

Research on the Construction of "Green Heart" Urban Agglomeration under the Thought of Ecological Civilization

The Practice of Taishan Urban Agglomeration

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Abstract

By summarizing the planning of Randstad urban agglomeration, this paper studies the framework and ideas for the construction of urban agglomeration with natural elements as the core from the three levels of system level, control level and implementation level, explores the specific implementation path of "Green Heart" urban agglomeration planning and with Taishan urban agglomeration as the practice.

Keywords

Ecological civilization, Green heart, Urban agglomeration, Mount Taishan

1. Introduce

For a long time, urban planning determined by single planned economy and single market economy has caused great harm to urban sustainable development. China has to face a series of problems, such as the shortage of resources, the intensification of environmental pollution, and the continuous erosion of the ecosystem¹⁻².

In recent years, ecological civilization has been raised to a prominent position by the Chinese government, which has led to a change in the thinking of urban and rural planning and development in Chinese academic circles. Urban agglomeration is an important carrier for the coordinated development of large, medium and small cities in the future, and a key element to participate in global economic competition and industrial division.

However, at present, there are problems of siphon effect of large cities and unequal distribution of resources among cities in China's urban agglomeration. Under the background of ecological civilization, urban agglomerations are required to not only ensure the continuity and integrity of their own ecosystem, but also promote the coordinated development between cities, so as to play the leading role of urban agglomerations.

This paper studies the framework and ideas for the construction of urban agglomeration with natural elements as the core from the three levels of system level, control level and implementation level, explores the specific implementation path of "Green Heart" urban agglomeration planning and with Taishan urban agglomeration as the practice.

Including the aspects of overall pattern, transportation, industry, culture, public service facilities, government cooperation mechanism, etc.

2. Ecological civilization & urban agglomeration

As the main spatial carrier of China's urbanization, urban agglomeration has always been widely concerned by scholars.

Although there is no unified conclusion on the concept of urban agglomerations, and there are also disputes on the definition of indicators such as the size, spatial scope and economic strength of urban agglomerations³⁻⁵.

It is generally believed that urban agglomerations are specific areas formed by one or more large cities as core cities and surrounding towns of different sizes through transportation, spatial connection and other means, and the regional economy and society are closely linked³⁻⁷.

In terms of urban agglomeration planning, it is necessary to focus on coordinating land use⁸⁻¹⁰, infrastructure construction and economic links among cities¹¹⁻¹⁴, and emphasize the driving role of core cities¹⁵⁻¹⁶.

However, the trend of the continuous expansion of urban agglomerations has put great pressure on the ecology and environment, and its sustainable development has been severely challenged. This has led scholars to pay attention to the ecology and environment of urban agglomerations¹⁷⁻²².

Some scholars believe that in the future, the urban agglomeration should be infused with the new concept of ecological civilization, and the internal development of the urban agglomeration should gradually shift to the development stage based on connotation cooperation, and explore the planning practice¹⁹⁻²².

In 2017, the 19th National Congress of the Communist Party of China raised the ecological civilization to a very high level, believing that "building ecological civilization is the millennium plan for the sustainable development of the Chinese nation".

In fact, the idea of ecological civilization has long been reflected in Chinese traditional culture. Taoism, Confucianism and Buddhism have expounded the views of "man and nature" from different angles, such as Zhuangzi's "theory that man is an integral part of nature", Dong Zhongshu's "telephony between human and nature" and Buddhism's "all beings have Buddha nature".

In the 1980s, Mr. Ye Qianji, an ecologist, clearly used the concept of "ecological civilization" for the first time in the academic circles, and defined it as "human beings are not only beneficial to nature, but also beneficial to nature. While transforming nature, they also protect nature, and maintain a harmonious and unified relationship between man and nature".

Since then, the "ecological civilization" has been widely concerned by the academic community, and its development connotation and practice mode have been constantly improved. In general, the core issue is the relationship between man and nature, including natural ecology, system ecology and philosophy Ecology.

Therefore, we believe that the core concept of ecological civilization is to pursue the harmonious relationship between human beings and nature, while maintaining the balance of natural, economic, social and cultural complex systems.

Under the new concept of ecological civilization, the traditional urban agglomeration planning mode with spatial planning as the core and emphasizing the economic links between cities is challenged. We take

the Taishan urban agglomeration as an example to integrate the concept of ecological civilization into the construction of the urban agglomeration.

3. Randstad - a model for the construction of "Green Heart" urban agglomerations

Randstad is located in the west of the Netherlands, straddling the South Netherlands, the North Netherlands, Utrecht and Flemish provinces. It is a ring-shaped multi center urban area composed of the four largest cities in the Netherlands (Amsterdam, Rotterdam, Haihe and Utrecht) and many small cities in between (Fig. 1).

Randstad is the most developed core area of the Dutch economy. It is also known for the "Green Heart" strategy, which refers to the agricultural area of about 400 square kilometers in the middle of Randstad, with both landscape and ecological functions.

All cities in the region are arranged around the "Green Heart", including the infrastructure construction between cities. Therefore, Randstad is called "green metropolis".

The construction of Randstad gives us some inspiration.



Figure 1. Spatial structure and "Green Heart" distribution of Randstad. Source: ResearchGate.

3.1. Spatial organization with natural elements as the core

At the end of the 1950s, the Dutch government began to take countermeasures against the blind expansion and disordered development of the cities in Randstad caused by the rapid growth of economy and population, and tried to protect the central agricultural green space in Randstad through national spatial planning.

The first national spatial plan was issued in 1960, which clearly proposed to reserve the green center in the middle of the region, and the protection strategy of "Green Heart" was continued in the subsequent national spatial plans (Table 1).

The boundary of "Green Heart" was also adjusted with the development policies of different periods. It was not until the early 1990s that the boundary of "Green Heart" was formally determined and became the sacred area of Randstad spatial planning (Fig. 2).

Table 1 Five spatial planning in Randstad, the Netherlands Source: References 23.24

Time	Plan	Primary Coverage
1958	1958 Randstad development Plan	Keep the scattered circular distribution of the urban agglomeration in the West Netherlands, and protect the central agricultural area as a large-scale open space
1966	The second national spatial planning	Adopt the core diffusion planning mode and strengthen the concept of "Green Heart"
1973-1983	The third space planning	The specific development plan replaces the scattered layout and proposes to take 14 towns as the growth centers
1988	The fourth national spatial planning	All residences are arranged outside the boundary of "Green Heart" to separate urban and rural areas through "Green Heart".
2000	The fifth space planning	Introduce "red line" and "green line" to delimit urban development areas and important green spaces

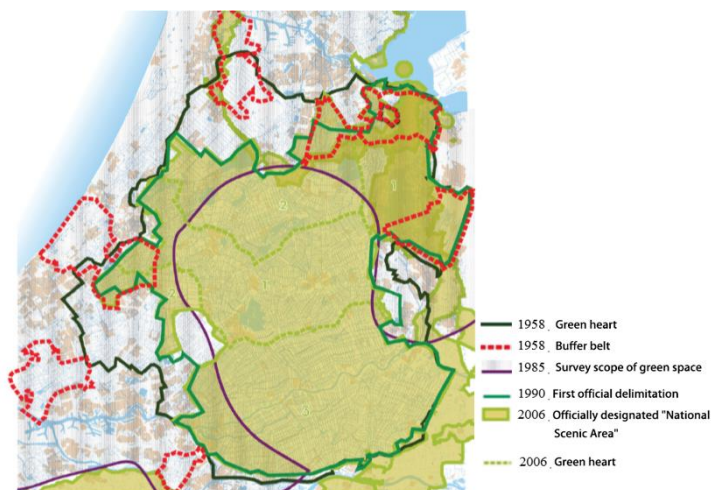


Figure 2. Changes in the scope of "Green Heart". Source: reference 23.

3.2. Urban network with complementary functions

Randstad is a typical case of an urban agglomeration composed of multiple functionally complementary cities. Its adherence to the planning policy of "Green Heart" protection is one of the important reasons for the formation of the unique multi center network structure in the region.

In order to prevent the excessive expansion of urban population and land use from eroding the "Green Heart", the Dutch government has focused on the implementation of multi center planning in Randstad area according to local conditions since the 1950s.

In the 1960s, the Dutch government proposed to evacuate the population, functions and other elements of Amsterdam, Utrecht, Rotterdam and other large cities to the surrounding small towns in an orderly manner, so as to relieve the resource pressure of large cities and prevent the continuous development of cities. This action effectively avoided the emergence of mega cities and formed a flat urban hierarchy.

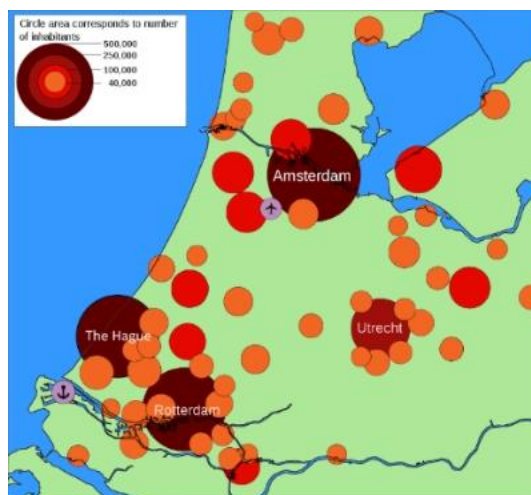


Figure 3. Population size distribution map of Randstad urban agglomeration. Source: Wikipedia.

On the whole, Randstad has no so-called first city. Amsterdam, the largest city in the Netherlands, has a population primacy of only 1.7 (Fig.3).

The reason is that the region has always emphasized the division of labor and complementarity among cities, and dispersed the various functions of a large city to cities of different levels and scales to form an independent and connected urban area ²⁶.

Therefore, the four major cities and small and medium-sized cities have gradually formed their own characteristics by relying on their own advantages (Table 2).

Table 2 overview of main cities in Randstad. Source: References.

	Development	Urban positioning	Prime Mover Industry
Amsterdam	capital	Financial, trade, tourism, culture and Art Center	Finance, services, network and communication technology, publishing and printing, tourism and culture
Rotterdam	The second largest city in the Netherlands	International shipping hub and international trade center	Transportation industry and port manufacturing industry
Hague	The third largest city in the Netherlands	political center	Numerous government agencies, national assembly halls, embassies, international organizations, etc
Utrecht	The fourth largest city in the Netherlands	Transportation hub city and National Conference Center	Transportation, culture and education, trade wholesale

3.3. Efficient and convenient traffic conditions

Since the 1990s, Randstad has paid attention to the construction of infrastructure and tried to build an "urban network" through efficient transportation network construction. Subsequently, under the background of global informatization and network development, relying on the efficient and convenient transportation conditions in the region, the economic links between cities are more frequent.



Figure 4. Spatial structure and main traffic network of the built-up area in Randstad in 1870, 1950 and 1990
Source: References

3.4. Diversified regional management platform

In order to form a real "urban network", Randstad has established regional coordination organizations such as the Randstad region, the Administrative Committee for the Randstad, the "Green Heart" platform, and the Delta Metropolis Association, forming a diversified participation system with regional organizations as the platform under the leadership of the government.

In order to ensure the coordinated development of land resources, ecological environment, infrastructure and industrial economy in the region, and avoid the scattered situation in which local governments only focus on their own interests under the background of urban autonomy (Table 3).

Table 3. Important regional coordination organizations in the Randstad region Source: Reference 6.

Organization	Time	Participant	Main Responsibilities
Randstad region	1991	South Netherlands, North Netherlands, Utrecht and Flemish	Consultation policy and external publicity
Administrative Committee for the Randstad	1998	The central government, the four provinces of Randstad, the four major cities of Randstad and the municipal authorities	Advisory body, which initially coordinated the central government's space investment in Randstad, and later discussed the spatial planning of Randstad
"Green Heart" platform	1998	Relevant national ministries and commissions, provincial governments and four major cities	Do a good job in the protection of "Green Heart" and the implementation and supervision of national policies
Delta Metropolis Association	2000	Four major cities and other local councils and interest groups	Promote the transformation of Randstad Delta Metropolis and encourage mutual cooperation between regions

4. Take natural space as the core to construct the theoretical framework of urban agglomeration

We believe that ecological civilization includes three levels: natural ecology, system ecology and philosophy ecology. Philosophical ecology is the highest state of the development of ecological

civilization, representing the cognitive transition from the most literal meaning to the natural social complex system.

In essence, the philosophical meaning of ecological civilization is to build a natural social life community, which is reflected in the theory of urban agglomeration, that is, it is regarded as an open composite system, including three system levels: natural ecological system, social environmental system and natural social composite system.

The focus of the construction of urban agglomeration is to coordinate and control all elements in the system. It is required that the internal and external relations of the system should be stable, and the coordinated development of urban agglomeration should be ensured through specific planning and Implementation (Fig. 5).

(1)System level

In the process of urban agglomeration planning, the first consideration is to maintain the integrity and continuity of the regional ecosystem.

In addition, the nature society composite system regards nature and society as a community. In the process of the development of the urban agglomeration, it should not only respect the natural elements, or only emphasize the initiative of people to society, but also pursue the harmonious development of human and nature in the urban agglomeration, so as to achieve the coordination and unification of ecological protection and social progress, and achieve the double improvement of natural and social elements through planning.

(2)Control level

The complexity of urban agglomeration determines that it involves many elements, including ecological environment, industrial economy, urban culture, social life and other fields.

Among them, the control and protection of the ecological environment is the primary objective. In the traditional urban agglomeration planning, the natural environment is often regarded as the restriction and constraint condition of economic development due to the lack of obvious interest subjects, which is squeezed or even destroyed. Taking the control of ecological elements as the premise of the construction of urban agglomeration is conducive to protecting the natural environment from erosion.

The coordinated allocation of economic elements is the core driving force for the development of urban agglomerations. With the development of globalization and informatization, the new economy is rebuilding the location space of cities. It requires that the planning of urban agglomerations should proceed from the overall interests and make the economic elements flow through the coordinated division of industries.

The inheritance and innovation of culture is the brand building of the urban agglomeration. Due to the geographical similarity, the cultures of different cities in the urban agglomeration have the same root. The cultural characteristics of the urban agglomeration can be strengthened through optimization and integration.

(3)Implementation level

At the implementation level, attention is paid to the solution of the actual problems of the urban agglomeration, which requires the implementation of element control through operable planning strategies and methods, which can be specifically divided into two aspects: factor planning and support system.

Factor planning focuses on the coordinated allocation of resources, including natural resources, economic resources and cultural resources. The support system emphasizes resource sharing, mainly including infrastructure sharing and cooperation mechanism construction.

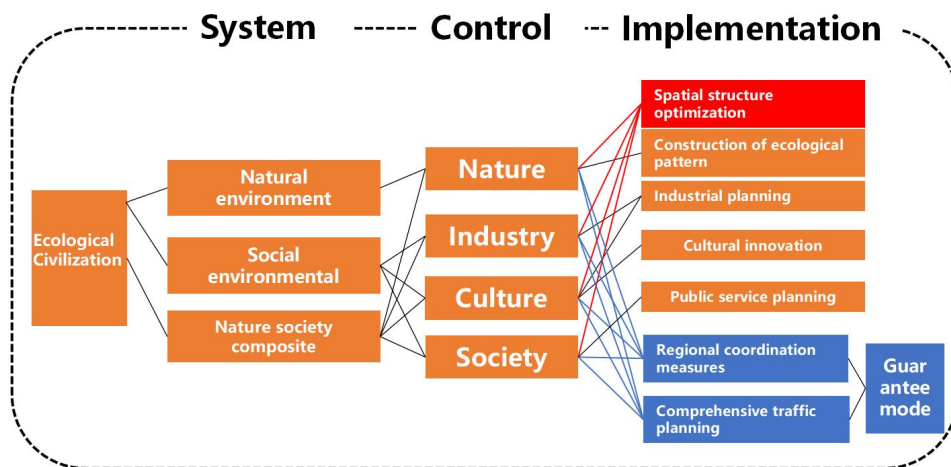


Figure 5. Framework of building urban agglomeration with natural elements as the core. Source: Author.

5. Planning practice of Taishan urban agglomeration

Taishan urban agglomeration is located in the central and western regions of Shandong Province, China. It covers seven prefecture level cities including Jinan, Tai'an, Zibo, Laiwu, Dezhou, Liaocheng and Jining. The Taishan mountain range stretches between Jinan, Tai'an and Laiwu. It has rich cultural heritage and beautiful natural environment. It is a world natural and cultural heritage.

Some data of all cities in Taishan urban agglomeration are as follows¹:

Table 4. Economic and population data of the Taishan urban agglomeration in 2020
Source: 2021 statistical yearbook of Shandong province

City	GDP (100million yuan)	Population (10000 persons)	Prime Mover Industry
Jinan	10140.9	924.16	Equipment manufacturing, computer communication, steel smelting and processing, petrochemical industry
Tai'an	2766.4	547.85	Coal, equipment manufacturing, oil processing, cement manufacturing, agricultural and sideline food processing
Zibo	3673.5	470.56	Ceramic processing, petrochemical industry, equipment manufacturing
Jining	4494.3	836.07	Textile industry, rubber manufacturing and paper manufacturing
Liaocheng	2316.8	595.25	Equipment manufacturing, mechanical parts manufacturing, steel processing
Dezhou	3078.9	561.36	Petrochemical, auto parts manufacturing, pharmaceutical manufacturing, textile industry

¹ In the 2020 index statistics, Laiwu City belongs to Jinan City, so there is no separate data statistics

5.1. Nature first: strengthening the ecological pattern of Taishan urban agglomeration

There are abundant ecological elements in the surrounding Taishan urban agglomeration. There are not only Taishan mountain range, but also Lushan mountain range and Yimeng mountain range. There are also natural water systems such as the Yellow River, Dawen River, Dongping Lake, Xueye lake, Weishan Lake and Daming Lake.

We believe that ecological protection should be taken as the premise of the development of urban agglomerations to promote ecological protection and environmental governance among cities.

Specific embodiments include:

- (1) Strictly protect important ecological spaces, delimit ecological protection red lines, and strengthen regional protection of ecological red lines.
- (2) In view of the damage of some mountains in the metropolitan area around Mount Tai, the mountain restoration and treatment project was implemented.
- (3) Water and soil conservation tillage, forest and grass planting and engineering measures shall be adopted to protect water and soil resources in urban areas.
- (4) Strengthen joint prevention and control of air pollution in the metropolitan area around Mount Taishan.
- (5) Strengthen the control of water pollution.

More importantly, it is necessary to strengthen the ecological corridor between Jinan and Tai'an, and reserve a green channel for the future of the city in combination.

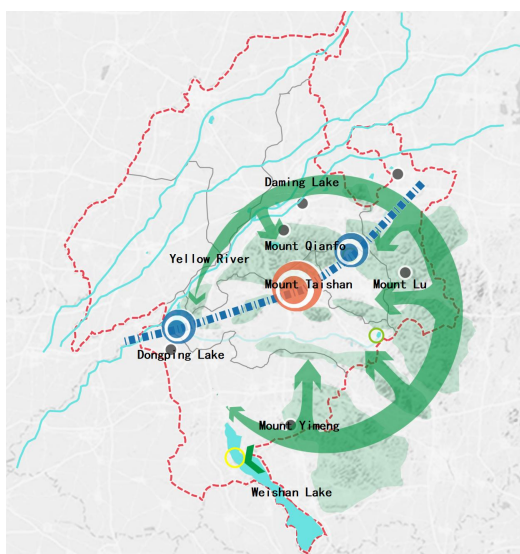


Figure 6. Integration of ecological elements in the Taishan urban agglomeration. Source: Author.

5.2. Collaborative Innovation: the building of industrial community of urban agglomeration

The advantageous industries of cities in Taishan urban agglomeration are similar, mainly concentrated in manufacturing, petrochemical, steel smelting, coal mining, agricultural and sideline food processing and other industries.

With the upgrading of industrial structure, the economic development of urban agglomeration is restricted. In the long run, while maintaining the development advantages of basic industries, cities should make use of policy advantages to stimulate industrial innovation, strive to extend the industrial chain, and strengthen the links between the industrial economies of cities.

The specific performance is as follows:

- (1) Integrate regional resources, create an industrial community, and strengthen the linkage with surrounding urban agglomerations.
- (2) Make clear the comparative advantages between cities and carry out differential positioning among industries.

5.3. Cultural inheritance: the construction of cultural tourism routes around the Taishan urban agglomeration

The Taishan urban agglomeration has rich historical and cultural relics. Different cities in the region have different representative cultures, such as the canal culture in Jinan, the Taishan culture in Tai'an , the Confucian culture in Qufu, and the spring culture in Jinan. These cultures are of the same origin and integrate with each other, so that the surrounding Taishan urban agglomeration presents relatively unified cultural characteristics.

Based on the historical culture and ecological landscape, we can build unique cultural tourism routes in circles to turn cultural resources into economic power.

5.4. Traffic support: rapid transit network stimulates integrated development

Most of the trips in the urban agglomerations around Taishan are short and medium distance trips, which determines that the urban agglomerations should build an efficient and convenient comprehensive transportation system supported by intercity railways and expressways and supplemented by other means to realize a one-hour traffic circle in the urban circle (Fig. 7).

- (1) Improve the expressway network layout, rely on the existing expressway network, and focus on increasing the connectivity between trunk expressways to improve the traffic capacity of expressways.
- (2) We will accelerate the development of intercity rail transit and build an "one ring + one belt + radiation" intercity rail network.

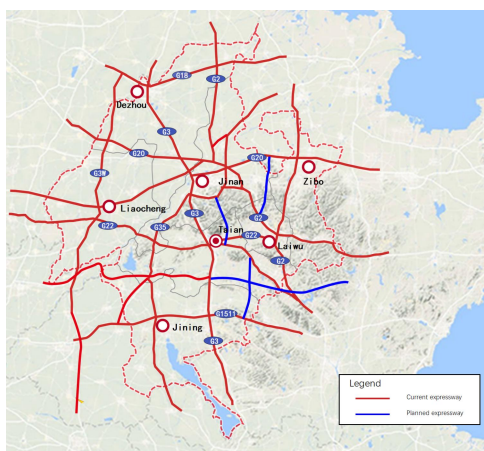


Figure 7. Traffic planning map of Taishan urban agglomeration. Source: Author.

5.5. Top level design: construction of government cooperation platform

The management system of urban agglomerations with natural elements as the core is a big problem. Unlike the traditional core urban agglomerations, such urban agglomerations lack a strong central city as the management traction.

In order to improve the synergy efficiency between cities, it is necessary to establish an innovative management system to implement top-level design and management for the protection and construction of natural elements of urban agglomeration, the spatial planning of construction areas and the coordinated development of social elements.

Based on the management experience of Randstad area, the following two schemes are proposed.

(1) The Committee of Taishan urban agglomeration was established. The Committee regularly held urban cooperation meetings with the participation of mayors to discuss common issues in the development and coordination of the urban agglomeration.

(2) In the form of "alliance", we will build a cultural, educational and Enterprise Service Alliance for the surrounding Taishan urban agglomeration. Promote the flow of factors between cities.

6. Conclusion

The "Green Heart" urban agglomeration is an innovative concept that conforms to the concept of ecological civilization. There are many famous mountains and rivers in the world, and the natural resources are abundant. The construction mode of urban agglomeration with natural ecological elements as the core has very important promotion significance.

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