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Isfahan's Organic and Planned Form of Urban Greenways in Safavid Period

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ABSTRACT: This paper reviews the experience of Persian designers and planners for creating the most livable and greenery capital city in the hole region of Middle East throughout the 17th Century. New concepts of urban green development emerged in that time. Some of these ideas where extremely creative and vanguard from there era and still some of them are the main theoretical basics of urban green planning in the modern world. This paper focuses on Isfahan's greenway planning ideas and discusses how the city transformed to a sustainable city in Safavid period. The discussion is based on the combination of the organic and planned forms of greenway design, which was unique by that time and made the garden city of Isfahan. The Maddies[1], which are the branches of water derived from the river and flowed inside the urban context, are studied as the bases of organic greenway and the Charbagh[2] and Naghshe-Jahan Square are investigated as the planned green developments.

Keywords: *Isfahan Greenway Planning, Isfahan Greenway System, Isfahan Green Infrastructure, Isfahan Urban design in Safavid Dynasty3, Isfahan Maddies, Isfahan Charbagh.*

INTRODUCTION

Greenway planning is one of the most important tools for increasing quality of life for residents of a city. Green space and greenways are essential to enhance urban environmental quality and considerably increase its aesthetic values. Protecting the ecology of a specific natural system, providing recreational opportunities for people in metropolitan and rural space, increasing economic benefits and protecting heritage and cultural values are some of the advantages of greenway planning. These benefits are more highlighted as you plan greenways in dry and arid cities. However, first the question is what is the definition of Greenway?

"Greenways are networks of land that are planned, designed and managed for multiple purposes including ecological, recreational, cultural, aesthetic, or other purposes compatible with the concept of sustainable land use" (Fabos & Ahern, 1996). The term greenway comes from the "green" in greenbelt and the "way" in parkway, implying a recreational or pedestrian use rather than a typical street corridor, as well as an emphasis on introducing or maintaining vegetation. Some greenways tend to have a contiguous pathway, allowing urban commuting via bicycle or foot.

Recent enthusiasm for pushing forward greenway planning indicates that greenway has become a 'muster point' for academic, public bodies and practical agencies interested in green space issues and a way to help develop environmental thinking across disciplinary and political boundaries. In Persia, the importance of greenway has a long history where as in Achaemenid Empire; they designed the landscape of the Pasargadae Palaces by crossing two quadrant ways, and making four green patches. This is the oldest greenway in the history of Persian landscape architecture founded until now. The project is estimated to be finished in 550 BC. (Fig. 1)

The intersection of two quadrant ways is called Charbagh. As mentioned before it has long lasting history in Persia region. After Islam, the landscape architects in Persia emphasized more on this concept of design and they developed the idea. By the time, the idea was expanded to larger scale of landscape design in urban context. The urban planners divided a part of city to four green parts that each was compromised of several gardens. These intersected urban greenways were also called Charbagh.

The most splendid and successful urban greenway planning was done in Isfahan in the period of Safavid Dynasty. In that time Isfahan was the capital city of Iran and the center of all

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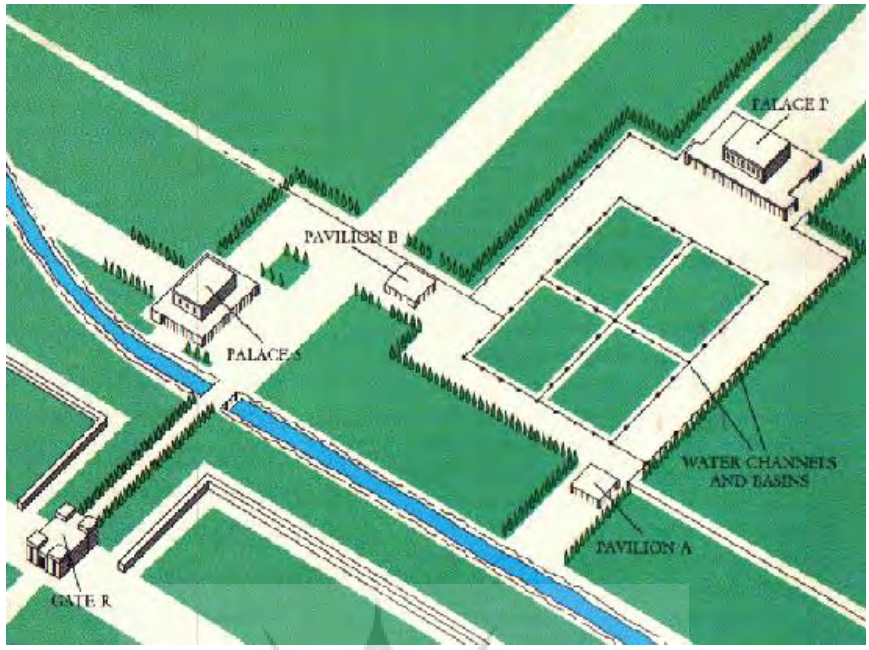

Fig.1: A reconstruction of Cyrus (or Cambyses) the Great's palace garden at Pasargadae 550 BC. This is the earliest known remnant of what became the classical Persian garden. The plan is based on David Stronach's Pasargadae.
(Source:Lendering, 2010)

political and scientific development and with respect to the rapid progress in Islamic art and architecture, it became the state of Islamic Art in the world. In the field of urban design and planning new ideas emerged and Isfahan is still considered as an outstanding example of urban planning. The new square of the city, a wide straight thoroughfare, the new quarters, and the complicated networks of bazaars (Abouei, 2005) and greenways planning done by Sheikh Bahaie are the main items of Isfahan's urban development. Sheikh Bahaie is a prominent scholar, philosopher, architect, mathematician and astronomer in the history of Persia. He is well known for designing the master plan of Isfahan in Safavid era. In his urban planning for Isfahan, he used Zayande River (Zayanderud) as the main structure of the greenway system and set apart some manmade streams from the river called Maddies. The Maddies idea let the water flow all over the city and made a comprehensive green network in the urban context. This kind of greenway planning in Isfahan was a crucial decision to transform the city from an arid region into a green city. He also designed the great Charbagh and the great square of Naghshe-Jahan and made a planned and geometrical greenway in the urban context.

Nowadays the development and planning of the cities in Iran are far from the application of greenway planning model. This paper analyzes the greenway structure of Isfahan in Safavid dynasty and extracts the main idea of the planning to get applied in future urban planning in similar cases. More specifically the goals of this paper are:

dynasty;

Study the green infrastructure of Isfahan in Safavid Study the organic and planned form of greenways in Isfahan;

Extract the benefits of green network planning in arid cities such as Isfahan.

MATERIALS AND METHODS

This research is based on evidence and library studies as well as field and analytic-descriptive method. Since Madies and Charbagh are the base elements of Isfahan's green network, analytic-descriptive method has been used in this research and for gathering information in theoretical part of project, library method has been used, also structural data are gathered through field method. This research reveals the necessity of study and recognition of successful greenway planning in arid regions such as Isfahan through a pervasive discussion regarding the green master plan used in Safavid period to develop and maintain sustainability aspects in the city.

Isfahan, the Glory City of Savaid Dynasty

Isfahan, located about 340 km south of Tehran, is the capital of Isfahan Province and Iran's third largest city (after Tehran and Mash-had). Isfahan is located on the main north- south and east-west routes crossing Iran, and was once one of the largest cities in the world. It flourished from 1050 to 1722, particularly in the 16th century under the Safavid dynasty,

when it became the capital of Persia for the second time in its history. Even today, the city retains much of its past glory. It is famous for its Islamic architecture, with many beautiful boulevards, covered bridges, palaces, mosques, and minarets. (Wikipedia Contributors, 2015)

The city's most splendid time began in 1598 when Shah Abbas the Great (1587-1629) decided to make it his capital and rebuilt it into one of the largest cities of the world. It seems that he has had a strong personal liking for Isfahan, and he may have felt that to move to his favorite city would give him his best opportunity for building his ideal capital. Gradually, royal urban planners under Shah Abbas created the new heart of the city to the south of the old city center, an open space called Naghsh-e-Jahan square between the older Seljuk city and the river Zayanderud (Abouei, 2005). Garden and paradise are two themes, which are inextricably attached to Isfahan and recur in associative descriptions as well as taxonomic distinctions. A closer examination of the layout of Safavid Isfahan shows an internal order, which is structured along the axial quadripartite pattern of a Chahar-bagh (literally four gardens) formed by the axes of the river Zayenderud and the royal avenue Khiaban-e Chahar-bagh. This underlying urban plan or composition combined the principles of Turco-Iranian forms of city and Perso-Islamic and Timurid patterns of garden. It created a dialectic relation between garden and city, based on the implicit practical interdependence of the natural environment and the architectural semiotics of royal political representation (Waltcher, 1997).

The essential structure of Isfahan in the Safavid period can be described by two major axes of development: first, the north-south axis alongside the old backbone of the city, which was formed alongside the main chains of the bazaar and extended through Charbagh Avenue to the south of the river; and second, the east-west axis alongside the Zayande river and its artificial branches, or Maddies. Whereas the first axis of development shaped the built environment in Isfahan, the second axis provided the natural element and its influence on the urban life. (Haghighat bin et.al., 2012) (Fig. 2)

Isfahan's Urban Planning and Green Network in Safavid Era

Isfahan, the new capital of the Safavid Empire, adopted a new

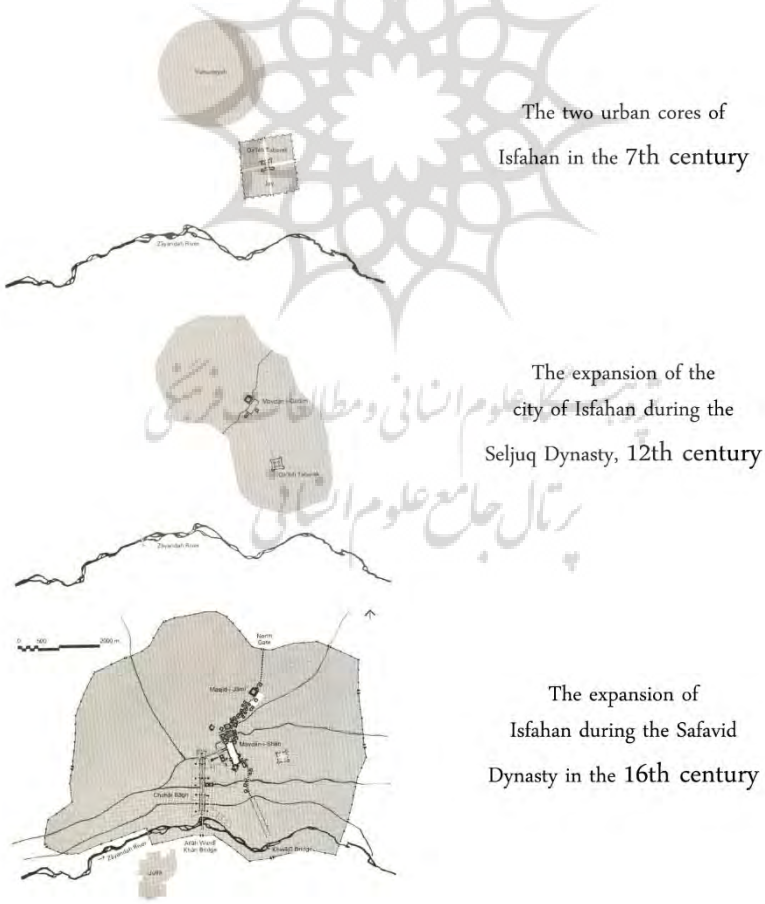

Fig. 2: Three crucial stages of Isfahan's physical transformation
(Ardalan & Bakhtiar, 1973)

master development plan in the seventeenth century. In this development, the city grew all the way to the river, passed it and contributed to the Zayande River in forming and making the new urban spaces (Haghighat bin, et al., 2012). Sheikh Bahaie, one of the scholars of Isfahan in Safavid era, started a new urban planning system. He built garden city of Isfahan by designing a connected ecological structure between the river and the constructions. The river with a general direction of east to west and the main axis of Chaharbagh with a north to south direction, created the basis of this urban system design. The design of the main avenue buildings and secondary axes in the form of checkered network as in Iranian Garden's structure has been the basis of his thought. Many gardens have been built along this network and these gardens like royal palace-gardens have had both fruit and decorative trees. The design of fountains and water axes, which have branched from the river and have been connected together by means of the wonderful system of the Maddies is an ecological design devised hundred years ago. (Agha Ebrahimi Samani, et al., 2012).

Before the contemporary physical growth of Isfahan, the Zayanderud was considered as the natural southern border of Isfahan. The access to the south of this river was provided with several bridges over it, which was constructed in different periods. However, the river and its bridges had been never a crucial element in the socio-spatial relations of the urban fabric of Isfahan, since the river was not located inside the city. The river had run through the middle of the city, and it along with the Chaharbagh axis had divided the city to four sections. Zayande River was utilized throughout the city and had formed Isfahan according to a model of a garden city. Safavids designers had caused sustainability in the green urban spaces by the intelligent use of the Zayanderud water all over the city. However, the significant role of the Zayande River and its water in the emergence and evolution of Isfahan during the course of its life should not be overlooked. Zayande River has used as a sustainable water resource at the present and past. Important role of river in the Safavids dynasty was:

Commercial activities that had depended on water had spread all over the city.

Celebrations were conducted on the Zayande River bank. (Agha Ebrahimi Samani et al., 2012)

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The greenway model of the city transformed Isfahan to a famous garden city in the 17th century. The travelers who visited Isfahan in the seventeenth century were astonished by the extent of its greenery and intensive garden complex. Indeed, the city seemed like a huge, smooth, green stain, crossed by a blue line -the river- in contrast to the rocky background of the desert. Chardin who wrote a book about its travel to Iran in 1666, states that Isfahan with its suburbs was the largest city in the world, resembling a forest from every direction; approaching the town, only the minarets and domes came to the eye (Chardin, 2010). Tavernier admits that Isfahan was not smaller than Paris and the entire town structure was enveloped by green foliage (Tavernier, 1670). Pierre Loti, Pascal Coste and the other travelers confirm the mentioned accounts. In short, Isfahan was a garden city. The reason for such a miracle in the heart of the desert can be attributed to the Zayande River, the largest interior river in the Iranian plateau. An irrigation system (Maddies) originating from the river dispersed water to al1 parts of the town. These Maddies where manmade stream that let the water of Zayande River flow inside Isfahan's urban context. These Maddies where designed by Sheikh Bahaie. This penetration of water in the urban context had a great greenery consequence in Isfahan's landscape. Zayande River and the Maddies were the main green infrastructure of Isfahan (Fig. 3).

Prior to the Safavid dynasty, the largest garden cities were built in the Timurid period (1370–1405 AD) in Central Asia, which survived until 1857 as the Mughal Empire of India). In the Timurid era, many residential government gardens were built around Samarqand and Herat. (Haghighat bin et al., 2012) It seems that Isfahan urban planners have been influenced by the urban design of Timurid period where they have also flowed derived channels of water from the river into the context of the city. (Fig. 4 & 5)

Sheikh Bahaie also designed green thoroughfares in Isfahan named Chaharbagh. These green streets were public open spaces and they were used as walking and transport routes in the city. The axis of Chahar-bagh is perpendicular to the Zayanderud. Isfahan's greenway model is consisted of riparian and thoroughfare greenways. Regarding to the design of Sheikh Bahaie we can see both geometrical and organic urban design. The Maddies made an organic greenway in the city and the Charbagh made a geometrical green patches.

Maddies as the Main Infrastructure of Isfahan's Organic Greenway

Water has been like a precious gem for a long time, which has created natural and artificial habitats around it. Water is the first factor of human adherence to the ground in order to meet the basic needs; also, it is one of the main factors of locating cities. As we can observe this fact for ages that wherever there was a river, there was development around it too. Iranian, just like other people, have always considered water sacred as a valuable material and regarding region climate and lack of water tried to use it in a best way. That`s why they have used rivers as a vital artery for formation and location of cities and

Fig.3: Maddies in Isfahan (The main structure of Isfahan's Greenway Model)

Fig.4. Herat in 850/1447 (Allen, 1983) & City plan and water canals (Golombek & Wiber, 1988)

Fig.5: Samarqand in the Timurid period, City plan and water canals
(Golombek & Wiber, 1988)

also relation of different spaces, and have coordinated urban fabric and perspective with water according to region climate. Zayanderud is one of these rivers, which is the main reason for creation of sustainability city called Isfahan. This river has caused beauty, elegance and urban design. (Amjad et al., 2012)

Isfahan city is located in the middle of plain in the north of Soffeh Mountain, where the river passes through it with a west-east direction and city historical axis extends perpendicular to this direction to southern parts of the river. Water usage through Maddies branches has been so effective on sustainable design of urban green areas in Safavid era that Sharon and Tavarnieh call Isfahan a city in a jungle (Talebi Rizi, 2005). Social-economic evolutions of past decades changed city economic infrastructure from agricultural base to industrial one, although the main function of Maddies altered, today the role of psychological and physical refinement of this network for noise and vision pollution and overcrowding is undeniable. Maddies with their branches and small streams present freshness, coolness and life to hot fabric of city, and adjust urban environment in hot and dry climate along tens of kilometers with their green borders. These spaces are called Isfahan lungs and actually have been a natural protector against hot desert winds. Maddies accompanied with a continuous green border, flow inside alleys, streets and districts. Flowing water in Maddies, branched gutters and density of trees have a significant impact on air purification and blowing cold breeze made by water and trees presents very fine and enjoyable weather (Heidari, 2008). Maddies have created high-dense tracks of trees beside the river, which is a new kind of urban space in Isfahan. Plants and green areas around Maddies are so effective on air pollution control. Plants delete suspended particles and pathogens through photosynthesis and producing oxygen through transpiration and increasing moisture. Live green covers, due to the form of their leaves, reduce and absorb sound waves even solve the problem of light reflection. Green vegetation is variously used due to color variety, density, dimension and fabric of environmental design. In addition, trees are live and dynamic unlike the artificial spaces. In fact, Maddies just like capillaries spread moisture all over the city and bring greenness into the urban space (Amjad et al., 2012).

The Maddies pattern was based on the topography of city so that water could flow inside the city and reach to far places from the river. These Maddies made an organic form inside the context of Isfahan city and gardens and greenways beside these Maddies were adapted to these organic form. (Fig. 6)

Charbagh Greenway

Outlining the orientation of the royal city, the Zayenderud

Fig.6: Schematic map of Isfahan's water channel (Madi) system, the Maddies made an organic design in the city (Ardalan & Bakhtiar, 1973)

created natural east west axis, crossed by the Chahar-Bagh Avenue, which was divided by the Shah-jub; the main canal in its center and stretched from north to south. The direction of the Chahar-Bagh Avenue with the center and sideway Jubs, or water channels, was in this way used for the conscious re-construction of the quadripartite Persian Chahar-bagh on the scale of a city (Waltcher, 1997).

Zayanderud is creator and identifier of major urban spaces of Isfahan. Linear parks extended beside the river, Maddies and branched streams are all producer of very strong urban spaces with social function. Moving and stopping along pathways and pause spaces in districts next to Maddies are daily events, which create memories and consequently make city identity.

Maddies distinguish Isfahan from other cities of Iran and somehow they give identity to central parts of city and distinguish these parts from new districts. The word of Madi reminds many residents of these areas of their childhood memories, manifestation of living and life. Many people still use Madi route as their guide to go around. Maddies as one of the meaningful key elements of Isfahan cause this city to be unique and also cause Isfahan residents to have sense of belonging and affiliation towards them. The expression of "sense of place" is truly obvious in this case (Majedi & Ahmadi, 2009). These spaces based on their social and interactive role in reunion of human and environment can motivate people to meet and discuss and invite residents from private areas and isolationism to public and cheerful spaces in order to strengthen and associate memories and create sense of belonging for future generations. These kinds of spaces are effective in city identity and its cultural promotion due to their role in transferring memories to present and future generations.

Maddies have an important role in forming Safavid city therefore; they perform as an element of urban design. The relationship between Maddies network and different parts of the city as well as the role of them in relation with city structure and fabric are remarkably noticeable. Extending from the southwest to the northeast, this network acts as the most convenient axis in urban fabric, actually a minor axis separated from the main and central ones (Talebi Rizi, 2005) so that most parts of this network cut the city as a shortcut from the southwest to the northeast. Maddies are used in structural design of Isfahan as following:

1. In Charbagh axis as they are truly designed to create geometry-linear urban space.
2. In other pathways such as alleys which move windingly towards out of the city.

Maddies have defined green axis in organic fabric of Isfahan, in alleys and passages, which has changed Isfahan to a garden city in many people opinions. Moreover, Maddies

and branched gutters are expanded like a network all over the city and provide security against natural disasters. In fact, Maddies are basic elements of city against flood danger and disposing surface water so they are inseparable elements of city and perform as a drainage network. Increasing the number of Maddies in Safavid era, palaces, mosques, inns, bazaars, public baths and houses of many rich people were built along Maddies in order to use water. So morphology of residential spaces has been affected by Maddies curves, houses located beside Maddies and branched gutters have been built east-westward or west-eastward based on Maddies directions which a remarkable sample could be seen in Charkhab district beside Niasarm Madi. Although houses are not opened to Maddies in some districts, water flows in all gutters through Maddies, so a city with natural organic architectural forms has been created. Interaction of Maddies with buildings along them is different, so in some public buildings except baths, Maddies are inward and inner courtyard of the building surrounds water flow. Safavid Palaces have spectacular view to Maddies and in Jolfa district, wherever possible, houses have some porches over Madi in addition to openings to Maddies therefore architectural forms are identified based on definition of Maddies and garden-city spaces (Amjad et al., 2012).

Safavid designer built Charbagh Street as major new city axis. Charbagh had used to connect new and old sections of city. Charbagh had created as the most important element of Isfahan urban design and a Safavids invention in the new city section. This street has designed as the axis of Isfahan Garden City therefore; it has conformed to special features of Persian Garden axis. It has formed according geometrical order and pre design map. Unlike most of the old streets in the old Isfahan, this avenue was a wide, straight boulevard with two rows of large trees and a stream in the middle. This

Fig.7: The Planned form of Chahar-Bagh and the intersection to Zayande River (Ardalan & Bakhtiar, 1973)

boulevard was created as a north-south extension of the old city, continuing to the south, where an extensive complex of Safavid gardens was created. The glorious bridge of Sio-seh-Pol across the Zayande River was used to connect Charbagh to the south of the river (Honarfar, 2002).

Sheikh Bahaie designed Chahar-Bagh and the royal gardens beside them in a planned and geometrical form. These gardens are all located as green patches next to each other. On the northeastern part of these gardens, the great square of Naghsh-e-Jahan is located. From the northern part of the square, the old bazar of the city is located. Again, this part of the city is in an organic form, which belongs to the old part of the city. (Fig.7)

Isfahan: A conversion to a sustainable green city

Nowadays the term of sustainable development is used frequently and many congress and meetings are based on this field. The aim is to make the developments based on human present and future needs. The United Nations World Commission on Environment and Development (WCED) in its 1987 report Our Common Future defines sustainable development: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Commission , 1987).

Regarding the Millennium Declaration, sustainable development was based on three principles of economic development, social development and environmental protection. Different definition of sustainable development from scholars around the world was also based on these three principles (Fig. 8). Mohan Munasinghe believes "Having a sustainable city is possible when there is a mutual relationship among three environmental, social and economic factors, a city in which all citizens feel satisfied." (Munasinghe, 1993)

Beside all the researches made on principles of sustainable development in recent decades, we can see that Isfahan's urban development in Safavid period meet all these principles. Specifically with a focus on the goal of this paper, the greenway planning of Isfahan had a great impact on all these three fields.

Greenways are seen as a critical part of urban green infrastructure and as a positive way to conceptualize green space planning. The aim is to increase the quality of natural capital rather than concentrate solely on the quantity of natural capital. In the field of environmental aspect, the idea of organic and planned greenway in Isfahan had a great impact on enhancing the quality of ecological measurements in the city. Water usage through Madi branches has been so effective on sustainable design of urban green areas in Safavid era that Sharon and Tavarnieh called Isfahan a city in a jungle (Talebi Rizi, 2005). These Maddies played an important role in the creation of Isfahan garden city.

In the field of economy, it is important to understand that Isfahan's main economy in Safavid period was based on agriculture. Deriving water from Zayanderud (Maddies) e it possible to have more gardens and farming land in the city. This water usage planning made an exponential increase of agriculture products and subsequently an overall welfare for its citizens.

Greenway planning represents the coming together of various interests. It is not seen just as a way of providing an improved green structure for the landscape, but also as a mechanism for more informed decision-making and more 'joined-up' thinking in relation to urban and regional environmental planning. In the field of social aspects, the Isfahan greenways both the organic ones (beside the Maddies) and the planned

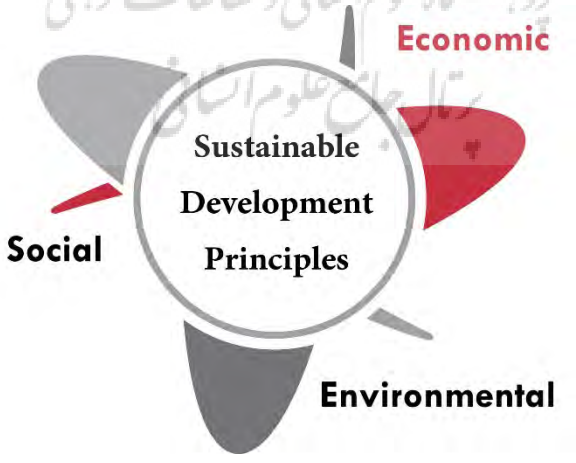

Fig. 8: Sustainable Development Principles (Munasinghe, 1993)

one (beside the Charbagh) and also the Naghsh-e-Jahan square made new modern open spaces which attracted people and it was a great public spaces. The idea of greenways and squares all led to increase of social activity in the city. Different ceremonies, national and local programs took place in these square and greenways. Furthermore, it motivated the importance of greenways in the memory of the citizens.

RESULTS AND DISCUSSION

The greenway structure of Isfahan in Safavid period can be described as two different forms of planning. The first is a planned and geometrical form of greenway design connecting the north to the south of the city, which is called Charbagh. In addition, Naghsh-e-Jahan square that is located in the north east of the city is a great planned greenway. The second is the organic form of the greenway due to the artificial branches (Maddies) derived from the Zayande River. (Fig. 9)

The combination of Organic and planned form of greenway in Isfahan in Safavid period converted the city to a unique garden city that is fully in accordance to the sustainable urban development factors (Environmental Factor, Social Factor, and Economic Factor).

In addition, this combination of two different forms of greenway has aesthetic and visual values in the city and gives different perspective experience to the citizens. Today we can see that the greenway planning concepts of Isfahan in Safavid Period are used in another word in the modern urban developments. The garden city movement initiated by Ebenezer Howard in 1898 and the theories of subsequent scholars are in some words the experience of old garden cities such as Isfahan.

CONCLUSION

In the last few centuries the vulnerability of arid and semi-arid regions to the climate change has been increased. These negative impacts require a more sophisticated and adaptive strategies. In Persia there are several cities which are laid in the central arid plain and they have been able to tackle their ecological problems. Their sustainable urban planning has transformed the city to a greenery region. These cities always had lack of water resources. The planners of these cities tried to divide the water resources throughout the urban context in a very reasonable manner.

As discussed in this paper, derivation of water from the river to the different parts of urban context is a very exceptional idea for creating a green city in an arid region. The penetration of green network all throughout the urban context could enhance the green quality of urban landscape. The planners of Isfahan used both organic and planned form of greenways. Sheik Bahaie the urban and landscape planner of Isfahan in Safavid

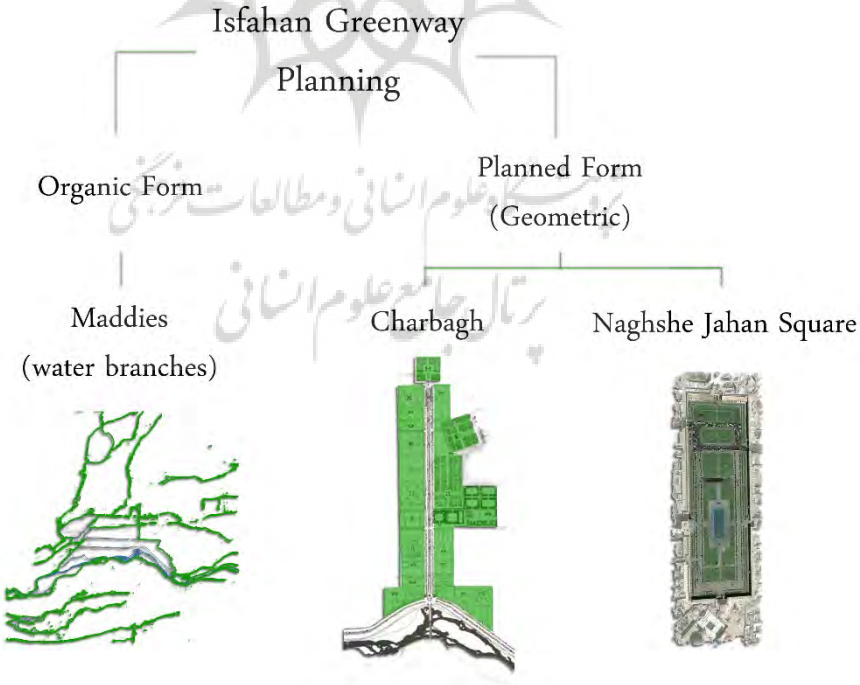

Fig.9: The Form of Isfahan's Greenway Planning in Safavid Period

Dynasty developed an intuitive way to make all the city green. He separated some water streams from Zayande River and passed them through the urban context. These streams made the city green. On the other side he also proposed the design of orthogonal urban garden called Charbagh. The aggregation of these two techniques including organic greenways and planned form of greenways, transformed the city to a greenery city in the heart of central desert of Iran. This city has been able to sustain greenery and ecofriendly throughout the last few centuries. In the last few decades, some urban planning modifications have deteriorated some parts of this green idea. Meanwhile the study of this paper and similar researches could help in the way to revitalize these valuable concepts.

Regarding the successful urban planning of Isfahan in Safavid period and a great response to the different requests of the citizens throughout the history, it seems that urban planners could use the benefits of Isfahan's greenway planning concept in other similar cases in Iran and outside Iran.

ENDNOTES

1. Maddies: Maddies are the branches of water derived from the Zayande River and flowed inside Isfahan's urban context. The Maddies were the main green infrastructure of Isfahan's urban development in Safavid Dynasty.

2. Charbagh: Charbagh or Chahar-Bagh is a Persian-style garden layout. The quadrilateral garden is divided by walkways or flowing water into four smaller parts. In Persian, "Chār" means 'four' and "bāgh" means 'garden'.

3. Safavid Dynasty: The Safavid was one of the most significant ruling dynasties of Persia (modern Iran) after the fall of the Sasanian Empire - following the Muslim conquest of Persia in the seventh century A.D., and is often considered the beginning of modern Persian history.

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