

Climate Change and the Impacts on Urban Planning and Design in Iranian Cities

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Abstract

Climate change is a key challenge 21st century that many countries are facing with and everywhere has different consequences based on local characteristics. Referring back to the substance of the century as century of cities, it's time to do a paradigm shift in urban planning and design. Such transformation in urban planning and design thoughts is critically needed in those countries which has a background of climate change geographically and historically. Iran is one of these countries that is touching the effects of climate change. Having different microclimate in the country, the challenge has been emerged in different face.

This article, first, is trying to elaborate the challenges resulting from climate change in Iranian cities and second assess the consequences and effects on everyday life of cities. Then, the text is directing to the introducing new solutions which is relating more to the process of urban planning and design.

As a methodology of the research two cities Tehran (the capital) and Ahvaz (the main reference city of dust storm) will be analyzed based on content analysis of official documents, environmentalist ideas and public opinions in social networks media. Also, some evidence of historical urban innovations adapting climate challenge will be analyzed based through case studies of Isfahan and Bushehr.

Some results demonstrate that complexity of climate challenge is more in metropolitan areas of Iran because combining the challenge with social challenges. Also, it is needed to change educational dimension of urban planning and design at universities, institutes and urban government section relating to climate change. To accelerate urban change according climate change, Iranian cities needs more engagement of people and urban-based NGOs.

Keywords: climate change, Iran, urban planning, urban design

1. Introduction

Starting period of 21st first century is an inspiring and disappointing ear for cities. It's a paradoxical situation because of the role of cities as main places of living, economy, and creativity and innovation one hand and crucial places for living, health and happiness because of complex, continuous and increasing challenges. Climate change is one these challenges which is encompassing and surrounding all of other challenges. Somehow it's more critical and essential than others. Such challenge is effecting on cities because of changes out of cities in regional, national and global level and also it has creating because of changes resulting of human actions in urban spaces and architectural level. Cities of this century tend to be extremely resource intensive and contribute hugely to increases in greenhouse gas emissions and consequently, climate change.

The impact of urban systems on climate change is illustrated by the fact that 75% of all greenhouse gas emissions are generated in the world's urban areas (UN, 2007); while only approximately half of the planet's population live in closer settlements. In other words, urban systems are a principal source of emerging climate threats (ESPACE, 2008 and Shalaby & Aboelnaga, 2017). The Third Assessment Report of the 'Intergovernmental Panel on Climate

Change' (IPCC) brought world attention to the likely impacts of climate change (Metz 2001). Climate change is now at the forefront of debate with dire warnings that worldwide temperatures may rise from 5 to 11 degrees C. over the next 50-100 years (Blakely, Edward, 2017) The extent of future climate change depends on a number of variables including the pace of greenhouse gas emissions, deforestation rates, and the response of ecosystems to the changing climate (Jeremy G. Carter. et al 2015) The specific effects of climate change on urban systems will vary depending on location, but may include reductions in potable water, more regular and severe weather events such as heavy rain-falls and cyclones, increased incidences of flooding, inland storm surges and an increase in extreme heat events.(Shalaby & Aboelnaga, 2017)

Referring back to the nature of climate change, the challenge is connecting local and global level of thinking on cities coherently which is opportunity and threat in the same time. Despite this role of climate change, knowledge of urban planning and design as a main discipline related to everyday life of cities is not well equipped. While urban planners are mostly seen as responsible and capable of adapting to disasters and climate risk (IPCC, 2007) their role, the actions to be accepted, and the responsibilities of city agencies are often unclear (Greiving & Fleischhauer, 2012). From urban design point view despite the discipline is the most effective discipline on urban form, climate change is not a key issue in urban design practices. This weakness can be seen also in urban planning and design pedagogy, so that's why we need a massive change in urban planning and design thoughts in the era of climate change.

Such need is more emergency and critical in the cities which have a prior context of climate change geographically and historically. Middle-east countries like Iran has this background from ancient times that's why we can see urban and architectural innovations adaptive to climate in Iranian cities during the history. We have different climate in Iran and the effects of climate change on cities in each climate are different. Mostly water tension or aridity is a key challenge for most cities of Iran especially those are in the deserts.

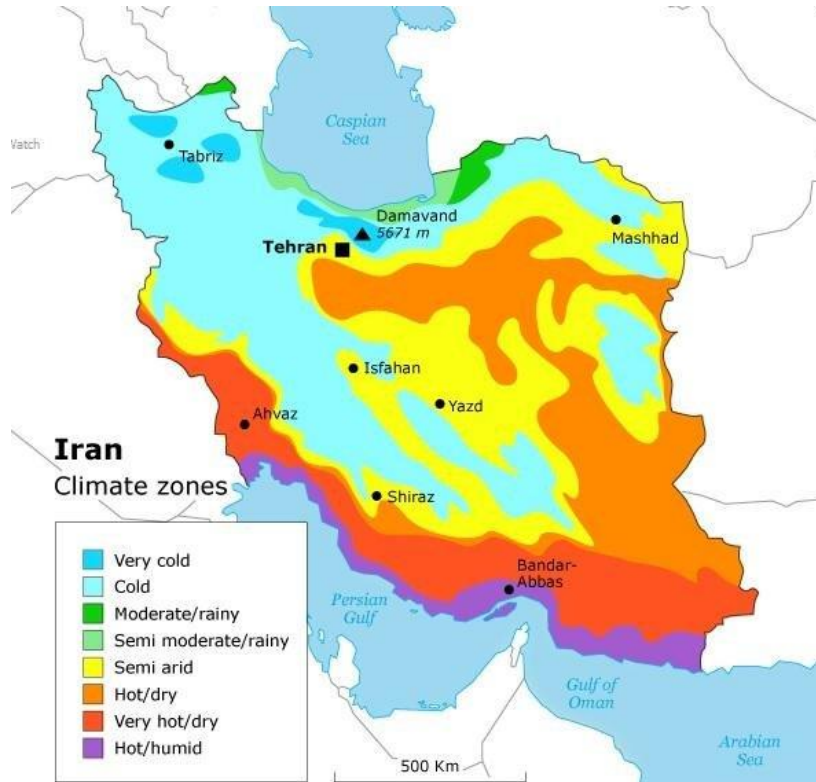


Figure 1: Climate zones of Iran (Alizade Govarchin Ghale, 2014)

But it's not all, there is another face of the challenge when we look at the water conflicts in the Middle East and the results are emerging in Iranian cities in the form of dust storm. For example environmental changes in Iraq including disappearing ponds effects on south-west part of Iran in the form dust in Iranian cities. Moreover, inappropriate national and regional policymaking in water management in Iran has created new challenges locally for instance the salt storm in north-west of Iran because of water tension of Uremia Lake. Adding everyday challenges related to pollution, traffic, quality of life, etc. especially in metropolitan cities of Iran, it's time for Iranian cities to make new decisions. Looking to Iranian cities situation according to face climate challenges in modern era especially in recent four decades reveals that they are directing in a way versus their history. With the enrich background of Iranian cities, they can recognize, recreate and regenerate facing climate change challenge.

This article is trying to highlight the climate change challenges in Iranian cities from urban planning and design point of view. After analyzing the impacts on urban spaces and everyday life, beyond formal and physical solutions like increasing green areas of the city, the article introducing approaches to change the way of thinking urban planning and design of contemporary Iranian cities.

2. Methodology

As a first step two case studies have been chosen to show the historical background of climate adaption knowledge in Iranian cities. Isfahan is one of these cases which is notable because of intelligent distribution of water in the city. The other one is Bushehr which is significant because smart design of city according to wind in sever hot humid climate. The goal of this analysis is demonstrating Iranian people awareness of mutual interaction of climate situation and form of city. The content analysis of selected previous studies is main method in this step. The second step of the research is concentrating on two contemporary cities in which the effect of climate change is crystal clear in different faces. Tehran (the capital) is first case in which we can see the effects of urban planning actions on intensification of climate change impacts. Ahvaz, the center of Khuzestan province, is the second case in which we can consider impacts of climate change happening out of the city in regional level but affecting on everyday life people. Content analysis of official documents, environmentalist ideas and public opinions in social networks media are methods in this step. These combination of case studies provide a basis to think about future of Iranian cities in climate change era.

3. Discussion

3.1. *Urban innovations adaptive to climate in the history of Iranian cities*

- **Isfahan; "Madi" an innovation of flowing water in a desert city**

Isfahan is a city in the central desert of Iran. Nowadays, Isfahan is one metropolitan cities of Iran in which water tension and aridity have caused a lot of changes. The river as the main element of city during the history has no water because of establishing a dam on the river. Water transferring projects from the source of Isfahan river (Zayanda-rud) to other cities in desert like Yaz has been effected on current situation Isfahan. In other word human intervention in ecosystem intensified climate change effects which in Isfahan mostly reflected in lack of precipitation. The climate situation of the city has not been changed a lot but human thinking about urban and regional planning of the city has been changed enormously in comparison to Safavid period (17th-18th century) when a scientist implemented a plan for flowing the river water in the city. He introduced new water ways with the name of "Madi" which was part of a greater plan of irrigation. Madi-s had a role of channeling water from the river into the city and its main elements like mosques, public baths and private houses. They were also used in cultivating fields and orchards (Falihat, 2014). Different studies have been

analyzed the effect of Madi-s on urban structure of Isfahan in different periods where most of main elements of city like mosques, gardens and square have been shaped according to Madi-s direction. (Falahat,2014and Namdarian, 2016) From perspective of thermal comfort we can understand the unique impacts of Madi-s in urban spaces of Isfahan coherent with the impacts on aesthetical qualities of urban spaces. Nowadays, most of Madi-s are empty of water and we need to refer back on the thoughts behind Madi-s such as urban- environmtal planning and design and multi-knowledge urban planner and designers.



Figure 2: (left) Madi-s and some of main urban and architectural spaces of Isfahan (Namdarian, et al., 2016), (right) creating special urban spaces in a desert city based on Madi-s

- **Bushehr; climatic urban design from site selection to architectural details**

The Northern side of Persian Gulf has a special climate which is hot and humid. The average humidity is 70 percent and the temperature increases to 40 centigrade between May and July. The old Bushehr somehow is a contemporary city in comparison to long history of Iran. The city has been created around 300 years ago with a special plan to tolerate the effects of such climate on everyday life. We can see clearly climatic design initiatives according to wind in old Bushehr. The unique value of these initiatives is related to a deep connection between public and private space to use wind. It has caused a unique townscape in old Bushehr. In other word there is a hierarchy of climatic design respect to wind from whole city to buildings. Different ways of using maximum wind have created a visual diversity in urban facades (Ranjbar, et al.2011). The urban innovations regarding climate condition in old Bushehr can be summarized in these points:

- The location and site selection of Bushehr as a peninsula is a first step to catch wind in the city. In comparison with linear form of city it is more complicated to conduct wind into the city but the amount of wind is more. The special urban open spaces network has changed this threat to opportunity of catching maximum wind.
- According to effect of topography on wind flow, Bushehr position has a windward topography.
- With regard to climatic effects of density and height of built up area old Bushehr has an appropriate roughness that creates dentate texture in the face of wind flow in the sky. This specific height distribution provides the context for more wind disturbance and conduction of it to lower level.
- According to locating high-rise buildings among lower buildings, review of plazas in old Bushehr present this principle. The height difference sometimes is four floors.

- Location of high building at the edge of plazas in Bushehr conducts regional winds to pedestrian level and specific form of plaza provide more movement of wind and its distribution to streets that connects to plaza.
- Specific design of streets in Bushehr like their orientation, special profile, wall projection at first floor, special facad design, organic form, etc. increase the wind disturbance in main streets and alleys.
- There are a few dead ends and buildings have four side that relates to open space. So each side can catch different winds in different directions.
- The external walls of buildings in Bushehr are climatic facades. Different forms of windows, Shenshirs, Boons, etc. shows various methods of absorbing and conducting wind into residential spaces.

So, old Bushehr is an important case that presents a maximum use of wind for creating thermal comfort in both urban public spaces and residential spaces. The next importance is mixing these climatic designs with specific customs and daily life. (Ranjbar, et al.2011)



Figure 3: old Bushehr, smart design of a city where a climatic design integrated with townscape design and everyday life planning

These two case studies of Isfahan and Bushehr show the record of Iranian cities mitigation with difficult climate condition all over the country in the history. It means there was local knowledge about adaptation to climate because in the history general people were urban planner and designers. So a big question is rising that what happened in these days that Iranian cities are not so successful to mitigate and adapt to climate change? In other word there was a culture of mitigating climate changes in Iranian cities which we need to remind the memory of people about this culture. The next two sections analyze contemporary mitigation with climate change in two cities of Iran to provide a better context of comparing past, present and future of Iranian cities regarding mitigation and adaptation of climate change.

3.2. *Tehran; an urban lab for environmental challenges*

Based on our living experience in Tehran and data from virtual social networks, from a decade ago one term has been fixed in everyday dialogue of people of Tehran which is the air quality. Mostly in winter time when the inversion phenomenon is accruing more. Having 200 polluted days in recent years of Tehran highlights the environmental challenge of Tehran. Researches on the effects of climate change on Tehran microclimate reveals these change in different classification (Saligeh, 2015):

- Air stability
- Increasing average temperature
- Changing pattern of wind flow

These consequences of climate change have been intensified because of urban planning actions especially in terms of mobility plans and land use planning. Death rate resulted from air pollution around 4800 people a year, shows the impacts on health and everyday life in

Tehran. Through different researches the effects of urban planning actions on creating urban heat islands in Tehran has been understood. In other word, urban changes inner the city intensifies the climate change impacts. Looking at to the data of Tehran Municipality tell us that during the recent 12 years, highways has been developed from 304 Km to 548 Km with 80 percent growth. In comparison to pedestrian public spaces area, the data about highways show a parallel planning policy that is not consistent to pedestrian mobility. (Ranjbar&Motalaei, 2017) Critics are raise up when we look at Sadr's Elevated highway. A lot of money has been spent on the project that it was better to use such resource for developing public transport. Ranjbar & Mashhadi Moghadam (2017) research "Upgrading urban highways: issues and negative impacts based on a case study of Sadr's Elevated highway" results showe the highway has significant negative impacts in ecological dimension, including air and noise pollution and energy-consuming parameters. Versus the highway projects, developing pedestrian spaces and zones in Tehran has been increased during the last decade and it has been successful, but it's not sufficient for an 8 million inhabitant city. According to Samavati & Ranjbar (2017) research "The Effect of Physical Stimuli on Citizens' Happiness in Urban Environments: The Case of the Pedestrian Area of the Historical Part of Tehran", pedestrianization of the area has been effective in overall happiness. So, there is a need to dramatic change from car oriented mobility to clean types of mobility in Tehran. Tehran Municipality planning policies regarding to climate change in recent decades are paradoxical. This can be related to lack of a comprehensive plan mitigating and adapting climate change issue. Lack of a comprehensive mobility master plan is affecting in this way. It's time for Tehran to make a new decision because each year the air quality is decreasing. The case of Tehran is a significant urban lab which confirms the interaction of urban planning and design policies and climate change impacts. Besides doing researches to scrutinize this interaction, there is a massive need to change urban government thoughts which is the main problem of creating such situation.



Figure 4: comparison of a clean day and polluted day in Tehran, 2015

3.3. Ahvaz; maximum impacts of climate change on quality of life

Looking at virtual social networks in Iran like Twitter, Facebook, Telegram, etc. brings up climate change issue when a name is repeating; city of Ahvaz. Around 50 million Iranian people are active in virtual networks. Comparing with total population of Iran (80 million people) a repetitive issue can explain their concerns. The case of Ahvaz completely stimulated Iranian people about climate change impacts. Ahvaz is not big as Tehran, the city has 1.3 million population but the impacts of climate change somehow is more severe than Tehran. We can see the effects of climate change in terms of dust and sand storm which is coming into the city from the sources out of the city. The immigration statistics of Iran shows Khuzestan Province is on top of main regions which are losing their population. There is not 100 percent reliable research which shows the source of dust storm in Ahvaz but speculations introduces aridity and drought as a main source. This face of climate change has created land without green coverages as hotspots of dust and sand. Also has affected on decreasing surfaces of ponds and lagoons in regional level and international level in Iraq. So, a part of the challenge is in other country which is creating a hard situation to mitigate the problem. The effects of such phenomenon are a part of everyday life of people in Ahvaz. Staying long time at home, losing electricity because of dust effects on urban electrical facilities, closing schools, changing detail of windows and doors, using masks for breathing, etc. in warm days that Ahvaz is experiencing 50 centigrade degree a non-place is creating.



Figure 5: comparison of a clean day and polluted day in Ahvaz

What urban planning and design can do in this situation? Although with some solutions we can adapt the city to this change but the case of Ahvaz introduce a new perspective for urban experts to think in a wider context, to broaden their minds, to have comprehensive knowledge and to be more intellectual for walking beyond classic, formal and temporary solutions. Thinking on Ahvaz can be a valuable opportunity for other cities of the world to mitigate such effects of climate change.

4. Results

Seeking climate change impacts on urban planning and design in Iranian cities reveals an interactive dynamism. A fundamental issue which is leading to maximize hazardous effects of climate change in Iranian cities, is an emergent need to provide new urban planning and design guides and laws regarding this challenge. Nowadays, main urban planning document in Iran is “comprehensive plan” which is quite old and classic in substance and process. The nature of these guides is relating back to 3 decades ago. Iranian cities need climate change action plans in level of national regional and international. From urban design point of view, it's needed to introduce new guidelines in green area management, street design and public spaces quality.

There is no ministry of environment in Iran which is compulsory for saving cities at this time. From educational point of view academic institutions in Iran need to change their syllabus regarding climate change. There is a lack of special course in teaching of urban planning and

design discussing climate change in official syllabus. Convergence of urban faculties with environmental faculties in Iran should be pursued as a key approach. So, urban planners and designers in Iranian cities should experience a massive change in broadening their thoughts to face urban challenges from international levels to local levels. It means classic education of urban planning and design should change regarding climate change issues.

Moreover, the Iranian Government should work on Iranian people's public opinion to refer their origins in history regarding climate change. In other words, the "Iranian culture of mitigating and adapting climate change" should be represented. In this way, we need more urban-based NGOs which are rare in Iran nowadays. Recognizing this culture by such NGOs facilitates to spread it out in Iranian people's mind. So, more than temporary ideas we need to change people's mind because climate change impacts are not temporary. Based on the historical background of Iran, the country should initiate an idea of Middle-east cities alliance to solve the challenges of cities like Ahvaz. It means that climate change mitigation and adaptation is an urban-environmental-social-political process in Iranian cities.

5. Conclusion

Looking at the current literature of interaction of climate change and urban planning and design demonstrates more attention to "how to do" not "how to think". The nature of climate change should be discovered more by urban planners and designers. This phenomenon is removing borders of cities, regions and nations. So, planners' mind should be flexible and flowing in these scales. It's also removing borders of knowledge. Maybe working in a group of planners, environmentalists, social experts, etc. is a good idea but it's not enough for urban planning and design in climate change era. Planners and designers should sit on the center of environmental knowledge to be able to have innovative and long term solutions. It means it's time of paradigm shift in urban planning and design theory regarding climate change because environment encompasses cities whereas urban planning and design discipline is more concentrated what's happening in inner cities. Also, in the current literature the impacts of climate change on urban planning and design are general. We need to analyze more especially in urban design level where real life is happening. Urban design as a main discipline related to urban form needs such change more than planning. If we should be more pioneer these two disciplines should be mixed in form of "urban-environmental design". New urban qualities should be introduced because of tangible impacts of climate change on urban spaces. It means starting a new urban knowledge. From an administrative point of view, we should start a practical "Cities Alliance Mitigating and Adapting Climate Change" (CAMACC) because it's a massive and enormous issue.

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