred at the intersection of Boundary Road and Eastcote Road on every loop where the bus was forced to articulately manoeuvre

through a very narrow section due to cars being park on both sides of the road. We consulted both bus drivers from the observations and they believed that this problem could not be alleviated through a different bus, as the problem was width no length of the bus. The bus arrived at Epping Station (19) on time and was early on arrival at Macquarie Centre (24), in this time the bus picked up an additional two passengers. Once departing Macquarie Centre (24) the bus remained on time at the major timing points until its arrival back at Macquarie Centre (47), this time period was between 7.04am and 7.48am, the primary peak period. We determined a bus to be considered on time if it arrived within 2 minutes of its timetabled time, this ensured any discrepancies between clocks should be accounted for. *Figure 12* shows the actual bus arrival time in relation to the timetabled time, as can be seen the majority of the time the bus was considered on time.

We believe the school zone around Epping Public School played no considerable role in delaying the bus on this loop, or the next passing, despite being in the middle of the school zone time. During the third loop of North Epping the bus picked up nineteen passengers, whilst 2 passengers departed the bus. These two passengers should be considered abnormalities as one was a casual and most likely irregular passenger for that time, while the other was a businessman who, from his bags looked like he was returning from the airport, obviously not a regular trip. This confirms that during the morning peak period the role of the North Epping loop is to pick up passengers and transport them to either Epping Station or Macquarie Centre, as shown in *figure 13.* Of the nineteen passengers, ten were casual passengers or retired, a contrast to the previous loop. The other nine passengers were comprised of office workers, University students and school students. This change in patronage is probably due to the bus arriving at Epping Station (65) at 8.55am, although late by five minutes at this point, the majority of office working or school student passengers that caught this service would be late to school or work, as there is only one school within close walking distance to Epping Station and a limited number of office corporations in relation to nearby Macquarie Park.

Therefore this service is undesirable for people wishing to get to somewhere for a 9.00am start. If the timetable was altered so that this service arrived at Epping Station (65) at 8.30am then the patronage of this service would be likely to increase without affecting the other 295 services in the morning. We also observed that at Epping Station (65) seven people remained on the bus, a large amount in relation to the other Epping Station stops. At Epping Road, Marsfield (68) four people depart the bus, a combination of school students and University student while 5 people board the bus, most University students. All passengers then depart the bus either at Herring Road (69) or Macquarie Centre (70). This change in patronage suggests that a number of University students will continue to use the service throughout the day to travel to Macquarie University, however we do not believe that they are overwhelmingly constricted to the 295 service as the majority of University students that board the bus during our observation did so on Epping Road, where at least eight Sydney Bus services operate in addition to any private bus services.

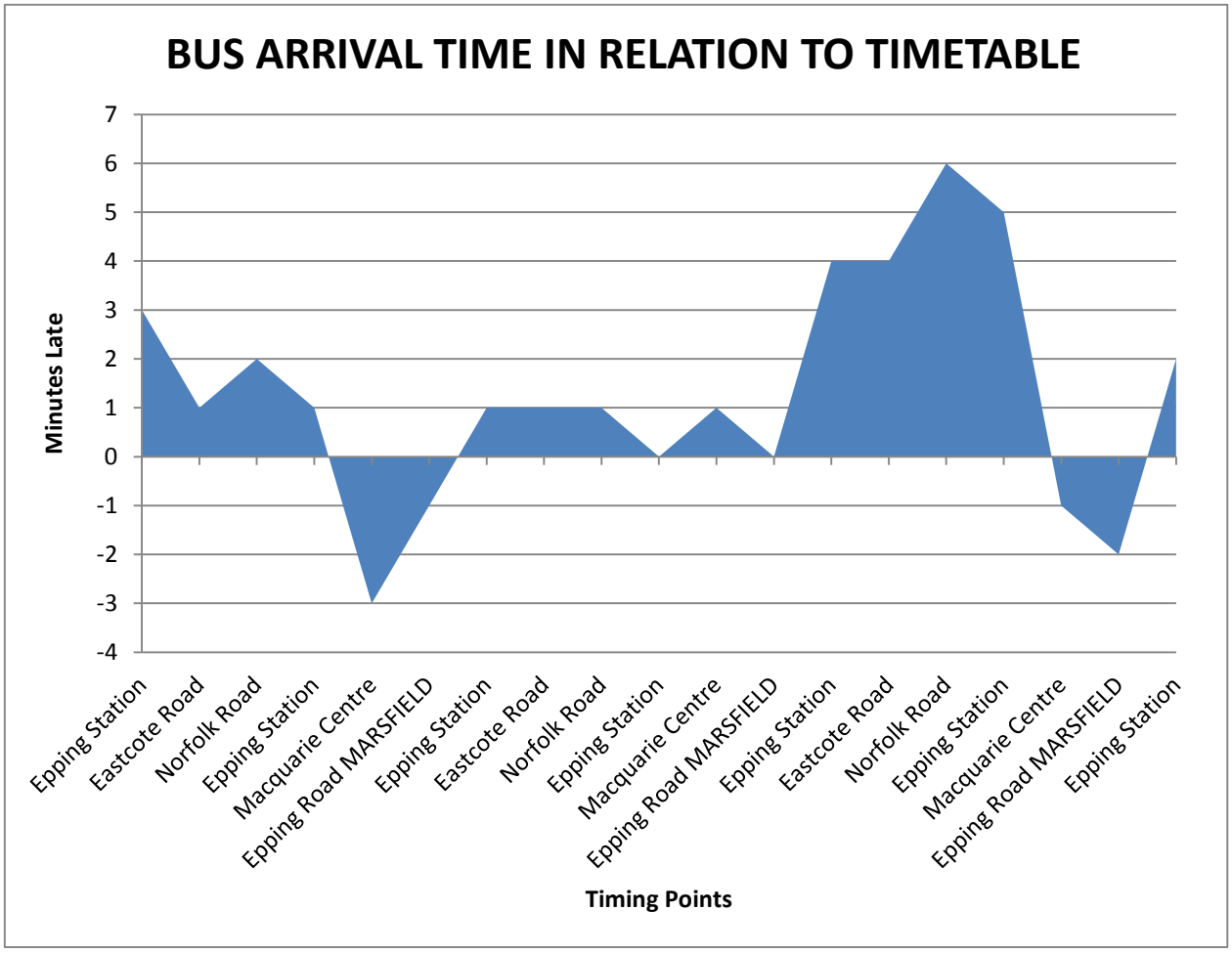


Figure 12: The actual bus arrival time in relation to the timetabled time

4.2 Options:

Shortening the bus route to a loop running through North Epping only.

The initial reasoning for this recommendation was due to patronage levels and traffic problems along Epping Road during the peak period. During our three loops during the morning peak our bus was on time except for the last loop to and from Macquarie Centre, where the bus slipped six minutes behind schedule. This was primarily due to the traffic lights at the intersection of Epping Road and Pembroke Street. As previously mentioned we were able to merge out of the bus lane near Terry's Creek, but could not pull into the slip lane at this intersection, this extra traffic caused the bus to be at the intersection for two rotations of the lights, thus delaying the bus. Apart from this unlucky occurrence we believe that the traffic along Epping Road had no considerable impact on the bus. We also believe that this would be the case in the afternoon as schools and businesses stager their finishing times, resulting in a longer but less intense peak period.

The busiest section of the 295 route during our observations was the loop to and from Epping Station, however over 40% of passengers departed the bus between Epping Station and Macquarie Centre; indicating that this part of the route is popular and necessary. Furthermore, summary data from the afternoon observation team show that the bus is busier throughout the afternoon than it is in the morning, with a large number of passengers boarding the bus between Epping Station and Macquarie Centre and travelling to North Epping, most of these passengers were school students who are most likely able to take

alternative transport to school in the morning due to school starting at a similar time to the average workplace, yet in the afternoon school finishes two hours before the average workplace. Therefore by shortening the route to a loop through North Epping patrons will have to catch two buses to get to North Epping, causing major inconveniences for school students who as a whole are not able to drive; it also requires an additional ticket to be purchased as public transport in Sydney does not have an integrated ticketing system. This is likely to decrease public transport patronage in the area and increase car transport, adding to the traffic problems of the area that may cause the delay of other buses, resulting in a flow on effect across all public transport in the area. We believe that the route should not be modified to only be a loop through North Epping.

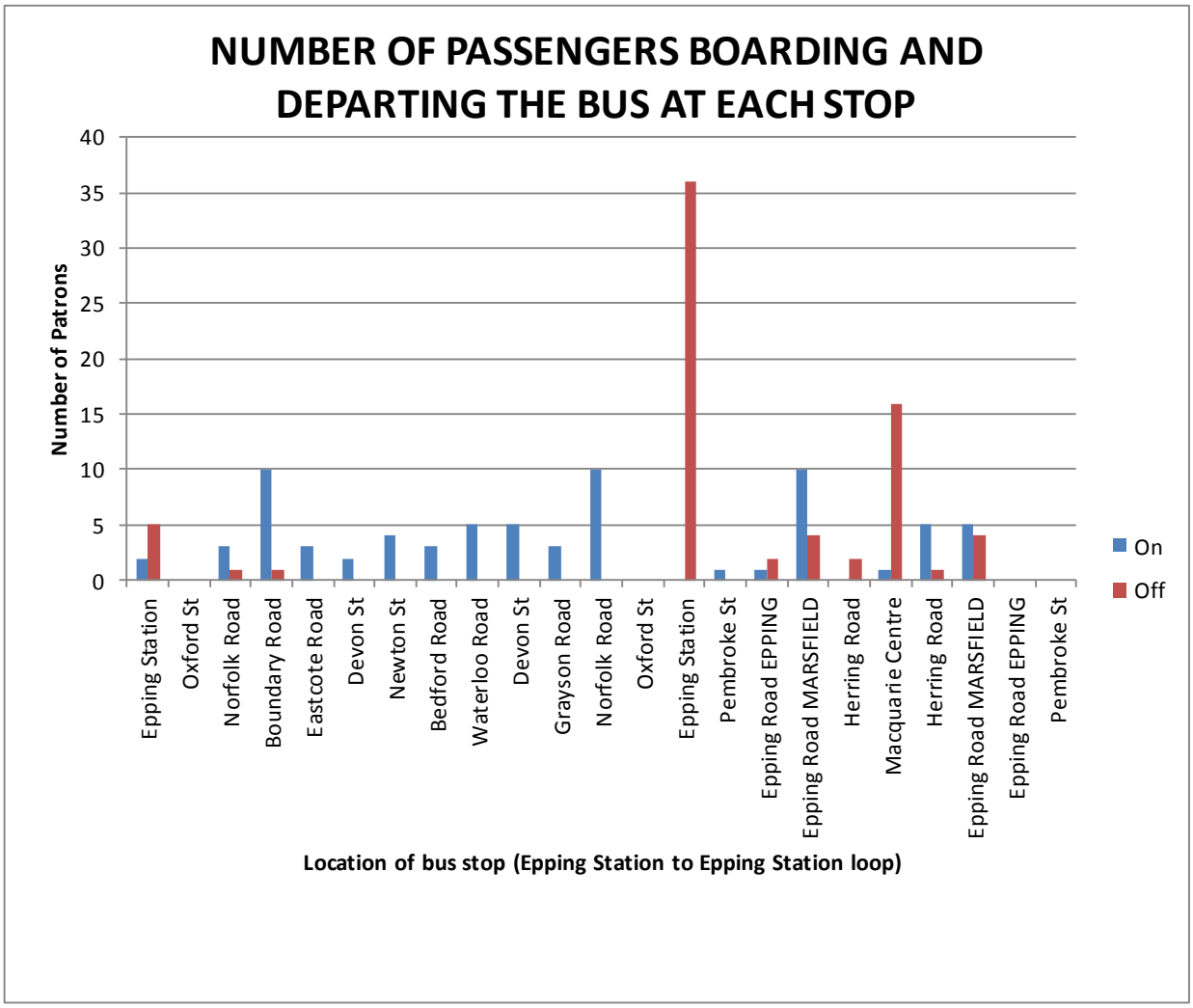


Figure 13: Number of passengers boarding and departing

Use of a more frequent bus service running without timetable.

This model has had considerable success with the 'Metro' buses and the T-ways out of Parramatta; however the major difference between these routes and the 295 route is that they are transporting people from major interchanges to other interchanges along a route not serviced by our existing rail network, but with enough passengers to merit a high frequency bus service. The 295 bus service does not have the patronage levels to warrant additional services, especially when a direct rail link exists between Epping Station and Macquarie Station, the two major stops on the 295 route. Furthermore at least eight Sydney Buses'

services run along Epping Road, not far from Epping Station to Macquarie Centre, thus alternative public transit is accessible. In addition, the two bus drivers that we had during our observations both agreed that, that morning was slightly below average, in terms of patronage, but during the morning peak the bus was never at or near capacity. Initial afternoon observations indicate that the bus neared capacity after school had finished, probably due to afore mentioned reasons, however this could be alleviated if a dedicated school bus was operated during this time. Apart from this period we do not believe the patronage levels of the 295 service warrant a high frequency bus running without a timetable. If this was established the service would become a liability without properly servicing the needs to the community in the region.

Use of smaller buses.

Our observations indicate that operating a smaller bus could harm the effectiveness of the service during the peak periods. As noted, the bus drivers said that patronage levels on our observation day were below average, meaning a smaller bus with fewer seats could cause overcrowding on the bus and in turn deter passengers from using the service. Additionally a number of elderly and less mobile people reportedly use this service regularly, the use of a smaller bus will result in less wheelchair/walking frame accessible seats being available. A large number of these seats are not required during the peak period, but are during the non-peak period, as more passengers require these seats. Therefore, the service cannot have a smaller bus during either the peak or non peak period without significantly disrupting the effectiveness of the 295 service.

A positive that may arise from using smaller buses is that they are easier to manoeuvre, a necessity during the North Epping loop. On each loop through North Epping the bus was required to slow down considerably to manoeuvre between parked cars. One bus driver stated that this would be made easier if using a smaller bus, but stressed that a smaller bus could not cope with the patronage levels during the peak period. The afternoon observation team noted higher patronage levels that would have put a smaller bus over capacity, demonstrating that a smaller bus is not practical for the 295 service. If this option was implemented in conjunction with a more frequent service, we do not believe this would make any operational difference to the 295 service. Essentially this will increase costs related to running the bus, for example petrol, maintenance and wages, without increasing the maximum patronage levels by an amount that would further encourage public transport in the area.

Rerouting the bus through North Epping local shops.

This option would not be a practical option during the peak periods as it would decrease the accessibility of residents north of Boundary Road and Eastcote Road. Although it would increase the accessibility of residents along Malton Road and Roma Street, more houses are affected in the north of the suburb; it can then be assumed that more people are affected. Additionally during our observation thirteen passengers boarded the bus along Boundary Road and Eastcote Road, while only five passengers boarded the bus at stops close to Malton Road, indicating that more people will be affected if the bus route was altered. Additionally North Epping shops are local shops specifically designed to service North Epping residents; as such the furthest a North Epping resident has to travel to reach these shops is 1.2km, easily within a comfortable walking distance. Furthermore as these shops do not have a supermarket; products that were purchased at these shops would be minimal and not difficult to carry for less than 1.2km. Residents who cannot drive for various reasons need direct access to a supermarket to purchase their groceries, however as stated North Epping local shops do not have a supermarket, therefore the 295 service should not consider

these shops as a destination but shops at Epping Station, along Epping Road and Macquarie Centre as destinations for shopping.

4.3 Recommendation:

From our observations we believe that the route of the 295 service should remain the same with a large bus. This option allows for patronage fluctuations and acceptably meets the demands of the service as well as providing an accessible bus service for the residents of North Epping. We do believe that during the morning peak period the timetable should be moved to start twenty to thirty minutes earlier. This will allow for an extra loop to be completed during the peak period with the last stop before 9am being at Macquarie Centre at roughly 8.50am. This will make the service more attractive to residents getting to work, without having time wasted because they arrive too early at work. A closer analysis of the afternoon observations may show that something similar be implemented to reduce congestion, alternatively an extra dedicated school bus, additional to the one that currently operates would help alleviate the afternoon peak problems allowing for more non-school passengers to board the regular 295 service.

5. Part 3 - Economic Analysis

This part of the report aims to bring up to date the information from previous field work on the case study of improving the patronage of Bus Route 295 for North Epping. Additionally, it will inform on the responses given by Dr Rhonda Daniels, who is a transport expert and Senior Research Fellow in public transport, in the Institute of Transport and Logistics Studies Business School at The University of Sydney. Furthermore, the additional information reported on will update and broaden the understanding of the economics and financial implications for Bus Route 295 taking into consideration variables and valuations of bus demand, departure and arrival times, walk and wait time, traffic congestion flow and possible route changes.

5.1 Introduction

Previous research was conducted on behalf of Transition Epping (TE) to increase patronage for Bus Route 295 for North Epping thus encouraging drivers to leave their car at home. Oil and the use of it are predominant in our everyday lives. Tony Blair cited in Rob Hopkins (2008) contends ‘fuel is our economic lifeblood’ and ‘the price of oil can be the difference between recession and recovery’ (p.15). Hence, TE in keeping with their ethos of sustainability, climate change and peak oil concerns are trying to find a solution to encourage motorists in North Epping to stop driving and frequent local bus services. Further information, using student group research, will be assessed for the economic and financial implications for Bus Route 295 in the hope to find ‘effective and cost effective’ ‘measures to improve ‘this ‘urban bus service’ (Currie & Wallis, 2008, p. 419).

Close to North Epping is Epping railway station which has recently been configured with an extensive upgrade to become a major passenger/transport interchange link with three new underground stations at Macquarie University, Macquarie Park and North Ryde. Epping railway station is state of the art and has been ‘streamlined with additional platforms added to cope with passenger capacity’ (Railcorp, 2008). More importantly, added to this facility is the colour coded bus interchange where there is an extensive array of bus route destinations, including Bus Route 295, which link up and cater for the public to get to many locations.

Historically, Bus Route 295 did a loop between North Epping and Epping Train Station. This loop was extended to include Epping Road to Macquarie Shopping Centre and return. Our previous research has shown it is the belief of some commuters that the impact of this additional leg on Epping Road has created unreliability in arrival and departure times. This

unpredictability causes chaos for many patrons with interconnecting transport links and family commitments.

Conclusions in our analysis of the first part of the case study resolved to look at the economics of changing Bus Route 295 back to a loop system only through North Epping in the hope to encourage patronage. A series of questions were prepared for our transport expert Dr Rhonda Daniels.

5.2 Discussion with a Transport Economist

Dr Rhonda Daniels spoke to us generally regarding economics of bus services throughout all of Sydney. She could not comment on Bus Route 295 specifically but instead had a more broad conversation with us rather than staying within the scope of the interview questions. She started off by explaining that North Epping was typical of some other suburbs in Sydney by the nature of its topography, a peninsula of development, identified by the fact it is either near bushland or a waterway. Some of these similar areas also wanted to improve patronage on the buses whereas others just wanted a better bus service.

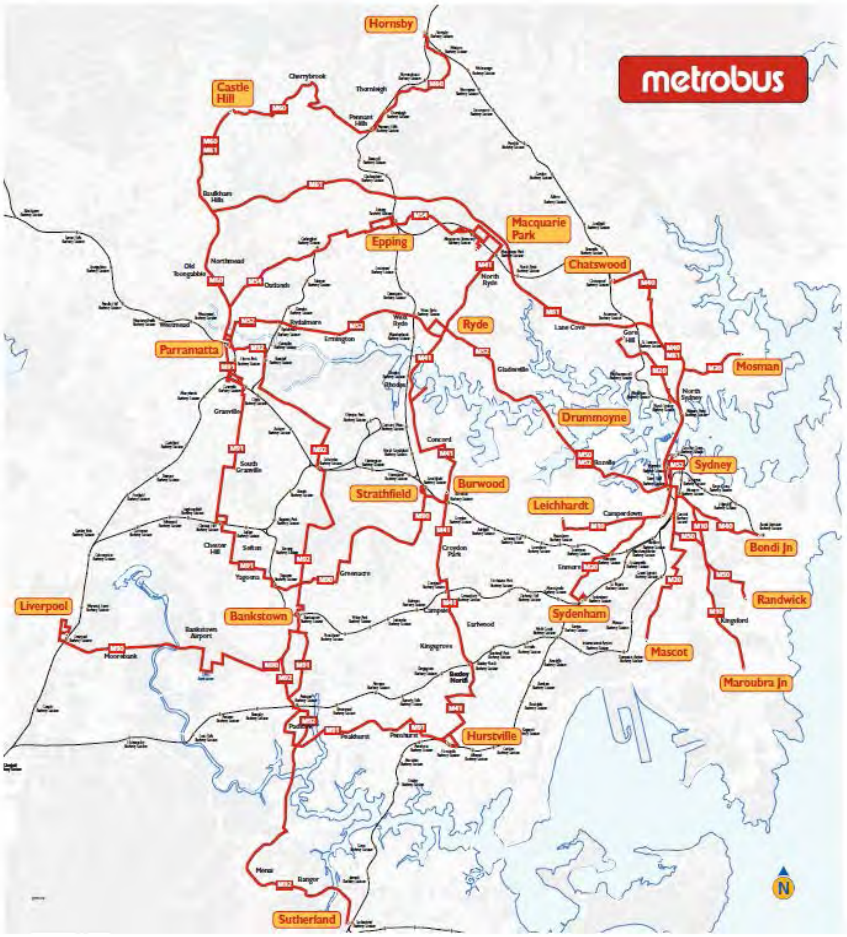


Figure 14; Sydney Metro bus system

We were told however, there are many considerations to be evaluated before bus routes are changed or added to. Explaining part of question one she clarified dollar values need to be put onto the costs and benefits of any transport alterations to work out the economic viability. Once this has been achieved and the various circumstances like school holidays, train and other bus timetables, frequency of service and more are taken into account over time, the

true cost and benefits can be reflected to see if one outweighs the other. On the other hand, it is not just about economics.

Politics is also involved and services of infrastructure must be taken into consideration. Dr Daniels mentioned she did not believe the new NSW government could sustain the current bus dynamics of some of the buses servicing Sydney. For example the Metro bus system *(figure 14)* also known as red buses was hurriedly put into place by the previous NSW government and more or less the plan just overlayed the existing bus transport route with a lot of unnecessary anomalies. There is a red bus service, Bus 288 which also goes to Macquarie Centre from the Epping Exchange. She pointed out two instances being an Artarmon to Zetland route and a Parramatta to Sutherland route both of which were rarely frequented. These and other out of the ordinary routes will be costing a lot of tax dollars and the actual bus kilometres could be put to better use. All governments have service planning guidelines and currently in Sydney 15 bus contractors are not meeting 90% of the target for these guidelines. Before making any changes on Bus Route 295 these points will also need to be taken into consideration.

When deciding whether to chop off or add on different sections to an existing bus route the needs of all patrons have to be considered. If there is a change there always needs to be a penalty time factored in between timetables for the passenger. There is documented concern from passengers like 'I might miss the connecting bus, what happens if I leave my book on the bus' – 'will I have time to go back and get it, will there be a seat for me because my old bus has been taken off the route'. Additionally, calculations are also done in comparison to motor vehicle travel taking the in vehicle time, considering waiting time (valued at 2 times the in vehicle time) and also including the penalty.

Dr Daniels suggested doing scenario testing over a period of time, for example calculate the cost if bus patronage increased by ten, then fifty percent as well as doubling the amount of passengers. She advised by doing scenario though there could be pitfalls as figures can still be unattractive even if patronage does increase. She informed us the cost of bus kilometres is currently calculated at $5.00 per kilometre so the equation for economics of bus routes is kilometres travelled multiplied by the current calculated cost multiplied by the days the service runs.

Additionally, Dr Daniels pointed out that one of our interview questions related to the economies of smaller buses. She said she is amazed at how often she hears that smaller buses may fix a problem, however she suggests economically they are just not viable. The cost of a different bus purchase, retraining drivers, retraining mechanics and sourcing different mechanical parts and tyres would set up a dual system which in reality is a duplicate of what already exists therefore exploding the already overburdened yearly transport budget. We were informed working out the economic implications or changes of a bus route is a time consuming and expensive exercise. Relevant data must be collected over an extended period of time and is not something that can be done in just a few days.

5.3 Method

From the information given to us by Dr Daniels for calculating the financial viability of a bus route, we can apply this method to work out the economics of trips taken by the 295 bus.

For example: The data reflects the most patrons on the North Epping Loop between 6.34am and 9.25am and the number of patrons was 61 including the two casual patrons on the third loop who got on at Epping Station. Time is calculated in days and for the purposes of our report we will be using the Monday to Friday timetable. From the data collected in three consecutive loops between the hours of 6.34am to 9.25am we are calculating the economics of the bus trips from Bus 295 bus leaving Epping Station after its return from Macquarie Centre and then again before it departs the bus exchange back to Macquarie Centre. This will give us information for the North Epping Loop. The findings from the calculations are shown in figure 15.

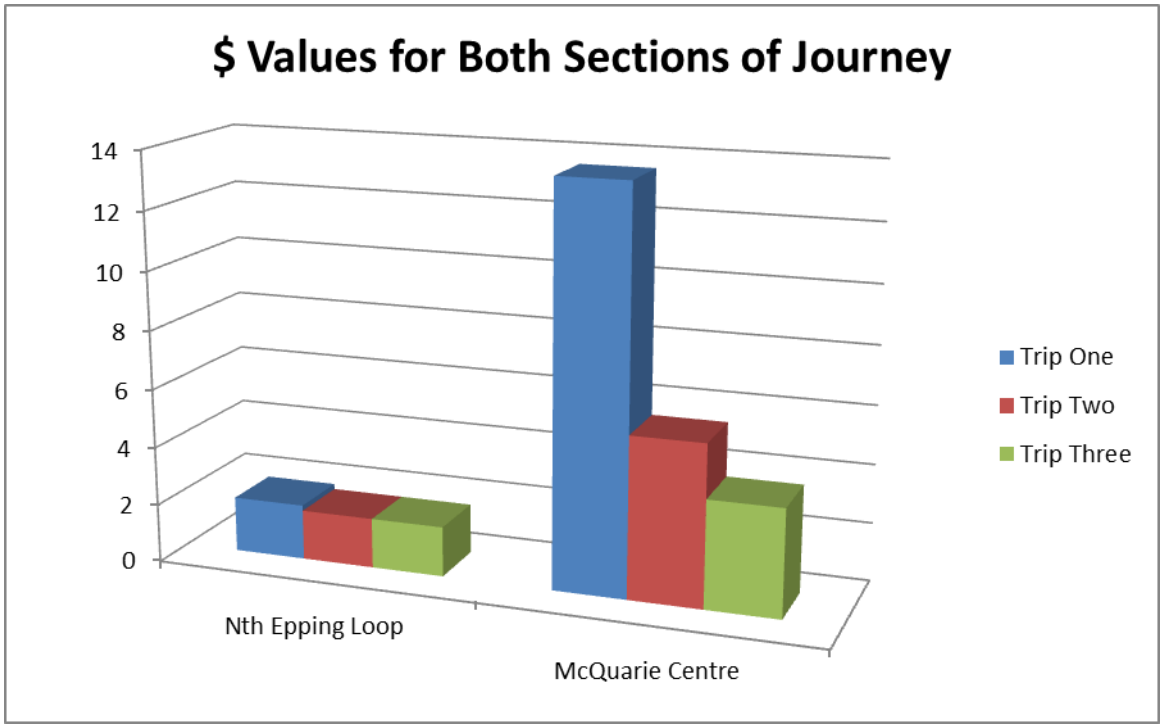


Figure 15: $ Values for Both Sections of Journey

5.4 Recommendations

Firstly, to ensure correct costing for the Epping Bus Loop a more thorough survey would need to be completed to prove patronage and enable more likely scenarios. Data should be taken in differing periods of the year including school and public holidays to reflect a more genuine picture of patronage.

It is evident from the data collected and the calculations that the economics of a bus loop for North Epping is feasible. On a purely economic basis from the data, the route to Macquarie Centre is uneconomical in relation to the amount of patrons on the bus. In contrast the North Epping Loop shows it may be economical and viable to reinstate Bus Route 295 for the North Epping Loop only.

Our opinion reflects that it is significantly economical and feasible to re-establish the Bus Route 295 for the North Epping Loop. Furthermore, we also believe the Epping Bus Exchange to Macquarie Centre route is not an economical option and these bus kilometres could be put to better use. Any passengers using this service could just as easily use one of the other eight bus services on this same route.

We believe further research will be needed to establish a more comprehensive listing of current patrons of both sections to enable analysis of true scenarios and consideration of the points made to us by Dr Daniels. We are both interested in Transport, Access and Equity, and find this research interesting and look forward to doing further work on this subject for Transition Epping (if they will allow us) in the hope we can achieve a positive outcome.

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Pollution management and environmental sustainability of harbours: the MESP project

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The protection of the environment and the prevention of pollution scenarios are important competitive features for the whole Mediterranean basin: the intensification of maritime traffic, both in terms of goods and passengers, needs to be accompanied by a sustainable management of port areas so to reduce harmful consequences for local populations.
It is well known that ports in the Mediterranean basin, particularly close to the urban populated area, contain different pollutants sources strongly impacting on the local population, port workers and tourists as well as on the delicate both terrestrial and marine ecosystems.
According with the general objectives of the ENPI CBC MED Programme, MESP project (Managing the Environmental Sustainability of Ports for a durable development) aims to reduce air, noise and water pollution in harbours and nearby areas deriving from port activities. Through the implementation of a multidisciplinary approach, in fact, it encompasses technological, regulatory and administrative solutions, with the purpose of ensuring environmental -both natural and urban- sustainability of harbour activities and high level of life quality in surrounding territories.
In this way, the MESP project target goals are the identification of best practice and of procedures which can help the management authorities and the port areas and infrastructures users in reaching a higher level of sustainability and in decreasing the pollution level concerning air and noise and water sectors.
To prevent a heterogeneous development of port infrastructures in Mediterranean basin, and above all, facilitate the entry of new methodology and technologies, MESP project has analysed the “status quo” of current ports condition both in the Northern and Southern part of the Mediterranean basin and identified best practices, methodologies, technologies and procedures adaptable and transferable in different port contexts. It proposes then a roadmap on methodologies, good practices and measurements assessment for the environmental sustainability of ports which allows to reach a higher level of sustainability and to decrease the pollution level reinforcing, at the same time, competences of public-decision makers and local administrators.
In order, then, to assess the collected procedures, validation tests will be carried on through the application of the selected methodologies to different real cases. In particular, each sector (air, noise and water) will have a specific pilot project in one port (La Spezia, Italy; Patras, Greece; Aqaba, Jordan) while only in Tripoli (Lebanon) the demo interventions involve all the three areas to have an overall overview of carried improvements.

1. Introduction

Port infrastructures, particularly in the Mediterranean area, are often integral part of coast-cities, deeply merged in the urban texture. Ports facilities and activities carried out within harbour boundaries often represent an opportunity for the local economy, but if not well planned and managed they can represent also a great threat for citizen living in the surrounding area. In fact, a not proper and sustainable management and development of ports mean usually difficult relationships with urban zones in terms of land use, pollution and citizens’ quality of life (Badino, Schenone and Tomasoni, 2010).
According to the general objectives of the ENPI CBC MED Programme, MESP project (Managing the Environmental Sustainability of Ports for a durable development) aims to

decrease the pollution impact from port activities concerning air, noise and water and give back to citizen, tourist and workers a healthier and usable environment. This can be possible providing suitable procedures allowing to value and increase the sustainability of ports.
In fact, the MESP project target goals are the identification of best practice and measure easily applicable within harbour contexts and the realization of pilot projects in different ports in order to assess the validation of the selected methodologies. In this way, these actions can help management authorities and infrastructures users in reaching a higher level of sustainability and in decreasing pollution levels.

2. MESP project

European ports represent today the main door of access to enter Europe and Middle-East territories for transports from all over the world. The sea and land traffic flows, both in terms of goods and passengers, are increasing due to the intensification of maritime traffic producing critical situation both within the harbour boundaries and on the urban neighbourhoods.
Ports present actually highly complex scenarios, encompassing a wide variety of activities linked directly with the harbour tasks, such as cargo and passengers transport, merchandise handling to and from the harbour, large ships powering, sludge and sewage, goods handling, and others indirectly related, e.g. heavy or light vehicle and railway traffic, wastes production, power plants.
It is well known that all these activities are actually relevant sources of pollution strongly impacting the environment of the surrounding area (Trozzi and Vaccaro, 2000) and, as a consequence, local population, port workers and tourists as well as both terrestrial and marine ecosystems.
Different fields are involved such as air, noise, water, lighting pollution, land use and landscape impact. Air, noise and water are the environmental components resulting most affected by the pollution caused by port activities and need to be strongly taken into consideration for a sustainable development of harbours.
Concerning **air sector**, fine particles, fumes and gases from ship drains, auxiliary engines, truck emissions, harbour craft, terminal equipment are released and dispersed in the atmosphere and carried inland by the wind (Bailey and Solomon 2004). This affects the health of port workers and people living nearby causing health disease such as respiratory and cardiovascular issues.
About **noise pollution**, the analysis results complicated due to the presence in the same area of several types of sound sources with different characteristics from each other (Hyrynen, Maijala and Mellin, 2009), such as ferries, ships and trade operations, industrial and shipyards activities and well auxiliary services. In this way, noise pollution can produce negative effects both to the natural eco-system and to the urban population, causing negative effects and damages on human health (effect on hearing, cardiovascular disturbances, high blood pressure, sleep disturbance, reduction in efficiency, annoyance, mental stress, lack of concentration).
Regarding **water**, port activities can have a strongly negative impact on the marine environment, causing long term significant damage and a critical effect both on marine wildlife and human health (Gómez et al., 2014). Coastal water quality is very important from environmental, economic and societal point of view and is deeply influenced by the surrounding land use including the quantitative and qualitative exploitation of agricultural/industrial use and urbanization including port activities. Quality of sea water is affected form ballast and industrial wastewater, waste from ships, leaking oil from machinery and other toxic substances from vessels, litter, gaseous air pollutants, dust, hazardous materials, devastating to the aquatic ecosystems.
In this way, ports authorities have to manage critical situations and, at the same time, promote the sustainability of ports and their durable development in order to prevent the impact of harbour activities on the environment by improving procedures, policies and tools and intervention priorities

According to the general objectives of the ENPI CBC MED Programme, the MESP project (Managing the Environmental Sustainability of Ports for a durable development, Grant Agreement contract number 10/2263) pursue the goal of ensuring environmental -both natural and urban- sustainability of harbour activities and a high level of life quality in surrounding territories by reducing air, noise and water pollution due to port activities.
MESP project (Schenone et al., 2014), started in June 2012 for a total duration of 36 months, is developed by 6 partners from four countries both from the Northern and Southern part of the Mediterranean basin: Italy, Greece, Lebanon and Jordan.
The partnership (Fig. 1) is composed of: the DIME department from the University of Genoa, Italy (as the Beneficiary); the Physical Oceanography Marine Science Station (MSS) from the University of Jordan, Aqaba, Jordan; the Port Authority of La Spezia, Italy; the Al-Manar University of Tripoli (MUT), Lebanon; the Department of Environment and Sustainable Development from the Patras Municipal Enterprise for Planning & Development S.A. (ADEP), Greece and the Exploitation Office of Port of Tripoli (OEPT), Lebanon. Moreover, two associate partners are present: the Jordan Environment Society (JES), Jordan and the Urban Community of Al Fayhaa (UCF), Lebanon as a support in the implementation and dissemination of the project.



Figure 1. MESP project partnership

The objective of MESP project are to safeguard the natural environment and the improvement of urban life quality in port areas, to reinforce the skills of public-decision makers and local administrators, to develop certification tools, which allow to assess the level of environmental sustainability of port areas and to create a long lasting cooperation network between partners first and then all the other Mediterranean ports interested in the sustainable development of their areas, infrastructures and procedures
In order to reach these goals, MESP aims, through a multidisciplinary approach, to identify the best practices, technologies and procedures for reducing and monitoring air, water and noise pollution due to port activities in the Mediterranean area, allowing an improvement of the life quality of port users and local populations.
Thanks to the MESP outputs and expected results, the pollution levels are expected to decrease in the city directly involved by the projects and in cities where MESP will be then able to transfer its outcomes as well as the impact on the environment, intended as both natural and urban. Final beneficiaries of MESP result, in this way, result to be citizens and, in particular, people who live near the borders of the port area, workers and employees often exposed directly or indirectly to many different sources of pollution for quite long and

uninterrupted period of time and tourists which will benefit of a more efficient port system (environmental sustainability could often come from better organized and rationalized systems) and will take advantage from a cleaner and more pleasant environmental during their visit.
On the basis of the obtained results, MESP partners developed a specific methodology for the implementation of the project activities and in particular the creation of a methodological approach for a harbour management, suitable for all port realities.
This not only allows reaching higher sustainability and decreasing pollution levels giving back to citizens, tourists and workers a healthier and usable environment, but also aims to help in preventing a heterogeneous development of port infrastructures in the Mediterranean basin and enable the entry of new methodologies which can facilitate work activities and environmental pollution abatement actions.
In order, then, to assess all the procedures, validation tests will be carried out through the application of the selected methodologies to different real cases.
For any sector two different ports for demo intervention have been chosen. To have an overall overview of improvements, pilot interventions on all the three sectors (air, noise and water) will be implemented, with a special focus, in the Port of Tripoli, as well as in Patras for noise sector, in La Spezia for air and in Aqaba for water.

3. Project activities

Topics that the MEPS project proposes to carry on are structured in an organic way inside several planned activities. The different tasks have been organized into three Working Groups, one on each identified section (air, noise and water), where skills and qualified competences can be applied, with experts coming from different partner structures. Each MESP activity is, therefore, developed in parallel ways into the three sections, allowing to have a simpler, but at the same time efficient, development in the different project stages.
MESP activities have been articulated in 5 Working Packages (WPs) as shown in Fig. 2. Besides the transversal WP1 on Coordination and Management and WP5 on Dissemination and Communication, the three Work Packages “Knowledge sharing” (WP2), “Tool’s implementation” (WP3) and “Pilot Projects” (WP4) represent the real project core in which the real scientific activities have been developed.
After a first step on the state of the art collection and sharing (WP2), WP3 activities have been finalized to the formulation of a common approach for procedures and tools allowing to improve the sustainability of ports through an appropriate approach and procedures. From the result of such analysis, the document “Roadmap on Sustainability Criteria: Guidelines for Port Environmental Management” have been then redacted as a roadmap on methodologies, good practices and measurement assessment for the environmental sustainability of Mediterranean harbour areas.



Figure 2. Schematic overview of the MESP Work Packages.

The applicability of the selected strategies will be then checked in different ports and urban realities through the realization of pilot projects (WP4). In this way the true project goals will be tested as a guarantee for project proposals.
The flowchart of the several tasks of the technical Work Packages is shown in Fig. 3.

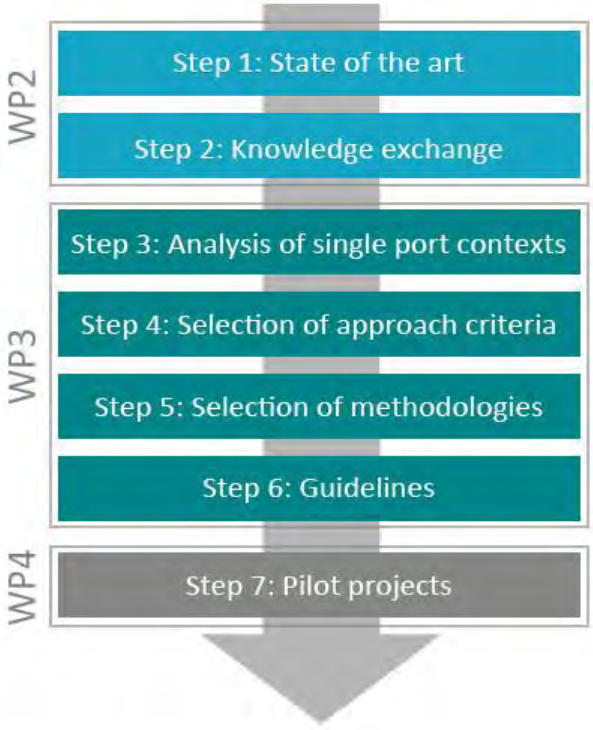


Figure 3. Flowchart of the MESP principal actions.

3.1 WP2: Knowledge sharing

The WP2 “Knowledge sharing” considers the state of the art at international level and in the partners’ countries about the air, water and noise pollution evaluated from different point of view such as legislation, management tools, technologies, and the most significant international experiences in the matter of study.
The purpose of the state of the art survey is a collection of documents concerning laws and regulation, significant experiences and best practices at international level, procedure and innovative technologies about pollution abatement local management tools and monitoring systems. The analysis of already tested methodologies and procedures has been, then, a common base for MESP activities as a guarantee of the developed efficacy and the quality of practices.
The research, carried on by each partner, have been thus organized in different topics: Management tools, Methodologies, tools, significant experiences and technologies for pollution reduction, abatement and monitoring tools, Laws and standards and Meaningful experiences and expertise (best practices), with specific focus on innovation, impact, sustainability and transfer capacity.
During this activity a large amount of documents has been collected and summarized in a project internal Report and classified on the three sectors air, noise and water.
The gathered state of the art documentation has been then transferred and shared among the partnership as a reciprocal exchange of information in order to create a common and homogenous base as a starting point for the conception of a single management tool for the pollution abatement in ports.

3.2 WP3: Tool's implementation

The WP3 "Tool's implementation" represents a very important phase of the project, inasmuch the collected information and the exchange of knowledge among several partners and the methodologies, technologies and practices outlined in WP2 represent the basis for the definition of a specific methodological approach for the sustainable management of ports.
In this way, in order to define the starting point for the built up of the guideline, a detailed study on real port situations and surrounding urban context appeared to be significant. So specific analyses of the four MESP ports territorial areas (Aqaba, La Spezia, Tripoli and Patras) have been conducted, collecting information particularly on trade, logistic, transport, mobility and future territorial planning.
To contrast the poor knowledge about existing technology and procedures applied outside each partner territorial contest, preventing an homogeneous development of port infrastructures in Mediterranean basin and, above all, hampering the entry of new methodology and technologies which can absolve works with a large savings of energy and a substantial environmental pollution abatement, MESP partnership draws up , as the main outcome of the WP3, the "Roadmap on Sustainability Criteria: Guidelines for Port Environmental Management" (Fig. 4), focused on methodologies, good practices and measurements assessment for the environmental sustainability of ports.



Figure 4. Cover of the "Roadmap on Sustainability Criteria: Guidelines for Port Environmental Management" document

This document represents the synthesis of the criteria and methodologies selection process previously conducted and is intended to globally provide directions and advices for correct use and application of improvement methods to all ports wanting to ensure a higher environmental impact of port activities and significantly improve life quality of the local populations.
In this way, the aims the MESP partnership want to follow are, specifically, to provide regulatory systems and procedures for environmental local port governance processes, offer simple and best-practice approaches to a sustainable management of harbours, especially in the air, noise and water sectors and efficient methodologies and technologies for the environmental pollution reduction and identify suitable criteria and indicators for verifying the environmental sustainability of Mediterranean ports.
Addressed to professional figures, in scientific, operative and technical field related to environmental pollution and scientific experts of the territory's governance and common development strategies, the report aims to provide regulatory systems and procedures for environmental local port governance processes. Moreover it offers simple and best-practice approaches to a sustainable management of harbours and efficient methodologies and technologies for the environmental pollution reduction.
In building this document, specific cross-cutting criteria have been selected from the partnership in order to approach the environmental and sustainable improvement and management suitable for all ports areas. In fact, beyond the peculiarities of the different pollution fields, there are actually some essential key concepts at the basis of the procedures in common among all, such as simple attitude, methodologies and indicators in order to have a general scenario, correct identification of the laws and standard to be followed and interference with port activities normal operation. These criteria, indeed, relate to the general approach to the pollution issue and can be applied a priori to any port context.
After this step, then, a deeper analysis of the criteria selected in the previous actions has been carried on. Through this action the most suitable methodologies, approaches and tools, finalized to the reduction of environmental impacts, have been identified and implemented by the different scientific competences. Their implementation aims to reach the target goal of the outcomes reproducibility and the consequent replication in the different Mediterranean ports background. The methodologies chosen within the activities has been addressed to the methods, skills and processes and to the approach to pollution problems by following the procedure outlined in Fig. 5.



Figure 5. Representation of pollution issues approach.

After an overview on the general approach to pollution reduction specific key element has to be focused on the analysis of different aspects such as the definition of the most significant indicators to be considered and evaluated and the basic measurement equipment to use in order to carry on proper measurement campaign, the technical standard and procedures of measurement to be followed, the measurement methodologies to adopt for the pollution sources identification, the individuation of the most critical sources and reports template for the correct collection of information and the measuring data.

3.3 WP4: Pilot projects

Once the prescriptions towards a port sustainable management have been defined and developed into the Guidelines document, the validation of the identified tools applicability and transferability will be carried on through the application of formulated criteria to several real scenarios. In this way, besides research activities, taking into account not only technical, environmental and regulatory parameters, but also the territorial and cultural context of different Mediterranean Countries, MESP project foresees the realization of demonstrative actions in order to test the reliability of the applied methodology. In this way, the interventions realized in WP4 will represent the true project result, as a guarantee of project proposals and theoretical considerations of previous steps (WP2 and WP3).
For any of the three thematic, a different port for demo intervention has been selected: La Spezia for air, Patras, for noise and Aqaba for water.
In order to have an overall dimension of carried improvements, pilot projects on the three sectors are going to be implemented in the Port of Tripoli (Kamali et al., 2014). This will allow, once the measures will be completed, to evaluate if the three interventions can influence each other, improving the results or hindering other outcomes.
The development of the WP4 “Pilot Projects” will be articulated in different tasks. First of all a measurement campaign to monitor and assess the actual environmental situation of pilot sites will be carried out. Basing on the results obtained from the measure surveys and on the provision from the “Roadmap on Sustainability Criteria: Guidelines for Port Environmental Management” document then the drawing up of the pilot projects will be implemented and their realization carried on by each partner and monitored by local port authorities. As conclusion, a second measurement campaign will take place and compared with the first in order to evaluate and establish quantitatively the efficacy of realized interventions in the different ports. As a consequence, it will indirectly validate the adequacy of the Guidelines and the standard criteria in ensuring a high environmental sustainability level in sites affected by elevated risk of pollution as port and nearby urban areas.

4. Conclusions

Due to their nature, ports represent an important and critical transit area between the sea and the city. The impacts of all the activities concentrated, often into a narrow coastal area, surrounded by urban texture, can produce negative effects both to the sea eco system then to the urban population. In order to avoid important environmental and social-economic impact, it is necessary an immediate action, involving the most experienced European and international professionals, local authorities, port managers and research entities.
The ENPI CBC MED MESP project joins the debate proposing, through a first identification of best practices, methodologies and procedures, an approach aimed to the reduction of air, noise and water pollution deriving from port activities adaptable to different Mediterranean port contexts.
The ongoing activities of the project, before its conclusion on May 2015, are consisting in the implementation of the demonstration actions as pilot projects in the four ports of the partnership: Aqaba, La Spezia, Patras and Tripoli. Results from the comparison between measurement before and after improving intervention will assess the effectiveness and the applicability of the methodologies selected during the previous project tasks in a real port scenario. At the same time, dissemination activities are being undertaken trough the participation of MESP partners to public events, meetings and congress and the connection to European projects on similar topics. This allows to transmit MESP target goals and results and to arise awareness on people, local authority and stakeholders on air, noise and water pollution abatement in ports.

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Economic Transformation of the Dar es Salaam Port: Lessons for the Lamu Port in Kenya

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1. Abstract

Ports were traditionally served a purely transport role offering port-related professions, such as loading and unloading of cargo and ship building industry. These professions were connected to casual labour which was once essential for many households in traditional port areas. With time port related activities have being modernized causing a decline of port-related jobs. The port no longer played a key role as a potential employer. Cities have evolved around the ports. Port cities are nodes of international trade, channelling movements of cargo and flows of migration. Economic and technological changes have fundamentally restructured ports around the world. Hoyle 1988 as well as Schubert, 2001 present a five-stage model which represents the transformation of ports, ranging from “primitive” inner –city ports, increasing industrialization of port economies to highly modernized container terminals far removed from the inner cities, with traditional port areas turning into urban wastelands and, eventually, into targets for urban renewal programmes. In the global context ports have transformed into transit points and interfaces of transnational migration. In many port cities, the port areas and surrounding areas have become an object of redesigning and restructuring the urban space. Ports all over the world have undergone economic transformation, all undergoing different phases of transformation.

Dar es Salaam port has experienced various economic transformations since its development in the 1900’s. The port has an underutilized waterfront which is under constant threat from development pressures yet has not explored its economic, cultural and physical role in the city. The Tanzania Ports Authority (TPA) is in charge of all Tanzania’s mainland sea and inland water-way ports. TPA has for the better part of its existence used the ports as transport harbour with the decline of traditional professions the Dar es Salaam port has experienced decline in employment opportunities and social exclusion. TPA contracted CPCS Transcom International Ltd to undertake studies to seek ways to transform the port economically.

The aim of this paper will therefore be on how to improve overall economic prospects of the Dar es Salaam port and improve its attractiveness to take advantage of Tanzania’s growing allure as a tourist destination. The paper will look at the most suitable mixed-land uses that will transform the port without compromising on the port function; of interest also is the integration of existing heritage buildings in the port area, integration of the port plan with existing region’s master plans like the Dar es Salaam City Master Plan and the new Zanzibar Ferry Terminal Master Plan. The paper will also touch on the design consideration to factor in climate change/flooding at the sea front as well as overall environmental impact of the project. Briefly the paper will touch on the market and financial feasibility and methods used.

2. Introduction

The port of Dar es Salaam is the principal port in Tanzania with a rated capacity of 4.1 million dry cargo and 6 million bulk liquid cargo. The port has a total quay length of about 2,000 meters with 11 deep-water berths. The port serves other landlocked countries: Malawi, Zambia, Democratic Republic of Congo, Burundi, Rwanda and Uganda. The port of Dar es Salaam is under development pressure as the wider city grows rapidly. The port’s waterfront need to balance economic development with creating a place that is

celebrated and enjoyed by all of the city's citizens, workers, and visitors. Its physical characteristics—the combination of a built-up maritime working waterfront and a relatively unspoiled naturalistic cove—endow Dar with a unique and almost unparalleled opportunity to create a world-class urban fabric, where city meets the natural water's edge and all are invited. The economic transformation envisioned encompasses development of mixed land-uses at the port's waterfront while maintaining a sense of local identify and character through culturally and climactically responsive building forms, materials and techniques





Figure 1: Location of Dar es Salaam

Figure 2: The Port of Dar es Salaam

2.1 Site Conditions

The study area included the waterfront stretching from TPA's Lighter Wharfs in the southwest to the edge of Kigamboni Ferry in the east.



Figure 3: The Project Site



Figure 4: Economic Activities



Figure 5: Inaccessible waterfront

The envisioned transformation and redevelopment has to take into account the critical port activity and capacity. It however does not taken into any consideration the improvement of the port activities. The port has a zone of the dredged shipping channel, two ferry terminals and other water activities. The natural edge extends from the eastern edge of the Zanzibar Ferry to the western edge of the Kigamboni Ferry and is characterized by a beach along the water and a landscaped, slopped bluff, leading to bluff-top waterfront roads. The beach and landscape are in varying states of disrepair. There are also small structures and uses along this area, including the Maritime Police, a stretch of terraces with informal food stalls, and various sidewalks and parking conditions at the road edge. Most buildings are opposite the water, across Kivukoni Road. Though once open to the public, this area is largely fenced off from public access. Drainage pipes empty into the basin at multiple points along this stretch.

3. Mixed Land-Use Design

Design Guidelines

i. **Balancing Public and Private Investment**

Investment from (and return to) the private sector is required to create amenities and realize the waterfront's economic and social potential. Successful development balances public and private benefit.

ii. **Strategic Phasing**

The first phase of revitalization must deploy resources strategically, minimizing costs while creating value and a critical mass of activity. Thus, a redeveloped Zanzibar Gate lies at the heart of any first phase.

iii. **Integrate with the City**

The first phase of revitalization must build off of existing uses and economic activity clusters. Any new growth should physically and visually link back into the existing city.

1.3 The Proposed Development Scenarios

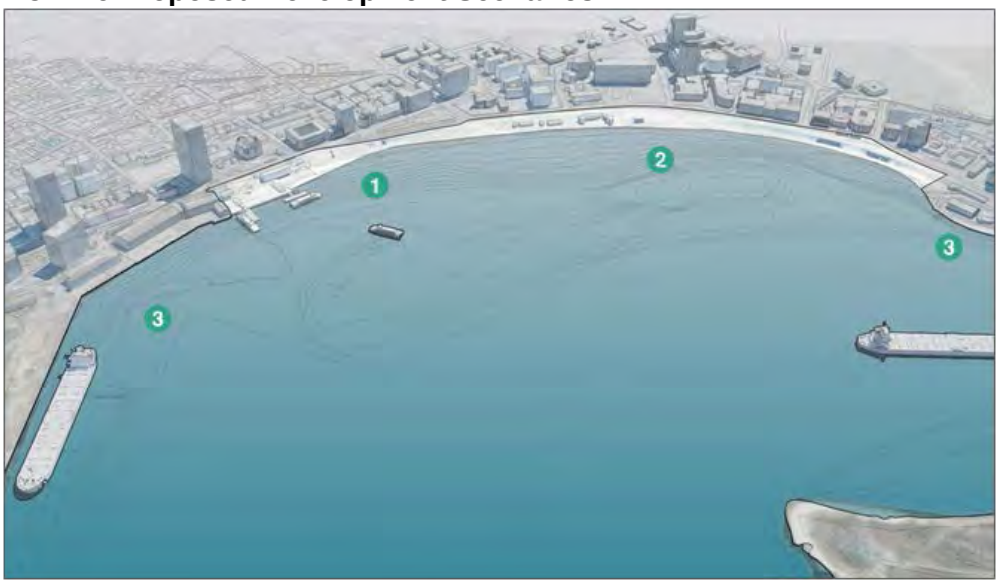


Figure 6: The Proposed Development Zones

1 "The Pier" Zone

Primary redevelopment along the Central Waterfront should concentrate in the area already most built-up, closest to existing densities and resources, and synergize with the prime generator of waterfront activity: the Zanzibar Ferry Terminal. A mix of uses including public parks, plazas, promenades, maritime facilities, ferry operations, markets, retail, hotels, offices and a conference center will support a vital new core for Dar Es Salaam's Central Waterfront.

Centered around a redeveloped Zanzibar Gate, this scenario sponsors unparalleled public open spaces and access to the waterfront with a critical mass of new mixed-use development including hotels, offices, retail, market halls, and a cruise ship facility. This scenario is divided into four phases. Phase 1 includes a new and expanded Zanzibar Gate and a pad for the Phase 2 "Central Pier" mixed-use hotel, retail, office, and conference center. Phase 3 "South Pier" continues the mix of uses to the east, including ample waterfront promenades and water- oriented recreation activities. Phase 4 "North Pier" creates a critical mass of mixed-use activities that frame a new central plaza for Dar at both upper and lower waterfront levels, a dramatic pier-promenade, and a cruise ship facility.

2 "The Cove" Zone

The existing beach frontage and naturalistic slope of the southern waterfront is a tremendous asset, almost without parallel in the downtown core of cities the size of Dar Es Salaam. However, it is in a state of extreme disrepair. Efforts in this area are focused on the rehabilitation and enhancement of its natural features, remediation of environmental problems, and expanding access and recreation opportunities for all.

Rehabilitation of the existing naturalistic slope into a world-class downtown waterfront esplanade and beach, with places for dining, relaxation, and play, for citizens, workers, visitors, and children. The treatment and redirection of existing drainage outflows will limit visual and olfactory nuisance; perhaps the first step in making the water's edge a desirable recreational destination. Renovation of the existing pavilions will provide new dining and amenity opportunities. Construction of children's play areas will bring new populations to the waterfront. Two public piers will allow small water- craft tie-ups, fishing, market kiosks, and tremendous views. Cleaning and improving over-grown landscape, will create a lush, green respite from the confines of the city. New public plazas at the upper

waterfront level will invite people to- wards new grand public stairs down to beach level. A beach promenade will link the east and west sides of the cove. A rehabilitated beach with cleaned and new sand will make the cove once again a recreational destination for all.

Implementation of cove improvements is predicated on the availability of funds from either redevelopment of The Pier scenarios and/or from other resources. Redevelopment would ideally be undertaken in whole and re-opened with great fan-fare, though incremental improvements will increase the livability and amenity offerings to citizens, workers, and visitors. Various elements were proposed to improve the “Cove” such as activity pavilions, play areas, terraces and public stairs as well as restoration of the natural landscape.

3 Working Waterfront Zone

The existing TPA Wharfs, Dar Maritime Institute (DMI), Kigamboni Ferry, and Mzizima Fish Market are intensive, water-oriented uses that should continue contributing to the industrial, commercial, educational, and transport life of downtown Dar es Salaam. Any proposals for the Central Waterfront should consider the future development of these areas, particularly the improvements planned for DMI.



Figure 7: Proposed Development Scenario

Ferry Teminal 4-6 berths 5,000m²	Public Promenades/ Piers 14,000m²	Public Parks/Plazas 14,000m²	Water Sports Marina berthing and recreational facilities
Hotels 1,000m²	Markets & Retail 13,000m²	Offices 15,000m²	Cruise Ship Terminal Berthing for up to 280m ship

Table 1: Proposed Development Scenario with tentative areas for various land-uses

4. Implementation of the Project

4.1 Financial Analysis

4.1.1 Discounted Cash Flow Analysis and Residualised Land Values

The model utilized was a discounted cash flow (DCF) analysis. The project's buildings are analyzed individually in each scenario to estimate the cash flow generated by each one. The outflowing costs of construction and maintenance are subtracted from the inflows to get a raw development value. Finally, the model channels this raw development value through the established capital structures to make interest and other financing payments—and then to pay out profit.

The primary open variable in the model is the "land" value. To derive that value, the price of the underlying property is increased until an estimated internal rate of return is reached. For example, if an office property with a land price of $1,000,000 carries a 24% internal rate of return, the land value in the model would be increased until the rate of return drops to the desired 20%. This value is the "residualised land value."

4.1.2 Three-Part Financial Analysis

The financial analysis was split into three parts:

i. the analysis of revenue-generating privately developed real estate products,
ii. the analysis of "onsite" costs to allocate in a public-private partnership that are necessary to the development, and
iii. the analysis of potential "offsite" improvements in the Cove area that may be possible with the funds raised from the development.

This categorization accomplishes multiple goals. The products in the first category (those certain to be developed privately) are examined separately from the surrounding infrastructure and amenities to both expose the raw value that is created by their uses and also to explore more purely the effect of density on that value. The analysis in the second category allows a comparison of two scenarios' underlying impacts—dealing mostly with onsite infrastructure and public space. The values produced in the first analysis are immediately offset by these immediate surrounding costs. The analysis in the third category explores what can be done with the remaining value that was created in category one after category two has been satisfied. TPA and the other public-sector actors may eventually choose to have a private developer build and manage most of the project. The analysis that follows can guide that decision.

4.1.3 Payback Period / Capitalisation Rate

A city's properties can be valued quickly and simply by using a market-based capitalization rate, which represents the number of years the market requires for revenues to cover the acquisition price of a property. The quality of the property, its use (e.g., office), its location, and the general risk of owning property that a city all affects this market payback period. In Dar es Salaam, some acquirers desire payback periods ranging from 4 to 10 years.

This period is important in the model because the leases on the buildings will eventually be transferred to third parties, as developers often do not hold onto buildings they have built. This transfer "terminal" value has a huge impact on profitability for the original developer. The model assumes a payback period of 8 years, or a capitalization rate of 12.5%. This rate strikes a balance between some stability, which Dar es Salaam currently exhibits in both its office and hotel markets, and some risk, which is inherent at least in the minds of private-sector developers building innovative new products in expanding markets. If the market were to stabilize even more, the rate could conceivably drop. A 10-year payback period, or a capitalization rate of 10%, would likely mark the upper limit of possible appreciation. If the market were to decline, a 5-year payback period, or 20% capitalization rate, might not appear unreasonable.

From the unlikely catastrophic side, the 5-year payback rate would reduce the underlying land values by more than $11 million, leaving very little for outside infrastructure and public amenities; in fact, TPA and various government entities wound need to subsidize most of those projects. From a more likely but still too optimistic perspective, a 10-year payback period would add as much as $25 million dollars to the underlying land value. The lack of foreseeability of market values will likely mean that any benefits would inure to the developer who had already purchased the land rights prior to the market changes several years later. If a developer wanted to shift some of the risks of declining market prices back to TPA, a deal could be structured within parameters that take into account changes in market value. And the payments could also be structured to account for that risk.

The key point to take from this market-required payback analysis is that the developer will estimate a future payback period at the time of bidding. Their perception of where the market is moving will affect, perhaps dramatically, how much they will pay for the underlying value of the property.

4.2 Financial Findings and Recommendations

Under current zoning restrictions of 4 storeys, the project is not financially feasible. TPA would have to pay a developer a subsidy of $7.6-9.9 Million to build the project. CPCS has proposed two scenarios with zoning of 11-14 storeys. Both Scenarios proposed by CPCS are feasible developments that can be realized in a 5-7 year time frame by a single master developer. For Scenario 1, a developer would be willing to pay an estimated $14.2 Million for the land on day one of the project. The infrastructure would need to be subtracted from this value, and any remaining funds would be used for the Cove improvements. The project would have a positive net present value of $8.1 Million (on the project start date) when discounted at a cost of capital of 25%. For Scenario 2, the amount the developer would be willing to pay upfront for the land at the start of the project would be approximately $10.8 Million. The net present value of the project (on the project start date) at a 25% discount rate would be $5.0 Million. The total cost of the “offsite” infrastructure improvements (i.e. “The Cove”) was estimated to be approximately $9.7 Million, which includes a $5 Million improvement budget for the sewage wastewater treatment currently impacting the site.

The rezoning was proposed to pave way for some public private partnership in the redevelopment of the waterfront. The rezoning was envisioned to allow developers provide:

- Onsite improvements including a public plaza and public walkways on the marina
- Offsite public amenities including revitalization of the beach, public walkways and pavilions, new wastewater treatment facilities
- Underground parking garages

Cost of development taken into account included: construction costs, infrastructure costs, geotechnical costs, miscellaneous development costs and operating costs. For financing the analysis assumes a 30% equity contribution upfront along with a construction loan of 70% repaid first with available project funds. The model includes a 24-month holding period for each building, which means the developer leases and operates the building for two years prior to acquisition by a third party.

4.2 Economic Impact Analysis

The waterfront project will bring significant economic impacts to Dar es Salaam. The project will generate between $56.1-104.4 Million in direct sales each year, will create 1900-3243 direct jobs, and will generate between $14.8-26.8 Million in tax revenues each year. The multiplier for tourism activities in Tanzania was estimated at 1.6 based on prior studies of tourism linkages both inside Tanzania and in other developing country

tourism economies. Scenario 1 generates approximately 1.7-1.8 times as many jobs and tax revenues as Scenario 2. In order to increase the distribution of these economic benefits to Tanzanian citizens (over foreign investors) the promoters of the Waterfront Project will need to work in partnership with tourism development initiative that work on development of small business and micro-enterprise opportunities for Tanzanians in the tourism sector.

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	Scenario 1	**Scenario 2**
Direct Spending	$ 104,493,518	$ 56,130,400
New Jobs Created	3,243	1,900
Tax Revenues (Total)	$ 26,861,665	$ 14,864,442
Hotel Tax	$ 16,745,334	$ 8,988,653
Income Tax	$ 8,755,791	$ 5,128,738
VAT Tax	$ 804,303	$ 439,697
Property Tax	$ 556,237	$ 307,355

Table 2: Direct Economic Impacts

Indirect Impacts

The largest potential economic impact of the Waterfront Project will come from the catalyst the project will provide to attract new visitors to Dar es Salaam and the associated spending with this increase in visitation. The increase in tourism will come from three sources:

i. Leisure/Holiday Travellers - who are in Tanzania already who will make a visit to Dar es Salaam
ii. Business/Conference Travellers - who will visit Tanzania for the purpose of a conference/meeting in Dar es Salaam
iii. Cruise Ship Passengers – who will visit Dar es Salaam on a day trip as a cruise passenger

4.3. Public Private Partnership (PPP)

TPA has limited funds for implementation of the mixed-land-use project to transform the port of Dar es Salaam, in this context the consultant was asked to provide a PPP recommendation for the implementation of the project.

CPCS recommended that TPA conduct an RFP process to put the entire site out to bid to a single developer. This was due to the fact that to coordinate public provision of onsite infrastructure and improvements is likely to be too difficult for TPA and a developer to manage. This developer will pay for all infrastructure, utility connections, and construction costs. The benefits of this recommendation outweigh the risks. In fact, it is in the best interests of everyone to go with Scenario 1 and to allow the developer to time and to pay for the onsite improvements to reap the financial advantages of phased investment.

The serious risk is that a developer could cease the project before it has been built out. This possibility will require the deal to include progress milestones that maintain certain incentives in TPA's control. These incentives (e.g., payments for public amenities from the funds paid for the land) will help to keep the developer enticed and working diligently on the project at hand over the long run. It is important, nonetheless, not to hold these incentives "hostage" to

make the developer do more than what can fairly be expected. Even if the developer chooses to default on the contract strategically prior to project completion, the scenario phases are structured to keep any unbuilt later phases from destroying the character of the waterfront. The PPP structure and these design features are key to mitigating developer risks.

The additional cost of maintaining the onsite and the offsite public amenities should remain with the developer, too, and should be legally transferred to subsequent owners. Enforcing these requirements and making new owners aware of them will be difficult. For that reason, TPA should encourage the developer to create a property-owners' association, which would pool funds to cover the cost of maintenance. In summary, the financial analysis shows that there is likely enough value in the property (if zoning limitations are relaxed) to provide these maintenance services, but the deal must not allow the developer to agree to provide them and then leave the properties behind with no long-term implementing structures.

For the offsite infrastructure and improvements (The Cove Zone); CPCS recommended, a one key scenario, payment would be due for the first phase at the time the deal is made. This amount could be kept in escrow and eventually returned, at least in part, to the developer. As part of the deal the developer would agree to make offsite improvements in the Cove area. These improvements would be timed to commence no later than the end of construction of Phase 1B/2B. Money received for the land in the first phase of development could be refunded based on milestones set in the deal related to offsite Cove improvements and onsite public amenity creation. This PPP structure is more appropriate for the offsite projects because they are not attached to the engineering and design of the buildings onsite. The offer of reduced land price would be the key benefit of performing these services. Presumably, the developer would have access to lower priced goods and the specialized skills necessary to build and maintain the offsite projects.

Upon completion of the offsite work, any remaining funds could be applied to the ferry terminal if necessary, or an endowment could be established to help cover the cost of maintenance of public amenities in the Cove, on the onsite plazas, on the waterfront paths, etc. The owners of the buildings could be paid from that endowment over time, or special instructions could be placed in the property records of the buildings requiring the maintenance of offsite and onsite public amenities. In exchange for the latter, the price developers would agree to pay for the land would be further reduced. The question of whether the government (including TPA) or the private developer would be better equipped to oversee this long-term maintenance of these public assets or to monitor the endowment is best left for TPA to decide. There are risks with both, and the issue could pose challenging legal questions, the most extreme of which would need to address who maintains the spaces if no one else is wiling to do so and whether there is any government recourse.

5. Lamu Port

The port of Lamu is envisioned in Lamu. Lamu town is on Lamu Island and is the oldest continually inhabited town in Kenya. The town's economy is mainly driven by tourism and fishing. Lamu town is known for its 'slow pace' where modernity has been gracefully folded into traditional culture. It is also known for its narrow alleys with countable number of cars and the main mode of transport being donkey. It geographic location favored its early developments, which saw invasion by the Portuguese who controlled shipping activities in the 1500's. The Portuguese were overruled by the Omanis who were later overruled during the colonial era when the town came under the Sultan of Zanzibar and later the German considered it to be of strategic location for their colonial activities.

Lamu has remained marginalized for decades since independence and only came into the lime light in the 1990's as tourism picked up in the town. The town is surrounded by deep waters which are sheltered by a string of islands making it favorable for deep sea port. The Lamu port was initially conceived in the 1975 but never too off until recently in 2013. The then president formed an authority- Lamu Port South Sudan Ethiopia Transport Corridor (LAPSSET). The port is expected to consist of 30 berths once completed and will be set on Manda Bay on approximately 1,000 acres. The port city will be connected to the rest of the country and neighbouring countries by railway and highways. The port city has a planned oil refinery and the oil will then be distributed by an oil pipeline with an estimated capacity of 500,000 barrels of oil per day.

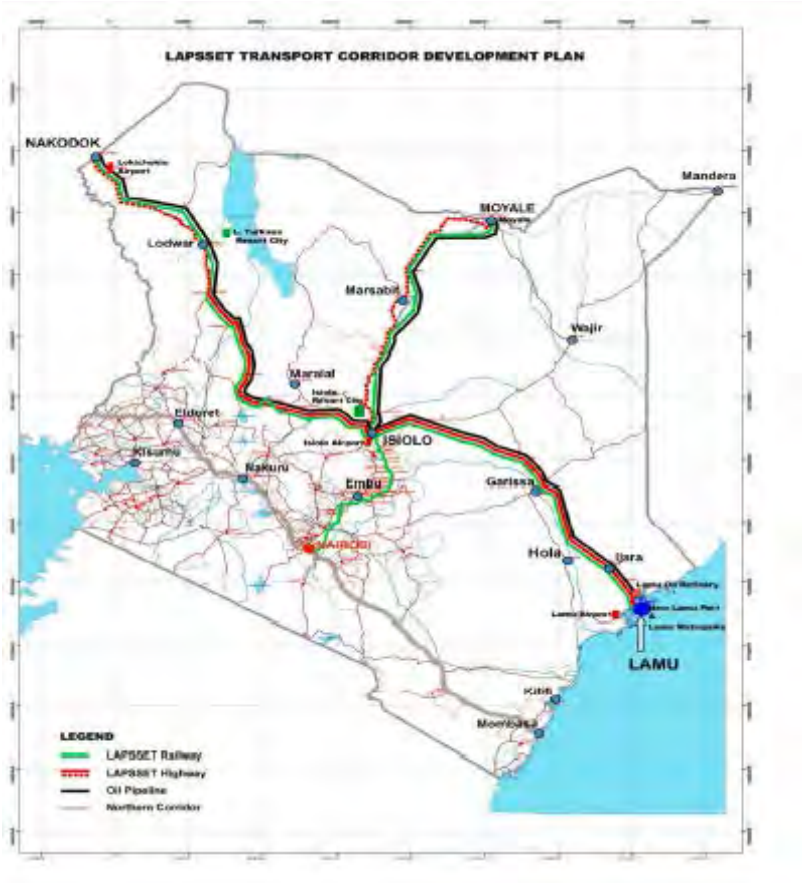


Figure 8: Lamu Location within the Kenyan Context



Figure 9: The Lamu Port

The vision 2030 envisions three resort cities along the LAPSSET corridor: Lamu, Isiolo and Turkana. The vision is to turn Lamu into an international port city. Like any major port city it will be an exemplary nodal point in the complex system of international labour and trade. In order to improve the position of Lamu in the global network, the LAPPSET project as well as the County Government will have to develop infrastructures and policies encouraging investments and establishment of new business enterprises, the professionalization of labour and high-end recreation and consumption, to reorient the city to the real and imagined interests of global mobile investors as Sassen 1994 and Loftman/Nevin, 2003 note.

Lessons for Lamu Port City

From the Dar es Salaam Waterfront development project it is important for the Lamu port to be developed as a port city incorporating mixed-land uses. The town has a rich cultural and historical heritage it is important to consider this in the development of the port and other related activities. Conduct financial analysis to determine the most suitable land-uses and zoning regulations (height of buildings, plot coverage among others). Also to determine the cost of infrastructure both onsite and offsite and factor in what the government can provide and what private investors can provide. Provide incentives and favorable policies to encourage public private partnership (PPP). Economic analysis to analyse direct job creations, taxes for the county and national government, direct spending, enhancement of tourism, and industrial activities among others.

Socially it is important to consider sitting up of institutions of higher learning and technical institutions to empower youths to equip them for the port city. It is crucial to sensitize the residents on the project to gunner support and acceptance of the project. It is important to ensure that a comprehensive environmental and social impact assessment is conducted to mitigate against any impacts.

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Sustainable Design Models
for the Belgrade Waterfront District "Bara Venecija"

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Abstract

Although positioned in the central area of Belgrade, the left bank of the river Sava remained the largest undeveloped potential of the city. Known by its historical name "Bara Venecija", it represents one of the most attractive sites covering around 100 ha. Nowadays, the only content of this area is a railroad network and the facilities of the Central railway station. Despite the great attention of professionals, numerous studies, plans and visions, the area is still waiting for a proper transformation which would achieve a necessary level of sustainability, environmental quality and energy efficiency. Depending on a key-feature of development, similar areas around the world emphasize elements of sustainable transport, density, compactness, mix use, diversity and greening, but the outcomes usually differ in a proposed spatial configuration and a relationship with natural elements. Considering recent environmental trends and the imperative of low carbon future, this paper will analyze the possible effects of various theoretical concepts of sustainable and ecological design which could be applied in the case of "Bara Venecija". It will also present the results of selected bachelor projects, created in the urban design studio supervised by prof. Zoran Nikezic and prof. Aleksandra Stupar and conducted at the University of Belgrade, Faculty of Architecture, during the spring semester 2013. Entitled "Belgrade 2030: Brown, Green and Blue", the studio was structured around the brief focused on new models of the spatial development of the waterfront which were supposed to follow one of the proposed themes - natural and artificial conditions of the site, city vs. water, density vs. green architecture, culture and sustainability. Starting from the same design brief, but with different theoretical foundations, students generated new models of urban living, as a reflection of their studies and creativity. These contributions will be analyzed and compared, underlining the dominating elements of environmental awareness, green design, technological reinforcement and utopian thinking.

1. Introduction

Along with their key-role in modern global networks, cities represent major consumers of all available resources, causing pollution and triggering climate change. Consequently, urban ecology considers cities as integral parts of ecosystems, anticipating their importance for environmental processes, especially in reducing consumption of energy, time and land resources. Following the latest environmental trends, the urban design studio conducted at the University of Belgrade-Faculty of Architecture during 2012/13 was focused on the area of 'Bara Venecija', positioned in the central area of Belgrade, on the left bank of the river Sava. Covering around 100 ha, this site represents the largest undeveloped potential of the city, although, currently, the only content of this area is a railroad network with the facilities of the Central railway station. Despite a great attention of professionals and their numerous studies, plans and visions, the area is still waiting for a proper transformation which would achieve a necessary level of sustainability, environmental quality and energy efficiency.

Entitled "Belgrade 2030: Brown, Green and Blue", the studio conducted by professors Zoran Nikezic and Aleksandra Stupar was structured around a brief focused on new models of spatial development which were supposed to follow one of proposed themes - natural and artificial conditions of the site, city vs. water, density vs. green architecture, culture and sustainability. Starting from the same idea, but with different theoretical foundations, students generated new models of urban living, as a reflection of their research and creativity. These contributions will be analyzed, underlining the dominating elements of environmental awareness, green design, technological reinforcement and utopian thinking.

The paper also emphasizes a development potential of the "Bara Venecija" in terms of sustainable urban design and a preferred merging of environmental and social principles. Considering the characteristics of selected (and envisioned) urban space the students were asked to propose an optimal development model, based upon major contemporary trends and concepts of sustainable design. Depending on a key-feature of development, similar areas around the world emphasize elements of sustainable transport, density, compactness, mix use, diversity and greening, but the outcomes usually differ in a proposed spatial configuration and a relationship with natural elements.

2. 'Bara Venecija': The largest brownfield in Belgrade

'Bara Venecija' is the historic name for the area of Belgrade that stretches along the riverbank of Sava. Until the late 19th century, it was marshland, often flooded by the river

and covered by ponds. Many craftsmen lived there, producing ceramics using clay from the site. The surrounding was recognizable by its lush vegetation and meadows that served as resting points for traders' horses. Roma people also settled there, temporarily living in tents. The whole area was unregulated, without solid structures, while frequent floods often reached the limits of the city centre.

Reclamation of the available land, as well as its draining, started with the construction of the Railway station in 1884, when 'Bara Venecija' finally became an integral part of the central area. However, the railway infrastructure actually disabled real integration with the existing urban tissue, causing even greater isolation of the site.

Over time, this area, envisioned as a new city centre, became known as 'Sava amphitheatre', referring to its geo-morphological features. The process of melioration was completed by 1930, opening new possibilities for the development of the site, but in spite of visions, initiatives and projects which always underlined its great development potential, it remained only - a potential. Many of these initiatives came from city authorities, under resonant labels, such as "City on river", "Europolis" or "Belgrade on water", and with similar aims announcing general economic development and "connection between people and the river". However, the relationship between built environment, its sustainability and ecology remained in a domain of general remarks.

3. The background - towards adaptive urban design

Elements of green and blue infrastructure can be classified by their scale to regional, city, neighbourhood or building levels. The same criteria apply to the elements of urban form (Jenks, 2010). These two groups of elements and their inter-relations constitute a foundation for developing adaptive urban design strategies. They are both complementary and based on the theory of hierarchy and dynamism of ecosystems that operate in several spatial scales (Wu and Qi, 2000). Therefore, it is possible to establish an inter-relationship between elements of green infrastructure and urban form. Urban form is closely related to spatial scale and its elements could be described as morphological attributes of an urban area (Williams et al, in Jenks, 2010). On a city level, urban form refers to a type of housing and/or street and their spatial arrangement. On a neighbourhood level, urban design refers to architecture, facade, materialization etc.

Since the intention is to establish urban design tools related to green infrastructure, it is necessary to understand multi-scalar dimension of a city, within a dynamic system that is in constant interaction with its direct and indirect green environment. This approach seeks to establish relationships and methods synchronized with the paradigm of integral urbanism

elaborated by Nan Ellin (2006), which emphasizes functional, social, disciplinary and professional re-integration, and favours design based on circulation, dynamism and flexibility. Consequently, the level of integration of urban form and green space is defined by relations between permeability and connectivity, using the elements of green and blue infrastructure. Furthermore, a diversity of people, activities and building types should additionally support (re)integration of natural and human elements of urban environment.

4. Generating ideas - "Belgrade 2030: Brown, Green and Blue"

Considering the elements of adaptive design, a design brief for the Studio was focused on the future vision of Belgrade, applied on the experimental polygon of 'Bara Venecija'. The proposed urban structures had to incorporate elements of technologically and environmentally advanced design, following the imperatives of energy efficiency and sustainability. Simultaneously, students were obliged to take into consideration the central position and the importance of the site, as well as its potential to become a hub of innovative development of Belgrade. The expected outcome was a transformation of the "brown" into the "green & blue" environment, anticipated on several levels - as a vision, dynamic model and flexible units.

The elements of green and blue infrastructures were used as an armature of the future transformation, guided by the principles of adaptation. Along with the overall improvement of environmental conditions, many adaptation strategies contribute to wider policy objectives and the creation of an improved public realm.[1] The imperative to manage high temperatures and reduce flood and drought impacts can justify the creation and maintenance of green infrastructure. In turn, a network of open spaces can be used to increase the quality of life. It also has a crucial role in maintaining and improving air quality, water management and biodiversity. Therefore, green and blue infrastructures are associated with all spatial levels and all types of land use, ensuring the efficient functioning of ecosystem.

Based on the proposed sustainable framework, students were assigned to give their urban and architectural design, i.e. an optimal development model of 'Bara Venecija', also applicable on similar areas. The first task was to define a general strategy of urban design related to one of proposed themes and, consequently, to create a concept based on selected principles. The proposed themes included:

- natural and artificial conditions of the site,
- city vs. water,

- density vs. green architecture,
- culture and sustainability.

These themes directed the outcome of design process, generating a variety of development models for the site.

Natural and artificial conditions of the site were analyzed through different periods of transformation, emphasizing current condition and basic elements of the surrounding (morphological features, solar radiation, wind and precipitation).

The relationship between the city and the river represented one of the most important issues which was analyzed and discussed with students. The selected case studies provided necessary information about contemporary strategies of urban renewal and best models of reactivation. The structure of activities, as well as their spatial distribution and intensity were also considered, defining new typologies and elements of urban and architectural form - based on the adopted principles of ecologically responsible urban design.

Furthermore, the question of density was debated, as an important factor of the preferred environmental balance. The students had an insight into two confronted views. Theory of compact cities argues that high density represents a prerequisite for the establishment of sustainable cities. On the other hand, the ambivalent relationship between the density of development and the increasing presence of green spaces in cities requires consideration of new models of integration of both built and natural spaces.

Cultural sphere was also considered, since it defines the approach to preservation, the expansion of existing cultural milieu and the establishment of a new culture of sustainability - transmitted through eco-conscious lifestyles. Representing a significant element of urban identity, 'Bara Venecija' has to preserve some elements of its cultural history, incorporate principles of social sustainability and establish new cultural patterns which will promote new trends related to urban agriculture, sustainable transport, cooperation and civic economy.

5. The outcome

Example 1: Self - sufficient structures

Based on the analysis of the relationship between density and green architecture, the project elaborates the concept of eco-skyscrapers. This solution enables the achievement of high density with low land coverage that is used for establishing green infrastructure (Figure 1). Master plan contains two distinct urban environments. The first one continues traditional urban matrix with residential blocks. Blocks have a conventional layout, but with low-energy buildings. They are equipped with solar technology, which includes solar photovoltaic panels,

green roofs, rainwater collection systems and optimized use of solar energy. Another dominant component, which extends along the riverbank, is a spacious park with two suspended platforms of public space in which a total of six eco-skyscrapers are placed. Design concept of skyscrapers is based on the principles of mixed use, so that each skyscraper has a ground floor annex with a different public facilities - culture, trade, business etc. Towers have double facade with a passive cooling system that uses vertical air flow.
Although a major effort has been given to integrate eco-skyscrapers in the surrounding park and the new landscape, there is a lack of proper response to the proximity of the river, which remains almost entirely unused, even "cut off" by placing traffic roads. Cultural and social dimensions of the project are also questionable, given that the whole area is reduced to two mega-plateau and open floor skyscraper with limited and pre-determined content.

Example 2: Greening Belgrade

Green areas flow within courtyards that have both private and public character. This integration is created with intention to combine green community- living and working qualities with the convenient attributes of urban environment. This approach creates tighter connections between new district and the existing city. Recreational spaces are seen as urban space that attracts both locals and visitors. Green atriums represent meeting points, gardens and places for playing (Figure 2).
This project establishes a close connection between developed and undeveloped area. The main idea is based on the redefinition of traditional city block and its courtyard, with its private/enclosed character. The greenery in the form of green corridor is drawn into urban blocks, making them permeable and blurring public-private boundaries. Privacy is preserved by raising the level of housing to the level of the first floor, leaving ground floor for public use. Links between old town and the river bank were achieved via green corridors, whose continuity is more important than the continuity of the transport network. Riverbank remains an open area connected to the rest of the city by green corridors.
In this project, the elements of green infrastructure represent key factors of urban resilience. Green corridors reduce the heat island effect, absorb excess storm water and provide comfortable public spaces for living. The built area consists of mid-rise multi-family housing, while public areas are diverse providing the ability to conduct a large number of joint activities.



Figure 1: Example 1, Self - sufficient structures

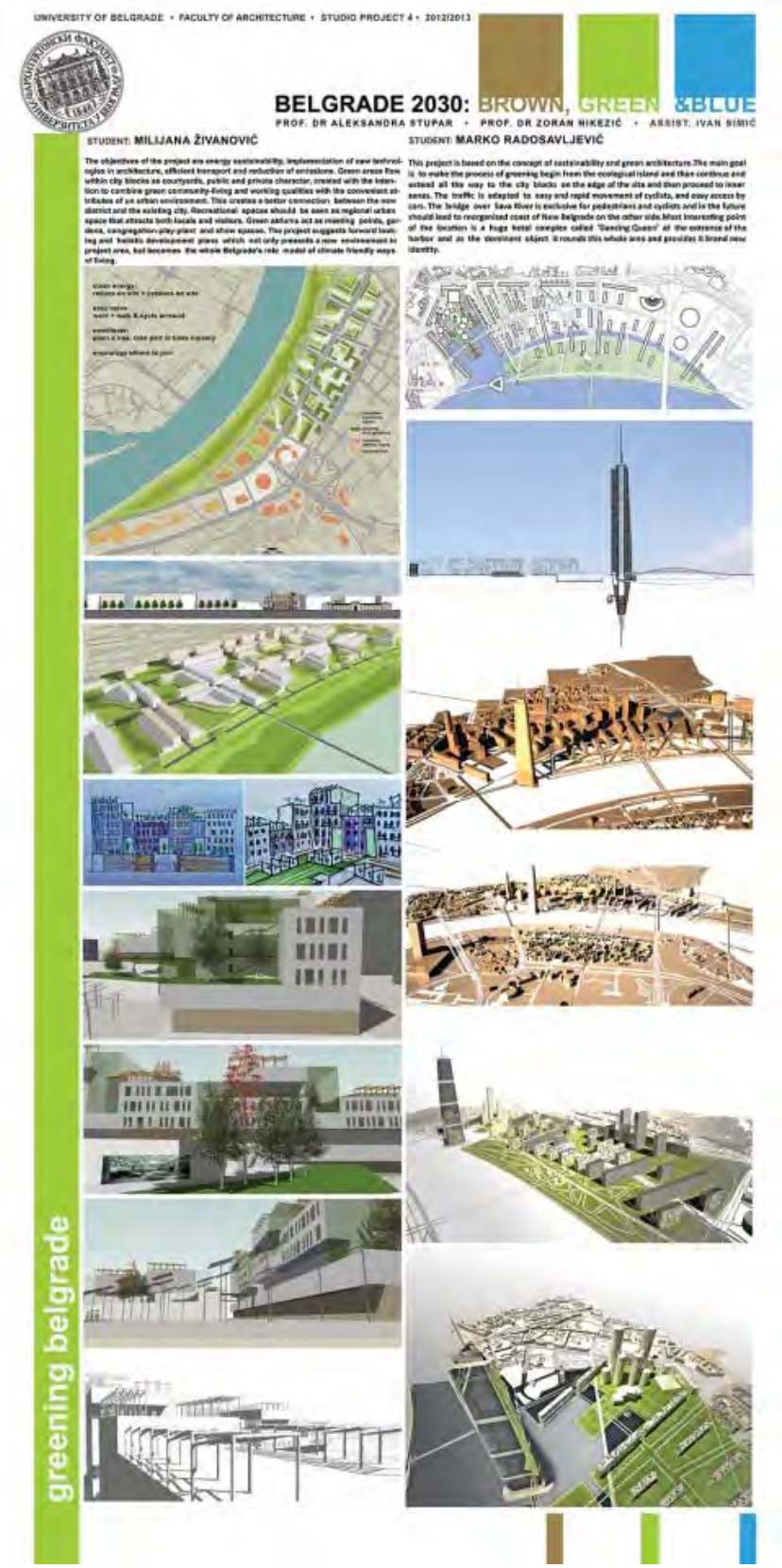


Figure 2: Example 2, Greening Belgrade

Example 3: Modified city

This project has successfully integrated all adopted principles of sustainable design (Figure 3). In addition, it has defined a relation of the city and the water, maximizing the benefits provided by the position of the site. 'Bara Venecija' is designed as a meeting point of the old urban pattern of Belgrade and a new green metropolis. This leads to hybridization and creation of new sustainable urban form. Features of traditional city blocks are combined with ecological principles that require more space, light and greenery. In addition, the concepts of energy efficiency and urban farming are implemented. Buildings are equipped with green technology enabling energy production, protection from solar radiation and urban agriculture. Interaction between the city and the river is emphasized by introducing canals with controlled flow passing through the centre of 'Bara Venecija'. These canals increase the value of land that becomes an attractive place for facilities such as hotels, housing and recreation. At the same time, canals become major elements of "blue" infrastructure playing an important role in adapting to climate change. They also regulate high water level and prevent seasonal flooding.

Example 4: New concept of living

This project proposes a new cultural model which promotes living and working along the riverbank (Figure 4). This model also reflects in the applied spatial typology displaying full integration of architecture and natural environment. Basic residential unit is a mega-structure with terraced geometry and green roofs. Formation of these units is articulated with the canal running through the centre of the area, creating special bridge-like structure. Housing units have terraces oriented toward Sava or toward the city centre, with east-west orientation. Large roof areas are greened, while space between buildings is designed as a park with facilities for relaxation and children's play. This space, however, is not enclosed but integrated with directions connecting the city centre and the river.

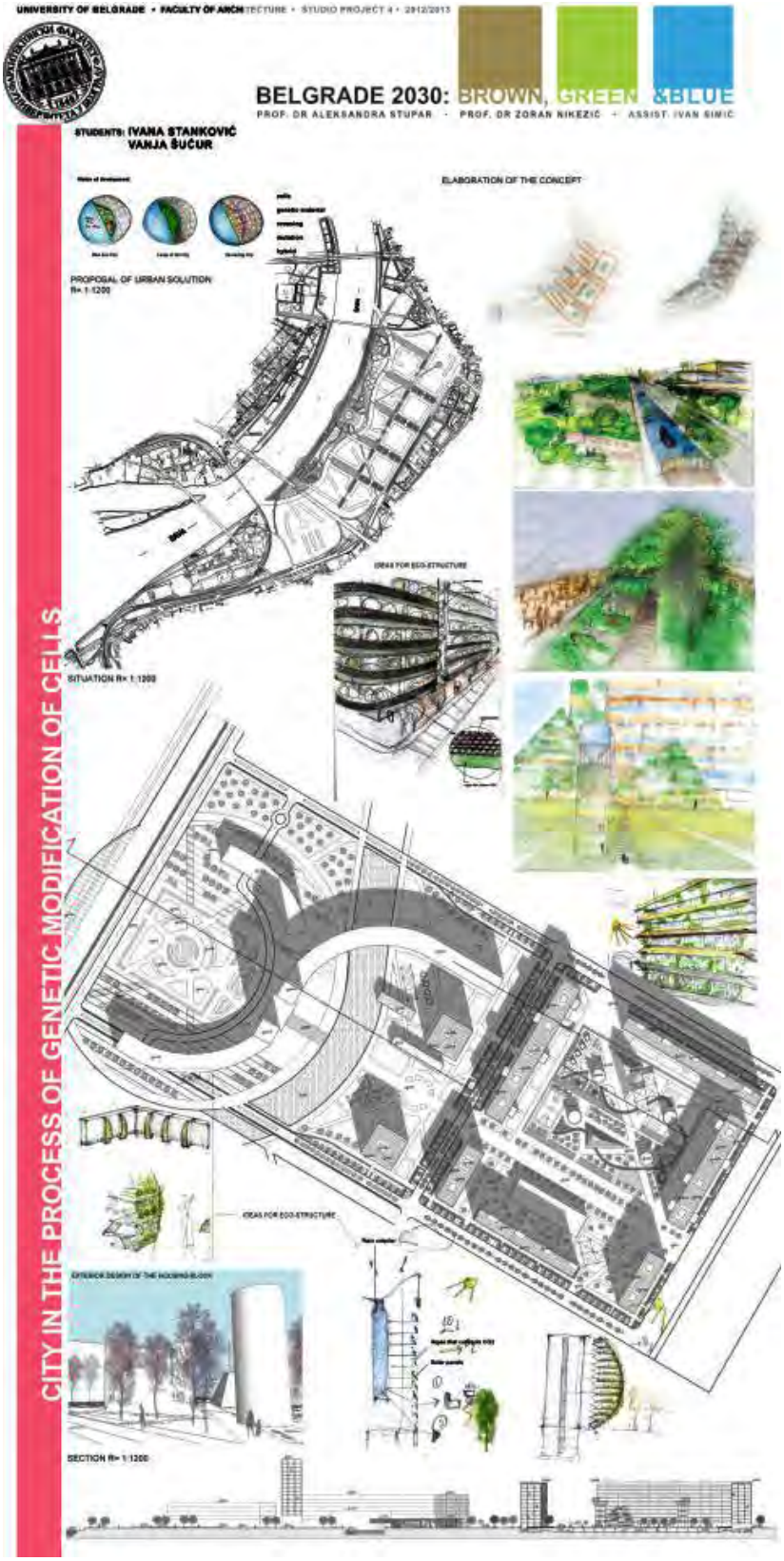


Figure 3: Example 3, Modified City

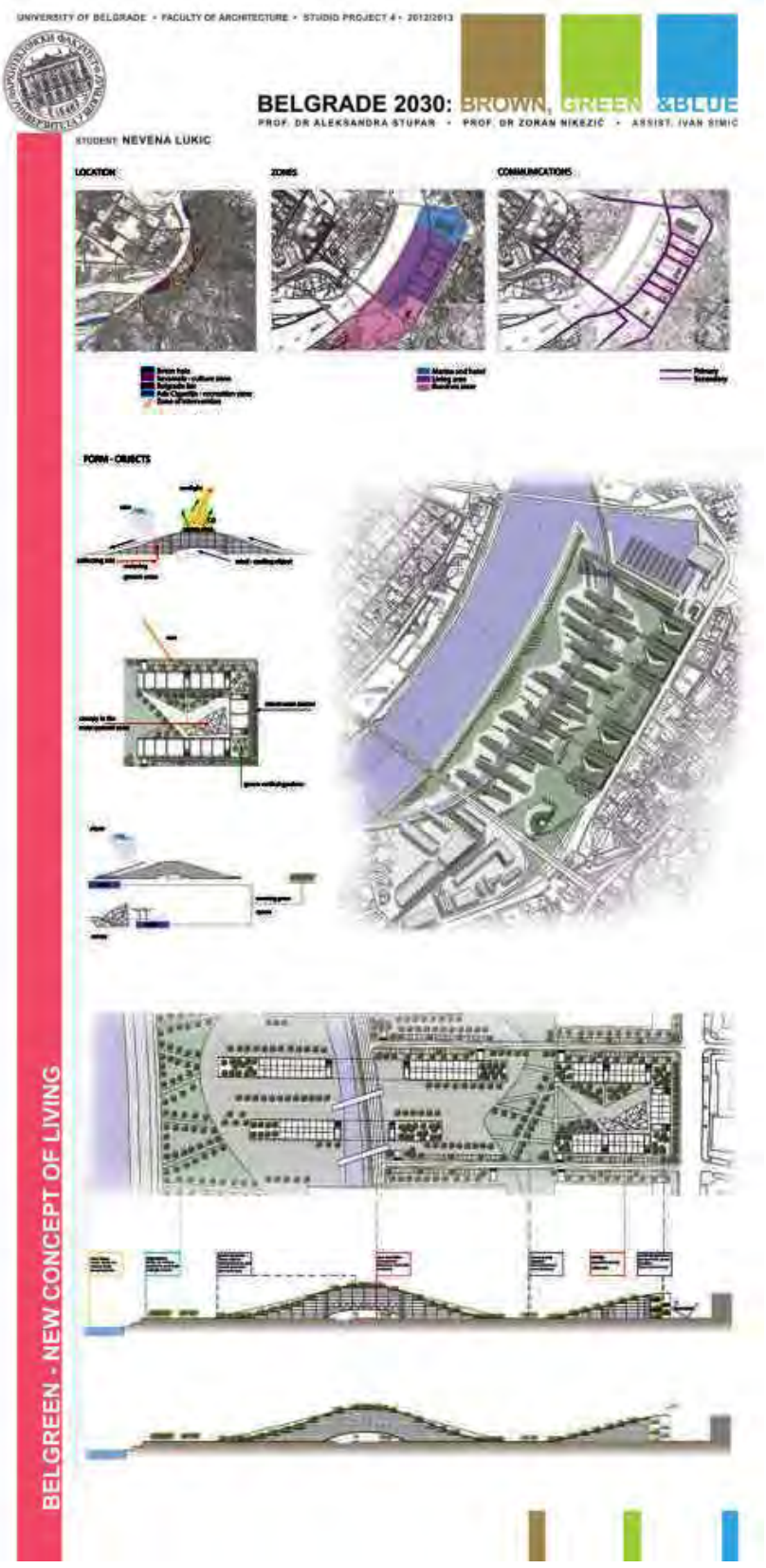


Figure 4: Example 4, Modified City

4. Conclusion

Following the general imperatives of sustainability, environmental quality and energy efficiency in the area of 'Bara Venecija', students chose different ways to achieve it. Referring to the main selected aspects, four specific themes were underlined: natural and artificial conditions of the site, city vs. water, density vs. green architecture, culture and sustainability. These themes directed production of various models which, in general, showed significant concurrence in the selection and application of sustainable design principles.

All proposed ides are based on the green and blue infrastructures representing a unique "armature" which guides and reinforces built environment, creating a foundation for anticipated resilience. Most of the projects use green corridors as connectors between the city centre and the riverbank. In most cases they are integrated with housing, recreational and other urban activities. Because of these close links established with activities, green infrastructure blurs borders between public and private sphere, natural and artificial environment. Blue infrastructure, consisting of canals, introduces element of water/river into metropolitan area creating the second most important factor of the future green city. Their merging creates opportunities for innovative solutions which are embedded in new spatial typologies. Therefore, green and blue infrastructures have proven to be the key elements of urban development and transformation, which tend to improve conventional urban patterns and make them more sustainable.

In terms of urban form, the presented examples provide a number of options to achieve high density and integration with natural elements of ecosystem. In order to created large continuous green areas and achieve high density, most of the proposed models opted for high rise buildings. Their sustainability is based on green technology that makes them more energy efficient and active regarding the use of solar, wind and geothermal energy sources. Alternatively, urban form in some examples has moderate height, but more intensive land coverage.

Obviously, the largest brownfield area of Belgrade - 'Bara Venecija', represents an interesting experimental tissue for application of sustainable design principles. Created models are significant contribution for predicting the future of environmentally-friendly cities, while the ongoing research - focused on optimal development models - certainly opens new windows of opportunity for the increase of ecological values, energy efficiency and resilience to climate change.

Endnotes

[1] Green and blue infrastructure refers to a strategically planned and managed network of green and water spaces and other environmental features vital to the sustainability of any urban area. (England Green Infrastructure Guidance, 2009.)

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Emscher Conversion and Quality of Life

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Emscher conversion presents an opportunity for improvement of health as part of quality of life in the process of urban transformation.

1. Introduction

The objective of this paper is to bring into the focus the importance of health as a part of quality of life during the process of urban transformation, specifically the Emscher conversion. The Emscher Valley encompasses 17 different municipalities in the shrinking Ruhr region in Germany. It is the most vulnerable area in this region due to environmental degradation followed by social and economic decay caused by industrial decline. The high proportion of people suffering from chronic diseases in this area is associated with lower levels of education and income, a high level of unemployment, as well as limited accessibility to and quality of services (Lopez 2012; Dannenberg, Frumpkin and Jackson 2011). In addition, living in proximity to brownfields, heavily traveled highways and open sewage canal in the areas with deteriorated streets and physical barriers likely degrades quality of life and increases health risks (Dannenberg, Frumpkin and Jackson 2011). Furthermore, lack of urban compactness and social coherence in the Emscher area present obstacles for the functionality of space, which is difficult to improve due to a lack of financial resources for urban interventions (Ryan 2012).

The regeneration of environmentally deteriorated areas likely benefits quality of life; however, it is necessary to critically evaluate projects and strategies to identify additional, non-environmental factors that present not only potential risks but also opportunities for additional improvement of health in the process of transformation. The Master Plan “Emscher Future” is guiding the Emscher conversion process, which will have a great impact on this region for many generations to come.

The Emscher conversion focuses on water management and includes impressive and innovative approaches; however, it is not the focus of this paper. Main focus is on the transformation of the built environment and its effect on quality of life. In that regard Phoenix Lake in Dortmund, an important example of successful transformation, is selected for the critical evaluation regarding its impact on quality of life.

In order to evaluate how this new development influences health as a part of quality of life after the transformation process, the New South Wales Healthy Urban Development checklist (NSW 2009) was employed, as one of the methods for Health Impact Assessment (HIA) (WHO 2013), and on-site researcher observations. In this paper, are evaluated conditions relating to healthy food, physical activity, housing, transport and physical connectivity and public open space (see Appendix 1).

2. History of the Emscher region in the context of urban growth and decline

Cities and regions, as part of a constant process of change and transformation to improve the existing physical and social structure, face different periods of growth, stagnation and/or decline. Historically growth replaced decline and decline growth. The Emscher Valley in the Ruhr region, a former industrial power engine of Germany, is experiencing similar challenges. With the industrial revolution a large proportion of agricultural land was transformed for industry and large numbers of people moved from the countryside to cities. Unplanned urbanization resulted in overcrowded living places, bad ventilation, and lack of sunlight, which facilitated the rapid spread of disease and large epidemics in many cities (Hampstead Tenants Societies 1910; Lopez 2012). Urban planning was introduced to improve urban living conditions and quality of life (Lopez 2012).

'Golden age' of industrial expansion (1870-1918) was followed by industrial consolidation, a period of urban growth and development during which early urban planning was established (Tenfelde and Urban 2010). Unqualified laborers came from the surrounding villages or even other countries to work in factories or mining. A massive inflow of workers caused housing shortages, which was addressed by constructing dispersed settlements of compact housing with small gardens near mines within the Emscher Valley. While exposed to high levels of pollution, paradoxically workers grew fruits and vegetables as an affordable solution for a healthy diet.

Industries discharged their waste water into the Emscher River, a common practice in the industrial regions because:

> *… it was the cheapest and most convenient dumping ground for all soluble or suspendable forms of waste. The transformation of the rivers into open sewers was a characteristic feat of the new economy.*
>
> *Mumford 1961, p. 459*

The Emscher River was prone to flooding, so it was necessary to regulate the river (Emschergenossenschaft 2006). Since it was impossible to construct underground sewage canals due to terrain sinking caused by mining, the Emscher River was transformed into a straight, open sewage canal.

Although "urban growth was viewed as permanent, inevitable and even desirable" (Beauregard 2003, p.31), the phase of reconstruction and reproduction (1947-1960) shifted to a phase of de-industrialization of coal, iron and steel in the 1960s due to the economic crisis (Tenfelde and Urban 2010). Development of information and communication technologies, among others, promoted globalization and shifted industrial production from traditionally industrial countries to developing ones. Cities and regions were transformed due to the shifts from industrial to post-industrial and information cities (Soja 2000), which require highly skilled labor instead of the unskilled workers characteristic of Fordism.

This shift resulted in a high number of unemployed, unskilled laborers, a deteriorated urban environment and a faltering local economy (Pinch and Adams 2013) – growth was replaced with decline. As a result of this new transformation process:

> *…many of these cities themselves threaten to become residual; abandoned and obsolete monuments to an earlier epoch. Or else, as twilight regions of once confident and rational projects, they are transformed*

into aestheticized cityscapes …, while their previous populations, if they have no role to play in this act, are inserted into other discourses: ethnic communities, urban poverty, inner-city decay, industrial decline, drugs, organized crime.

Chambers 1990 in Soja 2000, p.149

Ethnic communities of migrants, who came during the industrial expansion, were segregated in the areas of former industrial settlements. Poor quality of life in these areas was coupled with high levels of unemployment.

3. Main challenges in the post-industrial period

High environmental degradation and a difficult socio-economic structure resulting from decades of industrial production and the shift from industrial to post-industrial society have a great impact on health in the context of quality of life in the Emscher Valley. Economic decline leads to decreased income, fewer employment opportunities and higher unemployment, which affects accessibility to goods and services. Many neighborhoods in the Emscher Valley have insufficient retail due to the low purchasing power of residents, which limits accessibility to affordable healthy food.

A dense road and rail network, voids in the urban fabric and deteriorated streets present obstacles for the coherence of urban space, and thus discourage walking and physical activity. Furthermore, inefficient public transportation fosters car dependency for commuting and shopping for daily needs. Although there are many green areas in the Emscher area, few are accessible to the public due to safety issues, such as high dikes and polluted water. Housing located along heavily traveled highways exposes residents to high levels of air pollution and noise.

Poor environmental and socio-economic conditions negatively influence health as a part of quality of life. In order to identify the areas most at risk for poor health, socio-economic data (unemployment, low-income) were combined with morbidity data (ischemic heart disease, lung cancer and liver disease). The results are displayed in a sensitive urban zones map (see Figure 1, left) showing the areas most vulnerable to low quality of life in red. By adding the borders of the Emscher Valley (see Figure 1, right) it can be concluded that some of the most vulnerable areas are located in the Emscher region.

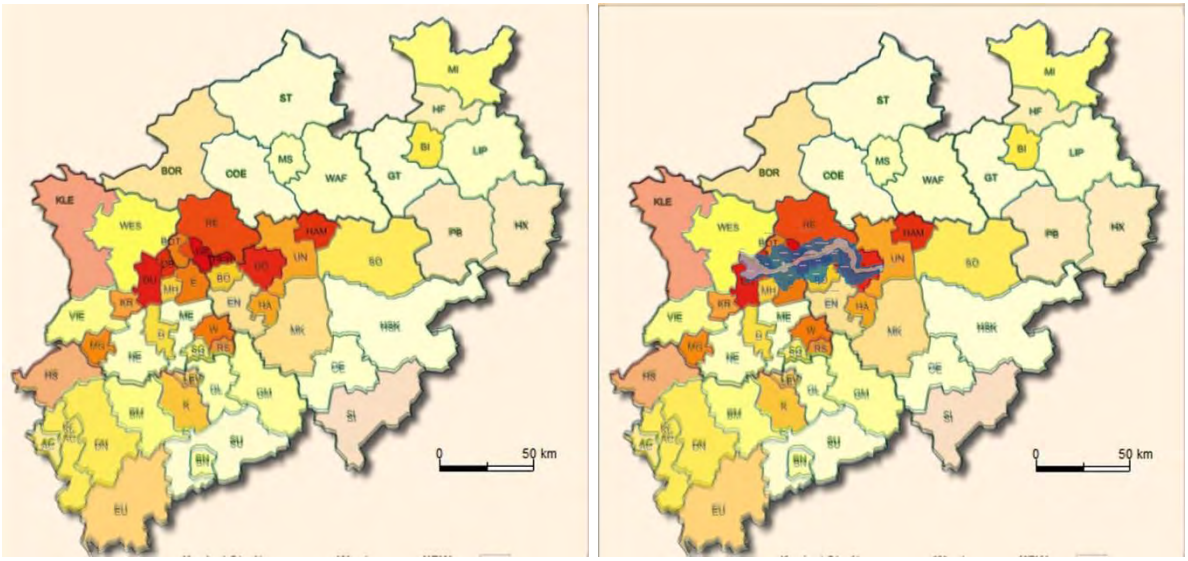


Figure 1: Sensibility map Sensitive urban zones, risk of premature death due to chronic disease and difficult socio-economic structure, cities in North Rhine-Westphalia, Germany, 2009
Source: own maps based on data from Landeszentrum NRW

Historical background of the region has great influence on current circumstances.

All the cities in the New Emscher Valley have similar conditions for the future development, because they have gone through a similar trend and now have to cope with the structural changes at the same time. In the proximity of Emscher River are located brownfields, infrastructure facilities of former industrial sites and housing estates that were originally formed in connection with the work. In the time after the industrial utilization they are too isolated and partially underutilized, unattractive settlement areas.

Emschergenossenschaft 2006 p.C8

Besides these characteristics that have direct influence on quality of life, another important aspect is the fragmentation of urban space in the Ruhr Region and marginalization of Emscher Valley during the industrial period (Figure 2).

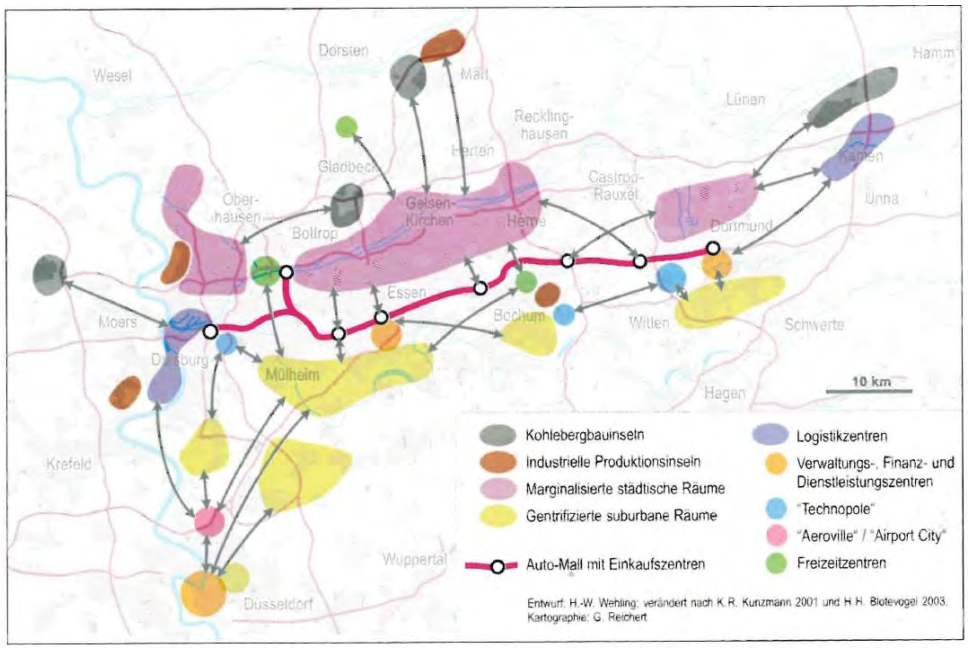


Figure 2: Fragmented Ruhr Region (Wehling 2011)

These challenges are recognized by the state government, which in 1989 initiated the International Building Exhibition (IBA) Emscher Park, a milestone in the development of the Emscher Valley (Pinch and Adams 2013).

4. IBA Emscher Park and Emscher Association

Conceived by the state of North Rhine-Westphalia, the main goal of IBA Emscher Park was to initiate the ecological renewal and urban development of deprived Emscher Valley through regeneration projects realized over a period of 10 years, from 1989 until 1999. Transforming and integrating industrial areas into a regional landscape park with recreational green areas and network of cycle paths was supplemented with efforts to renaturalize the Emscher River. An interdisciplinary approach combined with involvement of international experts resulted in

innovative measures and projects to improve housing as well as the socio-economic situation (Pinch and Adams 2013).

IBA Emscher Park had a project-based approach, due to vast areas and various stakeholders. Although lacking in comprehensive strategy, the main vision of creating sustainable and innovative projects to foster transformation of the region was met through a guided incrementalism, which allowed for greater flexibility to cope with complex structure of the region and stakeholders (Pinch and Adams 2013).

After this 10-year period the Emscher Association (Emschergenossenschaft) took over the coordination of projects in the region. The Emscher Association, founded in 1899 by the surrounding cities and districts, mines and industry, is responsible for all issues involving the Emscher River and its tributaries. Its main tasks are flood protection, wastewater disposal, and rainwater and groundwater management. Conversion of the open sewage system of canals and renaturalization of the river basin was initiated in 1992. Planning for a span of 30 years, with an impact on not just one generation, required a flexible approach.

Furthermore, planning and implementation of a regional project, without the aid of economic growth, requires a flexible approach wherein different stakeholders can be involved in the transformation process. Besides the European Union, which supports the project financially, and the Emscher Association, the Ministry of Economy, Energy, Building, Housing and Transport and the Ministry for Climate Protection, Environment, Agriculture, Nature Conservation and Consumer Protection of North Rhine-Westphalia also support efforts to improve quality of life and the ecological situation in the Emscher Valley.

There are two master plans for the New Emscher Valley: 1) Master Plan "Emscher Future," developed among Emscher's cities and the Emscher Association, which incorporates different projects related to housing, working, and recreation in the Emscher valley, and 2) Emscher Landscape Park 2010, which focuses on regional greenbelts.

It is important to explain the concept of the New Emscher Valley since it does not exist in a usual manner:

> *There is no valley in the topographical sense between Dortmund and Dinslaken. It's more about a programmatic definition of a new space extending far beyond the banks of the river and the Emscher Landscape Park's open spaces. The New Emscher Valley includes the region's housing estates, infrastructure, commercial areas and industrial facilities – spaces where other stakeholders outside the EMSCHERGENOSSENSCHAFT will take up the urban planning impetus provided by the river's conversion.*
>
> *(Emschergenossenschaft/Lippeverband n.d.)*

5. Master Plan "Emscher Future"

The Emscher conversion project is an important driver of transformation of the physical environment through the land-use and land-cover change in the 865 km^2 area along the 85 km long Emscher River. Although considered urban sprawl with low density, the Emscher Valley belongs to a densest metropolitan region in Germany, whose balanced development presents an important task of regional planning.

> *Regional planning asks not how wide an area can be brought under the aegis of the metropolis, but how the population and civic facilities can be distributed so as to promote and stimulate a vivid, creative life*

throughout a whole region—a region being any geographic area that possesses a certain unity of climate, soil, vegetation, industry and culture.

Mumford 1925

The Master Plan "Emscher Future" attempts to reduce fragmentation in the region by transforming previously avoided areas into attractive areas facing the water. The first step of the Master Plan "Emscher Future" was a competition in 2003. The interdisciplinary approach envisioned the New Emscher as wire strands representing action areas (Figure 3 right) and the essential building blocks of the project as interlocking puzzle pieces (Figure 3 left) (Emschergenossenschaft 2006).

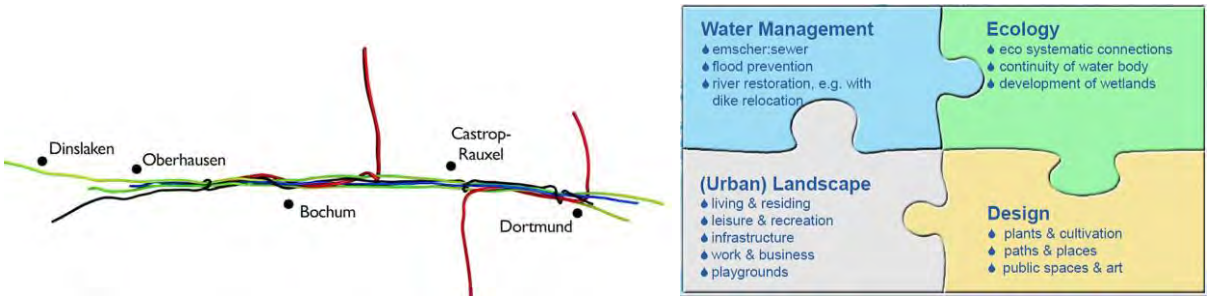


Figure 3: Concept for the New Emscher Valley (Emschergenossenschaft 2006)

Water development represented with blue wire comprises water management and aquatic ecology measures. One of the main goals, finishing of 400 km of underground sewage canal, is planned by 2019, while ecological development of 340 km open water courses requires a longer time span and is scheduled for 2027 (Kreis Recklinghausen 2008).

> *Green stands for the accompanying ways, the appreciation of the open spaces and the settlement edges along the Emscher as well as for the ecological connectivity of the Emscher system with the region. Close together are, for the most part but not spatially interconnected anchor points of industrial culture, landmarks, cultural sites, convention centers, parks, recreation and sports facilities linked through existing and new ways with the New Emscher.*
> *The red cable extends far into the region and intertwines formerly isolated areas together…*
>
> Emschergenossenschaft 2006, p. A18

Although an important strategic framework that provides guidelines for future projects in the Emscher area, the master plan is an informal plan and not a formal planning instrument. However, it is continuously updated by legally valid plans and regularly compared with the overall objectives (Emschergenossenschaft 2006).

Eight main principles guide development in the Emscher area:

1. *The flood security of the Emscher system will remain outstanding*
2. *The true ecological potential of the Emscher system will be fully exploited*
3. *Recreational and leisure opportunities will be created with useful benefits for the public*
4. *Living on the water creates quality of life and new economic potential*
5. *Architectural and urban integration generate a pride in regional history within a newly designed context*
6. *Clear, linear design elements stress the continuity and interconnection of open space and biodiversity*
7. *The recognizable style of materials and forms characterizes the unmistakable face of the New Emscher*

8. The new Emscher Valley offers independent attractions and means of identification as well as an attractive economic platform

(Emschergenossenschaft 2006, p. A26-A29)

Besides ensuring flood security, the Master Plan emphasizes the importance of combining a network of open green spaces with environmental and economic development opportunities resulting in increase of land values. From the economic perspective, increasing land value is positive effect of the regeneration process and improved quality of life; however, from the social perspective it can be a critical issue because it can initiate gentrification. Since the Master Plan envisions development of livable and sustainable cities in the Emscher Valley, it is necessary to balance all three pillars of sustainability.

Inspired by the Master Plan, many municipalities have developed their own projects related to Emscher Valley that will likely further influence quality of life. For example, the project "New Paths to the Water" (Neues Wege zum Wasser) in the city of Essen plans to develop three paths connecting the Rheine-Herne Canal on the south side with the Emscher River on the north side of the city (STEP Essen 2007).

6. Outcomes of the regeneration process

Results of the Emscher Valley regeneration and transformation are already visible at several locations along the Emscher River. For example, a new design element of the landscape and townscape near the Deininghauser Bach, an Emscher inflow, enhanced the vulnerable area of north Castrop-Rauxel. After more than three years of transformation, new waterfront was created where previously only asphalt surface was present, improving the appearance and the attractiveness of the area.

In addition, the Emscher River has already been renaturalized at several points including the old Emscher in Duisburg, Borbecker Mühlebachstrasse and in several parts of Dortmund. Regenerative aspects of the old Emscher in Duisburg contribute to the quality of life and could be easily added to the Landscape Park Duisburg North, since it acts as a blue backbone in the green landscape of industrial heritage.

Parallel with improvements in the built environment, there are different initiatives to enhance the socio-economic situation in the Emscher Valley. "Social City NRW" ("Soziale Stadt NRW") is a part of an urban development program initiated at the state and national level. Structural change from the industrial to service economies brings challenges related to a high unemployment level concentrated in areas with poor living conditions and a high number of migrants. The goal here is to support these vulnerable neighborhoods to mobilize existing powers in order to achieve stabilized development and a better quality of life (Städtenetz Soziale Stadt NRW 2008). One of the initiatives for long-time unemployed people, supported by the Emscher Association, was the "Park Hotel" training and employment promotion in Bottrop-Ebel.

Located on the site of an old purification plant, the "Park Hotel" in BernePark contains five 'rooms' constructed from repurposed, robust concrete drain pipes, with a diameter of 2.4 meters. Designed by Austrian artist Andreas Strauss, it presents one example of artistic works along the Emscher River.

6.1 Phoenix Lake in Dortmund-Hörde

The Phoenix Lake project provides an important example of a successful transformation of a ca. 100 hectare (ha) urban brownfield to a new urban development located near an inner-city.

Named after a blast furnace, the Phoenix industrial plant in Dortmund refined steel for more than one and half centuries (Emschergenossenschaft 2006). After the closure of the plant in 2001 when production moved to China, both Phoenix-West and Phoenix-East (approx. 200 ha in total) were turned into a brownfield (Emschergenossenschaft 2006). The Department of City Planning in Dortmund designed the Master Plan for the Phoenix-East to encourage new development around an artificial lake. The transformation of 24 hectares of highly contaminated wasteland into an artificial lake began in 2005. (Phoenixseedortmund 2010). The lake was envisioned given the favorable geology and the high level of ground water (*ibid*). With a total area of 96 hectares, Phoenix-East is comprised of residential, business and leisure facilities with the lake in the middle, as shown on the Figure 4.



Figure 4: Urban plan of Phoenix Lake, March 2013 (source: Phoenixseedortmund 2013)



Figure 5: View on the port from the Emscher River, June 2014 (source: author)

The Phoenix Lake, supplied with groundwater, has no connection to the Emscher River except in the case of flooding when the lake serves as a high-water retention basin. The Emscher River is renaturalized and relocated on the northern edge of the lake.

Although the Phoenix Lake is considered a successful outcome of the transformation process, project was critically evaluated to emphasize not only potential risks, but also additional benefits for the health as a part of quality of life. The following five (of ten) topics were selected for this paper:

Healthy food:

The provision of healthy food was not taken into consideration in the Phoenix Lake development, although individual housing provides space for growing fresh fruits and vegetables in the individual gardens. However, proximity to supermarkets and other fruits and vegetables shops with affordable prices would provide additional opportunities for a healthy diet.

Physical activity:

The attractive environment and pedestrian-oriented streets accessible to all users encourage walking, cycling and other forms of active transport. Additionally, the lake offers possibilities for water sports like canoeing and sailing. The area is integrated in the existing public transport network as well as in the "Emscher Valley Cycle Route" ("EmscherRadWeg") cycling network, which decreases car dependency.

Transport and physical connectivity:

Public transport was not identified as a priority; however, most of housing is located within walking distance (400-500 m) of a bus stop, except for the small number of single-family housing units on the east side of the lake that are beyond 800 m from a stop. Public transport nodes are safe and easy to approach by bicycle due to the availability of bicycle lanes. Parking is provided for all residences and facilities on the lake, favoring car over other modes of transport.

The project encourages integration with existing development through the provision of public open space and leisure facilities on the waterfront as well as easily accessible pedestrian areas.

Public open space:

The renaturalization of the Emscher River provides opportunities for access to green space and natural areas. Public open spaces are safe, healthy, attractive, easy to maintain and designed to be accessible to all age groups. They encourage physical activity and complement existing recreational opportunities in the area.

The "Culture Island" (Kulturinsel) contains Thomas Converter as a reminder of industrial history and encourages sense of place and identity.

Housing:

"Living on the waterfront" and "Living in the city" are two main topics pertaining to residential settlements from the development plan. The development included different forms of housing, such as energy-plus housing with intelligent solar architecture, insulated building envelopes that require little energy for heating and large-scale photovoltaic systems on the roof that generate electricity. This project provides a contribution to the project organized by State of North Rhine-Westphalia in order to promote climate protection through the "100 Climate Protection Housing Estates in North Rhine-Westphalia" (100 Klimaschutzsiedlungen in NRW n.d.).

The residential settlements include housing of different sizes and ownership structures to cover various population groups from students and seniors to families and business people. Additionally, 3,700m^2 is allocated for the affordable housing, which will be provided in the form of co-housing where families and seniors will live next to each other and share some of the common areas. Although, the project emphasizes a mix of social classes, only 3,700m^2 of affordable housing is planned in the 26 ha of residential area, which seems to be insufficient.

Transformation of the former wasteland into a lake with a high standard residential settlement, with business and recreational facilities creates new value for the Hörde district. The positive impact extends beyond the borders of the district, as other citizens also visit the lake and benefit from recreational and waterfront facilities. However, it is unclear for whom this large number of housing units is planned. According to results from the 2013 Census the city of Dortmund is experiencing modest population growth (0.2%, Stadt Dortmund 2013, p.8) and has an unemployment rate of 12.9% (12.1% Hörde district) (Stadt Dortmund 2013, p.34). Additionally, a high proportion of people receive social subsidies (125/1000 residents in Hörde district, 138/1000 Dortmund)(*ibid.*) and lack employment opportunities, suggesting that residential settlements on the Phoenix Lake would be inaccessible to most Dortmund citizens. Multifunctional Technology Park at PHOENIX West will provide a certain number of job positions for highly-qualified employees; however, it is unlikely that those would be local people. Filling in the new development without population growth tends to simply attract residents from other city areas, resulting in depopulation and shifting the problem from one district to another. Additionally, increasing land values could initiate gentrification process in the surrounding neighborhoods.

7. Conclusion

The transformation of brownfields to greenfields and the conversion of an open sewage canal to a river inevitably improves quality of life as well as environmental and human health. Coupled with urban redevelopment projects the Emscher conversion gives new impetus for the improvement of the region and its transformation into a place for future generations, who will have the opportunity to live and work in a green landscape with an industrial heritage.

The new Emscher Valley has the potential to connect different areas and improve coherence of the urban space, which could encourage walking and decrease car dependency resulting in better health and quality of life. Additionally, attracting new businesses through improved design could enable new employment opportunities and improve the economic situation resulting in improved access to goods and services.

The example of Phoenix Lake, an excellent showcase of successful urban transformation, gives insight into improvements in built environment that may directly enhance quality of life, and thereby have positive effects on the health of its residents. These positive effects go even beyond the borders of the district due to carefully designed, publicly accessible open spaces that attract people from the whole city of Dortmund.

Improvements in the urban fabric and a better quality of life should attract people to the newly created housing and workplaces as well as recreational spaces, which due to population decline – or even modest population growth – can result in the depopulation of urban centers. Additionally, increased land values could initiate gentrification in the surrounding neighborhoods, which could force social change. Careful planning and different measures in the implementation process may help current residents benefit from urban transformation instead of forcing them to move to another area and thereby merely shifting the problem from one area to the other.

Lessons learned from the Emscher conversion and its influence on quality of life may in part be transferred to other regions. IBA Emscher Landscape Park, which gave initial impetus for change, is a German-specific regional policy instrument. Additionally, urban transformation

and structural change are related to national and regional policies with financial support provided from various institutions at different levels, which may be difficult to replicate in another region that is facing similar challenges.

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Appendix 1

Evaluation questions derived from the Healthy Urban Development Checklist from New South Wales in Australia (NSW 2009).

Healthy food

Retail type and locations
Transport infrastructure to food retail locations
Food service locations (including fast food)

Physical activity

How does the development proposal:
Encourage incidental physical activity?
Promote opportunities for walking, cycling, and other forms of active transport?
Promote access to usable and quality public open spaces and recreational facilities?

Housing

How does the development proposal:
Encourage housing that supports human and environmental health?
Encourage dwelling diversity?
Promote affordable housing?
Ensure that housing is adaptable and accessible?

Transport and physical connectivity

How does the development proposal:
Improve public transport services?
Reduce car dependency and encourage active transport?
Encourage infill development and/or integration of new development with existing development (including existing key destinations and active transport infrastructure)?

Public open space

How does the development proposal:
Provide access to green space and natural areas?
Ensure that public open spaces are safe, healthy, accessible, attractive and easy to maintain?
Promote quality streetscapes that encourage activity?
Engender a sense of cultural identity, sense of place and incorporate public art?
Address the preservation and enhancement of places of natural, historic and cultural significance?

The Port of Piraeus: Industrial Zone or Urban Continuity

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Abstract

In addition to the important role of the ports in maritime industries, these transportation centers have received new attention towards development of the hinterland. Particularly, the ports could capture a greater share of added value by favoring the development of their surrounding in order to accommodate not only the full complement of services required for the maintenance and repair, but also the assembly units and freight distribution hubs. Thus, the subject of this paper deals with the topic of harbors and their intersection with the urban core of the city they territorially belong. In a narrow sense, this paper aims at evaluating current conditions for integrated spatial and transport development, considering the ports and the inland railway connection. The case study for this research is the port of Piraeus and its relation to the surrounding urban pattern. The main reason behind choosing Piraeus is the integral connection of the port city to the Greek capital, as well as recent transformation of the harbor in the international context. Considering the external interferences to induce the mass-transit freight and passenger transportation, neither the port city of Piraeus nor Athens is prepared for the urban transformation according to the principles of transport-oriented development (TOD). Hence, the central focus of the paper deals with the thorough analysis of the present spatial problems, possibilities and values in the Piraeus port and its direct surrounding, which further supports intervention on the nodal level. Research methodology consists of several steps. Firstly, since this paper is part of an extensive research project investigating the potentials of Athens agglomeration in terms of future spatial and infrastructural development, the data based on the field research will be analyzed. Secondly, the overview of existing documents (primary and secondary sources) on both spatial and transport development in the city of Athens will be critically analyzed. The paper concludes with the critical overview of the present state regarding TOD in the port of Piraeus (i.e. Rotterdam of the south), as well as basic recommendations for its future development, mainly aiming to respond to a dynamic of self-organizing governance in forging a new conceptual basis for long-term strategic partnership.

Key words: Spatial development, port development, railway transport, sustainable land use, Piraeus

1. Introduction

Ever since the permanent settlements became developed, the water proximity has been the key factor for economic and spatial decisions, survival and sustainability. However, city and water coherency arose many questions in different spatial related disciplines. Due to the urban growth, cities are facing new challenges, especially regarding the rational use of resources like accessibility to water and developable land.

The port city of Piraeus, located within Athens urban area, has almost a 2,500-year history and great archeological, strategic and commercial importance not only in Greece but also within Europe. Despite the multilateral importance of Piraeus, there is a lack of connection for reliable passenger and freight transportation to the city of Athens and the other main urban centers in Greece. Hence, in a narrow sense, the focus of the research is on spatial analysis necessary for the urban areas redesign, while having in mind the port-city interface by the railway and its integration into urban pattern. In broader terms, the research also contributes

to the socio-spatial analysis of the development of the city of Athens, which is nowadays faced with great challenges, i.e. further development of the eastern part of Athens due to its proximity to airport, and, on the other side, further decline of the western part of the city mainly consisting of brownfield areas. The analysis is mostly based on the following two research questions: How can the port mass transit indoctrinate the urban redevelopment of the port-hinterland? This leads to the next question: Is the city prepared for the rapid upcoming transit-oriented development and to what extent?

The paper is structured in the following way; after brief introductory remarks on the importance of integration of spatial and transport development in Piraeus, some external experiences on the topic are provided. For this purpose, the features of the most important transportation nodes across Europe are indicated. This is followed by the assessment of the Piraeus as a port of transnational, national and, finally, importance within Athens agglomeration. The next chapter deals with the elaboration of the present spatial conditions of Piraeus and environment within it is embedded. The parameters for such an analysis are: position of the port within the broader urban context of the city of Piraeus; communication network in the vicinity of the port; and, land use patterns, both current and future (according to the main planning documents). The paper ends with some general conclusions, as well as the basic guidelines for future integration of spatial and transport aspects within the urban milieu.

2. The port development in Europe: some experiences

This chapter deals with the current trends and potential challenges in port development across Europe. More precisely, the examples of port development in the Netherlands, Sweden, Spain and Germany are briefly explained.

Remarkably, Dutch approach of port development includes the legal and formal possibilities for various governing bodies (i.e., municipalities, regions and provinces) playing active roles in defining the policy context of inland ports. In other words, besides the Port Authority, municipality and province governmental bodies all have a seat on the planning committee for any issue ranging from long-range plan, terminal development to environmental and safety-related plans. To investigate the current trends in Dutch port cities, the paper focuses on the ports of Alphen aan den Rijn, Dordrecht and Rotterdam.

The port of Alphen aan den Rijn has been developed on the urban fringe, and this resulted to re-thinking of the inland port towards integration to the city center by developing a residential and leisure area. However, the port consists of container terminals, which are important for good distribution but are causing conflicts with the residents mainly because of the noise pollution. The analyses indicate that the conflict stems from disregarding noise nuisance in city plan on residential level as well as container terminal development. According to Witte et al. (2014), a strong infrastructural focus on accessibility and modal shift is combined with notions on the economic potentials and the sustainability agenda, while specific attention to quality of life in the direct surroundings is absent, and the local spatial planning problem underrepresented.

Dordrecht is also another Dutch port in a longstanding relation with good transportation network, which needs to accommodate increasing freight traffic flows coming from Rotterdam and going to the hinterland. The port is functioning in a wide range from local to the international level. However, this hub function deals with efficiently accommodating heavy industrial activity within a densely populated urban setting. No spatial conflicts could be identified from deductive analysis because land use claims and terminal plan-making are in accordance and since it is highly developed port with good accessibility, capacity, and level of service (Witte et al. 2014). Although a lack of physical space for further development is a continuous threat, there is a comprehensive policy attention to address this problem.

Besides dealing with land use compatibility, the above-mentioned ports in addition to the Port of Rotterdam concern about inland transport as well. This is due to road congestion in this

area. Currently, the ports of North-West Europe are very reliant on road transport for inland transport services. However these ports are well connected to the Dutch railroad system, yet the statistics in 2008 showed around 57% of container throughput at Rotterdam was carried by road transport, 30% by inland waterways and 12.7% by railroad. The wider comparison in 2010, as shown below, led to heightened concerns in Rotterdam about both congestion in the short term and sustainability in the longer term (OECD, 2010).

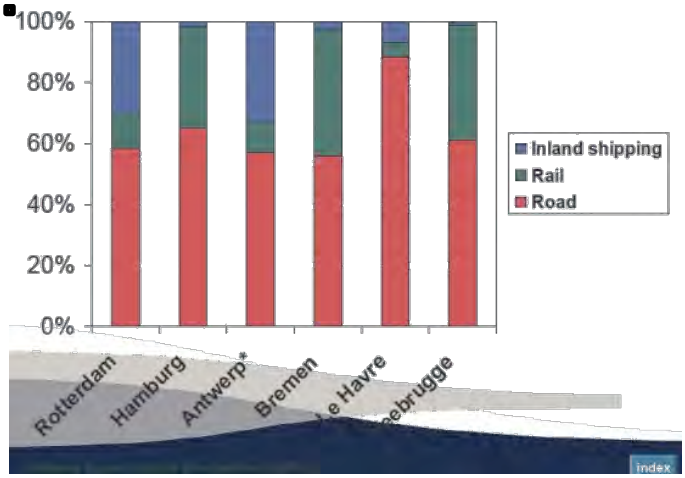


Figure 1: Modal split share of the six busiest ports in Europe (Source: OECD 2010)

Apart from inland ports, the port of Rotterdam only generates very significant volumes of inland transport. Therefore, the port authorities are aiming to implement a modal shift from roads to waterway and railroads by 2035. Therefore, the Authority is now firmly focused on increasing the shares on inland transport by inland waterways and rail transport. As it is shown below, the target shares for 2035 are: inland waterway 45%; road 35%; and rail 20%.

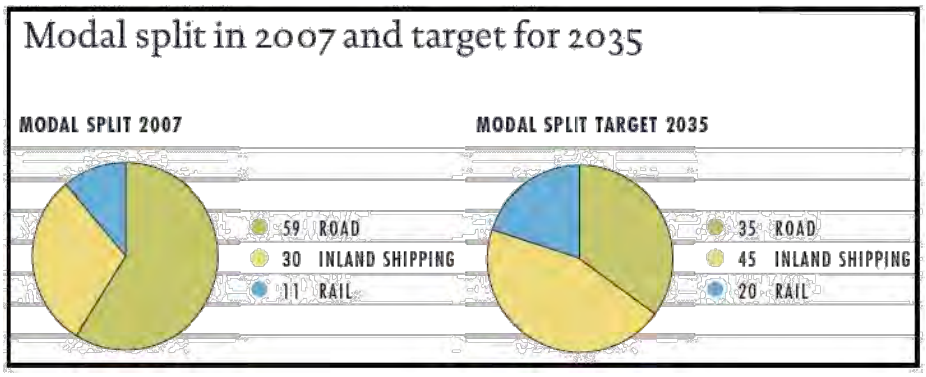


Figure 2: Modal split share of the Port of Rotterdam in 2007 and the target for 2035 (Source: Port of Rotterdam Annual Report 2008)

Several major European rail projects are underway in this region that can be expected to have very significant impacts on capacity, travel time and more reliability on inland connections between the Port of Rotterdam and European hinterland. However, there are still some challenges to confront for increasing rail's modal share of the port. For instance, difficulties in scheduling and trains speed issues; requiring investments especially in marshaling yards; and increasing demand and congestion on mixed rail passenger/freight lines.

The railroad, called Betuweroute, starts from the Port of Rotterdam and ends at the German border. At present, the line is handling around 200 – 300 trains (only freight) per week. The capacity is expected to be around 200 trains per day by now. In the long term, further serious challenges will be freight capacity problems on this line by 2030. Therefore, the Port

Authority solution to this potential problem is to increase the rail's market share as port volumes increase. Meanwhile they run into difficulties and physical constraints in longer term.

Port of Gothenburg (Göteborg) has developed an intensive network of railway shuttle in its hinterland in the last decade. Currently, the system consists of rail shuttle trains to more than twenty different dry ports, i.e. inland intermodal terminal directly connected by rail or road to a seaport and operating as a center for the transshipment of sea cargo to inland destination. Those are spread throughout the whole Scandinavia and are offered by 10 different railway operators.

However, the shortest distance by train is about 10 km within Gothenburg, which serves as a stuffing and stripping terminal. This system handles about 55 per cent of all containers to and from the Port of Gothenburg. The current rail shuttle system decreases transport cots by about 6 million EUR annually and it also relieves the streets of Gothenburg as well as decreasing CO^2 emissions by about 42,000 tons every year (Wilmsmeier, et al. 2011).

Situated along the North East coast of Spain, the port of Barcelona serves Catalonia as well as the South of France. Generating almost 19% of the GDP of Spain shows the importance of the port to the economic growth of the region. Connecting the port to the well-organized transportation system is a reason for high freight volume in this port. However, the dominant transport mode in the hinterland is truck transport, railroad play as the second important mode that connects Barcelona with the hinterland. With rail sidings on the container terminal, the port of Barcelona is connected to the four rail corridors.

In order to increase the connectivity of the port to hinterland, the authority of Barcelona (Autoridad Portuaria de Barcelona, APB) developed its hinterland network with terminals and also developed rail shuttles to other regions outside the traditional hinterland of Barcelona, like Lyon. By connecting the port of Barcelona to other regions by railroad, the port could be able to compete with other ports that are closer to a specific hinterland region. Formerly, Lyon was mainly served by Marseille, Antwerp and Le Havre.

Although Barcelona is located 300 km further away from Lyon compared to Marseille, APB truly believes cargo still can be attracted by a reliable railroad connection. All the hinterland activities in Barcelona's case are the result of the modal shift from road to rail. Despite the decrease in container volume, rail transport increased between 2007 and 2009 (Van den Berg 2011). Studying hinterland network in Barcelona, one might consider Zaragoza terminal as the central node. Due to its location, Zaragoza soon became the economic center and logistic hub of Barcelona, Madrid, Bilbao and Valencia.



Figure 3: The hinterland network of Barcelona (Source: Van den Berg, et al. 2011)

Port of Hamburg is well established among the North Sea ports. Owing to its geographical location, Hamburg is a natural interface between East and West Europe. Furthermore, the city is well positioned for the fast developing Europe – Far East trades. According to the estimations, in 2015 the Port of Hamburg will have annual turnover of 18 million TEU (twenty-foot equivalent units). Therefore, in order to cope with the future challenges in the container market, the Port of Hamburg continuously update and improve its 'Port Development Plan', within which development potential for the future extensions of the terminals is analyzed every five years. Additionally, hinterland connections and services are also considered due to Hamburg's role not only as a major container port but also a logistic hub. Here, priorities are given to the improvement of the rail connections, the necessary depth and maritime access, and the extension of road links. For the Port of Hamburg rail transport is the most important hinterland transportation mode. Nearly 30% of all container hinterland traffic is transported by rail. In long-distance traffic, this share is even 70% (ISL 2007). Within the City of Hamburg the Port Railway is responsible for the railway infrastructure. A modernization and development program has been set up to achieve the required capacity demand from 200 trains per day to 500 trains per day in 2015.

3. Strategic position of the Piraeus port within European, national and city context

3.1 Greece within transnational transportation network

Nowadays, Greece is considered as one of the most important strategic transportation nodes in the European continent. It is significant due to two main reasons. Firstly, since Greece is the most southern European state, the strengthening of its strategic position should contribute to the balanced development between the north and south of Europe, further territorial cohesion and socio-economic competitiveness. Secondly, Greece has the potential for the development of numerous intermodal transportation nodes. More precisely, the benefit of investment in the Greek railway transportation network certainly has the positive effect on the improvement of passengers and freight capacities of other transport modes, mainly maritime transportation. For example, the freight traffic of the Piraeus, the port of Athens, is 1,4 million TEU per year, which makes this harbor known as "Rotterdam of the south". In addition to this, Piraeus is the largest European port in terms of passengers transport with 20 million passengers per year.

The simplified version of the TEN-T (Trans-European Transport Network) was formulated in 2011 and this is known as TEN-T Core Network Corridors. It includes 11 relevant European corridors and the corridor no. 4 known as Orient/East Med(iterranean) connects Hamburg (D), i.e. Rostock (D) and Athens (with a possible lengthening to Lefkosia, Cyprus), while the second route ends in Burgas (BG). This corridor is one of the longest northwest-south eastern axes. More precisely, it connects central Europe with the maritime interfaces of the North, Baltic, Black and Mediterranean seas. Main goal of the corridor development is concerned with the optimization of the ports use, as well as the rail development along the north-south line from Budapest until Athens (EC 2011). Freight and passengers transportation in terms of both railway and waterway (maritime and inland ports) transport modes is indicated in the figure 3.1.

More precisely, this corridor connects the port of Piraeus to the German ports of Bremen, Hamburg and Rostock. Apart from passenger transportation, the Orient/East Med corridor (for freight) includes a long north-south eastern corridor that will connect central Europe to the maritime interface of the North, Baltic, Black and Mediterranean seas. Along projects 7 and 22, and integrating ERTMS corridor E and rail freight corridor 7, it will foster the development of those ports as major multimodal logistic platforms and will improve the multimodal connections of major economic centers in Central Europe to the coastlines (EC 2011).

Since the financial crisis reached its peak in Greece in 2011, all the international routes through the Greek railway network have been suspended. Although even before the

economic crisis, there was just one long-distance railway link from Athens to Sofia via Thessaloniki, which is no longer functioning. However, Athens-Thessaloniki railway connection has been experiencing fundamental improvements and redevelopments due to European Unions TEN-T program. Therefore, new international railway links from Thessaloniki are expected to connect the internal railway network to the transit European railway network (EC 2011).

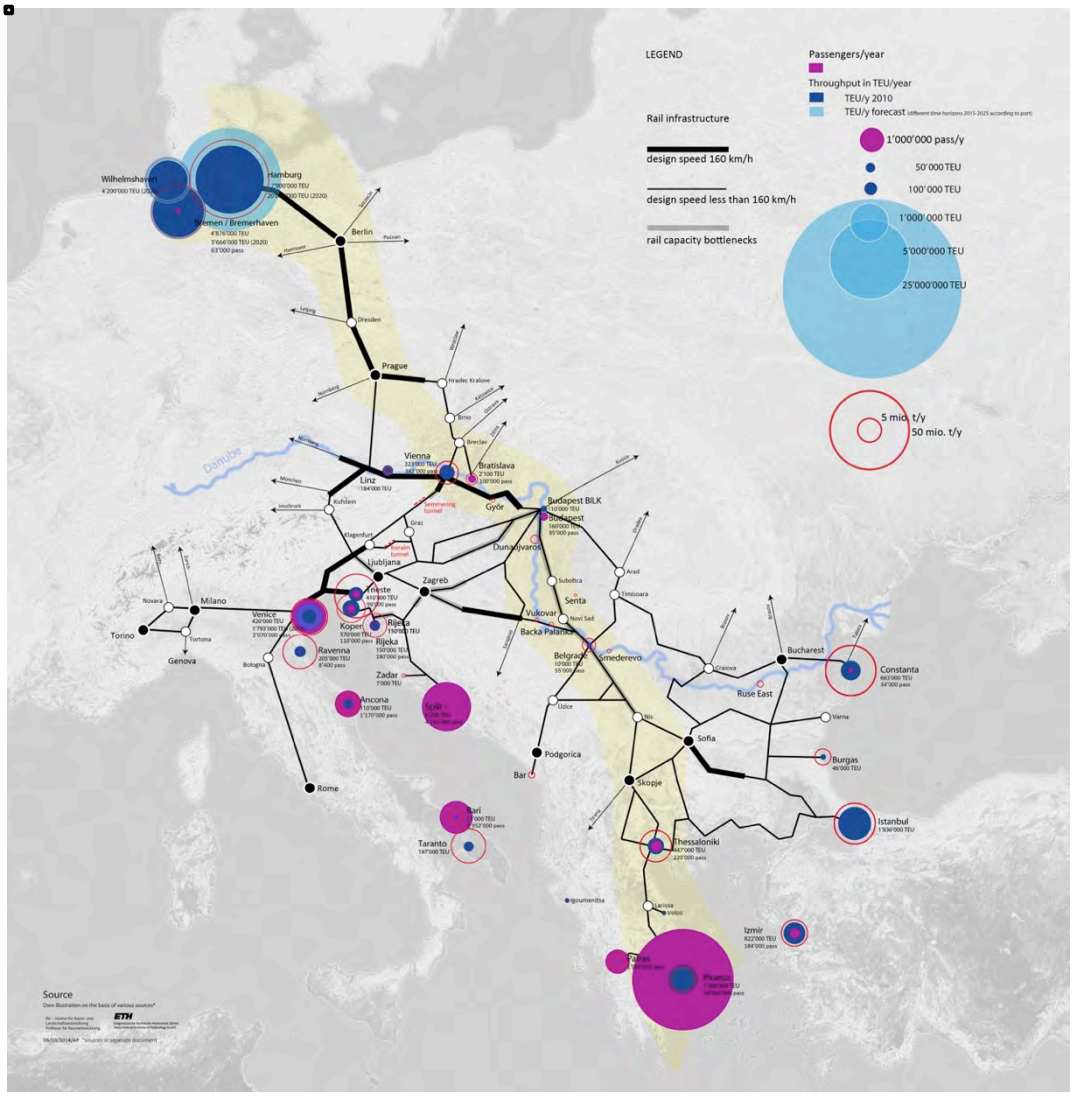


Figure 4: Freight and passengers railway and waterway transport along the Hamburg-Athens corridor (Source: ETH documentation)

The Commission is already granting EU support for a study that will analyze traffic flows and potential development of a rail link that will connect Budapest with Bucharest and Athens via Timisoara, Vidin-Calafat and Thessaloniki. The link is not fully operational at the current time. Thus, the support is directly needed for creating the right preconditions for development along this line, preparing investments in the oncoming multi-annual financial framework. Although there are numerous missing links in this corridor, especially between Hungary, Bulgaria, Romania, and Greece, the first priority of this project is to make sure that a comprehensive cross-border traffic management system on rail and inland waterways is implemented on many sections (EC 2011).

Finally, the strategic location of the Piraeus port city is not only of European, but also of worldwide importance. Recently, Chinese governmental company named COSCO is investing in the port of Piraeus and leasing two-third of cargo handling capacity in order to

provide a stable European market for Chinese exported products. However, neither the port city of Piraeus nor Athens is prepared for the urban transformation according to the principles of transport-oriented development (TOD).

3.2 National efforts for maritime transportation development

Despite the great potential of maritime transport, the Greek ports do not benefit the all load capacities. One reason for this barrier for optimization of the ports is lack of well-connected hinterland transport system. However due to the development of the international airport in Athens, there is still an enormous volume of passenger and cargo frequency, connecting the ports to international destinations. Based on Eurostat 2011, the port of Piraeus supports about 21 million passenger per year, which are mostly international and local visitors to the southern islands. Considering only the passenger transport, the port of Piraeus requires to become an intermodal transport node to be able to sustain this amount mobility. Moreover by loading 1.4 million TEUs per year, the port of Piraeus is the busiest container port in the region. The port of Thessaloniki is the second busiest container port of the country, by the far number of annual containers transport (0.2 million TEUs). The port of Heraklion, in Crete Island, is the second passenger port in terms of transportation annual frequency after the port of Piraeus. Additionally the ports of Patras and Volos are the third and fourth important passenger ports respectively. Figure 5 illustrates these five important ports by their transportation frequency and geographical positions.

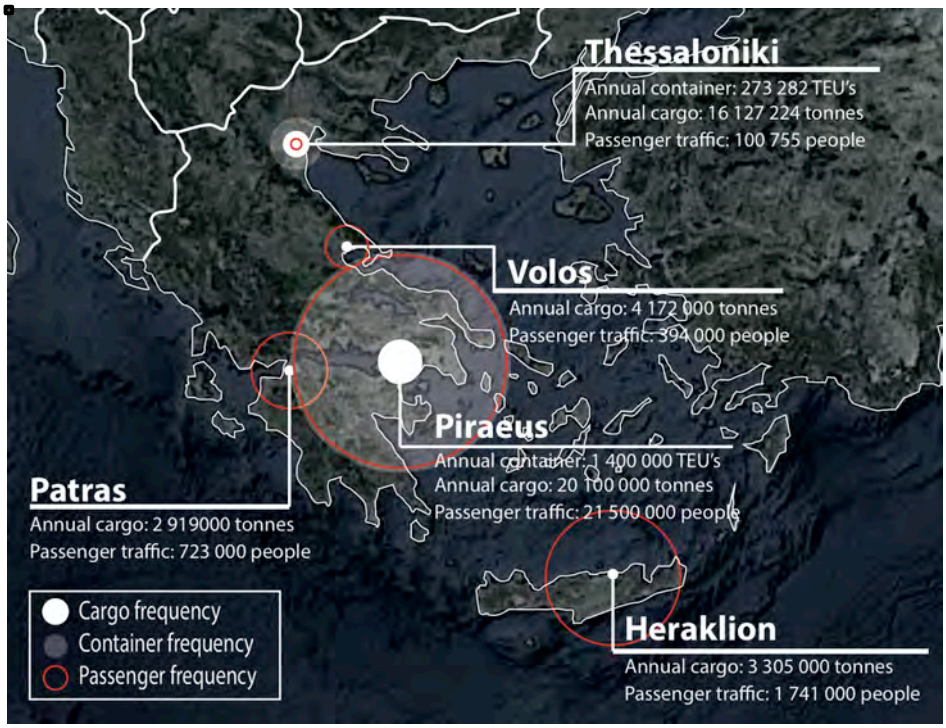


Figure 5: Annual frequency of four top busiest ports in Greece
(Source: Authors based on Eurostat statistics 2011)

3.3. Athens and its metropolitan competitiveness

Considering the city as one of the most strategic water gateways in Europe, people are not as mobile as expected as well as goods. Currently, most of the inland freight transportation is designed for motorways both in local and transnational scale. From strategic perspective, single-modal transportation systems are not capable to compete in economic growth, especially the ones operating in an oil-dependent mode. Therefore the city of Athens requires enhancing the multi-modal transportation system including a resilient railway infrastructure in order to be able to compete as a European metropolitan region.

Amongst Mediterranean cities, Athens had for many decades the lowest indicators of competitiveness due to a variety of factors relevant to its introverted economic traits, long lasting environmental problems and outdated infrastructure (Chorianopoulos et al. 2010). However, the 2004 Olympic games was the core of this competitiveness trend during the last decade, which influenced the metropolitan sprawl mostly towards the east. Access to the suitable agricultural land in eastern part of Athens is arguable as a warning for better controlling development eastwards of the Athenian conurbation. Concentrating more on competitiveness aspect of the 2004 Olympic games resulted to large-scale land use changes and replacing the proper agricultural lands to infrastructural uses such as the international airport and Olympic venues. The availability of high-quality agricultural lands in Mesogia area supports this argumentation for better controlling of future urban growth in eastern part.

Since Europe has been always considered as one of the most promising trade markets for China, Chinese government tends to expand the collaboration with Greece, considering Athens as a distribution channel to the vast European market, and invests its capital in sectors such as final product assembling, transport, logistics and supply chain. Thus the city should expect a huge migration from suburban areas to Athens, seeking new opportunities.

3.3.1 Urban railway transportation

Currently, city is serving public mobility mainly by bus system and metro lines. There are also some limited sub-urban trams connections from Athens downtown (Syntagma square) to the southern coastal area in three lines continue up along the seaside zone. Suburban railway also connects the main railway station to the port of Piraeus. Another suburban railway line supports the connection between Athens International Airport and Kiato through Ska Station. However, the suburban railway network with low passenger frequency, bad conditions, and small capacity are not well functioning. Along with this, the peripheral location of the main railway city station demonstrates the inattention of the public authorities to the railway sector. From a spatial planning perspective, there is a considerable development disparity between the east and west sides of the city in many respects. Since the current location of the railway station is in the border of this segregation (east vs. west), the local government plan to redevelop the station might be impulsive for spatial cohesion. From spatial planning perspective, the City of Athens should consider decentralization/poly-centralization, as does the region and the country. Generally, railway systems reinforce and usually accelerate decentralization trends. By improving accessibility to different parts of a region, extensive railway networks highly encourage suburbanization. If decentralization is intended, proactive planning of and around stations has to be addressed. While railways contribute to suburban growth, they can also support more efficiently organized development within existing built-up areas (inner-development process, brownfield development, and urban regeneration).



Figure 6: The port of Piraeus in Athens metropolitan context and transportation connections (Source: Authors)

3.3.2 Organization of urban public spaces

Comprising around one third of the total population of the country, Athens metropolitan area dominates the Greek urban network. Similar to Spanish and Portuguese cities, the socio-economic structures of Greek cities in the post-war period of urbanization were not based on manufacturing. In contrast to this, urbanization triggered industrialization, by creating economies of scale. Nevertheless, the following de-industrialization/distribution wave did not occur in such cities, unlike in Northern Europe since the 1970s (Chorianopoulos et al. 2010). Taking Athens as an example of such structure, the city kept absorbing population and, as a result, faced the unplanned mode of expansion up till now.

The municipality of Athens entrusted a study for the urban renewal project of the Central Business District of Athens (CBD Athens) in 1989, the so-called "Commercial Triangle" to the Urban Planning Research Centre of the National Technical University of Athens. After detailed land use analysis, these projects introduced by decrees the relevant regulations on land use and other parameters of urban development (The ENVIBASE-Project 1998).

Based on this study, the environmental crises have already hit the city. Athens is at the top of the list of polluted European capitals, and social problems accumulate and become more visible with the wave of immigrants from the non EU-countries. Moreover, environmental and social tensions are reflected in land uses. The bipolarity between central and residential areas is a field of conflict: centers of activity (supermarkets, music-halls, night clubs) often penetrate into residential areas; motor vehicle garages and warehouses often co-exist with housing areas; noisy activities produce linear centers which are contributing significantly to the traffic congestion of the main roads of the city, etc. This repulsive aspect of the city makes some neighborhoods unlivable and the inhabitants are leaving them (The ENVIBASE-Project 1998).

4. Piraeus: a hot-spot for integrated spatial and transport development

According to the 2011 census, Piraeus had a population of 163,688 people within its administrative limits. It is the fourth largest municipality in Greece. Regional unit (agglomeration) of Piraeus has a total population of 448,997.

Although the Greek port of Piraeus is already a destination for some Asian and African ships and has an annual 20,100 (2011) thousands of tones maritime transport (Eurostat 2011), it still has a great potential to reinforce its situation as an alternative southern gate to Europe for transshipment. Meanwhile a key concern here is to enhance the inland transportation functionality to transfer the imported goods to the northern parts of the country and Europe.

The port of Piraeus is functioning as one of the twenty busiest European container ports. It is also the busiest passenger port in Europe. Considering the spatial structure of the port city, the passenger terminal, cargo terminal, and fishery and craft harbors stand relatively close to each other in Piraeus urban business district. Therefore the port could play a multifaceted role as an urban/trade center not only in local scale but also regional and trans-regional. However, currently it seems the port city is the place where institutional and governmental conflicts are happening.

Therefore, there is a need to re-think of the port city in this new context. In a narrow sense, the city is missing a balanced plan considering future infrastructural transformation. According to the port system development literature, the port needs greater expansion for facilities at seaports and in the hinterland by the growth in cargo volume. Subsequently, inland ports receive a great attention for accessibility, as the cornerstone of distribution system.

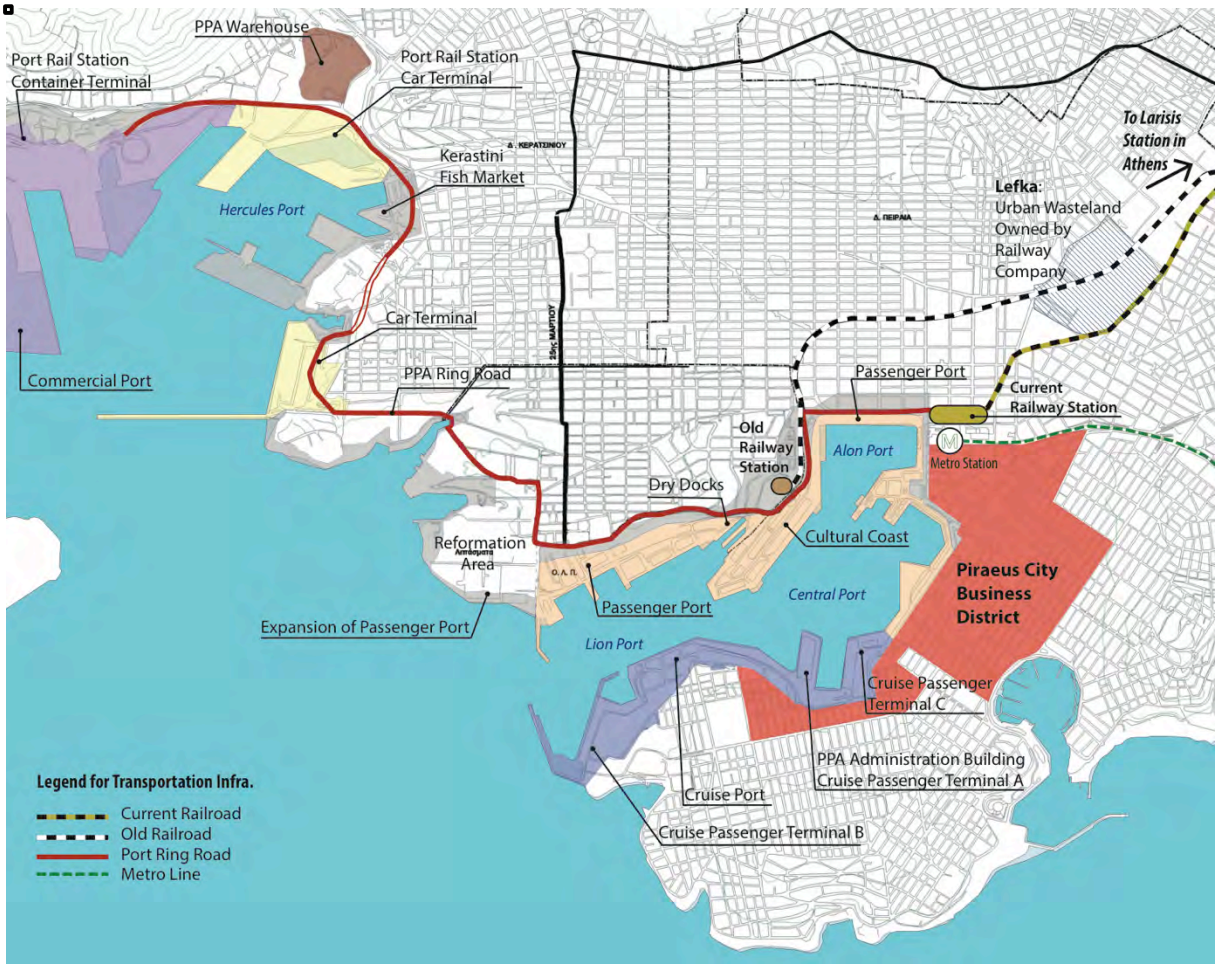


Figure 7: The port of Piraeus: terminals and urban context
(Source: Authors based on original map from ORSA-Planning Organization of Athens)

Similar to the Zaragoza station in Barcelona's metropolitan region, it seems the most sustainable situation is to adapt the Larisis station as the main railway node supporting passenger and cargo distribution coming from Piraeus to the national and European destinations. With respect to this possible solution, a strong connection between the city of Piraeus and the station of Larisis is required.

Introducing more long-distance railway connections in Athens area to Peloponnese region and to the north towards Thessaloniki might positively influence international visitors volume as well as providing better accessibility for domestic commute. Concluded from current situation in Athens, the city is short in any national transportation mode other than motorways. This issue will jeopardize not only tourism, as the second important industry in the region, but also urban growth. As mentioned in 'Athens metropolitan competitiveness' section, the planned urban decentralization mostly happens around regional railway stations as the main hub. Apparently, the Athens metropolitan area is suffering from great centralization due to lacking these stations with function of urban hubs.

Unlike the most European cities, the main railway station in Athens (Larisis Station) is not located in the city center, where the main business district is positioned and all the urban activities occur. Based on our evaluation of the current situation in Athens, the Larisis station is on the urban fringe, surrounded by low-income housing. The city tends to grow towards the international airport in the east part of metropolitan area, and most of the urban development is happening in the east part of the city.

The Hellenic railway company (OSE) is planning to construct a high-rise station building over 10 track lines in Larisis with major purpose of commerce and offices. Still, the city of Athens authority has not invested or planned for investing on this station and its interrelation to the city center. The major concern would be how to connect a station with 20'000 k passenger per year (Piraeus) to the Larisis station with a weak transport distribution system even in local scale (urban connectivity).

5. Concluding remarks

As the most important engine of the economic growth, Greek ports are capable of benefiting from a great geographical location. The port of Piraeus, as the busiest port of the country, has the opportunity to weight infrastructural changes on the highest development priority and improve the city's position in the territorial competitive setting by reduction of 'saving time'. However, the better transportation connection from other parts of European territory to this port provides a better market, therefore results greater geographic influence area and opportunities. Derived from the deductive analysis, it is anticipated that the country will face a great number of passenger and freight trains in the main urban nodes in a short time. Considering the significant port development and the TEN-T Mediterranean corridor, the city of Athens plays a double important role. Increasing the mobility might be a threat or an opportunity for the city of Athens at the same time.

The case study analysis, i.e the evaluation of the current conditions in the port of Piraeus lead to the following guidelines for the future integration of both transport and spatial development, everything according to TOD principles:

- Passenger port should be placed at the center of the port complex, rather on its periphery. Also, its connection to the railway station will connect an entire regional transportation to the surrounding community;
- Port position should foster the creation of activity center in its surrounding;
- Activities should include engaging of public spaces for various events such as concerts, exhibitions, markets, etc. bringing the vitality to the area and stimulate economic development of the entire areas;
- Pedestrian connections and continuous street-front experiences should improve the sense of place;
- Architectural design of the commercial facilities in the port surrounding should highlight the attractive landmarks and gateways.

Considering the abovementioned strategies, we believe the city will better adopt the oncoming transformation. However, dealing with inappropriate uses alongside this corridor and in railway stations' adjacent neighborhood will be a new concern that will show up especially in local scale. The central hypothesis for strengthening this connection is to shape a dual-center for Attica. From transportation planning perspective, the next step is albeit to differentiate the railway passenger transport from cargo, which is also important from city planning viewpoint. The last but not the least future topics in this area, is to reinforce the east-west connection in the city of Athens to avoid more construction in the eastern agricultural lands.

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Slow urbanism on the Antwerp waterfront

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Shortened abstract

Plans, ideas, master plans etc. for the transformation of the Antwerp waterfront have existed since the early 1990's. While progress is quintessential for any urban redevelopment, 25 years of planning and 'slow urbanism' have proven that continuity of ideas and on-going efforts are at least as crucial for the successful and durable development of new neighbourhoods. The economic crisis of the last few years has even had a positive effect on the areas, as large-scale, top-down project developments have gradually declined in favour of small-scale, bottom-up renovation projects by smaller private owners. This has created a richer urban mixture of old and new buildings and has attracted more small and medium-sized functions for a larger group of citizens. 'Slowly but steadily' is our key phrase in creating a liveable and lively waterfront.



The Antwerp waterfront: former port area to be reclaimed for urban use.

From City on the Stream to watered dream

The process of the development of the Antwerp waterfront has a considerable history. At the end of the 1980s, beginning of 1990s, civil society organisation *Stad aan de Stroom* picked up the concept of 'city on the stream' from Antwerp's first Global Structure Plan (1984). The organisation's main goal was the revitalisation of abandoned port areas. Together, *Stad aan de Stroom* and the city of Antwerp organised an international design contest. Three renowned planners and architects were selected to elaborate their proposals: Elisabeth Gali for the Scheldt Quays, Toyo Ito for Nieuw Zuid and Zuider docks, and Manuel de Solà-Morales for Eilandje.

Stad aan de Stroom was a decisively participatory process, with ample chances for the Antwerp citizens to convey their suggestions, remarks and ideas. Several organised meetings brought together citizens and designers. The broad dialogue of *Stad aan de Stroom* revealed that Antwerp is actually proud of its port areas, and well aware of their glorious history. At the same time, a shared sense of urgency emerged: it was time for renewal and change. This 'paradox' forms a remarkable constant in the dialogues: wanting to cherish the past on the one hand, while longing for renewal on the other. This dual conclusion is reflected in the plans of the winners of the international contest.

De Solà-Morales' master plan clearly 'hesitates' between past and future. Strategic actions contribute to an almost chirurgical renovation of the existing fabric, from which new elements arise as well: 'hidden' towers and towers rising from existing warehouses, for example. In a social-spatial strategy to create a mental connection between the city centre and Eilandje, the north-south axis from Falcon square to Nassau street is charged with cultural activities – or mental 'stepping stones' between city and historic port.

The plans for the Scheldt Quays want to reinforce the ties between city and River. The landscape of vast quay surfaces is enriched with a new topography of raised promenades. Vast areas that had been reduced to extra parking space for visitors of the city centre are to become pleasant zones to spend time by the water. At Nieuw Zuid, past and future are interwoven as well, as Toyo Ito's plans reopen the *Zuider* docks and extend the residential fabric towards the south.

In spite of the public's enthusiasm, a lack of financial means and political support brought *Stad aan de Stroom* to an end in 1993. The city government was not overly enthusiastic about the urban development plans, and the port authorities were not prepared to 'give away' port areas in order to be redeveloped. At this point the port company was chiefly concerned with valorising its patrimony in order to feed its pension fund. The plans were put away and the pioneers were left disappointed. In hindsight, *Stad aan de Stroom* ended the way it started: as a (mere) dream of Antwerp citizens.

However, the once 'forgotten' port areas themselves had now become a popular location for a variety of gatherings and events. Tourists visiting 'Antwerp, cultural capital of Europe 1993' flocked to several cultural happenings on the quays. Summer collective *Zomer van Antwerpen* started to organise a yearly theatre and circus event at this *terrain vague*. Stimulated by this socio-cultural rediscovery the first pioneers started moving into the old port areas. Along the quays luxury lofts were developed. New residents and entrepreneurs renovated and moved into the historic warehouses of Eilandje. In short, by the time that *Stad aan de Stroom* was put on hold as a project, the abandoned and derelict port areas had definitely been reintroduced to citizens' mental map of Antwerp.

From inspiring master plan to building site on the waterfront

New master plans

At the end of the 20th century, the city picked up the glove again and commissioned newly appointed *stadsbouwmeester* ('chief city architect') René Daniels to elaborate a master plan for Eilandje and to coordinate its execution. A team started working in the *Noorderpershuis* building, a historic monument at Cadix quarter. The team reported to a steering group in which the city and port authorities were represented.

As the new master plan involved a refinement of the principles of de Solà-Morales' plan, the public's concerns were maximally taken into account. And so *Masterplan Eilandje*, approved by the board of mayor and aldermen in 2002, respects the double strategy of conservation and renewal. On the one hand *Masterplan Eilandje* proposes a chirurgical strategy of renovating, restoring and 'filling in' the historical fabric. A good example of this strategy is the restoration of the Saint Felix warehouse, which today houses the city archives.



Masterplan Eilandje, Buro 5

On the other hand new buildings arise and new waterfronts are created. Examples of these new additions are the MAS museum, the Westkaai residential towers and new building blocks at Cadix quarter. De Solà-Morales' north-south axis between Eilandje and the inner city is taking shape as well, with the Academy, the Sailor's house project, the MAS museum, the Saint Felix Warehouse, the Ballet of Flanders and the Red Star Line museum.

Special attention is given to the refurbishment of the vast quay and water surfaces at Eilandje. These spaces have great potential to act as 'carriers' of social and public life. The ground rules were elaborated in the 'Image Quality plan for the outside space' by Atelier JPLX, a 'Green plan' by Michel Desvigne and a 'Water plan' by Urhahn-Vrolijks. Each of these plans advocates the mix between old and new. Quay walls, bridges and cranes are protected; cobbles are reused and the vast quay surfaces are kept open as much as possible.

At the macro level the Green plan gives Eilandje its own ‘green’ identity as an industrial landscape between two large urban parks: Park Spoor Noord and Droogdokkenpark. In order to provide the needs of a modern urban quarter, while respecting the area’s historical industrial character, groups of trees, lane-structured plantings, squares and small parks are added to the quays and boulevards.

The city approved a new Masterplan for the Scheldt Quays in 2010. The city and Flanders had organised a new design contest in 2007 to combine the wish for high-quality public space with the need to raise the flood defence. Portuguese PROAP and Belgian Wit architects were selected to elaborate a master plan. In keeping with the ideas of *Stad aan de Stroom*, the designers wanted to capture and preserve the Scheldt Quays’ unique atmosphere and character. Cranes, railway tracks and shipping infrastructure are to receive new urban functions. Public space is redesigned zone per zone according to the best possible combinations of flood defence possibilities and the needs and character of the adjacent city areas.



The new flood protection’s primary function is security, but in addition it needs to help restore the connection between the city and the river and even reinforce this connection wherever possible. Rendering by Proap/Wit.

The Belgian National Railway Company started to rethink the plans for former railway site Nieuw Zuid, but the results were mostly commercial variants of the original plans by Toyo Ito. The federal government developed plans for a new court of justice. Richard Rogers designed the ‘butterfly palace’ and in 2006 the ambitious project was finalised, restoring the grandeur of the southern ‘gateway’ to the inner city.

Take-off

In 2002 the port company initiated the first of many development projects to follow at Eilandje: the new marina in Willem dock. Soon the redevelopment of public space along Bonaparte dock and Willem dock (the city’s oldest two docks) followed. The Felix Archives opened in 2006. The building’s historical central gallery opened up a new passageway from the city to Eilandje. The opening of the MAS museum (‘museum by the stream’) followed in 2011.



Redevelopment of public space along Bonaparte dock and Willem dock (the city's oldest two docks)

The MAS museum, a joint project of the city and the port company, is the most important landmark on the cultural north-south axis. The remarkable red new-build in between the vast water surfaces of the city's two oldest docks seems to be composed out of stacked boxes. On the inside, a public 'vertical promenade' from the ground floor to the roof top offers amazing views over the inner city, River and port. The museum collection tells the story of the past, present and future of Antwerp as a port city. Thanks to the MAS museum and its thousands of visitors, the old docks are becoming a real part of the city.

In 2002 the port company carried out market research with a view to selling its patrimony at Montevideo quarter, which consisted of a number of monuments (the Shop, the Montevideo warehouses and the Red Star Line buildings) and the west quay of Kattendijk dock. The desired combination of old and new is attained by the renovation of the historic buildings on the one hand and the development of six residential towers along Kattendijk dock on the other. Also at Montevideo, Flanders restored the oldest lock of Antwerp in 2011, re-establishing Kattendijk lock as a maritime gateway to Eilandje. The opening of the Red Star Line – People on the Move museum in 2013 and the renovation of the surrounding warehouses are recent milestones.

At the South quarter the new palace of justice has attracted new restaurants, bars, hotels and lawyers' firms. These new activities have reprogrammed the southern gateway to Antwerp and fit into the revival of the 19th century South quarter that started in the surroundings of the Museum of Fine Arts a few years before.

Investment flow

The city has opted for a public-private cooperation strategy that divides the share of investments in infrastructure at Eilandje between the city, the port company, the Flemish government and private actors. The port company, for example, invests in the renewal of the old docks and the renovation of quay walls and bridges (e.g. Nassau bridge). The city tackles the cultural north-south axis (including Montevideo quarter) as well as east-west axis Londen-Amsterdamstraat. For the realisation of the cultural axis the city can count on considerable subsidies from different government levels (Europe, Flanders, province of Antwerp). The Flemish government invests in a brand new tram network, historical heritage and the renewal of public space. And, finally, private actors are funding the renewal of public space at Cadix quarter through the sale of plots by the city's property company AG VESPA.

The Flemish government and the city work together to finance public space and the flood defence on the Scheldt Quays. The considerable required investments are spread over a larger period and the execution is planned zone per zone. The first projects are the zones along Sint Andries quarter, South quarter and Eilandje. At the northern and southern ends of the quays, the city is looking for private investments to fund public space. At Rijnkaai a real estate project will possibly finance the redevelopment of the quay edges. At Nieuw Zuid a private developer is developing an entire new neighbourhood, including public space, green strips and a large park.

From false start to slow urbanism

In the early days a lot of energy went into finding financial means and elaborating a legal and organisational framework, cooperation structures, multi-year budgets. This complicated the redevelopment of the old port areas, and at times it somewhat weakened the support and confidence of citizens and investors. The laying of the first stone of the MAS museum in September 2006 was an important breakthrough. This retriggered the spirit of progress from the heydays of *Stad aan de Stroom* and boosted real estate development in the area. Renovation projects and new buildings in warehouse style popped up like mushrooms.



The building of the MAS (Museum aan de Stroom, in the back of the photo), boosted private development (front).

The reconversion of Sailor's Quarter (the red light district in between the inner city and Eilandje) into 'an attractive piece of Antwerp' in the early 2000s, served as a red carpet in terms of the mental accessibility of Eilandje. The port company, relieved from its old pension debts by the higher government, started focussing more on soft values and on the reinforcement of the bond between city and port. City and port signed a protocol allowing the city to gradually acquire land from the port company at the pace of ending port concessions.

The port company provided six million euros as starting capital for land remediation at Cadix. In addition, the port is still investing in the restoration of nautical infrastructure, a lot of which protected heritage, such as quay walls, cranes and bridges. The 'port pavilion' next to the MAS museum invites thousands of people to dive into the story of Antwerp as a world port. The port company is building its spectacular new headquarters at Eilandje's northern gateway to the modern sea port, a new icon that will mirror the MAS museum at its southern gateway to the inner city.

The broad set of plans for Eilandje consists of a master plan, image quality plans, action plans, a spatial execution plan and the selection of the area as a strategic programme within the strategic Spatial Structure Plan for Antwerp. This forms a flexible framework that allows for adaptations as new insights develop. There is a constant exchange between zooming in and zooming out on different scale levels. The strategic vision is translated both at the level of the quarter and in individual buildings and public space. In the other direction, each concrete realisation tests the global vision. The renewed RUP Eilandje (2011) anticipates a 'raid' on monumental buildings by obligating the elaboration of a cultural-historical value report.

On the other hand the city has seen property prizes skyrocket at Eilandje, ironically partly due to the realisation of the MAS museum. The action plan for Cadix 'corrects' this by demanding a 75% share of social and affordable housing in the city-controlled segment of the housing programme. There is a strong focus on sustainable building and amenities for the quarter as well as for Eilandje as a whole.

At Cadix, new blocks are being built step by step by means of conditional sales, ensuring a balanced social mix as well as the presence of amenities for the new neighbourhoods. In a first phase the focus lies on childcare, a second phase entails the construction of new lower- and primary schools. These open schools are a meeting place for the neighbourhood and offer space for sport and recreation. Land sale revenues are used to redevelop streets, squares and quays and to create green zones where residents can relax. The icing on the cake is the new park-like Cadix square on the parking lot of the former customs building.

The dynamics and focus in Eilandje's development are not just determined by the planning process. The economic crisis has made its mark as well, albeit a positive one. Paradoxically the crisis has proven to be a blessing rather than a curse. The redevelopment of a historical city area needs time. The crisis has allowed Eilandje to 'catch its breath', as the building craze from before the crisis was starting to threaten the mix between old and new. After all, this mix is such an important part of the master plan.

This makes Eilandje the perfect example of 'slow urbanism': urban development at a gentle pace, allowing modest actors to invest on a small scale. This allows for a rich multi-layered development. André Loecks opposes and prefers this type of slow process to 'instant urbanity' and stresses the importance of taking time to develop an ambitious vision and providing space for adjustments in time and initiatives in the meantime.[i]

From abandoned port to lively quarter

The development process of Eilandje has taken years, and is still in progress today. The space-time between plan and execution – or the *meantime* mentioned above – is used to organise meetings between the current, new and future users and residents of the quarter. The focus has moved away from the old docks and the cultural axis, although these spaces remain the scenes of large events such as WaterKANT, Tall Ships Races, the Royale de Luxe spectacles and of course the fairy-tale opening festival of the MAS museum.

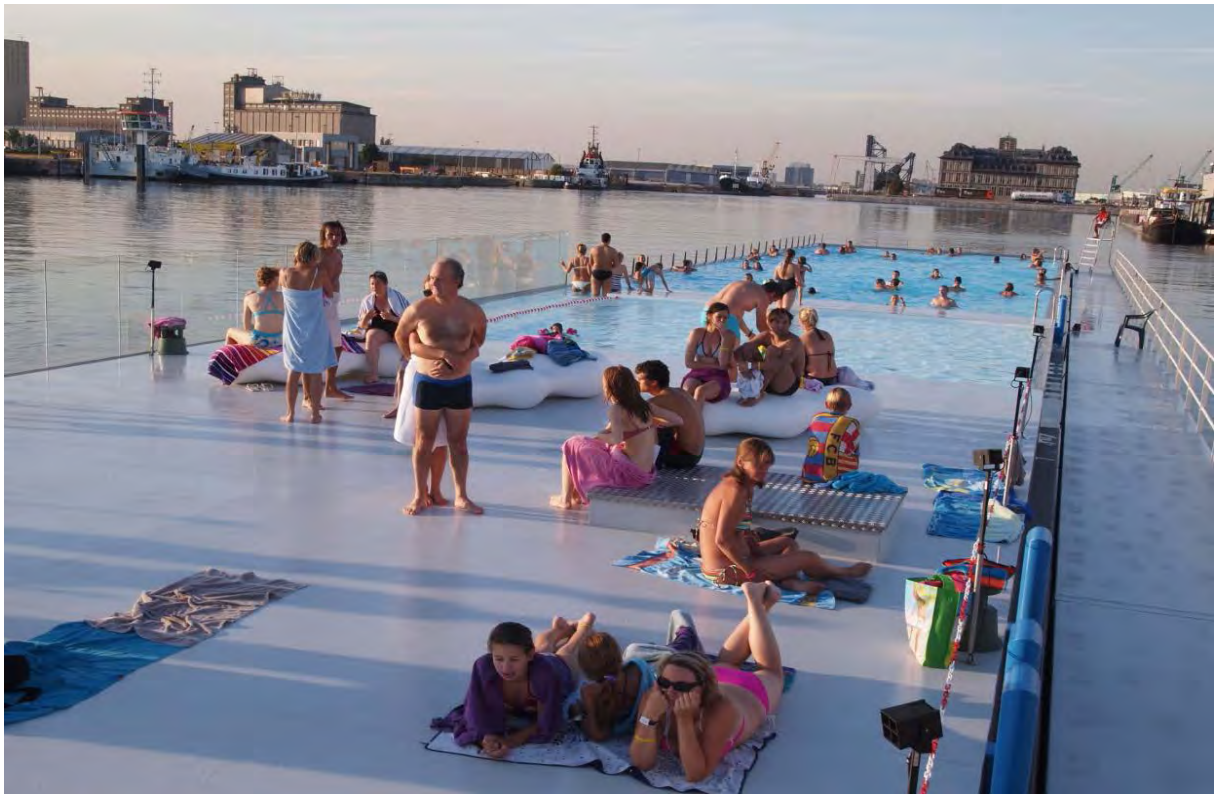
But the city departments for urban development and for social affairs and participation organise several smaller initiatives as well to help people discover Eilandje as a place to live. Examples are Campo Cadiz (small activities in and around a couple of caravans parked at the dock edges), amusing workshops, the yearly Cadix art walks and story tours about diver Jos den Duikelaar, Eilandjes own mythic figure. A spring pick nick or a glass of wintery mulled wine invites people to catch up about the development of the area.



Illustration of 'meantime' use. Temporary gardens occupy public domain waiting for redevelopment.

Written and spoken reactions from visitors and especially residents confirm that they have developed a certain proudness of Eilandje. Because the number of residents has increased over the years, the required critical mass for spontaneous neighbourhood initiatives has been reached. An open call in one of the many newsletters about Eilandje resulted in the organisation of neighbourhood committee *A-landers* (the name refers to the city logo's radiant letter A and sounds like *islanders* in the Antwerp dialect). *A-lander's* member base is growing with representatives from all the different quarters of Eilandje: the best evidence of the birth of a neighbourhood feeling. The need for a shared identity was apparent and a little push in the right direction from the city was all it took for residents to develop their own neighbourhood feeling.

A much heard question at residents meetings was: “When do we finally get to swim at Eilandje?” This inspired the idea of a floating open-air pool in which people would have the feeling of swimming in a dock. The successful Badeschiff in Berlin is an inspiring example. The idea also fits in with *Waterplan+*, an update and refinement of the original water plan. After extensive market research and a feasibility study, the city decided to go ahead with a public procurement for the construction and concession of the swimming pool.



Badboot was moored to Kattendijk dock in the summer of 2012.

The city had looked for temporary water animation in the docks as a teaser for the real swimming pool but the private sector had shown little interest. However, artists’ collective *Timecircus* started working on the idea. In the summer of 2012 floating pontoon *Welvaert Welton* opened in the shadow of the MAS museum under the motto ‘the next big thing will be a lot of small things’. *Welvaert Welton* is a neighbourhood platform about water and sustainability. Visitors can come and learn about sustainable city life and enjoy healthy food and drinks.

The development of Eilandje will continue in the northern direction with the redevelopment of east-west axis Londen-Amsterdamstraat, the realisation of Montevideo quarter and urban park Droogdokkenpark and the phased development of Cadix quarter. The development of a ‘museum port’ in Bonaparte dock, next to the MAS museum, will become part of a maritime open air museum amidst the city’s two oldest docks. The arrival of medieval ship *Doelse Kogge* at Eilandje for conservation treatment and eventually for display can be seen as a starting point.



The future 'Dry Docks' park will be the most northern part of the Antwerp Waterfront, where the urban landscape will gradually change in an industrial harbour. Rendering by Van Belle & Medina and Vogt.

The next big challenge is the optimisation of the connections between Eilandje, the city centre, the port and Park Spoor Noord, and thus finally making Eilandje into a real city quarter.

[i] Loeckx, André (2012), Stadsvernieuwingsprojecten in Vlaanderen 2002-2011, Brussel: ASP edition

PORT HERITAGE AS A MATERIAL SUPPORT FOR PORT-CITY'S IDENTITY

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INTRODUCTION

Water is a *sine qua non* of life installation. Population settlements historically developed along major rivers, lakes or sea coast. From basic resource to strategic point in international trade, through leisure space and fishing area, waterfronts had seen their uses and meanings diversify throughout history. Today, given the major ports reshuffle policies, some former port areas are even going to get into the huge 'heritage family'. Between necessity and opportunity, these new processes of heritagization make the connection between the initial and the more recent heritage conceptions. The idea that heritage preservation is necessary is embodied in the first half of the twentieth century, marked by the large-scale destruction that affected the built environment during the two world wars. The Charter of Athens (1931) and the Venice Charter (1965) were the first witnesses of the international community will to protect a common heritage. However, it was in 1972 with the adoption of the Convention for the Protection of the World Cultural and Natural Heritage of UNESCO that was definitely drawn the idea that the rich heritage of the world belongs to all of us, that things we decide to convert into heritage, so worthy to be transmitted to future generations, has a universal value. Since then, the concept of cultural heritage has evolved and expanded, taking into account the non-monumental versions, including intangible cultural heritage, cultural landscapes, or industrial heritage.

FROM THE NEED TO PRESERVE TO THE OPPORTUNITY OF CONSERVATION

This enlargement, institutionally supported by UNESCO, gradually transformed the needs to preserve into conservation opportunities. Indeed, as the reputation of the first monuments and sites have quickly created a *de facto* valorization of the labeled UNESCO objects, today institutional actors expect a *de facto* valorization of any item identified as heritage.

> *"On the one hand there are immediate and obvious fallen: better visibility at national and international level"*[1]

Thus, public policies organize the valorization of "protected areas" for their heritage qualities and transform images and mental representations, especially those carried by UNESCO, producing space, focusing on regional marketing and attractiveness of sites to build places of tourist consumption. From a cultural heritage resource, created or assumed, more festive events and leisure activities are available for this purpose to the citizens:

> *"A series of demonstrations and of festivities which were to put the heritage on the front of the scene and which were going to inaugurate the era of the media*

[1] Interview with Carpanin Marimoutou about 'Maloya' being on the UNESCO's Intangible Cultural Heritage list (interview by Julie Lausin, 2011)

treatment of the old stones"[2].

BEYOND THE CONSERVATION: A RECONVERSION

Such a valorization requires to re-examine the manner of protecting the patrimonial element, which passed from a conservation heard like a "setting under bell" to a conservation through a reconversion, in particular for the sites of great width in urban environment. The old urban industrial sites are, *vis-a-vis* the land pressure, constrained of being re-qualified, either by a real estate transaction economically efficient, or by a patrimonialization, considered somehow more ethical, and more consensual in terms of memory and identity. Today closed down, these buildings used to contribute to the growth of the city when their industrial function was at its apogee. In the memories, in the genealogies, they are the place of professional life of many forefathers, and if they became obsolete economically, their symbolic value worries, whether it is still very strong, or it is politically desired strongly. Indeed, today the concept of heritage no longer affects only the memory of an object: it also relates to the evolution of the effects of this memory on population, social practices, lived spaces. The semantic slip which makes the denomination of World Heritage passed to the one of Heritage of Humanity (Choay, 2006) testifies some. The evolution of the look we address to heritage makes that we take today into account the link between Heritage and Man and heritage importance in the present of human societies.

> *"Indeed, our major sources, archaeological, textual, and even sometimes morphological, have become heritage. This pervasive notion became a major component of the culture. The concept has expanded, encompassing categories, always new, of objects and practices. [...] The heritage is than the invention, totally modern, of a particular time, purely imaginary"*[3].

In these questionings around the criteria of patrimonialization of old industrial sites, we will be interested here in the typical cases of the port cities. With the traversal example of the candidatures for the "ESPO[4] Award on Societal Integration of Ports", we will see how the presence of built heritage, but also immaterial who characterize harbor spaces, is used today to build a speech around the urban renewal in order to attract tourists and visitors, and to consolidate the links between the cities and their port, on the basis of its evocative power of the collective memory. The ESPO Award on Societal Integration of Ports is an award established by ESPO in 2009 to promote innovative projects of port authorities that improves societal integration of ports, especially with the city or wider community in which they are located. In 2013 it was its fifth edition, the third on a specific topic, the other two having been "Creative Strategies to Communicate the Port to the Wider Public" in 2011 and "Youth - attracting young people to work in ports, educational partnerships, making school children aware of ports" in 2012.

This paper will discuss how the presence of built up (but also intangible) heritage inside ports areas is today used to build the discourse on urban renewal, to build a new place for port authorities inside the urban organism, to attract tourists and visitors and to build connections between ports and cities. In order to explain the importance of port heritage as a material

[2] Maria Gravari-Barbas, La ville festive – Espaces, Expressions, Acteurs, ouvrage de synthèse en vue de l'habilitation à diriger des recherches, Université d'Angers, septembre 2000, p. 100. [translation by the author]
[3] Gérard Chouquer, L'étude des Paysages, Essais sur leurs formes et leur histoire, éditions errance, 2000, p. 120. [translation by the author]
[4] ESPO (European Sea Ports Organization), Call for application award dedicated to the theme of "heritage - contemporary use and disclosure of port heritage" (2013), www.espo.be.

support for port-city identity, we will also present some non-European examples, as port heritage is nowadays a global tool.

HERITAGE, CITY'S (PORT) ICONOGRAPHY AND COLLECTIVE IMAGINARY OF PORT CITIES

From the second half of the XXth century, many port cities have seen their role threatened by globalization and the post-industrial transition, with the advent of containerization for the transportation and storage of goods. In most of European countries, but also outside Europe, the commercial port has increasingly developed through the centuries, but in the last one, it transformed in a high technological place. At the same time, it lost its characteristic role of goods' point of departure/arrival, becoming an intermediate point in which the speed and quality of service have become more important than its location or its infrastructure.

Technological and economic transformations have brought changes on urban, economic, social, environmental or cultural levels, creating effects on relations between the port and the city, the port and its local economic system to which it belongs. We passed from an 'organic' relationship (Chaline, 1994) to a progressive distance between port and town. That means that only a professional audience is nowadays truly aware of the logistic and industrial role the port has. Besides, parts of the harbor activities have often been moved out of the areas closest to the town center, and the population of the town lost the material contact with it. This phenomenon has often been depicted as 'de-maritimisation' (Vigarié, 1991), which clearly illustrate this disconnection between the two parts of what had been considered as a hole. These transformations provoked changes in the port's perception and in the city's identity, as the population no longer had a clear awareness of the port's significance and lost also the immaterial contact. Sometimes, the waterfront even comes to constitute an identity trauma because people see in this space, so active in the past, a picture of desolation and begin to develop a real nostalgia about the past activities (Boubacha, Davoult, Gueguen, 1997). On the other hand, we know that port and its related activities have often been led to the rise of maritime cities. Its presence and its needs - in space and infrastructures - have determined the mode of development of the entire surrounding areas, so much that it remains an indelible presence even when the ports' activities are abandoned.

As a matter of fact, as we can see at a first glance to ports infrastructures, lot of historic assets are still present today, some played important roles over the two world wars, some are still operational, other lost port activities and developed other activities, not especially concerning the port operational field but often related to maritime themes. Port presence is somehow always influencing the city and its community.

What remains of the port, even when it is no longer active, is deeply questioning about identity and recognition of the place itself. It is considered that identity of a place represents an element of continuity, a link between past and future, which is necessary in an increasingly globalized world (Moretti, 2013). Even before their functional aspects, historic assets are a cultural memory.

A point of great and critical evidence is represented by the waterfront. The relationships between city and water have become a central topic of urban planning, during the second part of the last century. One of the first served aims is the need to recover the relationship between urban border and water board, where different waterfront regenerations' steps influenced port-city image and identity (Chaline, 1994; Marshall, 2001; Gras, 2010; Savino, 2010). At an early stage, the desire to break with the past and with the previous activity, too

often associated with the negative aspects of port work such as noise, pollution, danger, was evident.

The architecture of this first phase creates a new 'neutral' and intact image mainly for leisure, shopping and recreation of citizens (i.e. *Festival Market Place*) that often led to loose or to remove the 'memory' of the port. Open spaces and buildings have been designed to accommodate cultural, entertainment, hospitality and recreation functions (well resumed by the recent concept of '*edutainement',* education + entertainment). The success of some of these operations has often led to the replication of these formulas in different places and different countries with the consequent effect of homologation.

In the further waterfront generations, these areas have been seen as workspaces for the tertiary sector and land reserve for real estate. As far as citizens have been more concerned by the offer of places to live or to work, heritage represented by its past port function became a source of inspiration to restore dignity and historical depth to these places.

The recovery of old under-used port areas, suddenly declared as "heritage" turn into an integral part of this *waterfront revitalization*. As known, the new infrastructure conditions dictated by the development of maritime traffic are obliging ports to leave the wharves and areas of greater contact with the historical city. Therefore, since the beginning of the waterfront restorations' operations, the restoration of buildings and elements that are part of the historical heritage played an important role in the regeneration of the relationship (both tangible and intangible) between port and city, with a particular emphasis in the last two decades. It is often considered that "heritage "contributes to the overall socio-economic development of society. It has become a paradigmatic element of several urban planning policies and urban projects in contemporary cities.

Nowadays, the underused areas of ports in direct contact with city are not anymore totally alienated to port activities, but mostly renewed as to be able to host both new functions and added value port functions. The port authorities, private or public/private owned, realized the importance of the strategic location of their property land.

In this sense, the sheltered water area can be given over to ports' logistic, to passenger traffic (local or ferries), to cruisers, fishing, historical boats or to marinas for pleasure and tourist crafts.

On land area and refurbished port buildings, functions and activities that are in their turn linked to the port, are preferred. Maritime services and offices, sea museums, cultural centers, aquariums, passenger terminals for regular traffic, new cruiser terminals and nautical centers are activities that can be located in the wharves and converted land areas, sharing them with the new public areas (coastal park and promenade) and the new commercial and leisure functions (cinemas, restaurant, discotheques, shopping centers) which most projects also include. The recent waterfront development generation pays attention in creating an experience referring to the city's identity. The eventification has begun "*an experience occurs when a company intentionally uses services as the stage, and goods as props, to engage individual customers in a way that creates a memorable event*" (Pine and Gilmore, 1998), although in a business-oriented representation.

What is important to underline is that nowadays most ports point out on their uniqueness while using the same 'keywords' of any other port.

The list of activities linking heritage to port and city is quite diverse, in particular since the tangible aspect of the buildings often only play a marketing role, they have to witness the 'real' identity of the city, while they often offer a reconstructed recent image. Only sometimes, when the stigmata of the past (and the 'forms' on the buildings) are too heavy, the 'restoration' of historic assets becomes an opportunity to create a new urban identity. In this paper, the purpose is not to analyze the difference between these two attitudes, neither to present them from the port-city planning point of view. Our interest is to underline that 'heritage' contributes to create an urban identity and that in port cities this is often linked to the port. The reason is obvious: more than in other cities, in port cities 'heritage' is clearly on view, its visual impact is immediate and inescapable. And more, it is not a simple question of being visible. 'Heritage' hold a growing importance for many reasons, ranging from those concerning the identity/history of the sites to their economic nature, through urban planning and architectural aspects, with the re-use projects and the possibility of re-launching these strategically located zones for urban and economic development in order to revive a positive empathy between port and city (on a port owned high valuable land).

PATRIMONIALIZATION OF HARBOUR SPACES: TREND EFFECT OR REAL CHALLENGE OF SOCIETY EVOLUTION?

The contemporary heritage obsession is flowing over ports where is certainly partly related to heritage conservation, but also very much related to "*the iconic value and contemporary use of port heritage […] as a strong promotion tool*"[5].

Current trend pushes the cities to re-appropriate old deserted urban harbor spaces since the administrative and strategic management of the port activity are maintained in the city center while the rest of the port activities are gradually delocalized out of the city. The space, so emptied of the more 'greedy in space' activities, often become the object of an heritagization, due to the consensual character of this process, that makes the re-appropriation by the population easier, and covers a double objective of economic efficiency and consolidation of the social links. It can be interesting to mention that in France, the Article 1 of the Law n. 2008-660 of the 4th of July 2008 stated that the "management and valorization of the domain of its property" is one of the missions of the port.

> *"Societal integration of ports also means focusing on the contemporary use and disclosure of port traditions. […] The public interest in heritage has increased considerably in recent years and has gained strong tourist potential. Most ports boast rich collections of industrial and other heritage, including equipment, buildings and monuments. This potential can be used in an innovative way not just to explain a port's history, but also to make the connection with present and future development".*[6]

In this spirit of setting in light of the harbor heritages, the ESPO (European Sea Ports Organization) proposes, since 2009, the "ESPO Award on Societal Integration of Ports", in order to promote the innovative projects carried by European harbor authorities, which improve social integration of the ports, in particular in the cities or spaces where they are established. In 2013, for the 5th Edition of competition, the topic was "heritage -

[5] *Ibidem*.
[6] *Ibidem*

contemporary uses and disclosure of port heritage". The projects of the candidates that submitted a file were evaluated on six criteria:

a) Original and innovative character of the project;

b) vision and leadership deployed by the senior management of the port authority;

c) involvement of partners and stakeholders concerned;

d) implementation and/or progress status, feasibility, commitment by investors and timing;

e) proven contribution in practice to the objective of the award;

f) overall presentation and documentation.

In order to study the current trend of instrumentalization of the heritage, on this example of the reconversion of unused harbor spaces, we worked out a grid of investigation questioning the 'keywords' of the harbors' projects, and we questioned the 16 candidates of the ESPO Award 2013, the 16 candidatures files, and more largely the cities member of the International Association of City and Port[7].

THE CONSENSUS AROUND HERITAGE: A SPRINGBOARD TO BETTER WORK TOGETHER

PORTS HERITAGE AS A NEW ECONOMIC FIELD

If the mercantile part of the heritage is still not easily acceptable for its "experts", it seems to be fully integrated by all the stakeholders:

> *"In addition to the general port development work, flanking activities such as guided tours, ports day, presentations for associations, organizations and companies, the preservation of building and environmental heritage are business as usual of the port's management".*[8]

> *"Generally speaking, the project, apart from safeguarding the port's heritage via the restoration of the oldest infrastructure, managed to communicate the port to the society and to attract thousands of people in the port area".*[9]

Touristic, and thus economic, repercussions from a patrimonialization, are clearly awaited.

> *"As Sweden's most important intra-European gateway Trelleborgs Hamn has a 150 years long-lasting history of sustainable sea transport. In the light of this heritage, the project's title reflects Trelleborgs idea, i.e. based on a clear vision that the port shall be developed into a leading Baltic seaport within a growing community".*[10]

[7] This research work was conducted together by Francesca Morucci and Laura Verdelli
[8] Quotation of the Port of Trelleborg file
[9] Quotation of the Port of Thessaloniki file
[10] Quotation of the Port of Trelleborg file

> *"The port of Thessaloniki launched the project 'regenerating the port's history' as a major effort to unveil the connection of the port and the city to the port's heritage".*[11]

CULTURAL ANIMATIONS AND EVENT-DRIVEN HERITAGE

The port of Livourne, in Italy, focuses on free cultural animations "to make local students, citizens, above all youngsters and the school sector, become familiar to the historic parts of the port". Among the methods of valorization of heritage, we often meet actions of animation, simple but continuous in time, and actions about event-driven, specific, transitory but not the least outstanding. It would seem that the public is in search of new experiments, of ludic visits, new staging. In other words, if the users want to visit exhibitions or to take part in demonstrations, they balk "to undergo" a course, a preset program of visit. The era of the spectacular heritage arrived. Force is to note that the new "consumers" of cultural heritage are not exclusively any more attracted by the prospect to contemplate masterpieces or official relics of moved back times, they are also interested – even more - by non academic representations of the past.

> *"The tourist market related to the heritage is presented consequently more and more segmented, since he answers the request of alternative stories (social, feminist, ethnic, cultural, industrial) (Schofield, 1996: 336).The result of this evolution, described by Edgar (1987) as the change "from aura to nostalgia", is that practically any aspect of the past can be "interpreted" in an imaginative, ludic and/or animated way, and presented to tourist as on consumption purposes.. […] This history is transformed into urban patrimonial "product", which presupposes an assembly of historical associations and vestiges or relics of artifacts, and their interpretation and promotion for a segment of consumers. […] But it is necessary to identify also there the efforts of dramatizing, production, esthetisation of these initially repulsive places" 2.*
>
> *"If the city is a product, festive is its packing (in the direction of the "packaging"). It reflects as such, more than other dimensions of the contemporary city, the esthetics of the territorial marketing of the last years. The handling of festive can indeed allow an immediate, spectacular, often calalizing, intervention on the city" 3.*

In fact, the city is at the same time a symbolic and a material construction. However, the urban reorganization is often a long operation, difficult to implement. Moreover it can seldom be assumed by those at the origin of the installation of the marketing operations, especially when they emanate from the public sector. It is thus on the demonstration design and organization point of view that are concentrated a large number of urban initiatives in terms of territorial marketing. "The festive preparing" is then the easiest means to diffuse, well before the permanent structures, a vision of the agglomeration to come: the one that will be set up on ashes of the city inherited from the past, in a strong and speaking way. Thus, the event-driven one is more and more privileged; constituting from now on the heart of the marketing strategy and it is not about a chance. Indeed, festivals, events, parades and urban productions make it possible to produce the desired image, to literally project the city in a brilliant and promising future.

[11] Quotation of the Port of Thessaloniki file

NEW CHALLENGES AROUND PORT HERITAGE

HERITAGE AND TOURIST FREQUENTATION

Usually, the development of the tourist activity, generated by the development of a site, requires to be delayed on the flow of visitors that it will involve, and its impact on the good. This is why, in UNESCO's files, the tourist challenge and the actions to be implemented sometimes constitute a specific part of the management plan (i.e: Fertö-Neusiedlersee or the imperial citadel of Ha Noi). The latter calls on a prefiguration based on an in-depth study amongst expected visitors, of the expected financial returns, the profits carried out and, by the same occasion, of the infrastructures necessary to this new tourist activity. A specifically touristic strategy is stated, with all the supports envisaged within the framework of the visit of the citadel: circuit of visits, center of interpretation, library…

HERITAGE PLACE IN CONTEMPORARY PROJECTS

> *"We must establish closer business relationships between those which preach a new esthetics and those which want to protect the existing sites; they are too often perceived like antagonists. Actually, they represent the two distinct faces but quite as important from the same part. The fact is that the new most stimulating places and most attractive are the results of a creative fusion between modern and old"7*

How to integrate contemporary interventions and projects in consolidated urban areas is a recurrent question in our cities today. Within national frameworks where the historic centers are subjected to strict regulations as for their possible evolution, the responsibility to decide contemporary projects is often delegated to the professionals of the heritage (in France, for example, with the Architects and Town planners of State AUE – in the past ABF – and with the Architects as chiefs of Historic buildings). Within less normalized frameworks, the real estate speculation and the market are finally directing the trend. However, the contemporary construction contributes to the construction of the future heritage and there is no strict partition between the times making it possible to define a deadline between what can be considered as heritage, and what is still contemporary. More especially as the stratification which agrees to read into vertical the history of a city capitalizes its recasting on itself as well as the re-use and the recovery of building materials. What remains today of major importance is the possibility of judging that contemporary insertion in historic site can be made in a harmonious way.

> *"A great attention should be granted to the harmony and the aesthetic emotion resulting from the sequence or contrasts of the various elements composing the units and which give to each one of them its particular environment" 8*

HERITAGE FOR CULTURAL EVENTS: VALORIZATION OR INSTRUMENTALIZATION?

The tourist valorization of a territory is often described like carrying economic development, but so that this development is effective, the mechanisms of management and regional planning must take into account this component in planning. The tourist valorization of the cultural resources and the heritages can indeed contribute to the sustainable development of the territories when its mechanisms, as well as the actors and recipients, form integral part of

the strategic planning of the territory and are regarded as an ingredient of its development. The study of various documents of communication directed to the actors, partners and general public, as well as talks near the organizers and of the public of various demonstrations, allows us to account on the presence of heritage like a driving force of adherence to various events. However, we can wonder up to what point the localization of these demonstrations inside heritage-labeled perimeters corresponds to a real interest for his specificities.

> *"This history is transformed into a patrimonial 'urban product', which presupposes an assembly of historical associations and vestiges or relics of artifacts, and their interpretation and promotion for a segment of consumers" 3.*

Many demonstrations, indeed, primarily conceived like genuine tools for promotion, are the opposite of "spontaneous" festivities. They are, on the contrary, issued events, decided several years before their unfolding and likely to be "consumed" or to have impacts several months, even years, after their end. Their analysis must thus take into account "the temporal thickness" of their unfolding, before and after festival, more especially as these are the dimensions which make it possible to seize fully the implication, positioning and the role of the various actors who carry them.

CONCLUSION

> *"The port is a platform where many stakeholders converge: companies, employees, shipping companies, local residents and authorities. They all have their own ideas and opinions about the activities that play out on and around that platform. It is the Ghent Port Company's role, taking into account the vision and mission, to consider these various opinions and, with respect for all stakeholders, to make progress in achieving the objectives in the Strategic Plan 2010-2020".*[12]

Ports are large institutions in a city, but they are not necessary a public owned one. As a private company, they must respond actively to the economic competition. Their relocation out of the city centers is an adaptation strategy to the evolution of the shipping economy. However, port institutions remain, even after relocating, great landowners. If at the beginning they abandoned their central lands, today their understood that they can re-use them for new purposes. Port institutions are, by eventification and heritagization, creating a new activity field. Indeed, in Europe the concept of 'heritage' has become a magic word (and it has taken a increasingly globalized sense) used in more and more urban (soft) development project. Regarding the port's territory, if, at the beginning of rehabilitation projects of deserted port lands and port waterfronts, only the new and contemporary reuses of the industrial heritage buildings mattered, today the symbolic recovery of the heritage buildings (and of their past as a port) is promoted as a factor of social cohesion.

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[12] Quotation of the Port of Ghent file

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Study On Harbor City's Development Model And Spatial Structure In China- Case On Tianjin

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1. Harbor and City

With economic globalization, port occupies an important position in global trade. Harbor city plays a significant role in world trade connection, and has a dual meaning of the harbor and city. It is an organic combination of these two characters. Harbor city is a city with excellent port resource, based on hinterland to develop advanced port economy. Harbor city is a special urban type, connecting cultures of sea and land.

1.1 key element

Harbor city relationship is the demand, influence and restrain between ports and city. It mainly manifests in the three following aspects.

1.1.1 Economic

Economic relations refer to the form of the port and city to realize their own economic interests. As a port, it plays a very important role in regional economy develop. According to relevant data, 31 of global 35 international cities are developed on harbor. And the top 10 cities are all harbor cities. 50% of the world's wealth concentrated in the coastal cities.

1.1.2 Transportation

Port takes great responsibility for transportation of both passengers and cargos, whose distribution has an enormous effect on urban traffic system. The port has hinterland transformation function, so the traffic is not limited to the harbor city. Transportation of the hinterland areas should also be taken into consideration.

1.1.3 Social culture

Port's social influence on a city is mainly reflected in the history and culture. Cultural relation refers to mutual penetration, influence, collision between harbor culture and city culture, as well as they bourgeon together. A lot of modern port cities have close relation with the port at the beginning of urban development. The harbor culture has deeply gone into the urban culture and become an indispensable part in urban historical evolution.

1.2 The relationship between harbor and city

The relationship between harbor and city is dynamic in scale, scope and characteristics. It constantly adjusts in the influence of government and market to meet the needs of the local area economic development. The relationship between harbor and city shows a variety of modes in the historical evolution. It can be concluded into four following modes.

1.2.1 Mode one-Both port and city prosper

Harbor cities make full use of port advantages to develop manufacturing and services industries. These industries strengthen port of software and hardware conditions in turn. Harbor and city coordinated with each other to achieve interacting development. Hong Kong is a typical representative of this model.

1.2.2 Mode two-Port prospers while city decays

With port industry becoming urban dominant industry, if urban industries have not developed well, it would become excessively dependent on port industry. It will make living environment

deteriorate and city decay as attraction lacking. Le Havre in France is an example of this mode.

1.2.3 Mode three-City prospers while port decays

Port once plays an very important role in the early stages of the urban development, then it is replaced by other ports with more advantages. Depending on the third industries such as shipping services, logistics services, financial services, information services, harbor city urban updates industry and transforms function. Both London and New York are good examples of this mode.

1.2.4 Mode four-Both port and city decay

Port played an important role in the early stages of urban development, if city does not meet the new demand of the economic development and technological progress, or failed to seize the important historical opportunity. So harbor city is not in good position in the domestic outside the division of labor system. Harbor declines when the port city decays at the same time, such as Liverpool in the UK.

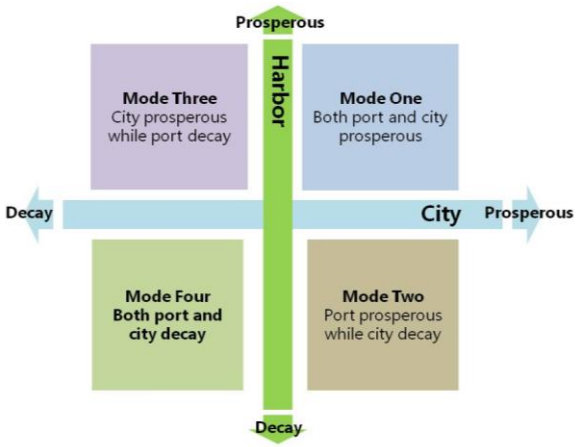


Figure 1: Modes of port-city relationship

Harbor city relations affecting urban spatial structure is mainly manifested in two aspects. Firstly, urban function changes in the action of port external force, leading urban structure change, such as Tianjin and Qingdao. Secondly, harbor has effect on urban economic structure, causing urban function changing, so is urban spatial structure. Ningbo is a typical example. The health of the harbor city relations is conducive to the expansion of urban spatial structure.

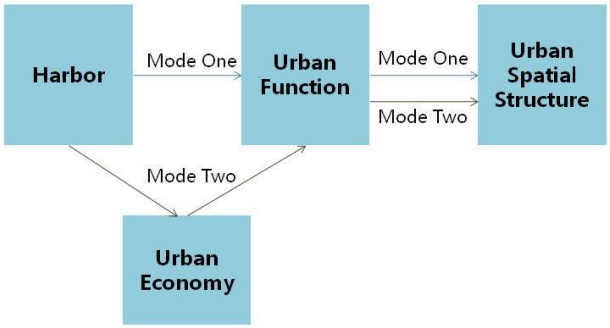


Figure 2: Two modes of harbour affecting urban spatial structure

2. Research on China's harbor city development

2.1 China's harbor city overview

2.1.1 Global position

There are almost 2 thousand ports in China, 23 of them are the one hundred million tons port. In 2012, Chinese ports completed 8.768 billion tons of cargo throughput, 144.8058 million TED, which is the first in world rank. China has eight seats in global first ten port cargo throughput. Status of Chinese port rises fast in global rank, promoting economic trade and harbor city development.

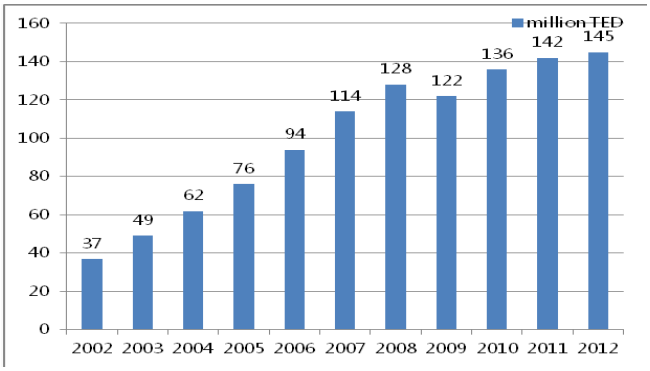


Figure 3: The TED of ports in China

Table 1: The global port throughput ranking in 2012

	Cargo Throughput	TEU million
1	Ningbo-Zhoushan(China)	Shanghai(China)
2	Shanghai(China)	Singapore
3	Singapore	Shenzhen(China)
4	Tianjin(China)	Xianggang(China)
5	Guangzhou(China)	Busan
6	Suzhou(China)	Ningbo-Zhoushan(China)
7	Qingdao(China)	Qingdao(China)
8	Tangshan(China)	Guangzhou(China)
9	Rotterdam	Dubai
10	Dalian(China)	Tianjin(China)

2.1.2 Development Features

Being rich in river and coastline, China has a large number of harbor cities. Most of them are located in eastern coastal region, social economies are developed. Synchronization with the process of modernization, a series of the port cities arise in China. There are 14 open harbor cities in China, 6 of which gathering more than 6 million population, 4 of which with more than 4 million people. The relationship between harbor and city presents different laws and characteristics in China. It can be concluded into the several following aspects.

(1) Compatibility.

It reflects the sharing and interaction between harbor and city in resources, transportation, personnel, technology, infrastructure, culture, etc.

As an important hub, port plays a significant role in urban industry development. City attracts various elements of agglomeration by using port facilities, in order to improve the capacity of urban radiation to surrounding areas.

(2)Conflicts
When the city's economic develops to a certain stage, conflicts between port and city reflects in following aspects. Ports and cities compete with limited natural resources such as land, coastline, water and energy. Port operations produced sewage, dust, waste gas, noise, traffic jams will affect urban living environment.

(3)Complexity
For different port cities, complexity refers to dissimilar economic, geographical, governance, cultural situation.

(4)Periodic
According to urban economic environment, the relationship between harbor and city can be divided into four stages.

Table 2: Four stages of port-city relationship

Stage	Social Features	Harbor City Type
The agricultural economy period (Before the industrial revolution)	Agriculture	Commercial and transportation center
At the early stage of industrial economy (From the industrial revolution to The Second World War)	Light industry	Industry center
Late industrial economy period (From The Second World War to the end of the 20th century)	Port-neighboring heavy chemical industries (such as steel, heavy machine, petroleum chemical industry, etc.)	Urban agglomeration and economic circles
Service economy period (21 century)	The tertiary industry	Service center

2.1.3 Harbor cities spatial structure in China

Port city in China is divided into harbor and inland port. Harbor mainly distributed in the eastern coastal areas, inland port mainly along the important river, such as the Yangtze River, the Yellow River and so on.



Figure 4: Harbour cities spatial structure in China

China's coastal port group formed five container ports groups.

Table 3: Five container ports groups in China's coastal

Container ports groups	Ports	Cargo Throughput	TEU million
Shandong coastal	Qingdao	4	1450
	Yantai	2	185
	Rizhao	2.8	171
Liaoning coastal	Yingkou	3	480
	Dalian	3.03	801
Jing-jin-ji	Tianjin	4.76	1230
	Qinhuangdao	2.6	40
Yangtze River Delta	Shanghai	7.36	3253
	Suzhou	4.3	525
	Nantong	2	60
	Ningbo-Zhoushan	7.4	1683
Pearl River Delta	Guangzhou	3.6	1474
	Zhuhai	1	80
	Shenzhen	2.3	2294

2.2 Important harbor cities development study

Dalian, Tianjin, Qingdao, Shanghai, Guangzhou not only has the highest throughput, but also are the important economic center cities in China's eastern coastal areas. All of these five harbor cities have historical evolution process, which has complex relations with urban development. Five cities are similar in the develop history, ports level, city size, so they are comparable.

2.2.1 Natural features of the ports

According to the natural characteristics of ports, they can be divided into inland port and coastal port these two types. According to the spatial characteristics of the port, river port including neighboring, separation and enclave these three modes, coastal port can be divided into the bay, outer bay, narrow port and natural port these four styles. According to above characteristics, five ports respectively belong to different types, with different natural factors.

Table 4: Natural features of five ports

Ports	Types	
Dalian	coastal port	bay
Tianjin	inland port	separation
Qingdao	coastal port	bay
Shanghai	inland port	enclave
Guangzhou	inland port	neighboring

2.2.2 Development history

These five harbor cities are similar in development history. In ancient times, they are important nodes in Maritime Silk Road and significant gateways for China to communicate with the foreign countries. In modern times, they are the treaty port opening to the outside world. After the Reform and Opening Up, they are the most important carrier of China's eastern coastal region development. In recent years, they are the key points in regional development under the background of domestic policy.

2.2.3 Develop mode study

Based on Neming and Hayllth theory, Dueruet makes the relationship matrix between port and city. In the matrix, square represents port function, the circular represents urban functions. The X-axis matrix describes the port function change, Y-axis describes the change of the city function. The farther from the origin, the stronger is the function. A diagonal line of Matrix describes the process of a coastal port city development into a global port city. In this process, the importance of the city and port almost remain the same, such as Hong Kong. Another diagonal shows their uneven functions, from the city function blocking harbor's development to the port limiting city's, like Calcutta. The intersection of two diagonals is the best state to harbor city relationship. However, with the time variation, few harbor cities can maintain this condition.

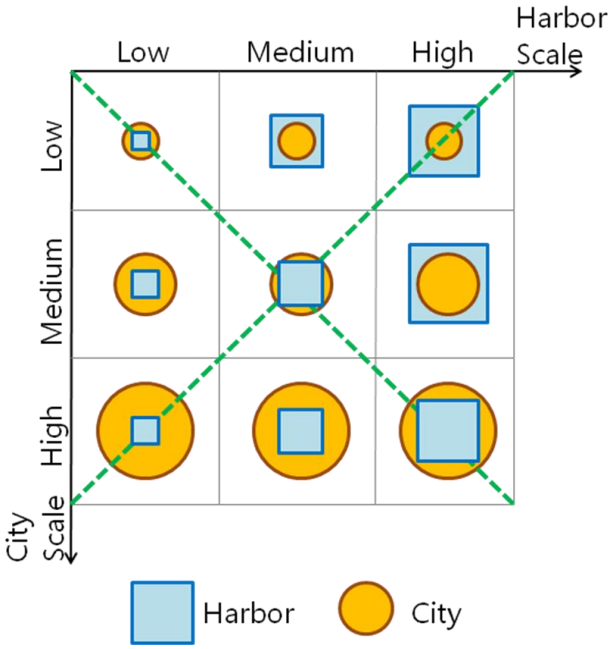


Figure 5: Harbour cities develop modes

$$RCI = \frac{T_i / \sum_i T}{P_i / \sum_i P} \quad (1)$$

Ti—Cargo Throughput of harbor i;
Σ T—Hinterland Throughput
Pi—Urban population of harbor city
Σ P—Hinterland urban population

According to the related research, critical values of RCI are determined. Any harbor city with RCI close to 1 (0.75-1.25) shows a kind of balance between port and city functions. Three cities on the diagonal in the figure are in this state, the size of the circle reflects the size of the city. Generally, RCI over 1.25 is interpreted as port function is too strong, while less than 0.75 means urban function is too strong. If RCI above 3 or below 0.33, it indicates that the relationship between city and port is extremely uneven, the development of city and port will be restricted. Cities' scale can be completely different with the equal RCI, the nine combinations with different harbor scale and city functions are divided into five types.

1Ce 'sat Ducruet. Sung–Woo Lee. 2006

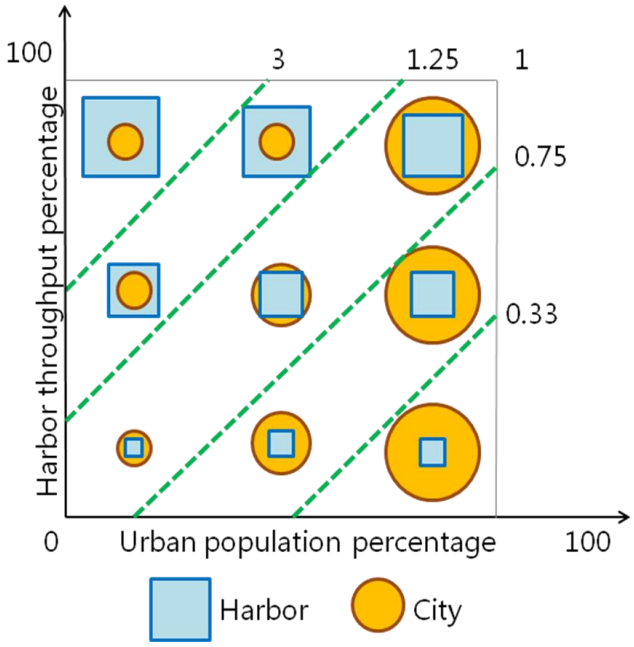


Figure 6: Harbour cities RCI

According to the model, the paper analyzes these five Chinese harbor cities and determine development mode.

Table 5: Harbor index and urban index of five harbor cities

Cargo Throughput (One hundred million tons)			Urban Population(Ten thousand)		
Dalian Port	Liaoning coastal ports group	Percentage	Dalian Port	Liaoning Province	Percentage
3.03	20.4	14.9%	508.44	2884	17.6%
Tianjin Port	Jing-jin-ji ports group	Percentage	Tianjin Port	Jing-jin-ji	Percentage
4.76	8.25	57.7%	1145	6129	18.7%
Qingdao Port	Shandong coastal ports group	Percentage	Qingdao Port	Shandong Province	Percentage
4	10	40.0%	523	3971	13.2%
Shanghai Port	Yangtze River Delta ports group	Percentage	Shanghai Port	Yangtze River Delta	Percentage
7.36	19.28	38.2%	2118	9307	22.8%
Guangzhou Pott	Pearl River Delta ports group	Percentage	Guangzhou Pott	Pearl River Delta	Percentage
3.6	10	36.0%	1079	4706	22.9%

According to the mode analysis, in these five harbor cities only Dalian's RCI is between 0.75-1.25, it' s in the balance phrase. Tianjin, Shanghai, Guangzhou port function are too strong. The relationship between city and port in Qingdao is uneven, its port function has limited urban develop.

Table 6: RCI of five harbor cities

	Dalian	Tianjin	Qingdao	Shanghai	Guangzhou
RCI	0.84	2.91	3.04	1.68	1.57
Mode	Balance between city and port	Port function is too strong	Relationship between city and port is	Port function is too strong	Port function is too strong

			extremely uneven, the city development is restricted by the port		

3. Study on the relationship between port and city of Tianjin

3.1 Tianjin development background

3.1.1 Urban

In "Tianjin comprehensive planning(2006-2020)" , its positioning is International port city, north economic center, the ecological city. In 2012, the population of Tianjin is 14 million, GDP is nearly 215 billion dollar. Tianjin binhai new area is an important national new district in China, its development is in the national leading position for many years. And the spatial structure of Tianjin is" Two cities and tow ports". As a traditional industry city, the second industry is still dominant. In 2012, the industry structure is 1.3:51.7:47.0.

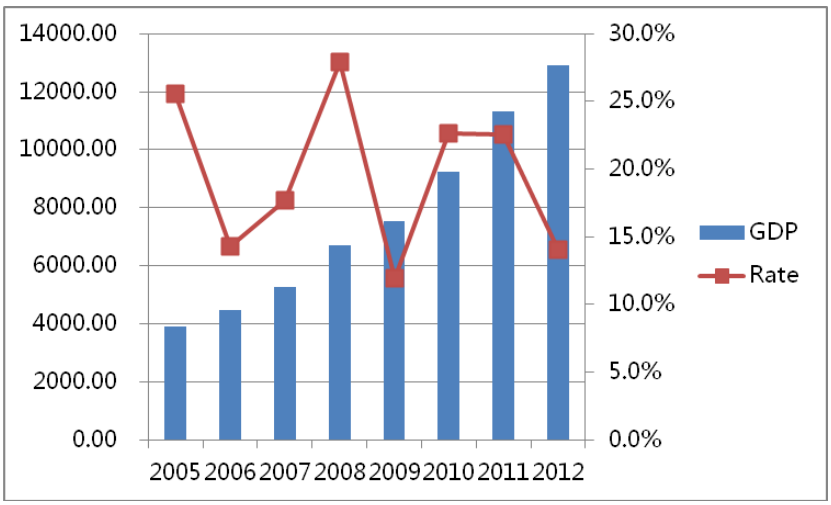


Figure 7: GDP development condition of Tianjin

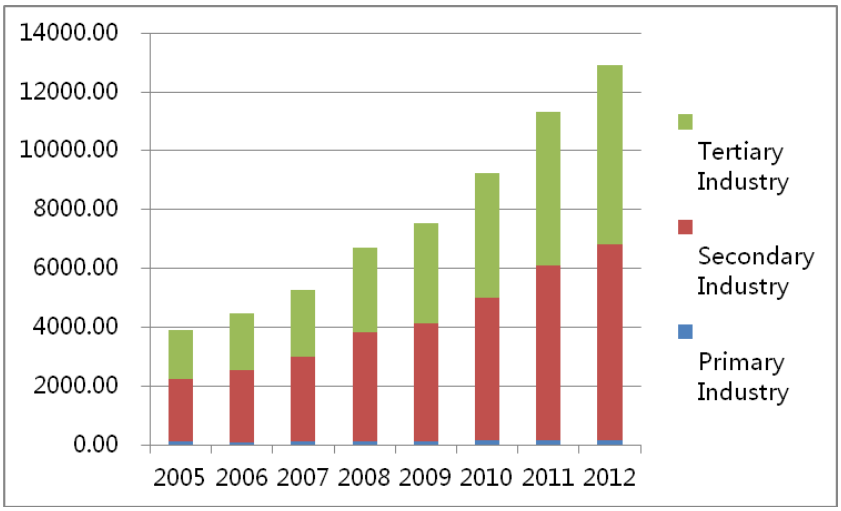


Figure 8: Industry structure of Tianjin

3.1.2 Port

Tianjin port is located in the west of bohai bay. It is the shortest port to connect north China and northwest inland. Tianjin port is an important waterway transport hub for the north , northwest, and the Beijing-Tianjin region. The transportation is extremely developed, which has formed a considerable scale of three-dimensional traffic transportation system. Tianjin port is the largest comprehensive port in northern China. Its land area is 132 square kilometers, with 160 all kinds of berth , including 103 ten thousand tonnage-class berths.

3.2 The develop process of the relationship between city and port of Tianjin

According to Hoyle and Murphey's evolution theory, the port-city relationship can be divided into five stages.

(1) The primary stage of port-city relationship

In this stage the port and city interact with each other, achieve win-win, the port import and export goods for the city. It's a long historic stage.

(2) The expansion stage of port-city relationship

With the continuous development of industry and commerce, the road transport system is improving. As the international trade increases, port scale is growing. Harbor city expand for more space to perfect its function. The relationship between port and city is updating.

(3) Further separation phase of harbor city

With the development of modern industry and services industry in this stage, container transport and highway are continuous developing. It makes port facilities to take up more and more space. With the support of rail and sea comprehensive network, port service scope is extended. At the same time, port is separating from city.

(4)Port leaving stage

Due to the development of transportation and informationization, port range is more and more wide. It has become international trade portal. If the city is not correctly positioned and its special structure is not adjusted accordingly, t, it will lead to imbalance between city and port. Or the port will appear to evacuate, the city and port failed to effectively combine;

(5) The waterfront redevelopment stage

With scale and deepwater development of the port, city and port compete for resources worse. It puts forward new requirements for the ecological environment. City hardly meets the demand of port development. So the development of waterfront is to coordinate the relationship between the city and port.

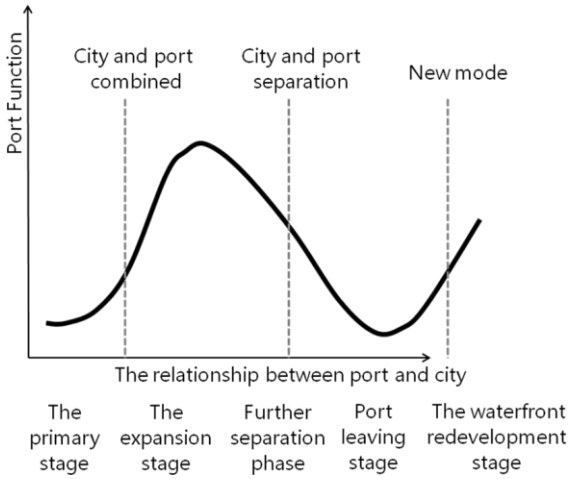


Figure 9: The stages of port-city relationship

According to this theory, combined with the actual development situation in Tianjin, the paper summarizes the five stages of Tianjin port -city relationship development.

(1)The primary stage of port-city relationship(-1840)

The colorful part represents Tianjin construction area in 1840.
The relationship between city and port in Tianjin originated in Tang Dynasty, meeting military purposes. The modern Tianjin was formed in Ming Dynasty. Due to the water supplies of Tianjin was significant to Beijing, the trade communication by water system was promoted. Tianjin has developed to be the trading and business center. The port was built by the river and the city is constructed next to the port. From morphological analysis, Tianjin had formed crumb agglomeration forms in this stage, but in small urban scale.

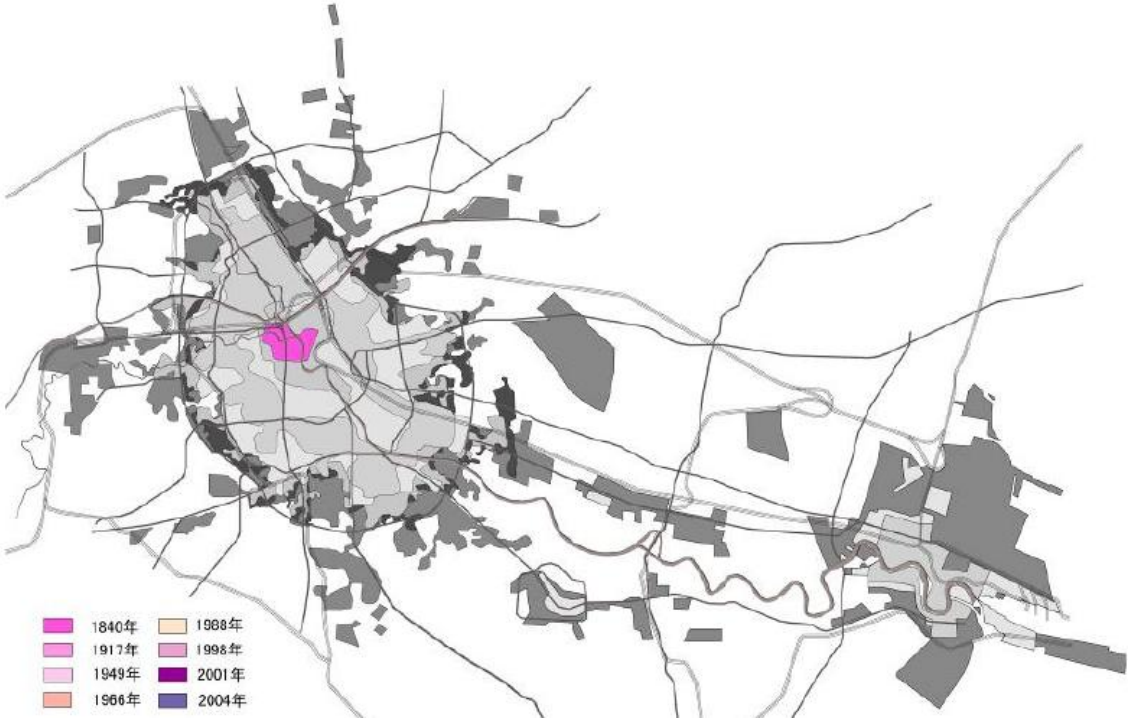


Figure 10: The primary stages of Tianjin

(2)The expansion stage of port-city relationship(1840-1949)

The colorful part represents Tianjin construction area in 1949.
At the end of the Qing Dynasty, Tianjin was set up as trading ports and foreign concessions. The nature of the Tianjin port was changed from domestic trade port to colonies open ports. So was the port scale and function. Sail ship transportation was gradually replaced by the large shipping. River transportation was gradually replaced by coastal transport; Single domestic trading has changed to various foreign trade. From the results of urban morphology analysis, the construction of Tianjin city was concentrated in the Haihe river upstream region. It showed expanding ribbon features along the river. And southeast development trend was significantly stronger than the northwest .

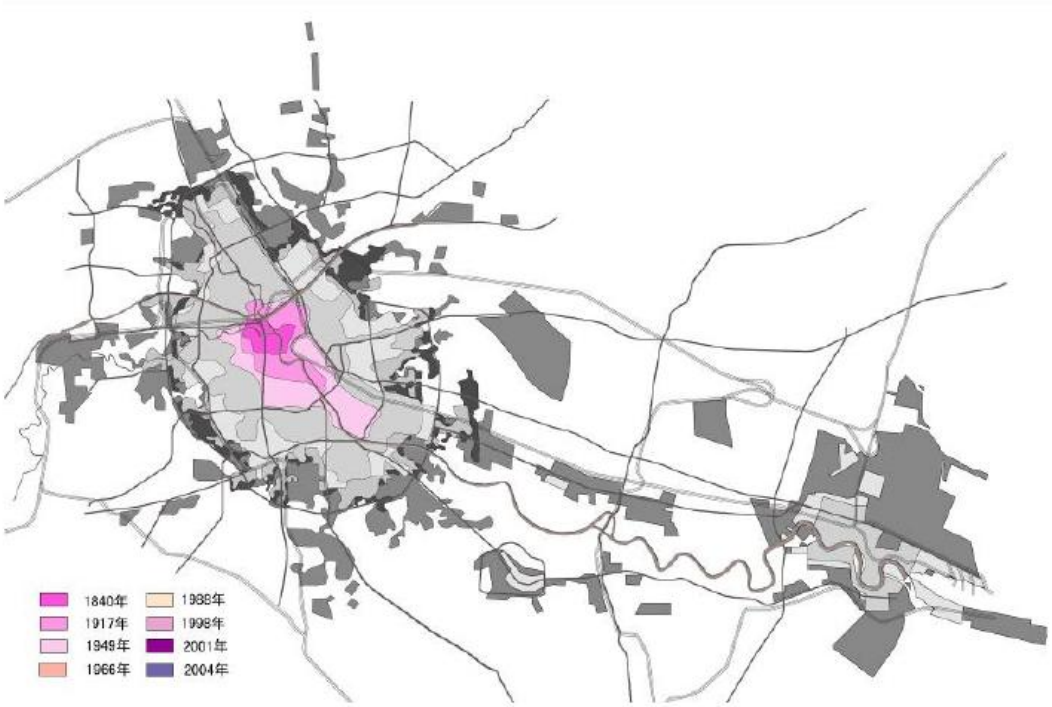


Figure 11: The expansion stages of Tianjin

(3) Further separation phase of harbor city(1950-1966)

The colorful part represents Tianjin construction area in 1966.
1951 Reconstruction of the port area began. Tianjin port started to shift from river port to coastal port. As a result of the macro-economic system, the relationship between city and port became weak. Tianjin focused on industrial development and made space layout planning to implement the industrial projects. From the urban morphology analysis, "single center" structure was remained a feature at this stage. Tanggu(now called Binhai) district was only one of the suburban towns. It was still in cohesion and integration stage, not strong enough to participate in the growth of urban core form.

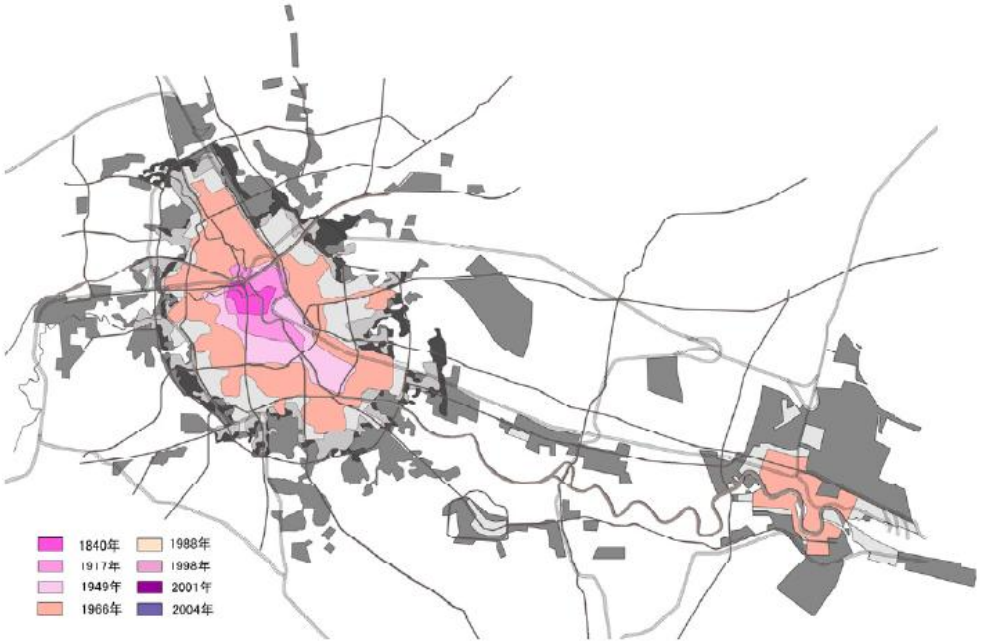


Figure 12: Further separation stages of Tianjin

(4) Recombine stage(1967-1988)

The colorful part represents Tianjin construction area in 1988.
At this stage, the city scale grew slowly, featured with introverted adjustment. Tianjin was one of the first 14 open coastal port cities in China. The transportation function of Haihe river upstream part disappeared. Tianjin port's function was completely moved to the downstream of the Tanggu Newport area. In the 1984 version of urban comprehensive planning redefined urban character, Tianjin was not only comprehensive industrial base with advanced technology, it is also an open multi-functional economic center and the modern port city. General idea of urban layout was: Haihe river was the axis, transforming the old city areas into the center; Industrial development focus moved to the east, developing the coastal areas. Industrial east-moving became the first strategy of city development. At this stage, urban spatial structure changed a lot in morphology. Groups of spatial pattern started to take shape, but each group followed different trajectory, interaction was weak. Power of outward expansion was relatively weak.

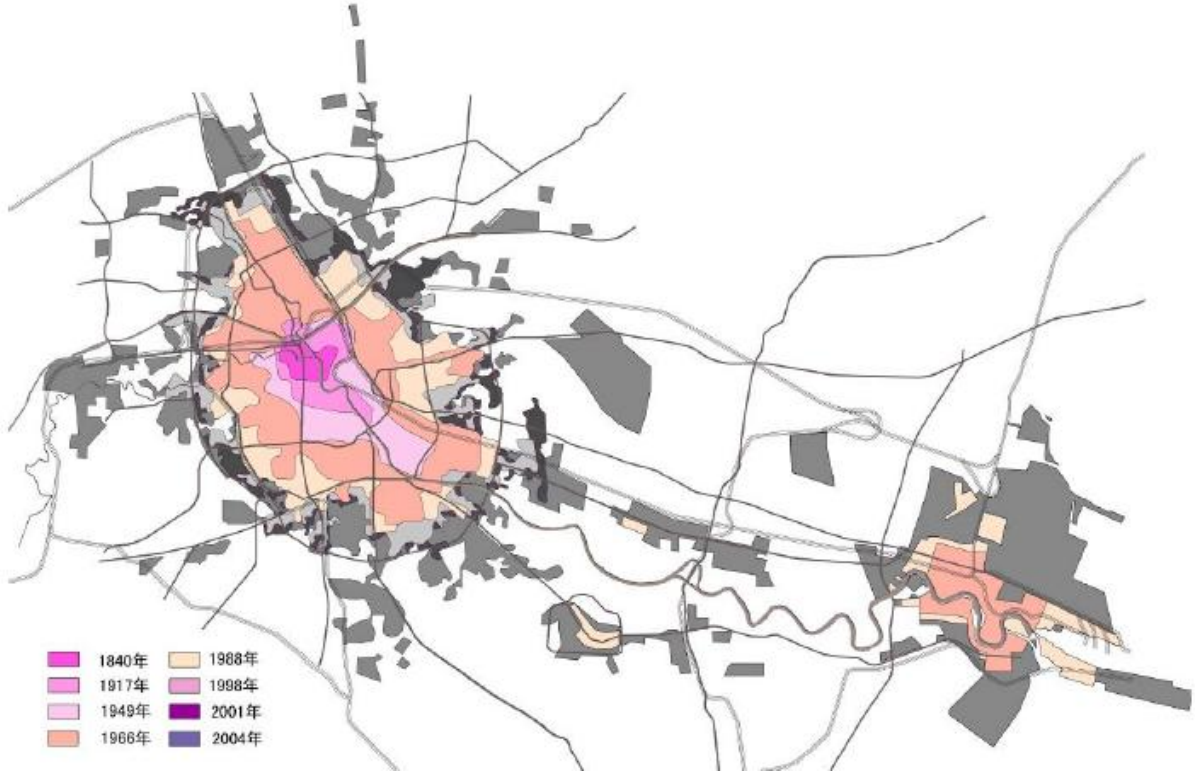


Figure 13: *Recombine stage of Tianjin*

(5) Close connection stage(1989-)
After the Reform and Opening Up, Tianjin entered a new development phase. Especially after Binhai was set up as national new district, urban spatial structure of Tianjin has changed a lot. In this stage, downtown, Tanggu district and the corridor region had significant ribbon characteristics. The city center represented strong outward development trend, new growth axis appeared. As growth axis, Haihe river connected the "twin cities" structure.

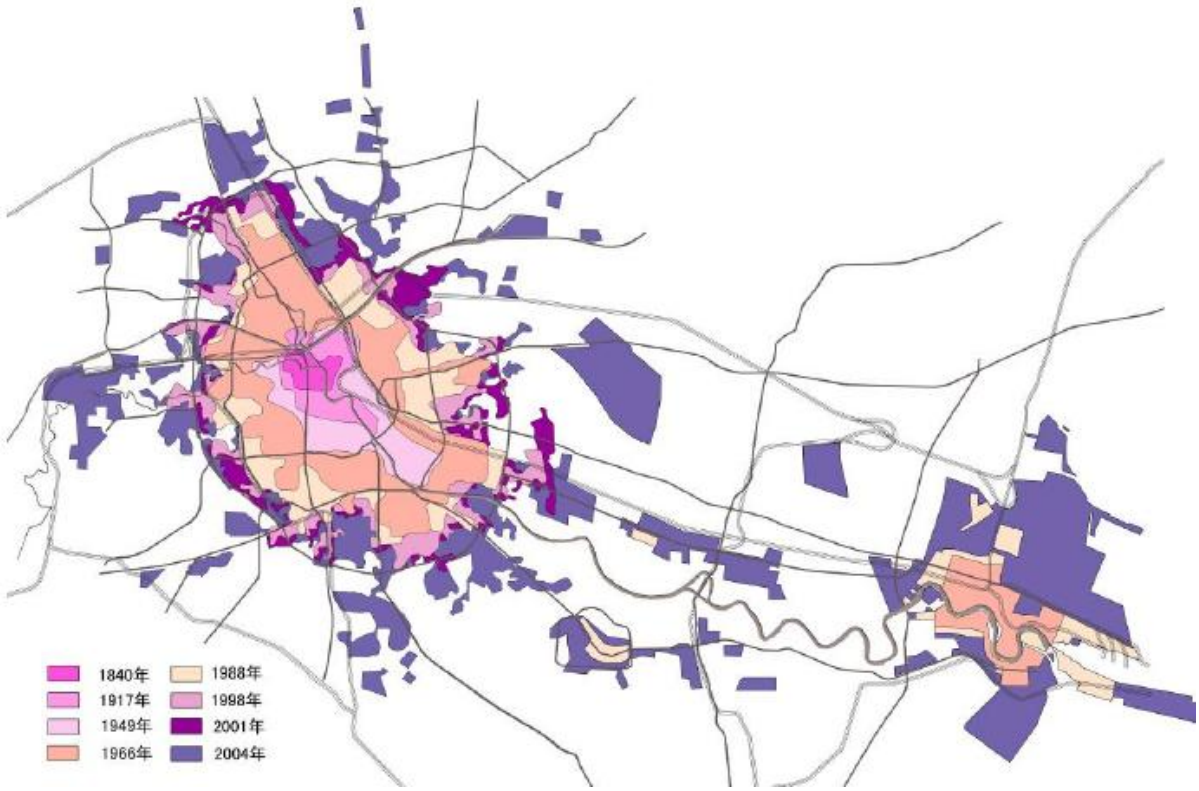


Figure 14: Close connection stage of Tianjin

3.3 Study of city-port interaction development of Tianjin

3.3.1 Develop mode

Based on port - city relationship matrix, the article studies Tianjin port-city development mode.

Table 7: Harbor index and urban index of Tianjin

	Cargo Throughput (One hundred million tons)			Urban Population(Ten thousand)		
	Tianjin Port	Jing-jin-ji ports group	Percentage	Tianjin	Jing-jin-ji	Percentage
1990	0.20	0.6	33.3%	487.85	2142.89	22.77%
1995	0.58	1.25	46.4%	534.9	2579.95	20.73%
2000	0.96	2.31	41.6%	720.53	3518.91	20.48%
2005	2.41	4.66	51.7%	783.0	4251.904	18.42%
2010	4.02	7.17	56.1%	1011.2	5792.94	17.46%
2012	4.76	8.25	57.7%	1145	6129.33	18.7%

Table 8: RCI of Tianjin

	1990	1995	2000	2005	2010	2012
RCI	1.22	2.24	2.03	2.81	2.89	2.91
Mode	Balance between city and port	Port function is too strong	Port function is too strong	Port function is too strong	Port function is too strong	Port function is too strong

Through the analysis of Tianjin port-city relationship, it shows compared to urban develop level, Tianjin port function is too strong. Espetially from 2000, RCI has bee closed to the critical value. It should be pay attention. In the future development, urban functions to

regional radiation should be strengthen, in order to balance the relationship between harbor and city.

3.3.2 Economic influence

Tianjin port is the largest core comparative advantage and strategic resources of the city, which plays an important role in promoting urban economy development. According to the measure of the specialized institutions, per ten thousand tons of cargo throughput of Tianjin port can provide about 1.2 million yuan of GDP, and nearly 26 jobs opportunities. In 2012, Tianjin port cargo throughput was 476 million tons, relative industry could create 57.1 billion yuan GDP and provide about 1.24 million employment opportunities. By making the most of the advantage of Tianjin port, Tianjin forms radiation to the hinterland, promoting hinterland economy development. At the same time, it attracts people, logistics, capital and information gathering in Tianjin, so as to promote Tianjin as the north economic center.

Table 9: Port index and urban economy index of Tianjin

	Port Index		Urban Economy Index			
	Cargo Throughput (Hundred million tons)	TEU million	GDP(Hundred million yuan)	Primary Industry GDP(Hundred million yuan)	Secondary Industry GDP(Hundred million yuan)	Tertiary Industry GDP(Hundred million yuan)
1991	2378	34	324.65	29.26	196.6	116.79
1992	2929	39.35	411.04	30.26	233.41	143.37
1993	3719	48.19	538.94	35.40	308.40	195.14
1994	4652	63.09	732.89	46.55	414.95	271.39
1995	5787	70.21	931.97	60.80	518.5	352.62
1996	6188	82.29	1121.93	67.67	609.10	445.16
1997	6789	93.55	1264.63	69.52	676.01	519.10
1998	6818	101.84	1374.6	74.14	697.99	602.47
1999	7298	130.19	1500.95	71.14	758.51	671.30
2000	9566	170.84	1701.88	73.69	863.83	764.36
2001	11369	201.12	1919.09	78.73	959.06	881.30
2002	12906	240.89	2150.76	84.21	1069.08	997.47
2003	16182	301.54	2578.03	89.91	1337.31	1150.82
2004	20619	381.58	3110.97	105.28	1685.93	1319.76
2005	24069	480.10	3697.62	112.38	2051.17	1534.07
2006	25760	595.01	4359.15	118.23	2488.29	1752.63
2007	30946	710	5252.76	110.19	2892.53	2250.04
2008	35593	850	6719.01	122.58	3709.78	2886.65
2009	38111	870	7521.85	128.85	3987.84	3405.16
2010	41325	1008	9224.46	145.58	4840.23	4328.65
2011	45338	1159	11307.28	159.72	5928.32	5219.24
2012	47697	1230	12893.88	171.60	6663.82	6058.46

Through the analysis of Tianjin port index and urban economic develop index, the paper analysis the correlation between them in order to study the influence of port to urban economy. The correlation coefficient was 0.992 and 0.989 between GDP and port throughput, representing that urban economy and port development are highly correlated. It means Tianjin port has a huge influence on urban economy. From three industrial structure, the relationship between port and secondary industries is the closest, then is the service industry. This suggests that the Tianjin port plays a great role in promoting. urban secondary and tertiary industries.

Table 8: Port index and urban economic develop index correlation of Tianjin

The correlation coefficient	GDP	Primary Industry GDP	Secondary Industry GDP	Tertiary Industry GDP
Cargo Throughput	0.992	0.936	0.991	0.985
TEU	0.989	0.908	0.994	0.976

3.4 Development Suggestions

3.4.1 Take advantage of the port to accomplish rational distribution of industries in Tianjin

The goal of harbor and city interaction is to promote urban economy develop. At present, Tianjin economic development still has some problems, such as unobvious industrial advantage, undeveloped new technology industry, small scale of service industry. Using the core resource advantages of Tianjin port will help the city to solve these problems .

(1) Continue to expand advantage of traditional industries
Tianjin should speed up the pace of technological transformation, constantly adjust and optimize the industry structure. We should continue to strengthen this advantage.

(2) Strengthen the high-tech industries development
Tianjin should use developed heavy chemical industry to attract other industry chain and aggregate technology, capital, talent, as well as the development of new and high technology industries. Electronic information industry, biotechnology and modern pharmaceutical industry, aerospace industry should be strengthened.

(3) Speed up tertiary industry development
According to the basic theory of port and city interactive development, city will eventually be away from the dependence on port. Tianjin is still at the early stage of cluster effect. The city has not got rid of the dependence on industry, the leading role of the service industry is not obvious. In the future, Tianjin should adjust the industrial structure and accelerate port industry chain development. Financial industry, modern logistics, information service industry should be strengthened.

3.4.2 Construction of "Beijing-Tianjin" dual core city

At present, Tianjin has not given full play to the harbor city's potential. Tianjin should focus on regional cooperation, strengthen the interworking with the hinterland, especially with Beijing. Though case study of Japan "Tokyo -Yokohama" ,the capital and the port city of twin mode type development, Tianjin should give full use of the coastal area and the geographical advantage of adjoining capital.

(1) Reasonable industrial division of Beijing and Tianjin
According to their respective advantages, Tianjin should focus on port construction, shipping , warehousing and transit trade development. The industrial structure of Tianjin should adjust to open and service-oriented economy.

(2) Develop integrated traffic system of the Beijing and Tianjin
Construction of comprehensive transport system, pushing forward the intercity transportation network is important guarantee of extended city layout and integration. Therefore, Tianjin should pay attention to traffic construction between two cities, to realize the intercity public traffic. Beijing, Tianjin these two major transport hubs will realize regional transportation network from "single center radiation type" to "the double center network".

(3) Make the most of the advantage of coastal resource
Compared to Beijing, Tianjin has yet to given full play of coastal characteristics.

In the process of Tianjin building international port city , coastal areas should be a significant character to planning and construction. Tianjin should fully excavate the advantages of Binhai, build the coastal areas as a symbol of international harbor city.

3.4.3 The suggestions to other harbor cities

(1) Make full use of the port advantage, establish the urban status in region area
In history, Tianjin was an important sea port in north China. It's radiation to Beijing, Hebei province and other areas. In recent years, with the rising of Binhai new area, Tianjin port grew radiation ability in Jing-jin-ji Area. Tianjin has established the northern economic center of Tianjin area. Harbor city has to make full use of the port advantages, enhance its radiation ability in region, so as to establish its urban status.

(2) Scientific dealing with the space relation between city and port, avoiding interference
Port city has to pay attention on the spatial separation of urban residential living function and port production function, avoiding mutual interference. Tianjin's urban structure is changing from single to double centers. In history, Tianjin's old city and port were separated, reduced interference of the port in transportation and other aspects to urban residential life function. In recent years, relying on the port, Binhai new area mainly services for port-surrounding industry. So the interference is relatively weak.

(3) Optimize urban industry structure, promoting harbor city relationship to benign development
With the advantage of port resources, harbor cities should develop port surrounding industry to make economy and port interacted develop. In recent years, Tianjin's port-vicinity industry directly promotes the secondary and service industry, which optimizes the urban industrial structure. Port city should reasonable plan its industry, and make sure the development of harbor city relationship mutual and benign development.

4. Conclusion

With the upgrading of the port economy functions and the transportation, economic, social ties between port and city increasingly close, the author holds the opinion that healthy port-city interactive development model will benefit the harbor city to expand its spatial structure. There are large numbers of harbor cities in China, which play significant roles in economic development. However, some harbor cities faces unbalance relationship between city and port, restricting harbor city developing.

By selecting five domestic regional representative port cities- Guangzhou, Shanghai, Qingdao, Tianjin and Dalian, the paper analyzes their historical evolution and spatial relationship between port and city. Based on Concentration Index and location quotient theories, the writer tries to calculate these five harbor cities' RCI (Relative Concentration Index), to determine each city's port-city development model and features. Dalian is balance between city and port. Tianjin, Shanghai and Guangzhou are port function too strong. Qingdao's relationship between city and port is extremely uneven, the city development is restricted by the port

Case on Tianjin, the article systemic analyzes the spatial structure evolution between the port and city. According to the West Hoyle and Murphey "Harbor City" relationship Evolution Theory, the author divides Tianjin port-city growth and development into five phases. The paper points out that Tianjin port function is increasingly growing faster than urban economy development, leading nowadays port function is too strong. As a result, the author makes several suggestions to promote Tianjin urban develop as to balance the relationship between city and port.

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The interactive mechanism among urban agglomerations, industrial clusters and port groups in the Bohai Economic Rim

(The Raising third growth pole area of China)

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Abstract：
The Bohai Economic Rim (BER) is a term used to describe the economic hinterland surrounding Beijing, Tianjin and Shijiazhuang. It also includes areas in Hebei, Liaoning and Shandong which surround the Bohai Sea, even more broadly, with Shanxi and middle-eastern Inner Mongolia. Meanwhile, with the development of the port groups, especially the north shipping center construction, there has been the Liaoning port group with Dalian port as the core, the Beijing-Tianjin-Hebei port group with Tianjin port as the core, and the Shandong port group with Qingdao port as the core, which has formed the competitive state of “tripartite confrontation”.

This region has gone through major changes in economic and infrastructures. This emerging region is rising as a Northern economic power house with great hopes from the government, and even rivals the Pearl River Delta (PRD) in the south and the Yangtze River Delta (YRD) in the east. There is no doubt that the port economy is its core, and its leading role of the regional economy is obvious. But for the whole regional coordination and orderly development of the region, the more important thing which is also difficult to deal with is the competition and cooperation between cities which developing on the basis of the port economy or not.

Due to the current industrial and economic structure, development stage and so on all have somewhat similar or overlapping, it is very competitive between each other. Besides, the interaction between city and port is always achieved through the industry development. So the competition is not just between cities, but also between ports, even between industrial clusters. The industrial clusters will serve as a medium in this paper, and the process and the interactive mechanism among urban agglomerations, industrial clusters and port groups will be analyzed.

Using the statistical yearbook data of the cities in BER for nearly a decade and the port yearbook data, the stage of development on the macro level will be discriminated firstly. Then the index of city system, industrial system and the port system will be selected respectively by using the PCA (principal component analysis). Based on the analysis of the interactive mechanism between them, two of the three port group, urban agglomeration and industrial clusters will be coupling analyzed using the coupling model and coupling coordination degree model. It turns out to get the industry - city - port relationship of each city, decide which system development lags behind, and provide certain guiding for the future development and planning.

This article analysis the process and the interactive mechanism among urban agglomerations, industrial clusters and port groups in the Bohai Economic Rim to get the industry - city - port relationship of each city, decide which system development lags behind, and provide certain guiding for the future development and planning.

1. Introduction

The Bohai economic Rim includes Beijing, Tianjin, Hebei, Liaoning, Shandong, Shanxi and central Inner Mongolia in general, a total of five provinces and two municipalities directly under the Central Government, which is the largest, most development potential economic circle of China. BER is an economic belt extended north along the west coast of the Pacific Ocean, with Shijiazhuang, Taiyuan, Shenyang, Ji'nan, Hohhot as regional fulcrum, and a city group in economic Strategy composed of 157 Cities. The position is particularly important in opening of the coastal development strategy of China, with obvious comparative advantage. In a narrow sense, BER includes the administrative region of Beijing, Tianjin, Hebei, Liaoning and Shandong, a C-type ring along the Bohai coastline, and has also created a unique structure of BER.

BER has a good geographical conditions, solid economic base and rich resources. But BER is obviously lagging behind and the function of growth pole is greatly reduced when compared with the first growth pole, the Pearl River Delta region, and the second growth pole area, Yangtze River Delta, which has grown up in fully system supply condition.

Besides, the convergence and industry isomorphism result is extremely high in BER because of the isomorphism resources and regional conditions. At the same time, because of the unique advantages of the port, a large number of government focus on the construction of the port, expect to make a bucket of gold. According to statistics, the Bohai area has more than 60 small ports, with about 40% cargo throughput of the whole country, becoming the world's largest port group. At present, facing the strategic historical opportunity, excess capacity trend has appeared, in urgent need of integration (Chen Xiaoyong, 2009).

When thinking about Bohai area development differently, relationship between port and city is undoubtedly one of the most important points. Most of the existing studies focus on the port and the city two system to promote interaction between port and city, as well as the regional coordination between city group or port group regional coordination, but ignore the important role played as the media-----industry, and the cooperation between the three systems in the area.

Therefore, this paper introduces the city-Industry-port three-element interaction model, and do some quantitative and qualitative analysis on the interaction of city and port in BER and the regional coordination.

2. Study area and data

Since the focus of this paper is the relationship between port and city, so we choose 17 coastal cities of BER as the study area. In this paper the data are selected by author from the *"CHINA CITY STATISTICAL YEARBOOK 2012"*, *"Chinese port Yearbook 2012"*, *"Statistical yearbook of Liaoning province", " Statistical yearbook of Shandong province", " Statistical yearbook of Tianjin city" and " Statistical yearbook of statistical yearbook of Hebei province"*. And the data were analyzed using SPSS and ArcGIS software.

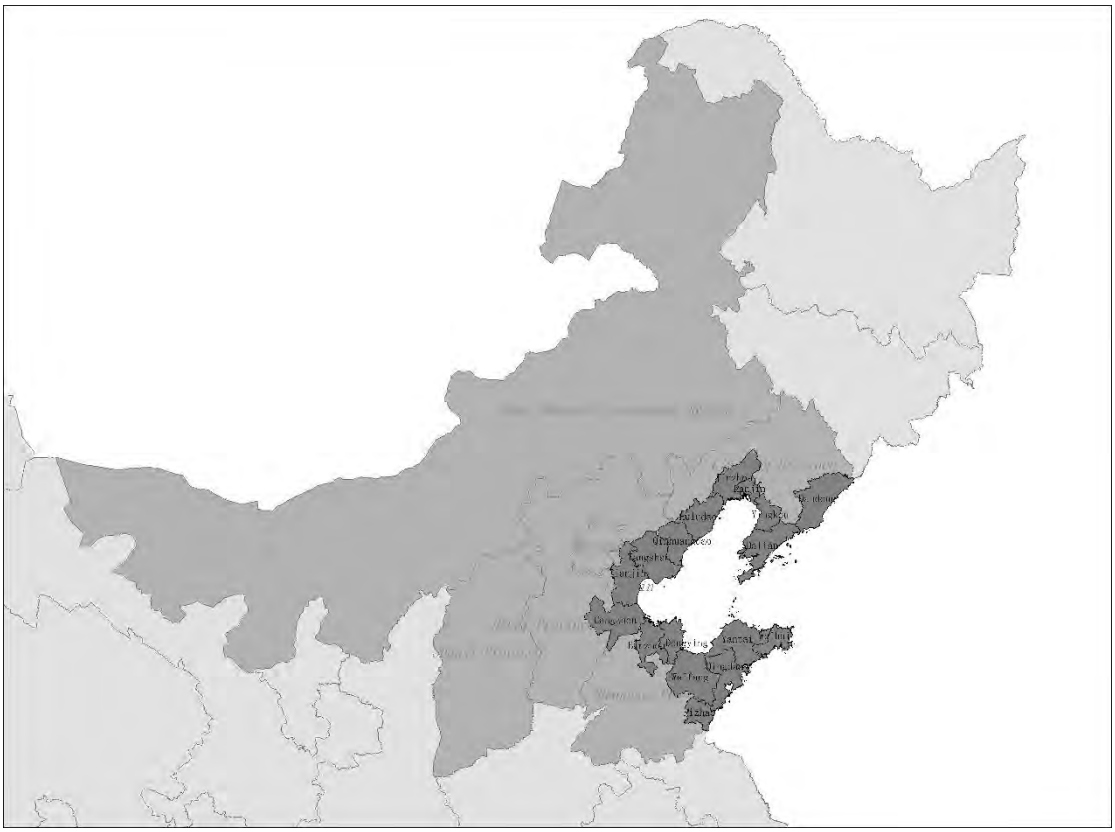


Figure 1：The map of study area

3. Model Construction and research method

3.1 model construction

The intrinsic power of city-port integration development stem from the mutual driven of city, port and industrial structure. There has the following structure between the three:

1) The port has the obvious industrial agglomeration effect, has gathered a large number of industrial enterprises in the port surrounding, formed the coastal industrial structure. At the same time, the industrial structure also affects the type of goods in the port of import and export.

2) The port offers a window or a shortcut for the development of export-oriented economy of city. It provides basic functions of port operation life function for the port city.

3) City continuous adjust the industrial structure in the development process. The industrial structure development continue to guide the development direction of the city. The

foundation of the development of city and industry categories further affect the size and location of port and their import and export goods type.

There is a mutual influence between the three, so the model constructed as follows.

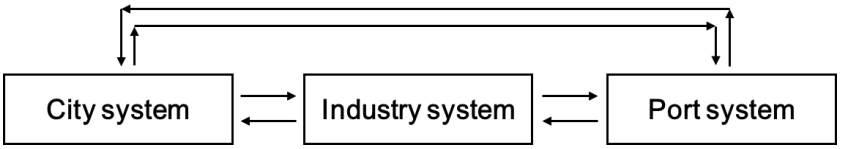


Figure2：City-Industry-Port Model

3.2 Research Method

Select six index for each of the city, industry, port system, and use the principal component analysis to extract factors, and get the comprehensive score. And then, using the scores to do the calculation of the degree of coupling between each two of the three system, and the results are discussed to get some conclusions.

URBAN AGGLOMERATIONS	
AREA	X1
TOTAL POPULATION AT YEAR-END	X2
UNEMPLOYMENT RATE	X3
TOTAL INVESTMENT IN FIXED ASSETSYUAN	X4
LOCAL GOVERNMENT GENERAL BUDGET REVENUE	X5
TOTAL RETAIL SALES OF CONSUMER GOODS	X6
INDUSTRIAL CLUSTERS	
GROSS REGIONAL PRODUCT	Y1
GDP GROWTH RATE	Y2
PRIMARY INDUSTRY AS PERCENTAGE TO GRP	Y3
GROSS INDUSTRIAL OUTPUT VALUE	Y4
TERTIARY INDUSTRY OUTPUT VALUE	Y5
PROPORTION OF FOREIGN CAPITAL	Y6
SEAPORT GROUPS	
VOLUME OF FREIGHT HANDLED	Z1
PROPORTION OF FOREIGN CAPITAL	Z2
PASSENGER HANDLED	Z3
THROUGHPUT OF CONTAINER	Z4
BERTHS IN PORTS	Z5
QUAY SHORELINE LENGTH	Z6

Table 1：The main index of each system

For the deep analysis of the coupling relationship between the system, this paper draws on the relevant literature and data(LIU Hongying, 2008), constructs the system coupling statistics Deltaδ, and standardize unity to compare easily, the formula is as follows:

$$\delta = \frac{|x - \bar{x}|}{\delta_1} \Big/ \frac{|y - \bar{y}|}{\delta_2}$$

In the formula: δ means coupling index between system. X, y denote respectively the comprehensive score of two separate systems; $\delta 1$, $\delta 2$ represent two system comprehensive score standard deviation.

The coupling development stage is a development from the low coupling to the higher coupling, is a process of coupling index from + ∞ or - ∞ to best of 1. The coupling development stage is divided to 1 as the center, to both sides gradually spread out, according to the related research, using the intervals to determine the coupling phase of the provinces and municipalities.

The coupling phase	The coupling index δ
High coupling	0.8≤ δ ≤1.2
Middle coupling	0.5≤ δ <0.8 or 1.2< δ ≤2
Low coupling	0.2≤ δ <0.5 or 2< δ ≤5
Incompatible type	δ <0.2 or δ >5

Table 2: Classification of Coupled development phases

4. Result and Analysis

4.1 Principal component analysis of each system

Name	*Urban Agglomerations*		*Industrial Clusters*		*Seaport Groups*	
	Total Score	Ranking	Total Score	Ranking	Total Score	Ranking
Tianjin	1.70403	1	2.25066	1	0.95274	3
Qingdao	0.60606	3	0.6112	3	0.65837	4
Jinzhou	-0.49763	12	-0.50862	15	-0.46066	12
Tangshan	0.66517	2	0.09956	6	-0.01473	6
Cangzhou	0.18832	7	-0.30556	10	-0.43462	11
Weifang	0.46913	6	-0.22756	9	-0.60098	14
Binzhou	-0.32865	10	-0.35258	11	-0.65202	17
Dandong	-0.03074	8	-0.4079	14	-0.37886	10
Huludao	-0.34792	11	-0.68589	17	-0.59832	13
Dongying	-0.64261	16	0.13283	5	-0.63565	16
Panjin	-0.57461	13	-0.16041	8	-0.62456	15
Qinhuangdao	-0.27836	9	-0.54476	16	-0.04756	7
Dalian	0.60444	4	0.64225	2	1.88781	1
Yantai	0.47847	5	0.29941	4	1.076	2
Yingkou	-0.77024	17	-0.03833	7	0.11598	5
Weihai	-0.61399	14	-0.40226	13	-0.08254	8
Rizhao	-0.63089	15	-0.40204	12	-0.16039	9

Table 3: The total score and Ranking of each system

From the score of city system, Tianjin and Tangshan score higher with better comprehensive development; followed by Qingdao, Yantai, Dalian and Weifang, obviously we can see that agglomeration trend of three city clusters of Beijing Tianjin Hebei, Liaodong and Shandong, Tianjin, Dalian, Qingdao respectively in the dragon head, and Tianjin as the scale, policy advantage superior to Dalian and Qingdao. In addition, three city cluster intermediate produced two relatively lagtrough, Dongying and Yingkou.

From the industry score, northern area shows the center-edge situation, while cities in Shandong Province on the south coast of Bohai has continuous situation, which the northern Tianjin and Dalian occupy absolute advantage, Tangshan, Yingkou,Panjin followed, other cities industry found relatively lags behind, especially the Jinzhou, Huludao, Qinhuangdao are connected with the industrial lag phenomenon. More prominent in the south of Shandong Province, Qingdao,Yantai, Dongying industrial development, other cities relatively balanced development, but the industrial isomorphism, malignant competition inferiority exist.

From the results of port system, the cluster phenomenon is more obvious, respectively formed in Tianjin, Dalian, Yantai as the center of the three port clusters. Dalian Port replaced the absolute advantage of Tianjin, jumping into the first. Visible, the scale effect and the development of the port is still obvious, however, with the further development of Tianjin Binhai New Area and Hebei Province with more broad hinterland and closer, will provide more development advantages and opportunities to the port.

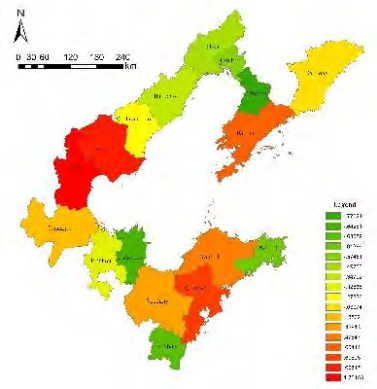


Figure 3: The total score of City System

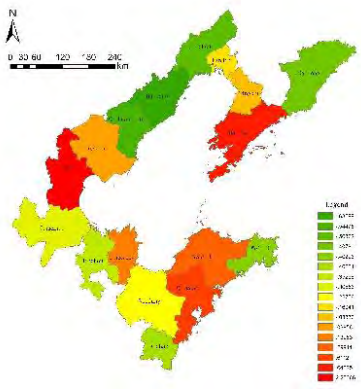


Figure 4: The total score of Industry System

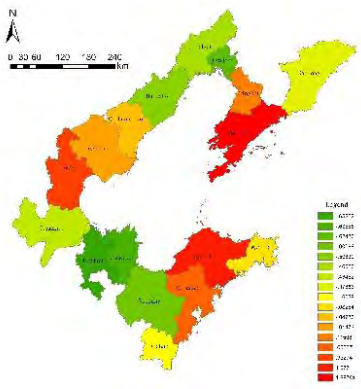


Figure 5: The total score of Port System

4.2 coupling analysis

According to the city-industry coupling degree, the cities of Hebei province get better coupling degree than cities in Liaoning and Shandong. The city-industry of Qinhuangdao and Huludao are highly coupled, so we can see the industrial development and the city development of synergetic effect is good, while the overall ranking in the middle. In

addition, Tianjin, Cangzhou, Binzhou are of middle coupling, but the overall ranking difference.

As for the industry - port coupling, in addition to Tianjin, Jinzhou, Rizhao, other cities were poor coupling degree. On the whole Shandong province and Tianjin city is better than that of Liaoning and Hebei cities coupling degree, concluding that coupling degree of the industrial and port is better than Liaoning. Especially in Dalian as an example, the scores of port is the first, while the industry developing power is insufficient, lack of coordination and interaction with the port. The area of BER port-Industry coupling degree is low, and several large port are coupling low, except Tianjin, one can see its industry-port lack of synergy, on the other hand, the industry has more support, improving the stability.

And the city-port coupling degree, Dongying is highly coupled. Moreover, besides Yantai, Dalian and Qingdao, the major traditional large port cities, Cangzhou and Panjin, the new port cities's coupling degree is also at a high level. The ability for the development of port city is obvious, especially in Yantai-Qingdao-Weifang city cluster group and Dalian-Yingkou-Panjin strip city group.

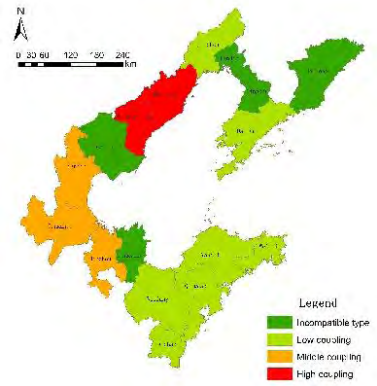


Figure 6: The Coupling Degree of City-Industry

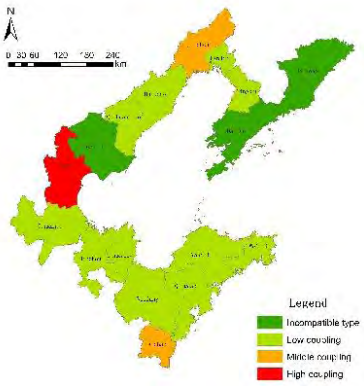


Figure 7: The Coupling Degree of Industry-Port

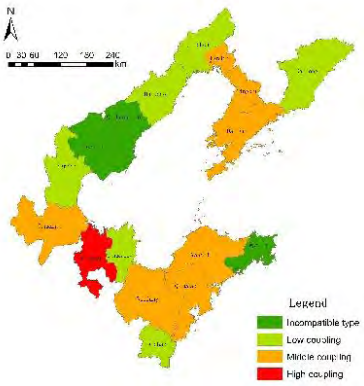


Figure 8: The Coupling Degree of City-Port

5. Discussion

The 17 port cities of BER has the character of the obvious differences between city centrality and port centrality, which causes the differences in the role of comprehensive development strength of the city and the ability of port driving of the regional development. The city centrality of Tianjin strength is the largest, followed by Qingdao, Yantai and Dalian. Tianjin is the first center city of the city system, with the strongest comprehensive development. Tianjin, Qingdao, Yantai and Dalian are the next level, the city's comprehensive development strength is outstanding compared to other cities, being the growth pole of the city system and even the whole region.

The port city space distribution tends to equilibrium, although the city scale is different, but the city tends to be relatively independent, reflecting the smaller role of city space. Bohai sea port city system needs higher intrinsic growth capacity, to better pull overall regional development. The overall optimization of the intrinsic growth capacity needs of industrial and port city coordinated development and the relationship between each city within the system. And the city space structure tends to equilibrium is not conducive to the exchanges and cooperation between the city, easy to form the unfavorable situation of the relationship between city loose, fighting the enemy separately and city system function cannot be effective, which then cause the restriction to regional growth capacity.

The port city economic development based on the city, the industrial structure become more convergent, and function of city space is relatively small. So, because of the lack of cooperation and sharing between the cities, the competition between the cities is increasing, especially between the ports, port cargo ship and the export of the goods and other aspects of competition. The system structure is not perfect, the whole function of city system is not prominent, and the overall system restricts the economic strength. The stronger economic strength, ability of aggregation of factor of production is stronger, market competition ability is stronger, and the radiation peripheral area is more. In accordance with the division of standards development stage city space structure four points, Bohai city system is in the primary stage of accumulation-----diffusion, at this stage. On the one hand, city system for regional impacts will gradually strengthen, senior economic activities agglomerate to the senior center city, to use the center grade advantage agglomeration benefits. On the other hand, the diffusion of lower levels of economic activity to a town or city, a town or city for development due to accept the superior City diffusion separation technology and industry, forming the corresponding or vice center. In this sense, in the BER, since the development of organizational system, it is important to promote the exchanges and cooperation between the cities, coordinated and efficient development, accelerate the evolution of spatial structure, to maximize the pulling effect of the area.

6. Conclusion

Through the research and discussion, three conclusions are promoted below:

1) The tri-polar pattern of the Bohai area still exists, development of border area lack of endogenous power.

2) The coupling degree of the city-industry-port of BER are mostly poor, synergistic effect between the three have not being a good play and used. In the future, the advantage point for each city need to be mining and interactive, constructing an ideal form of three-element together.

3) Within the port of BER and its development from the organization system, it is needed to promote the exchanges and cooperation between all levels of city, coordinate the efficient

development, accelerate the evolution of spatial structure, to maximize the area of the pulling effect.

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Braving a new life in the Old Dockyards - towards an integrated approach.

Ghent, Belgium

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In cooperation with:
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Abstract
The city of Ghent is a very interesting example of a city with a double relationship with its own water infrastructure. There are three main reasons for this relationship. Firstly, the main historical ground for the existence of Ghent along the water was purely out of living conditions and economic reasons (textile industry, water for drinking and canalization support…). Later, however, the polluted water infrastructure had to be filled up to make place for another economic reason: free mobility access for cars, extra parking and open space. The third - and fairly recent - reason is that the city council together with urban planners discovered the water-backbone again, and gave it a third life as the new generator for the city, as a way of making the city "full of pleasure, with open perspectives and open sustainable public spaces" again. Ghent shows how the city can reuse its inner structure and how the water structure can change the future of the city. Sustainable water infrastructure can truly be the basis for city evolution and urban planning.

Water in the city: a rediscovery

From windmills

The town of Ghent and its waters are inseparably bound, one unable to exist without the other. It was already in the Roman period that the town started to grow around the confluence of the rivers Lys (in Dutch: Leie) and Scheldt (in Dutch: Schelde). Because of that, the Flemish name 'Gent' was derived from the Celtic word 'Ganda', which means 'confluence'.

By the 12th century, Ghent was rapidly growing into a flourishing city. The cloth trade, based on the import of English wool, flourished like nowhere else and within a century Ghent had become an important industrial city. Until the 13th century, Ghent was the second biggest city in Europe, north of the Alps, preceded only by Paris. By the late 15th century, the cloth trade had begun to decrease, though Ghent remained prosperous by shifting its economy to the shipping trade along the rivers Lys and Scheldt. In the latter part of the 15th century, however, the closing of the Scheldt brought commercial decline, not to be reversed until the revival of cloth working during the industrial boom of the 19th century.

From then on, the cotton industry started to flourish and Ghent turned into one of the most important industrial centers of the French Empire. The Ghent-Terneuzen canal was constructed and Ghent continued to grow as an industrial center. As waterborne traffic and port activities increased, the sea canal was extended several times. At that time, as industrial activities developed in the city center as well as in the docks, windmills were making place for big industrial cranes…

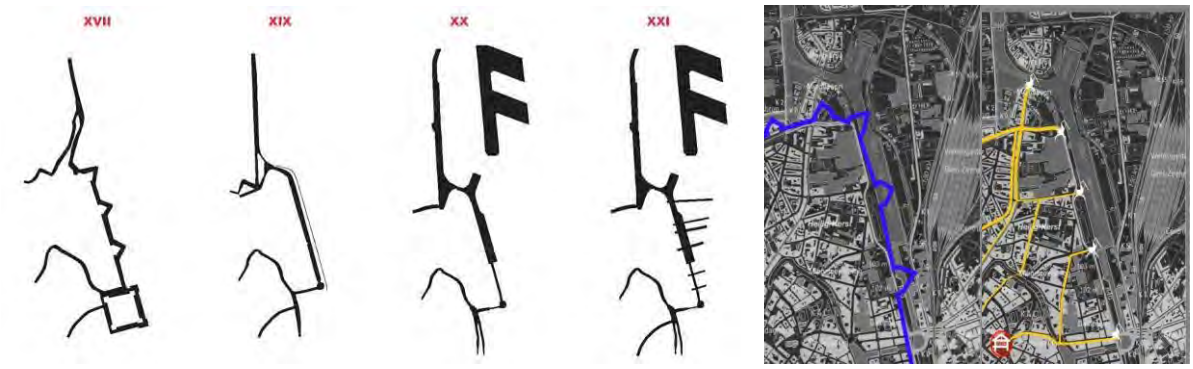


Image 1 and 2 : The evolution of water infrastructure in Ghent, sogent.

Through cranes

A century ago, filling in water and canals became an everyday affair, and there was every reason to do so. Cholera and tuberculosis were rife in deprived working class districts, diseases surely encouraged by the canals that in those days functioned as open sewers. Water was a threat to public health. Besides, many canals and waterways had lost their function as supply routes. Trains and later trucks became far more important means of transport than shipping.

The danger was not only merely pollution, but also its unpredictability. In the 19th and early 20th century, water was a regular menace to the city as a result of high water levels. Moreover, after the Second World War, the number of cars rose spectacularly. 'Abolished' watercourses were filled in or vaulted to make place for new traffic roads or parking lots. By filling in the Lower Scheldt (in Dutch: Nederschelde) in 1960, the historical confluence of Scheldt and Lys disappeared.

To bridges

Already in the mid-1970s, attitudes were changing and respect for the role of water in the city was only growing. For example, the past decades, important investments have occurred in the water treatment, with the construction of a comprehensive collector plan which drains the sewage waters towards a purification unit and not any longer in the rivers. From the end of the 20th century on, lost canals and ports fallen into disuse were revalued. One started to realize that city watercourses had a tourist and an economic value, and might have a sustainable significance for the historical city, which could help improve the quality of life. In short: the water could render the public space more attractive, thereby enhancing the economic position.

Urban transformation: Water as a spatial beam

Spatial Structure Plan of Ghent

During recent years, Flanders has introduced the structure planning as an important opponent to the functional zoning in the planning. It is an important tool for the city policy to provide strategic choices and actions in the planning. At the same time, the structure plan is very helpful to guard and realize the long term visions. As in Flanders, the same needs occurred in Ghent and were very quickly translated into the Spatial Structure Plan of Ghent. The plan was legally obliged by decree of the Flemish Government; it was published in the year 2003. It consists of balanced choices, in order to have a sustainable and qualitative spatial development.

The plan provides vision and certainty for all actors on the short and (mid)long term, with a focus on spatial elements and key issues. It has no direct effect for citizens and is tuned to structural plans on other levels, such as Flanders and the province.

Current bottlenecks, with which the plan had to deal, were a lack of green spaces on different levels, outflow of residents from the city, too densely built 19th century belt neighbourhoods, the highest amount of buildings in poor condition, a lack of zones for economic activities, underused train stations and the public transport network.

Despite the fact that long term visions usually need a lot of time to be realized, the Spatial Structure Plan for the city of Ghent certainly has become a successful tool to speed up the strategic policy decisions as well as the application of the visions. Several targets and ambitions of the structure plan became a real priority in the political planning and thanks to that, the image of Ghent is now changing day by day. Policy priorities (this is the strategic content of the plan) focus at development of green areas, redevelopment of the city and its districts and the development of a railway station site.

But one of the main new visions was the way to transform water structure into the main spatial beam and leading factor. The city government describes its vision on water as follows: *"The water and the confluence of the Lys and Scheldt rivers form the basis of the origin of Ghent. Still now, water remains an important structuring element for nature, economics (port, Ring Canal) and parts of the scenery in and around the city. Although it has been quite affected in the past (by filling in, vaulting, canalization, pollution) and though it may have become less functional, water in Ghent is still very present, compared to all other big Flemish cities (except Bruges). These chances should be taken to their full extent, in order to strengthen the functioning of the city in several areas and to emphasize the typical character of Ghent as a 'city of water'".* Stad Gent, 2003, Ruimtelijk Structuurplan Gent.

Opening of the Lower Scheldt watercourse

The Lower Scheldt project is a perfect illustration of the renewed respect for the recreational, economic and historical value of water in the city.

Already in 1885, part of the waterway was covered, in order to secure a smooth link between the former South railway station and the city centre and to create a new town square. In the 1960s, because of city forming and water pollution, the remaining part was filled in up to the Lys estuary, except for a small section at the Castle of Gerard the Devil. As a consequence, it was no longer possible to take a full boat tour. At the south east, boats sailing the Lys had to turn around at the point where the Lower Scheldt had been filled in.

At the beginning of this century the city of Ghent set the aim to restore the broken connection between the rivers Lys and Scheldt, to provide pleasure craft passage through town, combining this with re-zoning the public space and building a marina. Already round the year 2000, Ghent started restructuring the Portus Ganda marina area to be situated at the historical cradle of Ghent, the Lys and Scheldt confluence and Saint Bavo's Abbey. The Rodetoren Quay would be stepped, making it an ideal spot to relax with a view on the Veer Quay across, which would be extended with wooden jetties and boardwalks, while the surrounding area was being enhanced with present-day street furniture. On 30th of April 2005, the fourth marina of Ghent was officially opened. Meanwhile, an extensive part of the Lower Scheldt has already been uncovered. And recently, on 18th of February 2008, the Bavo, the Nieuw and Wijdenaard Bridges were officially opened.

The Old Dockyards Project: towards an integrated approach

Introduction

Not only in the very centre of the city is the value of water being restored. Also the dockyards area to the north of the centre is heading for a major transformation during the next twenty years. The Old Dockyards project (in Dutch: Oude Dokken) will radically change the view and

the function of an entire part of the city. The aim of the Old Dockyards project is to redevelop the former harbour area called Old Dockyards and to enhance the liveability and employment in the neighbourhood.

Situation and history

The Old Dockyards area is situated around the three oldest docks of the city (Achter, Handels and Hout docks), just outside the historical city centre, between the 19th century belt of the city and the railway station environment.

In the Middle-Ages, this area already had a strategic position: for a long time, it was a wasteland that could be flooded within a very short time, to protect the city against foreign armies and enemies. After the cranes had replaced the forts and windmills during the 19th century, it was in 1829 that the first dock was built: the Handels Dock, parallel with the fortress and the moat. During recent years, because of expansion of the port, the harbour and economic activities moved to the north area of the city, around the Ghent-Terneuzen canal. As a consequence, the Old Dockyards area became neglected, harboring outdated factory infrastructures with inadequate equipment, daily traffic jams, a scarcity of green areas and public spaces, etc.

This evolution was caused by two elements: the scale-enlarging of harbour activities (larger ships, more containers, etc.) and the transformation of the industry on a more global level. While production was being moved away from Europe, the focus on high-tech production and various services grew. Also, these days, waterways are no longer used for production ends very often.

As the area is situated near the historical city centre, it is easy to reach and full of potential for future developers. All this together - an area of emptiness, without any function and pretty much futureless, but at the same time with an extraordinary character, soul and so much potential - convinced the city council to look for a sustainable evolution and gave the kick-off for the Old Dockyards project.







Image 3, 4 and 5: The air view of the Old Dockyards, sogent and the Handels- and Hout –Dock, archive city of Ghent.

Quality of urban planning and design

Years ago, the port of Ghent was located in the area of the Old Dockyards, located to the to the east of the historical city centre. However, the port activities gradually moved to the new municipal port, to the north of the city. Little by little, the grounds of the Old Dockyards (ca 25 ha) around 15 hectares of docks water transformed into a real no man's land with a few scattered buildings, a couple of sheds and two industrial cranes.

From the remnants of a rich industrial past, a brand new vivid quarter now arises, a place where old and young inhabitants of Ghent will be able to live near the waterfront and in a green environment. The challenge for Ghent is a creation of a place where old and young inhabitants will be able to live near the waterfront and in a green environment based on sustainable and water sensitive related urban planning between the remnants of a rich industrial past by re-using the abounded heritage elements.

Approximately 1500 housing units will be constructed, fulfilling the promise of dealing with housing shortage. Modern houses will offer something to everybody's taste. Juniors and seniors, couples and large families, everybody will certainly find a place and will be able to contribute to a cosy neighbourhood. Besides, there will be enough room for offices, shops, recreation, culture and nature. The additional public services (elementary school, daycare centre, neighbourhood sports hall), the extension of the public transport network, bicycle and pedestrian bridges and high-quality public areas will certainly give a strong impetus to the surrounding quarters and the entire city.

Main actors of the initiative

In 2003, the Ghent city council took decisive action by including a vision for the area in the Spatial Structure Plan for the city: *"an approach of social, economic and physical rejuvenation of the Old Dockyards would lead to the development of an area of mixed use, a new, sustainable, mostly residential urban quarter."*

The development of the Old Dockyards project is being supervised through a partnership between the City of Ghent and the Autonomous Municipal Ghent Development Authority (in Dutch sogent), an operational agency owned by the City of Ghent.

Obviously, in a project of this complexity, a lot of other partners play important roles:

- Waterways and Sea canal (Flemish Government, construction of bridges for pedestrians and cyclists, and renovation of quay walls)
- AWV (Flemish Government, construction of motorways)
- Ovam (Flemish Government, mediation of soil)
- Private developers (Public Private Partnership to realize the project)
- A lot of corporations and links with universities and research institutes, collaborative networks and global relationships.

Financial aspects

Due to the complexity of the project it is very hard to name an exact amount of money involved. The project comes about thanks to a lot of subsidies: the European Fund for Regional Development, the Flemish Fund for City Renewal, the Federal Urban Policy… The City applies for different subsidies for all possible subprojects and aims to break even. But the main opportunity is the fact that sogent owns more than 80% of the grounds and can set high standards for the project development at all levels and demand a creation of the high sustainable environment.

For example in the year 2008, eight cities in Flanders and the Netherlands, which all planned to transform their former industry ports, joined forces. In the context of the European Interreg IV A-project 'Revitalization of Old Industry ports' (ROI), they all received a European fund for the realization of one part of their project (building the first bridge for cyclists and pedestrians in Ghent). Besides that, they created a platform which made it possible to exchange knowledge about all aspects of city development in former industrial areas. The City of Ghent was the leading partner of this project. It took place in cooperation with the University of Ghent. More information: www.roi-project.be

Master planning by OMA

In 2004 the Ghent Development Authority organized a European urban design competition for the Old Dockyards project, won by the Office for Metropolitan Architecture (OMA), from Rotterdam in the Netherlands.

While historically the North-South docks borderline had always been a dominant factor of the site, OMA proposed to rotate the structure into a transverse position, opening the views up to the waterfront and the city beyond, and adding new transverse canals. This was the start of a new vision towards evolution of waterfront areas.

While in other cities the expansion line is actually visible and high buildings are erected along the waterline, the master planning of OMA proposed a sustainable connection with the second plan - the 'B' and 'C'-area, situated further away from the docks - by transverse alienation. By making this opening inland, the discussion about the future of the whole area further away from the 'golden waterside' could be reopened. This was an important moment; it became clear that extra studies about the entire area were necessary. In conclusion of the master planning of OMA, three zones were created for each of which the evolution could be proposed: 'A', 'B' and 'C'-area. At present, sogent is developing the 'A"-area and for the 'B' and 'C'-area there is a new spatial structure plan in preparation.



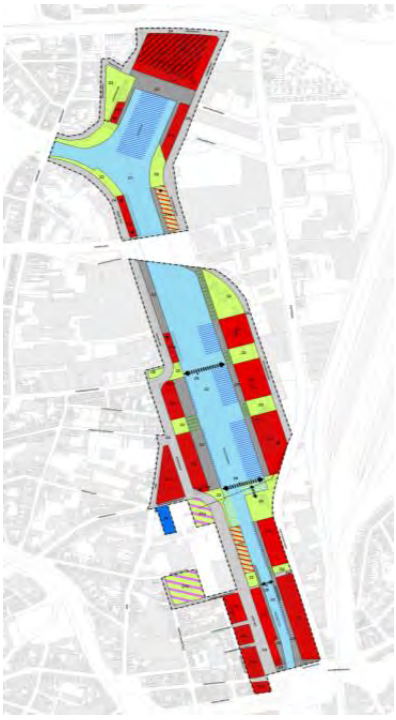


Image 6 and 7: The air view of the Masterplan, OMA, and the Spatial Structure Plan, archive city of Ghent.

Waterfront: a dream for a developer or for the citizen?

Because of this new policy, the concept of the waterfront in Ghent will be different than in other cities. The focus is not on financial aspects, but on creating a livable and vibrant new city district by fulfilling the needs of the city inhabitants. This means that the green areas will support the needs of the new dwellings, but will also give an answer to the lack of green in existing dwellings and that houses for families will be the first priority; this means less high-rise buildings and more one-family units. Also very important is the creation of a social network by providing playgrounds, a school and kindergarten, multifunctional halls for youngsters, a quarter library, and so on… For once, the sky is not the limit.

Every 19th century city should be grateful with such an evolution. The key success factor for the creation of the Old Dockyards project is general water management, involving the reorientation of the boat moorings, the creation of a new yacht harbour for tourism, the innovative stabilisation of the quays (12 different types of embankments, with a total length of nearly 5 km) by creating the new 'harbour' for houseboats and new parks on the water level.

Other important factors are the transformation of the accessibility of the Old Dockyards project and the creation of sustainable new public spaces. Different transport solutions are required to transform the accessibility of the Old Dockyards project. To increase the livability, the city ring road will be transferred and the new 'Verapaz' bridge will be constructed in 2018. The new walking and cycling bridge (Batavia-bridge) is already constructed and the two more are following up next years. Further, plenty of new open spaces, parks, urban squares, playgrounds and sports areas, water promenades, etcetera have to be modelled.

Our main aim is to create a successful waterfront project for the next generations. It means that in the Public Private Partnerships the issue of the sustainability is very important. All Public Private Partnerships are competitions and only the project with the highest level and most long term vision can succeed and can be chosen. It is not only the matter of building passive houses, we are asking for the innovation in sustainability, for example by winning the warmness from the dish and washing water, of by producing the bio-gas production based on the faecal water, creations of the smart city grid and so on. The first PPP for the realisation of 400 dwellings on the eastside of the Handels-dock subscribes those ambitions. Another innovative idea was to choose the consortium of developers and architects not only asking the help of the unintended jury, but to organise a "dialog café" for more than 100 inhabitants of Ghent who were discussing the project together and giving their pro's and contra's per project. This was quite unusual for Belgium to hold such an open "people-referendum".





Image 8 and 9: The air view of the first PPP-project by cvba Schipperskaai and a "dialog café", archive city of Ghent.

Innovation, creativity and uniqueness of the Bataviabridge

Considering the fact that the three bridges will be the focal point for all citizens entering the new district, an ambitious design, in close relation with the maritime history if the site was needed. Apart from that, inland navigation has to remain possible with the bridges in place, without breaking the continuously connection with the inner city for bicycles and pedestrians.
Dietmar Feichtinger Architectes from Paris submitted the winning design for the three bridges. The design concept is based on the idea of a jetty in steel and wood that links both sides of the water and forms an extension of the public space. To allow vessels to pass underneath the bridge, the central part is lifted, whilst still letting bicycles and pedestrians cross safely. This answered the demand of the city to have an ambitious and appealing design that acts as a (tourist) attraction for the city. At the same moment this is innovative design of the bridges by applying quite new techniques. When the Bataviabridge opens the movement speed is very low so everyone can still use the bridge, also when it is in an open position it is still accessible because the slope of the parts hanging on the lifting table increases from 0% to 9,0%.

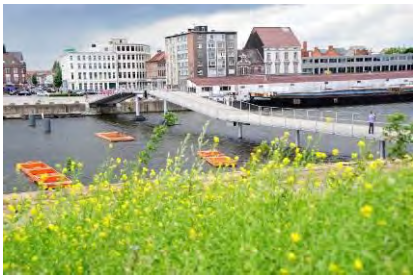




Image 10, 11 and 12: The opening of the Batavia bridge and the renovated quay wall Handels dock, archive city of Ghent and sogent.

Innovation, creativity and uniqueness of the quays

The renovation of the unstable quay walls is technical a very difficult issue and also it is very expensive. The sogent decided in corporation with the Flemish Waterway Manager to choose for a design with high ambition: in the Handels-dock the new quay wall provides a new pedestrian promenade of more than 600 meter long and gives the modern mooring structure into the first inhabitants of the Old Dockyards – the 34 houseboats are provided this way by all necessary utility services; in the Hout-dock the new quay wall provides a new pedestrian promenade of more than 400 meter long on the water level and a slipway makes a new marina possible.





Image 13, 14 and 15: The construction of the quay wall in Hout dock, and two futuristic views, archive city of Ghent and sogent.

Innovation, creativity and uniqueness in re-use of heritage

An interesting part of the plan is the commitment to maintain the historical character of the area by re-using elements of the architectural and industrial heritage. The strongly industrial scenery will develop towards a new municipal scenery which owes its character to the port.

Four cranes, a yellow and three blue ones, will always be part of the skyline. A former concrete plant will be largely preserved and will receive a new destination. It will be part of the largest park in the area. The remaining typical tracks for the goods carriages and the ship bollards will be integrated as much as possible in the layout of the new public spaces. Furthermore, a range of additional maritime industrial elements will be reintroduced into the public spaces of the Old Dockyards, from anchors to old train wagons. The intention is to create a touristic industrial route and at the same time provide some game incentives for children.

A very specific project, in terms of heritage and cohesion, is the renovation of a series of disused gravel tanks, formerly used for transferring gravel and sand between ships and trucks. By means of some limited interventions, a team of a young architect and an artist transformed this area into a unique multi-purpose public space. Today the setting is a hotspot for youngsters, artists and people from the neighbourhood.

More information: http://www.wallpaper.com/architecture/rotor-installation-at-the-grindbakken-warehouse-in-ghent/6103





Image 16, 17 and 18: The construction of the gravel tanks and two futuristic views, archive city of Ghent and sogent.

Innovation, creativity and uniqueness - temporary uses

Between the making of the plans and the effective realization of the project, years go by. The City of Ghent has special attention for the temporary use of grounds and buildings during these periods. Certainly in the Old Dockyards, where a whole new living area arises amidst existing surroundings, this aspect of the development is extremely important. By offering all kind of happenings, such as film, exhibitions, theatre, sports, city farm, urban agriculture, flea markets, handcrafts, and so on… for the neighbourhood and for Ghent's inhabitants, the Old Dockyards already become a part of the city. Today, the neglected dock area is putted on the mental map of the inhabitants and is alive. At the same time, it offers enormous opportunities in terms of communication. In a pleasant way, the City of Ghent can inform all visitors about the future plans.

More information: www.oudedokken.be, www.dokgent.be, www.de-stadstuin.be and www.019-ghent.org.

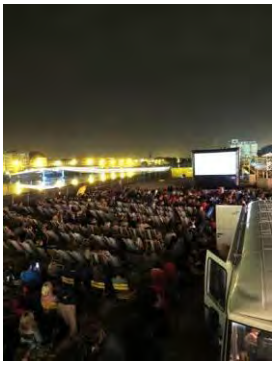








Image 19, 20, 21, 22, 23, 24 and 25: Some examples of the temporary use of the Old Dockyards area in 2013, archive city of Ghent and sogent.

Conclusions

In extremely complex projects such as this, flexibility is a necessity. The planning process of the Old Dockyards project took over ten years. During such a long period, the social and legal context is changing while working on the plans. The financial crisis arrived and changed ideas as well. A rigid attitude would be fatal. Which makes things even more complicated, is that there are tons of stakeholders: project partners, surrounding companies, future and current inhabitants, press and politics, and so on. You have to invest a lot of time in each of them. The result is that the project advances much slower than planned. Then again, a broad social basis is a mere condition for a successful project.

Another important, and very complicated, item is time. Will the implementation and realization of the urban planning policy indeed make the difference in one lifetime or one generation? In any case, already today there are various examples that really make the difference for anyone living in Ghent. Every day, the progress of the different urban renewal projects in Ghent is facing the complexity of the city evolution as a living organism. Every day, the city, the politicians as well as the developers are looking for the perfect equilibrium between the urban planning and the economic reality.

During the last couple of years, the city of Ghent has really turned its face towards the waterside. This process of reorientation has already made, and will be making, the city much more livable and attractive, in the inner city as well as in the old dockyards. This surely proves that a sustainable water infrastructure should be perceived as so much more than only the basis for city evolution and urban planning. It certainly gives an extra dimension to the city, a dimension that is not measurable or cannot be put into drawings or collages. Undoubtedly, thanks to that particular dimension, Ghent has been given the title of 'most enjoyable city of Flanders' (National Geographic Nov/Dec 2008).





Image 26 and 27: The futuristic views of the Old Dockyards, archive sogent.

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Industrial Development Zone: China's Contemporary Characteristic City Development Pattern

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Industrial development zone of China is defined and approved by the State Council, provinces, autonomous regions and municipalities in their urban planning areas, acquiring national preferential policies with tittles of Economic and Technological Development Zone, Free Trade Zone, New and High-Tech Industrial Development Zone, and National Tourism Vocation Zone，including preferential land use policy, tax policy, investment incentive policy and efficient management services.

At the beginning, Chinese industrial development zone was founded as an imitation of foreign export processing zone, but including not only the function of the development of industry, the understanding of central government decision-makers about it far exceeded the export processing industry. In fact, the development zones played a role of reform experimental area, and later became an important driving force of city development in China.

What course have Chinese industrial development zones experienced? How the construction of the zones promoted urbanization in China, and with what characteristics? This paper starts discussion focus on these questions, and suggests that now is a quality improvement stage after the earlier scale expansion phase.

1 The development course and construction characteristics of Chinese industrial development zones

The development course of Chinese industrial development zones can be divided into three stages so far: the initial stage, the roll out stage and the optimized development stage. There are many types of development zones in China, and the national economic development and hi-tech zones play a leading role. So we put these two types of development zones as the research objects, summarize the construction characteristics of the zones in different stages.

1.1 The initial stage (1984--1991)

The concept of industrial development zone first appeared in 1984, when the state council approved 14 economic and technological development zones in 12 coastal open cities. As early as in 1979, China has already had such type of special policy area—Special Economic Zone. In 1979,the government piloted "special export zone" in Shenzhen, Zhuhai, Shantou and Xiamen, later renamed to "special economic zone". In 1984, the central government continued to expand the scope of the special policy, 14 coastal open cities approved to establish special zones, which purpose was to "create a new situation in the use of foreign capital and the introduction of advanced technology; to grasp the technical transformation of old enterprises, develop a number of small investment, quick turnover, good earnings small and medium-sized projects; accumulate strength in terms of financial, material and human resources, support the nation, sum up the experience, and to the promote inland"[1]. In order to avoid political and ideological debate in that special era, the approval document specified new open city districts called "Economic and Technological Development Zone"[2].

The development zones of this phase, macro layout mainly scattered in the southeast coastal areas, coincided with treaty agreed open commercial port in last stage of Qing Dynasty.

At meso city level, the development zones were all isolated to the urban areas, which had a relationship with the ideological controversy at that time. For example, Beilun industrial development zone, was 27km away from downtown of Ningbo, Dalian development zone located in the Gulf of Jinzhou, 30km away from the urban area, Tianjin development zone, 50 kilometers away from the urban area, Qingdao development zone and Qingdao downtown separated by a Strait, Guangzhou development zone in Whampoa, Fuzhou Development Zone in the Mawei.

At the micro level, the new industrial space this period broke the “small and complete” mode of the Planned Economy Period, namely compound, in which the life and production function no longer entirely solved in the single enterprise, but achieve a variety of functions at the level of the development zone through the way social services. However, these services were mainly targeted at foreign investors, rather than Chinese workers.

1.2 The roll out stage (1992--2002)

After the Deng Xiaoping southern speech in 1992, the socialist market economic system gradually established in the Chinese in the voice of "emancipating the mind". The local governments broke the cautious, the development zones into a rapid development stage, also the laying stage of development zones’ strategic position.

At the macro perspective, the national economic and high-tech development zones approval experienced two high-tide periods. From 1992 to 1993, the state council approved 18 industrial development zones, including the Yingkou, Changchun, Shenyang, Harbin, Weihai, Kunshan, Hangzhou, Xiaoshan, Wenzhou, Dongshan, Guangzhou Rongqiao, Nansha, Huizhou Dayawan, Wuhu, Wuhan, Chongqing, Urumqi, Beijing, where spread at the eastern coastal area and along the main railway and Yangtze River. After the third batch of permission of 17 development zones from 2000 to 2002, including Hefei Zhengzhou, Xi'an, Changsha, Chengdu, Kunming, Guiyang, Nanchang, Shihezi, Xining, Taiyuan, Hohhot, Nanning, Yinchuan, Lhasa, Nanjing, Lanzhou included, almost all provincial capital cities had a national-level economic development zone.

At the meso level, different from the previous stage when the development zones far away from the city, the local governments founded the new development zones basically relying on the main city on this stage, and most zones built near the edge of the city and suburb. The zone closed to city can make use of the resources of the main city. Still, a few zones were built in the outer suburb of the mother city, but was set up close to the port, geographic island form no longer as a result of the political situation requires. The high-tech industrial development zones had more obvious characteristic of relying on mother cities.

At the micro level, the development zones of this stage had beyond the connotation of the initial industrial zone, and have had multiple functions just as a new town.

1.3 The optimized development stage (2003--)

After the rapid development of the second stage, the development zones had achieved remarkable results, also had many problems, we will discuss in detail at the following text. After the year 2003, the development zones transformed from extensive period to scientific and optimized development phase.

At the macro level, more development zones upgrade from the provincial level to national level in the nationwide. At the middle level, the interaction between the zones and the cities enhanced in this period. Also, it is the fastest stage that the development zones transform from industrial space to the city metro. At the micro level, some of the development zones have entered into the re-development phase, where land function replacement were very common.

2 The development of the industrial development zones and the advance of Chinese urbanization

Industrial development zones were the main battlefield of Chinese industrial development. Until 2002, there have been officially running 47 state-level economic development zones, in about 300 square kilometers of land ,which has obtained 311 billion yuan, accounting for 3% of national GDP, industrial added value 221 billion yuan, accounting for more than 6% of the national industrial production, tax revenue was 50 billion yuan, accounting for 2.9% of the whole nation, the total exports accounted for $27.54 billion, 8% of the national export, the actual use of foreign capital of $7.74 billion, more than 15% of the whole country[3]. Also, economic development zones promoted the city development. In 2003, the National Development and Reform Commission managed development zones rectification work. Before the rectification, there were 6866 national development zones in total, and the planning area was 3.86 square kilometers, more than the whole urban construction land area at that time[4].

2.1 The characteristics of contemporary city development pattern of China

There are four characteristics of Chinese city development pattern: first, it is a kind of urbanization model by leaps and bounds; second, it is developed from the industrial space gradually to the comprehensive new city; third, it is based on the land system of Chinese characteristics; lastly, the city government of China has played a very important role in the whole process.

2.1.1 Urbanization by leaps and bounds

Different from the European cities, which expanded mainly with the development of urban economy development, China's development-zone-driven urbanization mode is bouncing enclave. Development zones are usually in rural areas that leaving a certain distance to the urban areas, and these areas were often do not have large scale of industrial base and urban infrastructure. The management committee of development zone as the resident agencies of the local government, expropriated peasants' homes and farmland. Through the "seven accesses and site leveling" to build suitable facilities for industrial development and urban living in the areas where were no infrastructures originally.

2.1.2 From the industrial space gradually to the comprehensive new city

The development zones in China are mostly located in the outskirts of the city, they were not urbanization area and played the role of industrial production on the original. As the industries there are usually foreign capital enterprises and their technical level are relatively high, they represent the industrial development direction of that time. Thus , they are able to attract labor forces into unceasingly. As the population agglomeration, other industries also follow up, the function of the industrial districts transform into complex urban. In the process, there are two main groups people to become citizens, the first group is migrant workers, who engaged in non-agricultural production, and changed their profession and way of life here– namely urbanization; the other part is extremely has the Chinese characteristic, they are farmer group of passive urbanization in this area of landless, the original farmland are expropriated by the city government, so they engage in non-agricultural industries in the city after compensation.

2.1.3 Special land system is the basic condition

China's land belongs to the state and the collective, individual farmers do not have the ownership of the land. The inertia of the government's strong position in the Planned Economy Period, made the land expropriation relatively simple in a long time. Unlike Europe and the United States, the land in China is owned by local governments and rural collective, expropriation of rural collective land don't have to deal with every farmer, but deal with a "collective" which was not existed in fact, so the transaction cost is relatively low. According

to "the land law", the main value of compensation is limited the farmhouse and QingMiaoFei(compensation for crops), therefore the local government in the process of land expropriation preferred to plan large area, imposing more than needed.

2.1.4 The positive role of city government

The city governments of China have played an important role in the process of the development of the development zones, known as the "government company", because the government played as organization to produce and distribute.

The basic logic is: (1) the government monopoly in the primary land market, land obtained from farmers at a relatively low cost; (2) the local government sold a part of land to industrial enterprises at a very low price or even zero price, attracting enterprises to invest; (3) the industrial enterprises to invest in the area of land, and create jobs, pay taxes; (4) as mentioned above, industrial jobs increase, which driven the development of other industries, as a result, population concentration, compound function, and eventually to the city transformation; (5) in the process of the transformation, the local governments used another part of the land for residential and commercial development to earn a higher value-added benefits; (6) the value-added income produced from the change of farm land to industrial and commercial land was known as the land finance, which is the main source of infrastructure construction of local government, government workers wages and the land-lost farmers compensation. In the whole process, the city government just as an active large company, with the land monopoly, earned money and political performance.

2.2 City development pattern promoted by the development zones - A case study of Jiangning Development Zone, Nan Jing

Here we choose Jiangning Development Zone, a typical industrial development zone of the Yangtze River Delta, as the case to illustrate the characteristics of contemporary Chinese urbanization mode, showing the process of how a rural area in Nanjing, Jiangsu Province, China transformed into industrial development zone, and then became vice city of the large metropolitan area.

In 1990, Jiangning County of Nanjing City, was still rural area, the population of the center town (Dongshan Town) was less than 46000, the floating population rarely, and the rural industry underdeveloped, the area near Nanjing urban mainly bear the function of agricultural products supply just as most suburb in China.

In 1992, Jiangning district government established development zone by self-financing, grasped the opportunity of foreign investment and factory transfer from Nanjing city and rose up quickly. To the year 1997, because of the good development situation, the zone was approved by the central government upgraded to state-level development zone.

With the construction of development zone, the rural land began to be expropriated, and the original village population urbanization on the spot. At the same time, labor intensive industry developed in the zone, and floating population continued to increase. At the beginning of 2000, the city's population has increased to 280,000, including 68,000 temporary workers, and built urban area increased from 5 square kilometers in 1990 to 30 square kilometers and 20 square kilometers under construction.

About 2010, the urban population increased to 420,000, in which temporary resident population run up to 160,000, and built urban area increased to 65 square kilometers. Jiangning development zone has changed from industrial zone to the comprehensive function urbanized area, and Dongshan District’s development orientation in the overall planning of Nanjing city (2010--2020) development orientation development orientation development orientation is the "Vice City", which would rise the comprehensive service ability and enhance the ability of radiation on the surrounding area. With the subway line 1, 3 and 6 opened, Jiangning Development Zone and Nanjing city has been connected as one, the zone has become one important part of Nanjing city.

3 The current problems and new changes of the city development pattern

Urbanization promoted by the development zones has relatively low economic cost, it is the engine of Chinese export-oriented economic. The development speed is very fast, and become drive booster of urbanization during the thirty years after Chinese reform and opening. However, there are many problems and new changes in the economic and social challenges, these problems determine the development pattern must change from the scale expansion type to the quality optimized.

3.1 Extensive development caused land waste

Chinese special land ownership has made the land acquisition cost far less than the profit, which caused the local government's expansion impulse in land acquisition. The amount of land is not set with the actual need, but to maximize the land area. At the same time, in order to attract investors, the local governments also tend to sell land in large area and low price, which resulting in Chinese development zones land puffiness and waste popularly. For example, many types of development zones in Hebei Province near Beijing, occupied arable land but with low degree and criticized by public this month[5] (2014 June), this problem is very common in much development zones in China .

3.2 Not people-oriented but growth-oriented city development

For city government, the urbanization pattern promoted by development zone is a "low cost" urbanization so far. On the one hand, according to the existing land requisition compensation system, the local government in the process of land acquisition is relatively low compared to the later profit. On the other hand, because of the limits of the household registration system, city governments do not undertake public services for the migrant workers who engaged in non-agricultural labor in the zones. Migrant workers dedicated the best age to the construction and development of the zones but the city governments "save" a large amount of money in the migrant workers' personal and family welfare.

The low cost of city development pattern caused great social injustice that rural migrant workers cannot obtain the necessary welfare, in addition, the welfare isolation enhancement discretization of the migrant workers' families, and then becomes a social problem. While the economic costs reducing, in fact, the social cost is increasing, in which will become a bomb to the social stability.

Besides, part of famers who lost their land and become citizens passively lock the ability of employment are difficult to live in the city, that also become a destabilizing factor.

3.3 Changes in basic conditions – shake of land system and public consciousness of civil rights

Although rural land owned by the village collective, but the farmers have a permanent contract right of the land. If the farmers do not give up the contract right initiatively, they are the really owner of the land. In the earlier period, due to the ideological inertia, the farmers are subject to the local government's policy[6]. They did not recognized the high income of the local government obtained in their land, so they never think is there anything wrong to the city government's behavior.

But now, the farmer's consciousness in property rights gradually enhanced, they are recognizing the value of their land. If cannot get a high gains, they will not give up their property now. Therefore, the path of local government get financial resources through land acquisition are encountering challenge now, the original model is hard to endure. Nearly years, the events often appear in newspapers that the farmers defend their land property by extreme ways in China have a great relationship with this background.

3.4 Weakening status of the development zone as special policy area

The development zone is a specific area formed at a very special period, it has the support of special policies, such as tax, land use, management services advantages. However, the development zone as a special area is gradually disintegrating now.

First, strict limits on development zone land use. The state council in 2003 promulgated a policy named "the notice on the revamp of the zone, to strengthen construction land management", then in 2012 three departments of the state council issued the another policy named "the notice about carrying out all types of development zones cleaning rectification work ", ask the local governments to control the land use scale of the development zones strictly.

Secondly, the development zone is facing the change of policy environment. China began all-around open after joining the WTO in 2003, foreign enterprises will be give national treatment everywhere besides in the zones, which greatly weaken the attraction of the Development Zone. Also, the preferential finance policies gave by the central government to the development zones have ended after 2003. In 2007, industrial land sold must through the process bidding, auction, quotation, therefore, the advantage of low land price no longer exist. And in 2008, the preferential tax policies to foreign capital expired.

Thirdly, the concise and efficient management system of development zone is also facing pressure and challenges. Development zone management committee system is a product in special period where there are much control, conservative ideology, traditional thinking habits, and poor strong legal situation. At present, along with the market economy system gradually improving in the China, the government's function is changing and the legal system has great progress, so the original advantage of management committee system has been weakening.

Outlook

Chinese contemporary city development pattern is a mode promoted by development zones. The zones are important driving force for industrial development and urbanization since the reform and opening. In the support of special policies system, special land system conditions, and positive role of the city governments, Chinese city development promoted by the zones has characteristics jumped and from industrial space to comprehensive new town.

However, this pattern has some problems in the current stage, such as the land waste, ignore the human need, in addition, with the rise of farmers awareness on property rights and the end of special policies, the development mode must be transformed. Therefore, the city development pattern has gradually changing from the rapid size expansion to the internal quality optimization, especially in the coastal cities.

In addition, high-speed railway construction accelerated the integration of different cities in metropolitan level, and industrial cooperation between different development zones and regional commuter population would affect the reorganization of the development zones and the cities in regional level. Also, the industrial characteristics of the development zones' workforce now mainly are the new generation of migrant workers, they have more strongly needs to perfect social security, so the path only responsible for land compensation without service and guarantee now cannot continue, migrant workers' personal and family welfare become an important content must be considered. What's more, the labor intensive industries gradually transfer to the cost lower area, such as Vietnam and Indonesia, so the industrial upgrading to support long-term prosperity of the city is necessary.

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