AEXTJ
AGRICULTURAL EXTENSION JOURNAL
ISSN 2582- 564X

Available Online at www.aextj.com
Agricultural Extension Journal 2026; 10(1):27-57

REVIEW ARTICLE

Persian Gardens: Ancient Pattern of Indigenous Knowledge for Sustainable Development of Cities and Settlements, Environment, and Optimal Life

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Received: 16-01-2026; Revised: 22-02-2026; Accepted: 18-03-2026

ABSTRACT

The Iranian garden, with its brilliant history as one of the best landscape models, is a result of the productive interaction of the Iranian man with nature. The Persian garden is enclosed by a rectangular fence with vertical axes that are parallel to the sides of the fence. The plant, the earth, the water, and the architectural components are four elements forming the body of the garden. The Persian garden is both a physical and spiritual experience. The aroma of succulent plants, the melody of water and birds, the smooth tiled texture and taste of wet earth and the sun, the fruits, the flowers, and the colorful mosaics that are reflected in a calm catchment, are all outstanding. Considering the existing environmental potential as well as Iran's ancient history of gardening, it is hoped that environmental and landscape designers keep with the principles of sustainability in planning and designing. The rehabilitation of Persian gardens, along with respect for the principles of sustainability and consistent with sustainable urban planning, can play an important role in the development of urban green spaces and, consequently, sustainable urban development. The concept of the Persian garden is known as one of the symbols of civilization and architectural patterns of the Iranian region, from Transoxiana to Mesopotamia, due to its continuity and widespread presence in the geography of Iran. A closer examination of documents, travelogues, and the analysis of the evolution of the physical aspect of this phenomenon reveals that social, cultural, political, agricultural, and economic conditions have had a slight influence on the symbolic system of the Persian garden in each period. a Persian garden is a phenomenon derived from the interaction between the Iranian mind and nature on a specific path to interpret the environment; therefore, this phenomenon underwent some physical changes from pre-Islam to the present, which was accompanied by the entry of Western colonizers. In Iranian culture and art, a garden is an integral part of Iran's identity, reflecting how human beings have interacted with nature. In fact, the Persian garden creates a pure, calm space. It is a space without any tension and an environment of great thinking. It can be said that the quality of comfort and relaxation, and its quality as a place for thought, contemplation, meditation, and creativity are created by structural elements, such as number, geometry, color, and material. In this article, the author discusses and states the most important aspects of Persian gardens in desert areas of Iran and their indigenous knowledge for sustainable development plus elements in ancient pattern of Iranian gardens for optimal utilization of scarce water resources, etc., and introducing UNESCO World Heritage Sites of historical Persian Gardens in Tabas and Birjand cities, namely, Golshan and Akbarieh gardens in South Khorasan province, Iran. plus state Persian gardens' importance and capacities for sustainable development of cities and settlements, environment safety and health, their ancient patterns for tranquility, healing, beautiful, safe, ecological, and an optimal life.

Key words: Desert areas, environment, indigenous knowledge, Iran, Persian gardens, South Khorasan province, sustainable development

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INTRODUCTION

Today, returning to nature and patterning it seems to be one of the most important needs in the world.

Iranian architects have been successful in applying scales and connecting different scales to one another, as well as facing nature around them (Kohnehshahri and Atashinbar. 2023).

The Iranian garden, with its brilliant history as one of the best landscape models, is a result of the productive interaction of the Iranian man with nature (Sharghi *et al*., 2020).

In Iranian culture, the garden is a landscape; in other words, a Persian garden is a phenomenon derived from the interaction between the Iranian mind and nature that puts the audience on a specific path to interpret the environment; therefore, this phenomenon underwent some physical changes from pre-Islam to the Qajar period, which was accompanied by the entry of Western colonizers, but its meaning remained constant for the Iranian audience (Sadafi Kohnehshahri and Atashinbar, 2023).

In Iranian culture and art, a garden is an integral part of Iran's identity, reflecting how human beings have interacted with nature. Planting and vegetation designs are an important part of a garden. Since vegetation is a decaying element of a garden, its replacement and restoration as an architectural monument is not quite easy. Therefore, examining the history of the garden and the study of its initial patterns are of particular importance (Ghasemi and Golzar, 2018).

Experiences, when are written and documented, can turn into knowledge and expand human sciences (Joudavi, 2017).

The concept of the Persian garden is known as one of the symbols of civilization and architectural patterns of the Iranian region, from Transoxiana to Mesopotamia, due to its continuity and widespread presence in the geography of Iran. A closer examination of documents, travelogues, and the analysis of the evolution of the physical aspect of this phenomenon reveals that social, cultural, political, agricultural, and economic conditions have had a slight influence on the symbolic system of the Persian garden in each period (Sadafi Kohnehshahri and Atashinbar, 2023).

Mirfandresaki defines Persian garden as follows: "Persian garden is enclosed by a rectangular fence with vertical axes which are parallel to the sides of the fence" (As quoted in: Ghasemi *et al*., 2018).

In the Persian garden, the garden architecture system is consisting of organizing, operational, physical, and semantic systems.

Furthermore, systems of landscape, perspective, light, shadow, and sound are combining and mixing the resulting quality of the physical system. They are specific to Persian gardens. Most researchers emphasize that "in the Iranian garden materialism will be improved to spirituality" (Bathaei, 2018).

The plant, the earth, the water, and the architectural components are four elements forming the body of the garden (Ghasemi *et al*., 2018).

In fact, the Persian garden creates a pure, calm space. It is a space without any tension and an environment of great thinking. It can be said that the quality of comfort and relaxation, and its quality as a place for thought, contemplation, meditation, and creativity are created by structural elements, such as number, geometry, color, and material (Bathaei, 2018).

The Persian garden is both a physical and spiritual experience. The aroma of succulent plants, the melody of water and birds, the smooth tiled texture and taste of wet earth and the sun, the fruits, the flowers, and the colorful mosaics that are reflected in a calm catchment, are all outstanding. These characteristics exist both at a symbolic and abstract level and at an experimental level, in the same time (Bathaei, 2018).

Available studies have focused on the architectural components (construction materials) and water, and the subject of the plants has been poorly understood. Even less has been documented on Tabas Golshan garden (Ghasemi *et al*., 2018).

Ecotourism must be marketing of Iran's target villages and towns for tourism, along with mountaineering, desert tourism, etc. (Barjasteh Askari *et al*., 2016).

The most important principle in the design of the Iranian garden is its structural system, which is based on the geometrical order. The Iranian garden, while a wall surrounds it, is divided by vertical axes on the main and secondary axes.

In addition to creating a peripheral composite wall, the construction work on the Iranian Garden deals with stair-breaking walls, paved surfaces, streams, ponds, and pools, all of which follow the geometric order of the garden and, in fact, form the landscape of the garden. The main garden buildings are on two scales, big and small. The big scale contributes to the main space of the garden and the small one defines the garden surroundings. On a large scale, the facade, staircase, and mansion are usually built on the main axis, while on the small scale, secondary structures, such as bathrooms and other services are located on the side walls, whose entrance is

sometimes simple and other times composite. The architecture of the Iranian garden is organic. The term "organic" represents an architectural concept, not an essence. The original meaning of this term in architecture is associated with the link between the total and the parts (Sharghi *et al*., 2020).

RESEARCH METHODOLOGY

The main source and initial information and data for writing this article is the author visiting from the three global world heritage and national Persian gardens in Birjand and Tabas cities, South Khorasan province, Iran. Plus visiting from the various Persian gardens in various provinces of Iran, during 1990–2025. Furthermore, other initial information and data were collected from published documentary studies and written sources in the field of Persian gardens and their ancient pattern of indigenous knowledge for sustainable development of cities and settlements, environment, and optimal life. The research method is descriptive-analytical in an interpretive approach and based on the collection of written documents and sources and the qualitative content analysis method is employed. The main methods of data collection in this article are direct observation and review of documents. Data were collected from scientific articles, official reports, laws, national and international statistics, and research history. Data analysis was conducted qualitatively and through document content analysis. This method allows for the identification of root causes and provides structural and long-term solutions. At the end, and finally, the research findings have been presented as a conceptual result, principles, and components of Persian gardens and their ancient pattern of indigenous knowledge for sustainable development of cities and settlements, environment, and optimal life. Furthermore, this article is an abbreviation and short communication of the author's book that was published at 2025 (Golmohammadi, 2025).

GOLSHAN GARDEN IN THE HEART OF THE CITY OF TABAS, JUST LIKE A GREEN GEM

The Golshan Garden in Tabas, is one of the most important Persian desert-historical gardens of Iran (Ghasemi and Golzar, 2018).

Golshan Garden is one of the most important gardens in Iran that shines in the heart of the city of Tabas, just like a green gem has an area of 8 ha.

Golshan Garden is one of the tourist attractions of Tabas in South Khorasan Province, east of Iran. It was founded at the end of the Zand era and the start of the Qajar era. It is inscribed on Iran's National Heritage List because of its unique features, including its design. The garden is known for being rich in diverse plants. The garden was constructed by a Tabas governor, Mir Hosein Khan. The date of garden construction in 1798 has been written in its endowment deed. Plants in different species from various climates and thousands of fruit trees have made the garden unique [Figure 1].

One of the main features of the garden is that it is a square-shaped one, just like the Taj Mahal mausoleum in India. This garden where has been developed in compliance to Iranian garden architecture. At the center point of this garden, there is a pond that is the habitat of two pelicans that are named in the Mir Hassan Khan Trust as beneficiaries, and these birds are very familiar with visitors. This garden has been constructed and developed in compliance with Iranian garden architecture, with two crossed water streams. At the center point of this garden, there is a pond where habitat of a number of birds, including some beautiful pelicans. In addition, there is also an 8-acre monument with different fruit trees in each.

Many poets have visited the Golshan Garden, and the beauty of the garden has fascinated them that there are so many descriptions in their poems about this green garden. Golshan Garden is almost square with a total area of 7 acres, a length of about 266 m and a width of about 260 m.

This must-see landscape is one of the most important gardens in Iran and in the world. Inside this garden where has been developed in compliance to Iranian (Persian) garden architecture. Golshan Garden is one of the rare Gardens in Iran because there is always permanent running water flowing. Many fruit trees on this 8-acre monument had created a unique nature. Various species of plants in the garden with different weather climates, such as plants for certain cold regions, alongside the palms, which grow only in tropical areas, can be found there. At the center point of this garden, there is a pond where is habitat of two pelicans and

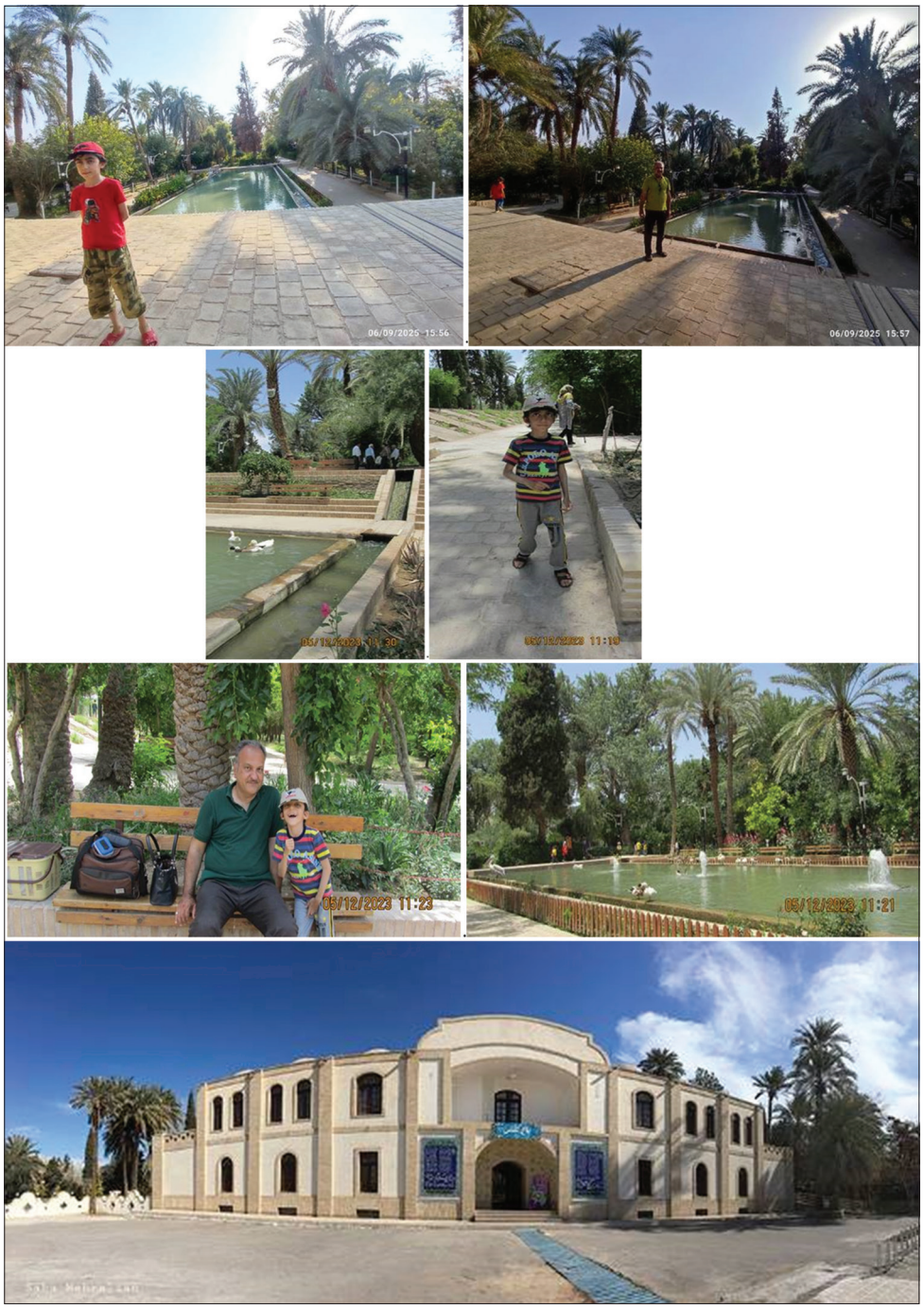

Figure 1: Golshan Garden in the town of Tabas, south east of Iran and its entrance gate, pool, trees, birds, etc. (pictures by author. 2023 - 2025)

these birds are very familiar with visitors, which this attitude is one of the features of this garden. You can spend time in this garden with family and friends whilst enjoying the cool and fresh air in the middle of deserts.

The design of the garden has been copied from Char Bagh street in Isfahan and Quran verses about heaven that two flowing and permanent streams pass from each other. The original gate of the garden was a historical mason that was ruined after the 1978 earthquake, and currently a new building with the same design has been constructed.

Golshan Garden is one of the vertical gardens. There is a big pond in the middle of it and pelicans swim there.

There are various plant species compatible with different climates. Different decorative palms, our orange and orange trees, grapes, and decorative

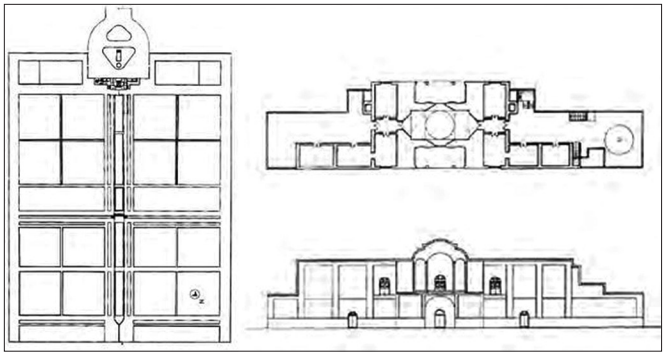

Figure 2: Plan, section and elevation of Bagh-e Golshan (UNESCO World Heritage Centre, 2000)

flowers have turned this garden into one of the most unique and dream gardens of the country. This garden is also the host of a considerable number of New Year tourists and passing travelers every year, especially during the New Year days in Iran.

There is a relatively large pool with three fountains inside this garden. The only building of this garden is the sardarb building. It is a two-story building with a small basement. The place where the Golshan Garden was built was originally the garden of palm trees. Therefore, the Golshan palm trees are the oldest trees in this garden. Flower bushes are an inseparable part of the design of the garden. Golshan Garden is a good and suitable place for Pelicans to live. We can receive a message from the old days telling us stories from the past [Figure 1].

The structure of Tabas Golshan Garden is comparable to fractal geometry in all parts of the garden, including plan, ornamentation, irrigation, and vegetation (Sharghi *et al*., 2020).

Bagh-e Golshan has a frontispiece that is located beside a rectangular form of a square. It was destroyed during the Tabas earthquake but has been reconstructed. The frontispiece is the only structure of the garden that is quite simple compared to other old buildings of the town. It has a ground floor, a first floor, and an underground (UNESCO World Heritage Centre, 2000).

Bagh-e Golshan is like a palm grove due to its large number of scattered palms. Main lines of garden design include two major paths, one upon the entrance pivot and the other inside the garden and at a vertical position upon it. Inside the plots created by the garden division, pomegranate and sour orange trees have been planted alternately.

Bagh-e Golshan is located on a stream created by conjoining the water of several springs coming toward Tabas. The stream enters the end of the garden and, after irrigating it via jets and waterways, exits from beneath the frontispiece bound for Tabas. Among the features that qualify Bagh-e Golshan as a perfect Persian Garden are:

Its vegetation, which is suitable for the local climate, its shadow-casting trees, its lovely, enclosed space at the heart of the hot and dry desert, as well as its irrigation system. It must be pointed out that the frontispiece has been damaged by the earthquake (UNESCO World Heritage Centre, 2000).

Tabas Golshan Garden, the city's most important garden, falls into the category of governmental gardens and has only a courtyard, and no other monuments can be found in its interior. The garden was built by Mir Hassan Khan, the third ruler of Tabas, appointed by Nader Shah. Mir Hassan Khan donated this garden and many other properties to the public and charity affairs in his will in 1803. The garden has a design that is most likely implemented in a palm tree field; the length of the garden from the entrance to the end of the entrance axis is 266 m, while the two front sides are 266, and the garden's width is 260 m. The garden has approximately 74438 square m of area [Figure 1].

The design of Tabas Golshan Garden is square, with geometrical divisions along the sides of its fence. The design of Chaharbagh is evident in this architecture. The pattern is a square or rectangular boundary between the garden walls, the surface of which is interspersed with two perpendicular intersections of water in four equal portions, and there is a water pool in the center.

However, the use of the word Chaharbagh instead of Charbagh has been reinforced from the Safavid period onward, which also includes research reports on Tabas Golshan Garden. From the architectural point of view, the facade of Golshan Garden is a fairly typical building, making one of the most distinctive and important buildings in the city (Sharghi *et al*., 2020).

PERSIAN GARDENS CONCEPTS AND UTILIZATION FOR SUSTAINABILITY TO CITIES

In these days of worldwide political stress, learning to cope gets more and more difficult. Most of us

crave moments of peace and security, a chance to mediate and smell the air, or quite literally experience the scent of flowers. We can find this peace in an enclosed garden. We can bring sustainability to cities by the concept of the Persian Garden. Because one of the basic concepts of achieving a sustainable city in the theoretical framework of the sustainable development is the impact of urban green spaces. Hence, principles and components of sustainable development and sustainable city are studied with relation to the Persian Garden. This approach proposes a practical solution for architects, how to re-create the Persian Garden in contemporary cities (Bathaei, 2018).

Hence, city sustainability requires sustainable elements in different dimensions to ensure its sustainability in addition to establishing relationships with the elements in the urban system. Furthermore, with due observance to the concept of sustainability theoretically and practically, and considering human needs in all physical and metaphysical dimensions, Persian Garden is seeking to meet the human needs. It showed the role of the garden in increasing the sustainability in the city and the permanence of ecological balance is very evident and undeniable, especially accessing of sustainability features in Persian gardens (Bathaei, 2018).

STREET CONCEPTUAL ROLE IN THE CREATION OF THE PERSIAN GARDEN

The first spatial perception of the audience in the Persian garden is a combination of tall trees and the endpoint of the main axis that extends from the entrance area to the pavilion, combined with the eye-catching play of water in the pools and basins, and the shade of trees. This image, the most important and enduring image of the Persian garden, represents the Street of the Garden and is one of the components of the Persian garden that has undergone the least changes in its shape and continuity in the historical process of the evolution of the Persian garden. The main street of the garden has a significant role in the design of Persian gardens and represents the highest manifestation of the garden's symbolic aspects.

Throughout the history of Persian garden developments, the street has had a conceptual role in the creation of the garden, and the stabilization of its constituent elements during different periods has led to the continuity of the Persian garden identity (Sadafi Kohnehshahri and Atashinbar, 2023).

Since the main features of Persian gardens are defined around their main axis, the street of the garden can be considered the main meaningful aspect in forming this archetype. Although it is possible to assign such a role to the other components of the landscaping of the garden, at the head of which is the Pavilion, the undeniable necessity is that the Pavilion and its magnificent architecture are part of the "Street of Garden scenario"; Therefore, sometimes even the location of the pavilion changes from the geometric center of the garden and is moved to another place, but still has a strong relationship with Street of Garden (Sadafi Kohnehshahri and Atashinbar, 2023) [Figure 3].

Abbasabad Behshahr Garden is one of the prominent examples where the main pavilion of the garden has moved out of the geometric center and its architecture is not even similar to the common architecture of pavilions, but the character of the street in the garden has remained strong and, in combination with other components, has created a powerful structure for the garden. It seems that the main essence of what is known as the Persian garden and has continued to this day, is the "Street of Garden," which is considered the identifier component of the garden; in other words, the various patterns of the Persian garden have emerged from the transformations of its Street.

"The Persian garden is an enclosed, organized garden with an internal focal point that is meaningful along the street" [Figure 3].

(Note: Street of the garden throughout this text refers to the main street of the garden, which is usually located on the main axis of the garden. (Sadafi Kohnehshahri and Atashinbar, 2023. P: 14).

FORMAL TRANSFORMATIONS OF THE STREET OF THE GARDEN IN THE PERSIAN GARDEN HISTORY

Before the Arrival of Islam in Iran

The root of the word "khiyaban" (Khoi + apan) was linked to the element of water, and for this reason, its concept can be related to the ancient period. The main manifestation of it was the garden, which is a

Figure 3: The Akbarieh Garden in Birjand, South Khorasan province, Iran. And its streets, pavilion, trees, pools, etc.… (Pictures by author, 2013–2025). Akbarieh Garden is a UNESCO World Heritage Site in Birjand, South Khorasan province, Iran. It was inscribed on the UNESCO World Heritage List in 2011. It annually receives thousands of domestic and foreign tourists. It is concomitantly used as a museum and tourist space

symbol of the history of Iranian civilization. This definition also includes the concept of goodness and sanctity for the street and its clear connection to "water" as a mythological element in Iranian culture and a symbol of authenticity and purity (Sadafi Kohnehshahri and Atashinbar, 2023).

The most famous reasons for the formation of the Persian gardens theory are also based on this foundation:

Following the exploration of the Pasargad royal garden, the discovery of stone water channels among the streets of the garden became the source of the first theorization in this field, which was carried out by Astronakh. He presented the theory of the Chaharbagh for the first time by drawing two axes perpendicular to each other in Pasargad Garden, admitting the existence of a formal garden due to the presence of a waterway in the middle of the main axis.

However, the Chaharbagh theory was later criticized and emphasis was placed on the straight geometry or street: "Looking at Pasargadae and many other Iranian gardens like those remaining from the Sasanian period, we find that Chaharbagh was not the pattern of Iranian gardening, but it can be assumed as a specific pattern of Iranian gardening."

Astronakh also refers to a garden called Khalvatgah-e Basafa or Ardeshir II Palace in the remaining works of Shush to prove the theory of the Persian garden. He also believes in this pattern for the Khosrow Palace, and the presence of a long waterway and opposite pavilions is an argument for the presence of main and perpendicular axes and a formal garden: "Khosrow Palace is one of the Sassanian palaces located next to the communication route between the Iranian plateau and Mesopotamia. According to Arab historians' written documents, this palace was built on a 7.5-m high platform surrounded by a 300-ha which included a garden, a pond, and water paths, which were arranged along the main street of the garden according to the expansion of the palace building" (Sadafi Kohnehshahri and Atashinbar, 2023).

(Note: "khiyaban" In Farsi, it is equivalent to the word "street") (Sadafi Kohnehshahri and Atashinbar, 2023. P: 14).

After the Arrival of Islam in Iran

Although the street is one of the most commonly used concepts in urban studies today, its civilizational roots are different in different cultures.

In Persian culture, whether before Islam or after, the street is considered a concept of landscape, which has a dual presence in its most influential cultural pattern, the garden: both mental (with symbolic and semantic features) and physical (as a functional, structural, and spatial element).

The street in the Persian garden before Islam has been associated with the concept of goodness, such as water. During this period, the Street of the garden is a long axis with an average width and the presence of water in it is mostly natural, and the mythical role of water in it is important.

The strong and dense presence of symbolic trees, such as cypress as a decorative element is directly related to the Street of Garden (khiyaban Bagh) in this period, emphasizing its symbolic and meaningful position (Sadafi Kohnehshahri and Atashinbar, 2023).

This process relatively continues, and the sacred aspect is also added to the mental dimensions of the Street of the garden. The selection of the Street of Garden stump, in the 1st–9th centuries AH, for establishing the tombs of the nobles is an example of this mental validation. During these centuries, the streets were wide and could even connect two neighborhoods. The Street of the garden in the Timurid period is central, meaning it is emphasized at the central point on the pavilion, and its landscape is accompanied by agricultural culture.

During the Safavid period, with the change in the role of the garden from a sacred place to an urban space, the role of the street also changed. The street of the garden becomes wider and various combinations of trees are observed around it; a predetermined and completely geometrical order dominates it. The use of pavement and fountain design is considered as the decoration of the Street of Garden in this period. In addition, the mansion of the Entrance Building and its architecture are also prominent in the Street of Garden (Sadafi Kohnehshahri and Atashinbar, 2023).

In the Qajar period, the Street of Garden is a place for promenading; therefore, the use of colorful architecture in pavilions and entrances is noteworthy. The width of the street of the garden is average and its length is short. A combination of fruit and non-fruit trees can be seen around it and water has a decorative presence. In a general view, the street of the garden has undergone various changes in terms of form during different periods, which can be interpreted as a symbolic representation of its cultural significance. Before Islam and after it arrived in Iran until the 9th century AH, the long shape of the street, combined with symbolic trees, was the origin of the landscape and framing of Pictorialism. These visual features reflect transcendental and sacred concepts in interpretations and texts. A significant change occurred during the Safavid period when Street of Garden left the celestial ambiance behind and entered into the daily life of society, and Chaharbagh Street in Isfahan is the epitome of this transformation (Sadafi Kohnehshahri and Atashinbar, 2023).

In the modern period, this approach has reached its maximum form, and the soul of the Garden, meaning the street, entered the city. Just as the Persian garden space has always had a perceptual influence on the Iranian people's mentality, the modern period is an era in which the urban space has a significant impact on the audience's mindset. Therefore, with the street's entry into the city and social life, its maximum cultural significance was institutionalized.

Street of Garden, as the main element of the Persian garden landscape, is the most important component of the garden landscape that manages the Persian garden like a comprehensive system and embodies various aspects of its identity, esthetics, and functionality; therefore, changes in the street of the garden have always been local and its nature as a symbolic whole has remained unchanged (Sadafi Kohnehshahri and Atashinbar, 2023).

The main street or core of the Persian garden has elements that make up its subsystems, including ponds, waterways, rows of trees, and the green landscape around the street, which in different combinations of width, length, changes in height, pavilions, and buildings create different landscape designs that shape the landscape differences of the Persian garden in the audience's mind during different historical periods. "So it can be said that Main Street of Garden has been a stabilizing component of the Persian garden pattern throughout history; because the developments that have taken place in its surroundings or its decorative elements have not caused a change in the spatial order and hierarchy of its perception." (Sadafi Kohnehshahri and Atashinbar, 2023).

(Note: "Chaharbagh" In Farsi, it is equivalent to "the quadruple division geometry Patterns in Persian Garden") (Sadafi Kohnehshahri and Atashinbar, 2023. P: 14).

TREES, SHRUBS, IVIES, FLOWERS, GROUND COVER PLANTS, HEDGES, AND VEGETABLES IN THE GOLSHAN GARDEN

History always holds natural and political events, etc. These events can bring changes to various places, including gardens. Understanding the elements of gardens, such as trees, which cannot easily be replaced, is of necessity. The degradability of this living element, which can cause changes in the pattern and the main form of the garden over the years, doubles the importance of documenting the information related to plants. Of fifty historic gardens in Tabas (Before the devastating earthquake of 1978), only the Golshan Garden left [Figure 5].

In addition to what has been discussed, gardens in the desert of Iran have been threatened by successive droughts. Having a better knowledge of the desert

Figure 4: Streets in the Golshan Garden in the town of Tabas, south east of Iran and its entrance gate, pool, trees, birds, etc. (Pictures by author. Spring 2023)

gardens in terms of plant species, their location, and protection can help us better design the garden (Ghasemi and Golzar, 2018).

Examining the documents showed that the types of plants used in each garden were primarily tied up with the function of the garden, the geographical location, the climate, and the area where the garden was located. In gardens where the issue of economic productivity was a concern, more fruit trees and different types of vegetables were raised. Shady and decorative trees were planted in ceremonial or government or chards (Ghasemi and Golzar, 2018).

The Plants in the Golshan Garden can be Divided into the Following Groups

Productive trees in the Golshan garden

- Productive trees are typically part of a Persian garden.
- In some references, it is written that the fruit trees are more planted in the side paths than the main ones. Daneshdoust says that, except for the main axis, the rest of the garden consists of small gardens full of fruit trees, which have been planted regularly. In addition, some various references randomly and briefly have explained fruit trees in the Golshan Gardens as follows:
- Inside the plots created by garden divisions, pomegranates and orange trees are planted alternatively. These trees are suitable for local climates, but shady trees have been sporadically planted (As quoted in: Ghasemi and Golzar, 2018).

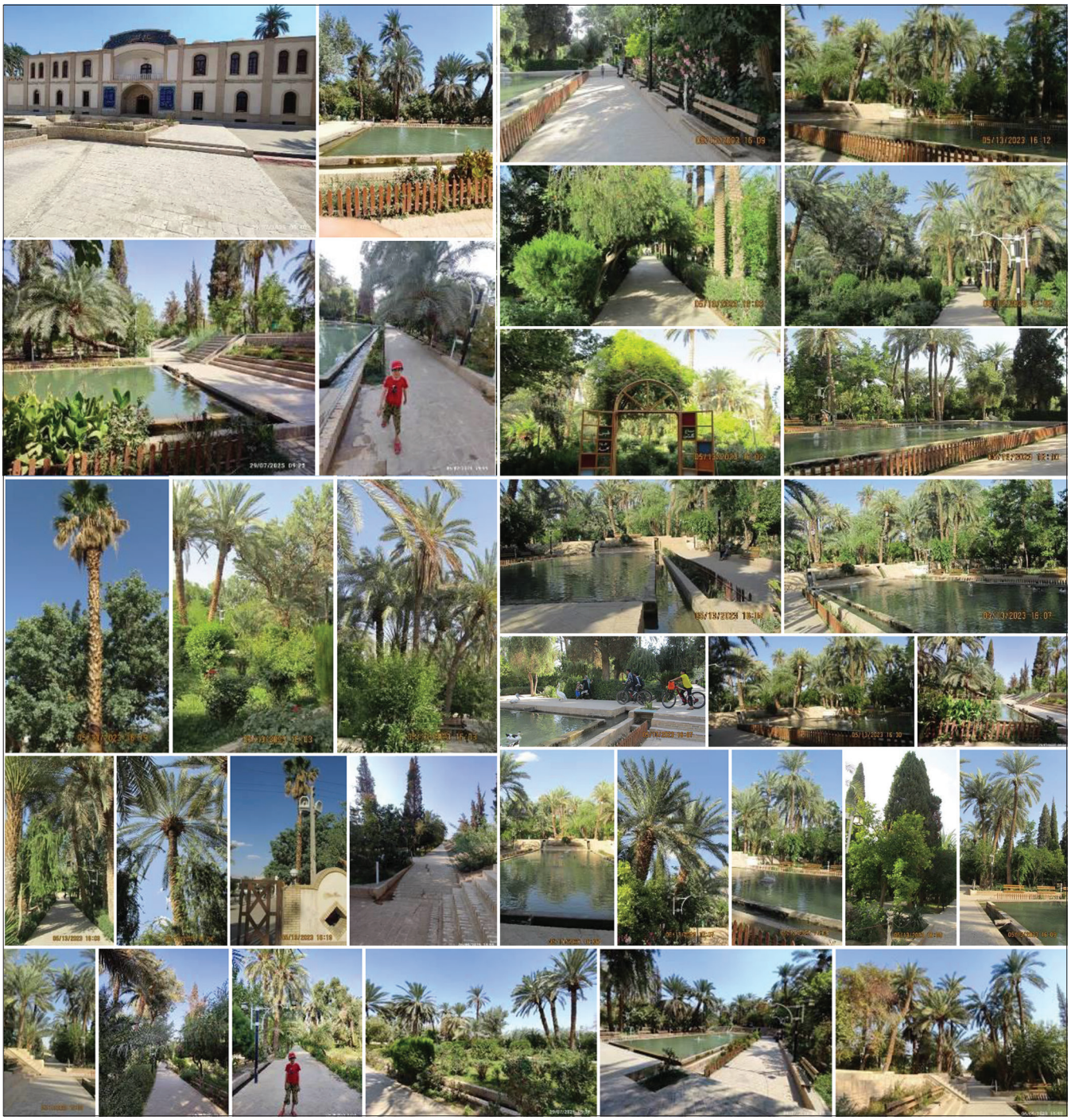

Figure 5: Some of the trees, shrubs, ivies, flowers, ground cover plants, hedges and vegetables in the Golshan Garden in the town of Tabas, south east of Iran and its entrance gate, pool, birds, etc. (Pictures by author. Spring 2023 and Summer 2025)

- Hedin states: "The very long and straight streets end in the city square, and there are streams on each side of the street. The berry and orange trees grown in several rows create the necessary moisture" (Hedin, 1976: 433 - As quoted in: Ghasemi and Golzar, 2018).

Confirming Hedin, in a similar vein, Daneshdoust also states: on the two sides of the street, the entrance axes of two other streets, which are paralleled, separated by the rows of trees. On their outer edges, there are rows of orange and pomegranate trees, and these rows of the tree are somehow orderly (Daneshdoust, 1990: 91-95 - As quoted in: Ghasemi and Golzar, 2018).

- In his travelogue, MacGregor refers to the Golshan garden in Tabas, and highlights the

cultivation of different fruit trees: "There are plenty of palm trees here and there, and oranges, pomegranates, and peaches grow here" (Macgregor, 1879 - As quoted in: Ghasemi and Golzar, 2018) [Figure 5].

- A systematic review of the Garden in a book titled Tabas Garden shows that fruit trees are planted in the side garden. These gardens are called Madoon. In Madoons, there are pomegranate and citrus trees, and other fruits, such as plum, apricot, green plum, and a few apple trees (Daneshdoust, 1990: 91-95 - As quoted in: Ghasemi and Golzar, 2018).
- In his article, Godard describes Hasan Khan Sheibani and states that: He built a wide street ending a very beautiful garden called the Golshan Garden; the garden held a variety of trees, especially dates and citrus (As quoted in: Ghasemi and Golzar, 2018).
- Daneshdoust also refers to the rows of palm trees and oranges in the outer edges of several streams. He also adds that in a slope caused by the difference in height between two upper and lower levels of the garden, the grapevine used to be planted, and in the last half-century, these sloping surfaces have been decorated with colored rocks for saving water (Ibid: 91 - 97 - As quoted in: Ghasemi and Golzar, 2018).

Within Daneshdoust's book, there is an image of a tree branch with some hanging yellow leaves on which there are red spots. These remaining leaves signify the end of the autumn. Based on the branch type, the tree must have been "quince"; the tree which is usually resistant to leaf shedding (Ibid: 113 - As quoted in: Ghasemi and Golzar, 2018).

Nonproductive trees in the Golshan garden

Reviewing historical studies and documents from various travelogues shows that not much exists on non-productive trees in the Golshan Gardens. This is because shady and unproductive trees are planted on the main routes of Persian gardens for their shadow.

Like a palm grove, in Golashan Garden, the tree seeds are sparsely sowed. The main designing lines of the garden include two main paths, one on the entrance axis and one inside the garden in a vertical position (Durighello, 2010 - As quoted in: Ghasemi and Golzar, 2018).

Sven Hedin, a Swedish traveler, has referred to the street in the Golshan Garden in his travelouge and written: on the sides of the streets, there were weeping willows and on each entrance axis, there was a water stream. On the inner edges of the streams, there were short willows known as Mashhadi or foreign Willows. He also mentions acacia trees on the outer edges of the stream (Daneshdoust, 1990: 91-100 - As quoted in: Ghasemi and Golzar, 2018).

In the geographic book of Tabas, Amini refers to weeping willow and tall cypress trees (Amini, 2005: 185- As quoted in: Ghasemi and Golzar, 2018) [Figure 5].

However, according to Daneshoust, the two cypress trees that did not use to be in the old photographs of 1317 can be seen in the photos taken in recent years. Without these two, the garden looks longer. Planting these two trees, which after a while, one of them became withered, has shortened the axial landscape of the garden and faded its beauty. Unfortunately, in other areas of the gardens, some cypress trees have been planted. The selected places for trees are not appropriate for Iranian gardens.

- Some trees and shrubs can be seen in the picture taken from the porch at the rear transom. A small collection of leaves in the upper right corner of the picture must have been related to a tall plant. This tree has already dried up, and nothing but a dry body of which has been left. In another picture of the garden, the passageways between the two plots, some parts of the tree trunks and the leaves of the pine trees behind the bench are visible and in the right part of the picture, there are the rows of the cypress trees (Daneshdoust, 1990: 136 - As quoted in: Ghasemi and Golzar, 2018).

Decorative shrubs and ivies in the Golshan garden

In the book titled Tabas gardens, there are references to the roses among the willow rows in the past: "... in the past there were roses in this row," which, of course, based on the images has been published, these flowers must be Mohammadi roses, which are commonly popular in our country nowadays.

In recent years (Daneshoust refers to 1971), some of the roses have been planted in the middle of the garden near the building, and they are not suitable

for this historic garden. Daneshoust describes the flowers of Tabas: Nastaran flower is white and pink, and used to cover the wooden gardens in the past. It also refers to a flower from the family of roses. Today, because of the emphasis on green space by the municipality, new shrubs and ivies have been added to the garden. However, the changes have been done without considering the design and landscape of the garden. Examples of these trees are glycine and jacaranda (Daneshdoust, 1990: 136 - As quoted in: Ghasemi and Golzar, 2018) [Figure 5].

Seasonal flowers in the Golshan garden

Not much has been documented on seasonal flowers in the garden. However, the available images from the past are of great help in characterizing the seasonal flowers. The absence of documents on seasonal ornamental plants could be associated with the authors' lack of information.

In the book of Tabas, the city was: "... The difference in the level of the garden by the sloping surface between the two waterfalls and staircase planting of petunia flowers has made the design and color of the garden special." This could be a reason for planting ornamental and seasonal flowers.

Wallflower, marigold, and petunia flowers have been planted on both sides of the main street, and on both sides of the big garden lying in the middle and in the parts of the large garden. According to the elderly in Tabas, there used to be other flowers like tumbleweed in the Golshan garden. (Ibid - As quoted in: Ghasemi and Golzar, 2018).

Ground cover plants in the Golshan garden

Generally speaking, the science of using ground cover plants, such as grass in Iran is still in its fancy. In different books, not much exists on this type of plants. Most of the available sources have mentioned alfalfa as a cover plant in the garden of Tabas. In travelogues and historical documents, it is written that alfalfa has been used as a cover plant. In his travelogue, Hiden said: "My tent was set on meadow in the midst of two streams... the tent was set up in a way that whole the day, there was a cool shade of palm trees" (Hedin, 1976: 434 - As quoted in: Ghasemi and Golzar, 2018) [Figure 5].

Hedges

The term "hedge" refers to a living hedge, or the living wall, which is widely used in gardening and landscape design. However, in the old books, there is no direct reference to its pruning method and the information is mainly gathered from the images of this art.

According to a picture taken from the main axis of the garden in 1938, the walls in front of the corridor are visible. The walls are a complete reference to Topiary science that has been part of the past in this garden. Most likely, the wall-mounted plants are privet (lingustrum vulgare). It is because this plant has been grown on walls in various parts of the garden since decades ago (Daneshdoust, 1990: 134 - As quoted in: Ghasemi and Golzar, 2018) [Figure 5].

In the picture taken from the center of the garden toward the western door, on the right of the right corridor and the left of the left corridor, regular and grouped shrubs can be seen. The outer parts of shrubs have been pruned. These plants are wall-mounted plants, which are regularly pruned owing to the pruning mechanization (Ibid - As quoted in: Ghasemi and Golzar, 2018).

Growing vegetables in the Golshan garden

Based on the literature, there were some vegetables in the Golshan garden years ago. In the book Gardens of Tabas, it is written: As the elderly remember, vegetables used to be grown in the two squares at the end of the garden (Daneshdouost, 1990 - As quoted in: Ghasemi and Golzar, 2018).

Since Tabas is a large vegetable area, especially in autumn and winter, it is likely that vegetable farming used to be practiced for earning money. Therefore, the presence of flowing and permanent water for vegetable farming in this arid area justifies why the garden is in the eastern part of the city (As quoted in: Ghasemi and Golzar, 2018) [Figure 5].

THE STRUCTURE OF THE GOLSHAN GARDEN IN TABAS

It seems that the Golshan garden has been designed in an old palm grove because the palm trees are scattered in the garden and do not follow any significant pattern. The length of the garden from

the entrance to the end of the entrance axis is 266 m and the length on the two sides of the square in front of the garden is 292 m and its width is 260 m. The garden is close to 74438 square m. The design of the square flower-shaped garden has geometric divisions aligned with the edges of the fence (Ghasemi and Golzar, 2018).

This work is based on the four garden pattern. This area is in the form of a square or rectangle between the walls of the garden. The surface of the area is divided into four equal parts by two cross-linked vertical axes of water and is located in the center of the water fountain.

However, the use of the term "Chahar-Bagh Gardens" instead of "Charbagh" dates back to the Safavid period and based on academic reports, the term includes the Golshan Garden in Tabas.

In many desert gardens, shady trees are planted on four main paths while the fruit trees are planted in the side gardens. Examples of such gardens are Dowlatabad Yazd and the Eight Shafts Garden of Isfahan (Ghasemi and Golzar, 2018).

COMPARISON OF THE GOLSHAN GARDENS IN THE PAST WITH THE PRESENT

To understand the historical status of the garden, we can refer to the points of the Golshan garden described by Seven-He din and compare their past status with the present in terms of changes. For example, he talks about women outside the garden. At the same time, it's hardly possible to see some part of the garden wall. This indicates a very low density of trees in the eastern part of the garden. This change can be seen by comparing the …image of the garden in some decades ago with the ones taken in recent years. In the available images, the eastern part of the garden, except for the main road, rarely can we see any trees. However, in another image, which is extracted from Google Earth, the Eastern parts are almost covered with trees and plants. Furthermore, the old image is completely empty, whereas nowadays this part includes green spots showing trees and plants (Ghasemi and Golzar, 2018).

In 1875, Meg Gregor wrote:

There were many palm trees here and there, and added that palm trees were scattered in the Golshan Garden. Most likely, the scattered trees of the eastern part of the garden are the same as the palm trees. He also reported his other observations as such: "Oranges, pomegranates, and peaches are here." About 15 years after these observations, Hedin did not explain about garden plants in detail. The French author, Andre Gedar and his wife who visited Tabas years ago, described garden and praised the palm trees, citrus trees, the cool shade of palm trees, the meadow between the two streams, the whispers of wind among the trees, as well as numerous fountains that give water as a gift to the heaven (Daneshoust, 1990: 93; Godard, 1965 – As quoted in: Ghasemi and Golzar, 2018).

The increase in vegetation could be associated with the annual donation of trees and plants in the garden. In part of the letter prepared on June 26, 1182, by Mir Hossein Khan (governor of Tabas), it is written: "... a religious trustee in any centuries or ages has not been exempted from the development, growth of estates, farms and other donations, Every year, he has to plant trees and seedlings, and refine and restore the buildings, and this obligation is more important any other things and praying for the donator and their parents is necessary" (Daneshdoust, 1990 – As quoted in: Ghasemi and Golzar, 2018).

A variety of factors have contributed to Gradual changes in vegetation and in its diversity: Donation made by the governor and his emphasis in executing his will, and the establishment of Tabas municipality in 1310. Danshoust also has referred to changes in trees, shrubs, ornaments, roses, and seasonal flowers in the garden of Tabas. He has highlighted that some trees are added to the garden regardless of its basic planting principles. According to him, two cypress trees did not use to be in the old photograph of 1938! This change in the main garden pattern has occurred later and continued.

In some of the main paths of the gardens, the productive trees have been added to the garden. Such changes have not been in agreement with the main pattern of the gardens, even some unproductive trees, such as Eucalyptus has planted alongside and some of the side-routes do not abide by the principles of the garden. One of these cypresses was removed by the municipality in the 90's and only one of them remained.

Water scarcity in the region has also been a major concern. In the past, some parts used to be decorated with colored stones, the slopes of the ground used

to be covered with grape trees, and now, due to the water shortage, neither of them is being practiced (Daneshoust, 1990: 36 – As quoted in: Ghasemi and Golzar, 2018).

Based on this evidence, planting some fruit trees, such as palm trees for saving water and having fruits can be justified.

Another issue that has damaged the landscape of the garden is trees that are planted regardless of the pattern of the garden. An example of this can be a hackberry tree among orange trees, or several pistachio sprouts, and fern trees.

Based on the ancient pattern of Iranian gardens and the historical explanations of the Golshan Garden in the past, this garden was initially a grove of palm and citrus trees describes four gardens, such as the vast forest of fruit trees and shaded and enclosed walls, with jetties and water-filled daisies (Alemi, 2011: 7 – As quoted in: Ghasemi and Golzar, 2018). This is not a description of the massive fruit trees associated with the original form of the trees in the Golshan Garden. However, the fruit trees in Iranian gardens reflects the impact of the Islamic-Iranian culture on agriculture and gardening; cutting productive trees is forbidden in Islam and farming the most legitimate occupation practiced by the prophets and, and introduced the palm tree as the best fortune (Khalili-Nezhad and Tobias, 2016: 6 – As quoted in: Ghasemi and Golzar, 2018).

Even in various books and in the culture of the Tabas in the past, there was a belief that cutting off the productive trees, especially the palm tree, is a sinful act and causes distress.

Informal or informal gardens, the plants were not grown only for decoration, but the plants were productive and its fruits that were given to as a wage to the gardeners or brought to the owners of the gardens.

The economic reasons and the use of products, and the self-sufficiency of the community have been among the factors contributed to the formation of gardens. Therefore, the gardens have long contributed to livelihoods (Khalil-Nezhad and Tobias, 2016 – As quoted in: Ghasemi and Golzar, 2018).

It should be noted that the geographical conditions of Tabas and its remoteness from the fertile towns have encouraged people to produce fruits and vegetables in the area. However, nowadays, the municipality annually put up the products of the garden for auction (Ghasemi and Golzar, 2018).

DESERT ECOTOURISM AND SUSTAINABLE RURAL DEVELOPMENT IN SOUTH KHORASAN PROVINCE

Today, tourism has become a very profitable industry with explosive growth and can solve many economic problems. Iran has a high potential to exploit the tourism industry at the international level. Today, different countries of the world are looking to turn the existing capacities in their country into tourist attractions.

After identifying and categorizing the types of tourist attractions in each country, it is possible to determine their importance for developing this industry (Khanifar *et al*., 2023).

Ecotourism must be marketing of Iran's target villages and towns for tourism along with mountaineering, desert tourism, etc. (Barjasteh Askari *et al*., 2016) [Figure 6].

The tourism industry has become one of the most important economic sectors. Tourism creates jobs, generates income, and contributes to infrastructure development. The tourism industry's contribution to the world economy's GDP was more than 10% before the Corona pandemic, and it was growing. The tourism industry in the world is expected to grow by 5.8% annually until 2032.

Although Iran has many tourist attractions, it has not been able to take advantage of this industry significantly. Undoubtedly, marketing is the most critical action that must be done to develop Iran's tourism industry at the international level. Tourism marketing seeks to make tourist destinations better places to live in and better places to visit (Khanifar *et al*., 2023).

Identifying the spatial structure of tourist attractions is one of the basic requirements for developing a country's tourism industry. Identifying destinations will improve planning and management by providing tourism actors with information about how tourists consume the goal. Furthermore, identifying the forces that bind attractions together is critical to efficient management, promotion, and preservation. The tourism industry is significant for job creation, alleviating poverty, and economic growth; therefore,

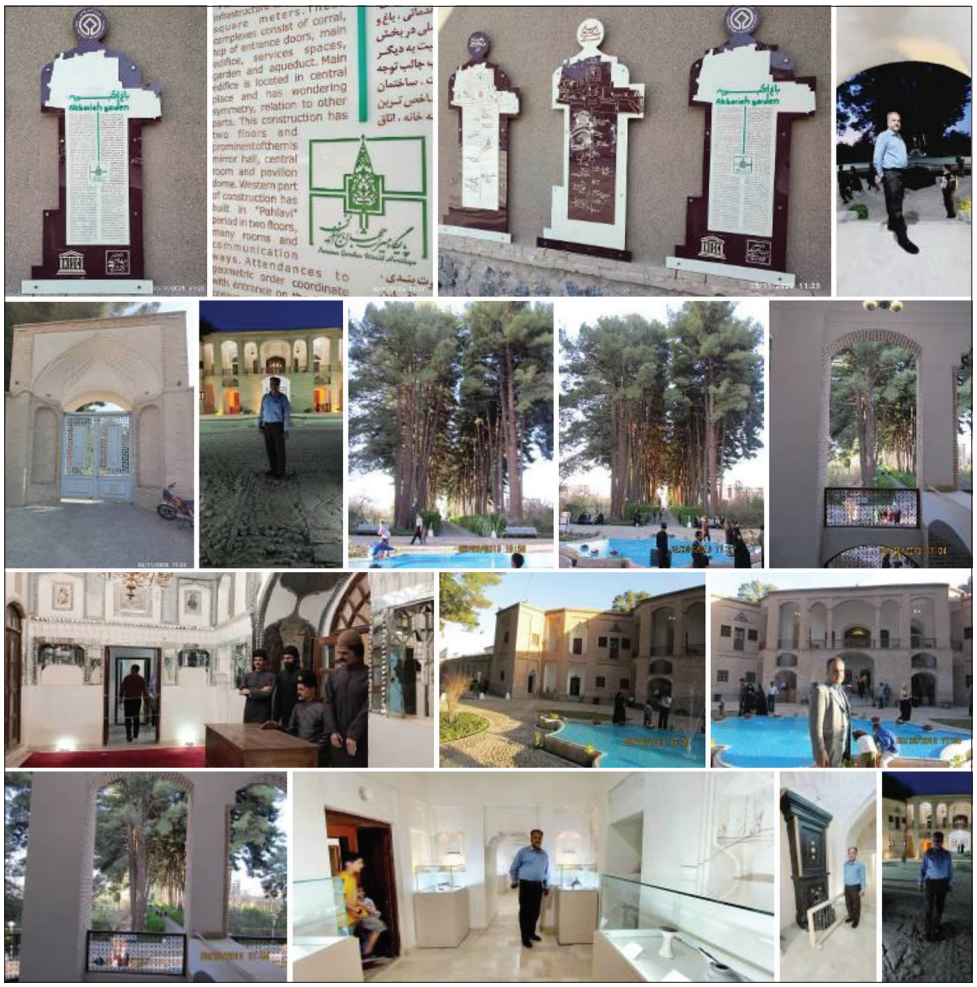

Figure 6: Visiting from the Akbarieh Garden and its inside museum in Birjand, South Khorasan province, Iran (Pictures by author, 2013 – 2025). Akbarieh Garden is a UNESCO World Heritage Site in Birjand, South Khorasan province, Iran. It was inscribed on the UNESCO World Heritage List in 2011. It annually receives thousands of domestic and foreign tourists. It is concomitantly used as a museum and tourist space

it is necessary to provide marketing objectives. The first step to offering marketing objectives is identifying and categorizing Iran's tourist attractions (Khanifar *et al*., 2023).

Historical and natural attractions are part of conventional tourist attractions, and Iran is one of the wealthiest countries in the world in this area. Unfortunately, Iran, having many historical and natural attractions, has been unable to attract many international tourists.

As nature-based tourism grows, protected areas will witness increasing pressure from tourists, with the quality of destination attributes exerting a considerable influence over their experience. Nature-based tourism in protected areas of low-income counties can contribute to regional economies, reduce poverty, and help to develop rural areas, but there are also significant challenges.

Fortunately, Iran has many protected areas that can be offered to international tourists by developing tourism services. For example, Shidvar Island in Iran can compete with Wasini Island in Kenya.

Ecotourism pursues sustainable regional development, improved livelihood for the local population, employment opportunities, income source creation, and enriched service exports.

Iran's deserts are unique in the world. Iran's deserts alone can create a strong competitive advantage in competition with other countries (Khanifar *et al*., 2023).

Ecotourism, as a type of tourism in nature, is of interest to Iranian planners because it has a key role in strengthening the local economy. Despite environmental constraints that exist regarding growth and development, South Khorasan province

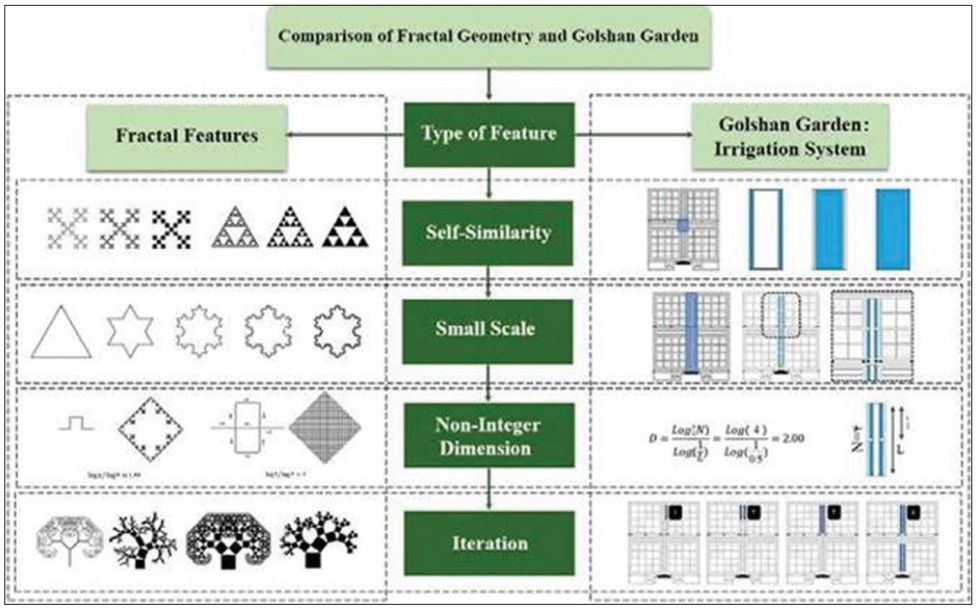

Figure 7: Comparison of fractal and irrigation system geometry of Tabas Golshan Garden (Sharghi *et al*., 2020)

has diverse capabilities and attractions in natural tourism, one of which is desert tourism. Desert tourism and touches upon the challenges of developing settlements around the deserts that are the target of tourism.

There are many factors involved in the development of tourism in desert areas, the most important of which were related to creating mental and emotional peace and using specific desert landscapes for activities, such as photography (Falsolyman, 2022). In terms of the economy, the impact of tourism on the economic status of households was evaluated in different dimensions. In addition, regarding tourism obstacles in desert areas, adverse natural conditions, such as temperature conditions, dust, and fine particles must be described (Falsolyman, 2022) [Figure 6].

FRACTAL GEOMETRY IN GOLSHAN GARDEN

Today, returning to nature and patterning it seems to be one of the most important needs in the world. Iranian architects have been successful in applying scales and connecting different scales to one another, as well as facing nature around them. Geometry, while being abstract, is the most important language through which the architect creates specific spatial qualities.

The Iranian garden consists of a combination of water, plants, and buildings. Fractal-sized plots are found in the overall structure of the Golshan Garden plan. One of the main features of the geometry of the Iranian garden is symmetry and proportion, which is seen in the vast majority of them (Sharghi *et al*., 2020) [Figure 8].

Tabas Golshan Garden is not an exception and this symmetry, as well as proportion, can be observed in structural, irrigation, and vegetation dimensions of the geometric plan. The Iranian architecture has been paying special attention to privacy and introversion from the beginning. This introversion has been created in this garden due to the reticulate design of the walls around the garden, the shaded trees, and also the mansion. Another characteristic feature of this garden is its multi-layered structure (Fold style), because it can be said that the garden is made up of three layers that are connected by vertical connections. The first layer is at the beginning of the entrance, while the second layer is concentrated on the central pond, and the third layer is the highest level at the far end of the garden. In addition, the planting layer, the pedestrian crossing layer, and the third layer for the water flow are seen in the formation of Golshan Tabas garden components. In this plan, a micro and macro scale rotation can be observed, so that the intersection of the lines of symmetry makes the center of the plot's rotation, and the paths of water flow. The decoration of Tabas Golshan Garden contains Islamic nodes whose structure is self-similar. In addition, the iteration and replication of this structure is of a small-scale

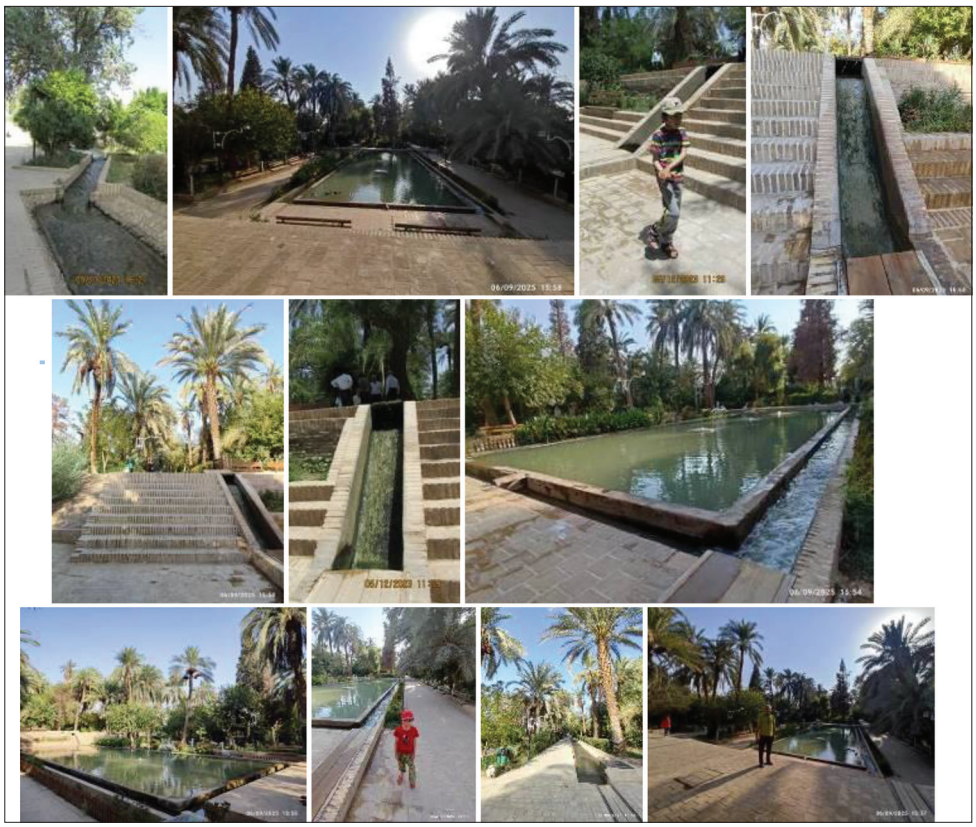

Figure 8: Some elements and comparison of fractal and irrigation system geometry of Tabas Golshan Garden (Pictures by author, 2023 – 2025)

nature, so that what is sought in detail can be found at a large scale. The nodes are extremely regular and extendable in addition to possessing a highly sophisticated structure (Sharghi *et al*., 2020).

Irrigation System

In an Iranian garden, water is directed underground and is fountains in special places water flows everywhere in the garden. Its motion in four directions and streams is the same as the symbol of four streams in the heaven, applied to the Iranian garden design. In addition to its functional and vital role in plant irrigation, water plays a prominent role in landscaping and creating pleasant sounds.

Water has the properties of refreshing, moisturizing, cleansing, reflecting, and life-giving. Water in Iranian architecture is considered as a central element and the architecture around it shapes places, links spaces, and influences environmental comfort, ritual, and fluidity. The presence inside the mansion and the movement between interior and exterior, especially in relation to the garden and the courtyard, as well as the presence at the entrances, indicate the functional value of esthetics and belief in water in Iranian architecture (Sharghi *et al*., 2020) [Figure 8].

The irrigation system in Goshan Garden has a self-similarity feature, so that in the whole irrigation system, water movement paths are larger scales of water resettlement sites, and the dimensions of water movement paths are increased relative to their resettlement location. In small-scale features, each set consists of a smaller subset, which are similar to larger sets. In the central fountain of the garden, the water pond and the waterways are observed on either side of the garden, each of which is a representation of the large pond in the middle of the garden, which reflects the small-scale geometry of the Golshan Garden irrigation system. Water paths are repeated along the garden, so that there are totally eight similar paths (Sharghi *et al*., 2020).

Vegetation System

In the Iranian garden, the plants have their own order of shading trees on either side of the garden

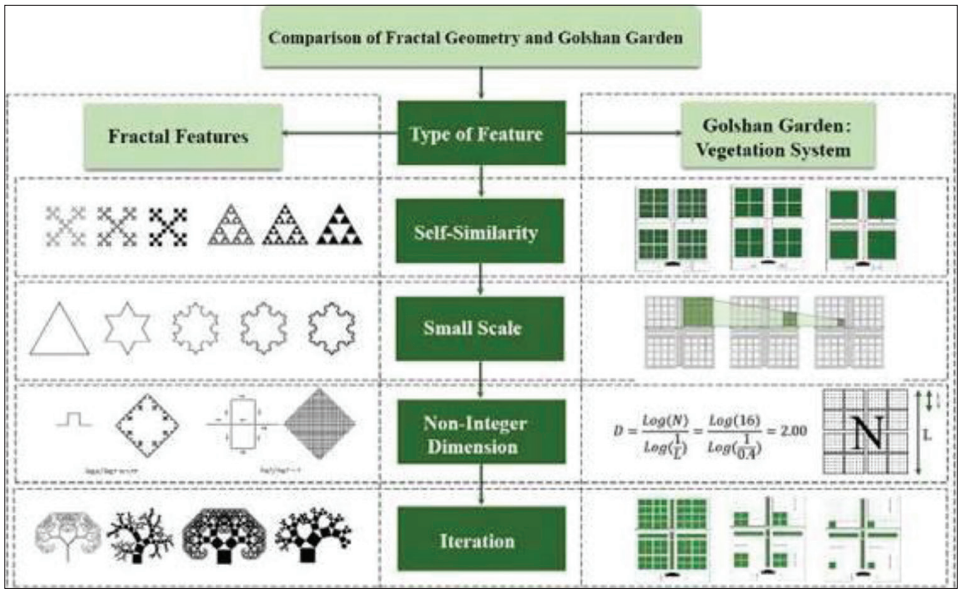

Figure 9: Comparison of fractal and vegetation system geometry of Tabas Golshan (Sharghi *et al*., 2020)

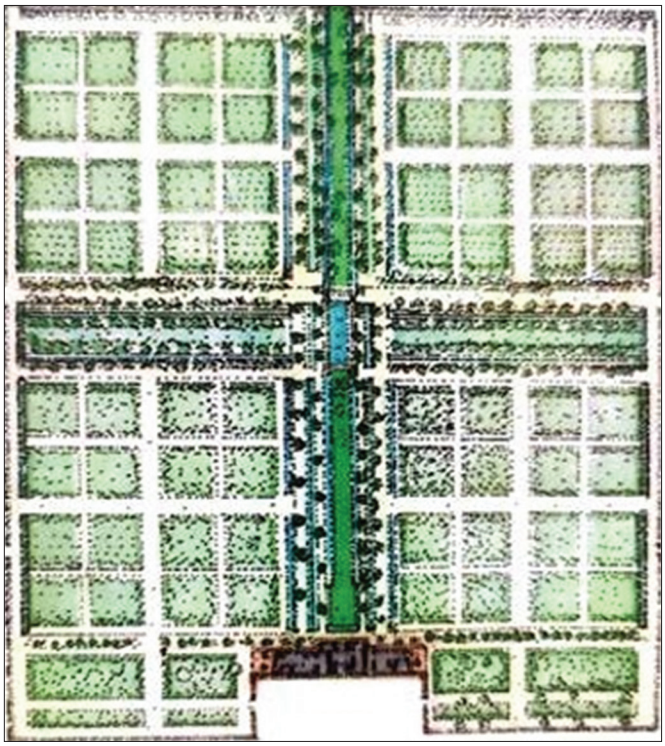

Figure 10: Design of Golshan Garden as Chaharbagh (Sharghi *et al*., 2020)

paths, emphasizing the pivotal paths given their importance, and relying on the variety of shading trees. These trees are only one type of tree at a time, such as plane trees, and at times two species, such as plane and cedar trees. In the lateral axes that intersect the main axis orthogonally and form paths between the plots, there are also rows of shading trees (Sharghi *et al*., 2020).

Rows of trees and buildings, as well as intersecting paths that make it possible to exchange, can be a fractal. Moreover, the trees with their fractal leaves and branches catch the light and stand against the wind, while the leaves are located in optimal conditions. The rules governing vegetation growth lead to features, existing in small scale and being transferred to larger scales as well. In Tabas Golshan garden, the vegetation and plots have self-similarity, so that each plot is a smaller version of the larger plot. As the dimensions of the plots grow, the plots increase in size and are replicated. It can be said that the structure has a hierarchy in addition to the plant system, which reflects hierarchy in terms of planting and shading features. The fractal non-integer dimension of a self-similar object is calculated as the absolute value of, in which represents the length of the reticulate dimension and N indicates the number of cells that measure the object. Regarding the fractal dimension of the vegetation system in Tabas Golshan Garden, it should be noted that according to the calculations for the garden plots in which $n = 16$ and $L = 1/4$, the answer to the equation will be 2, which is equal to the non-integer fractal dimension of the Peano curve in fractal categorizations (Sharghi *et al*., 2020).

The Fractal Word

The fractal word derived from the Latin word fractus – meaning irregularly broken and crushed

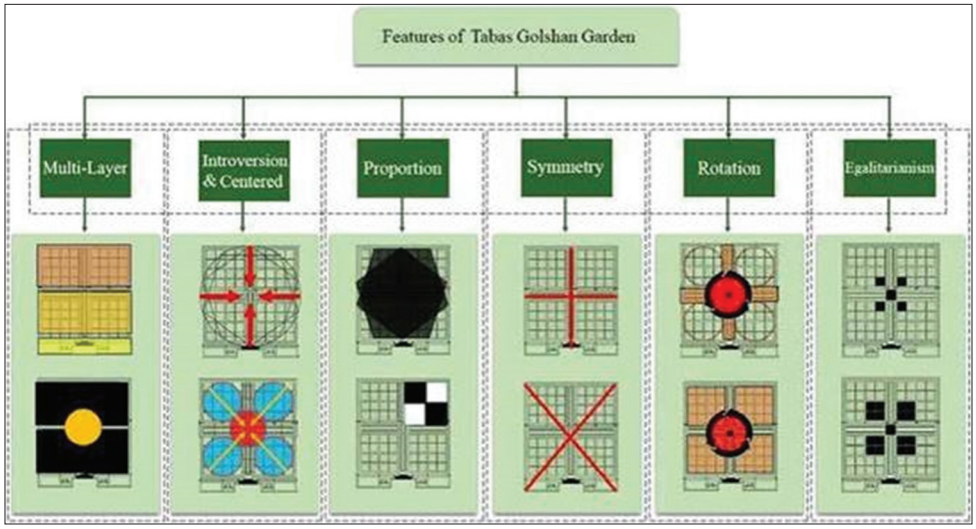

Figure 11: Comparison of fractal geometry and geometry of Tabas Golshan Garden structural system (Sharghi *et al*., 2020)

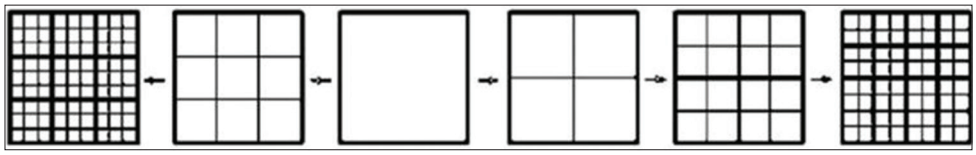

Figure 12: An example of fractal form with continuous (Sharghi *et al*., 2020)

stone – was first introduced by Mandelbrot in 1975. Fractals are shapes that are by no means regular, unlike Euclidean geometrical shapes.

Considering the shapes in nature, it is clear that Euclidean geometry is not capable of explaining the complex and apparently disordered shapes of nature. This geometry has been discussed by many architects and mathematicians for many years, and its use in architecture and artificial geometry has been questioned, violated, or defended.

Fractal theory is applied to describe the complexities in the shapes. Fractals are shapes that are by no means common or regular. These shapes are, first of all, irregular, while the irregularity is similar in all scales, indicating a type of regularity by itself. Fractal objects are seen as similar from near and far (Sharghi *et al*., 2020).

Today, when the issue of the creation of spaces with sophisticated uses and flexible structures is raised, the contemporary western architecture and common theoretical foundations in the modern world will be evoked.

Experts generally believe that only with architectures from Western schools that have a particular spatial geometry we are able to create complex spaces that can be expanded in different spatial dimensions. This is while Islamic architecture is inherently of a geometric nature. Muslims' love for mathematics, especially geometry and numbers, is directly related to the principle of Islam's message, which is the belief in monotheism. In the Islamic worldview, the sacredness of mathematics has never been reflected anywhere greater than in the art. In art, the matter obtains nobility through geometry and calculus and a sacred space is created in which the presence of God is directly reflected everywhere (Sharghi *et al*., 2020).

The infinitely expanding geometric patterns represent the intrinsic dimension of Islam, and this mystical, infinite concept of creation reflects the grace of being that is issued by God: plurality in unity. Therefore, geometry plays an important role in architectural space, and since the architecture of the Iranian garden, in simple words, represents architecture, free volumes and clear geometries, the whole of the Iranian garden follows a single geometry in which all the elements and components are subordinate to the original order. Therefore, it can be hypothesized that there is an intrinsic relationship between geometry and Iranian gardening (Sharghi *et al*., 2020).

Iranian architects have been successful in applying scales and connecting different scales to one another, as well as in dealing with the nature around them. Their natural interplay with the structure of

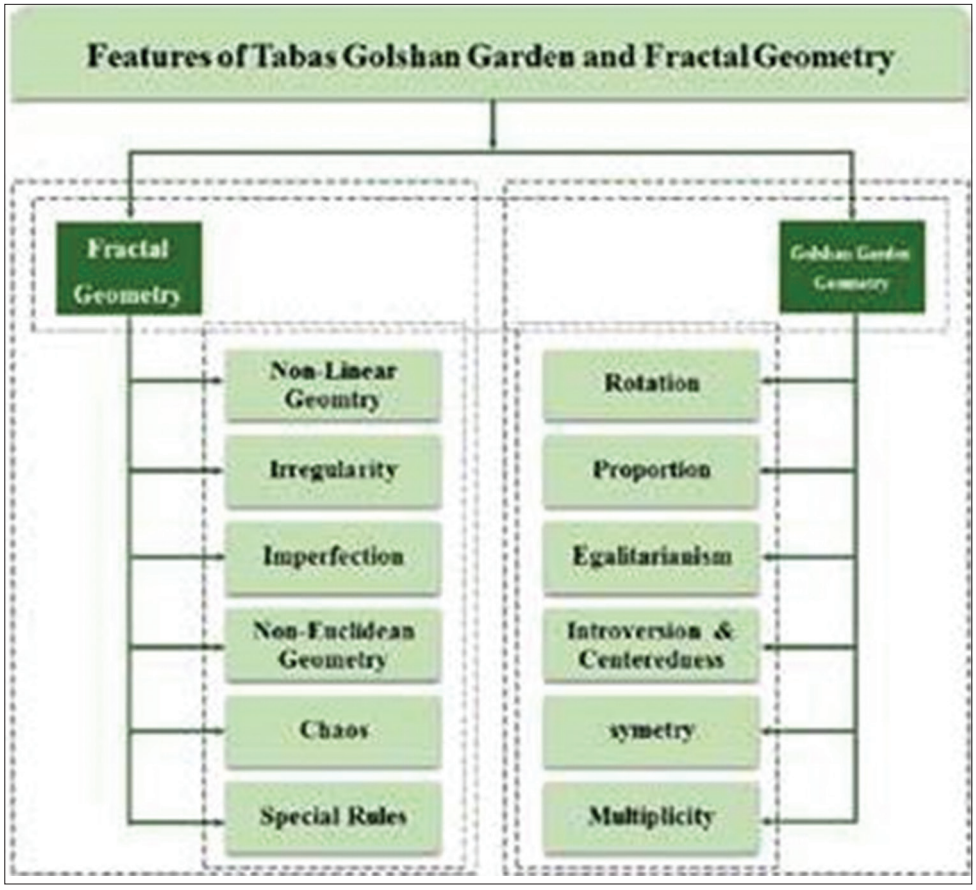

Figure 13: Features of Tabas Golshan Garden and fractal geometry (Sharghi *et al*., 2020)

nature and the impact of natural spatial qualities on the process of architecture and design in the Iranian Garden is impressive and remarkable. The pattern of Iranian gardens is based on precise mathematical equations, and nature with advanced mathematical patterns has always been a source of inspiration to engineers and artists in the Islamic world (Sharghi *et al*., 2020).

It is the man who gives meaning to nature and with his ever-increasing empathy, he can discover the hidden secrets of nature (which are undoubtedly his innate secrets).

Among artists and art professionals, architects have had a great place in the use and imitation not only of natural structures and the environment but also in form modeling, content modeling, and modeling of the laws of nature (Sharghi *et al*., 2020).

Characteristics of Fractal Geometry

- Self-similarity: Self-similarity is one of the features associated with using symmetries in patterns, such as the use of pattern elements and components that are repeated at different scales. Each shape is made of smaller pieces that resemble the original shape; in other words, when one of the small pieces is changed into the scale of the original shape, the same shape is exactly obtained.

Henry believes that Iranian geometric decorative patterns follow an alternative principle in which self-similar shapes are recursively broken down into smaller proportional copies of themselves. Henry has also studied the interior decoration and geometric structure of Islamic architecture and has found that the complex geometry of Islamic architecture reflects the artists' attempt to express emotions through sophisticated geometric designs that incorporate iteration, weight, tone, scale, and composition (Sharghi *et al*., 2020).

- Small scale: As it can be observed in the following figures, fractals look similar in every scale. Fractal sets include sub-sets that consist of larger sets. Again, these sets include smaller sub-sets which are also similar to the larger sets, and this feature is called small scale.
- Non-Integer dimension: Fractals have unique dimensions that are defined mathematically.

Fractal dimension is a mathematical criterion to determine the degree of texture complexity, called a non-integer dimension.

- Iteration: Fractals are formed through an iterative process in which every repetition is formed by the previous result. This feature is called iteration (Sharghi *et al*., 2020).

Spatial System and Geometry of Iranian Garden

Iranian culture does not consider the human separated from nature, but sees him along with other elements of nature to understand as signs of God. Therefore, Iranian architecture and art seem to be extremely naturalistic.

The Iranian garden is a combination of simple and harmonious elements, a well-balanced and robust relationship, a distinctive geometrical system, perpendicular lines, rectangular garden beds, and a well-watered, wide-open network.

Referring to the historical origins of this word, Mirfendereski basically calls the Iranian garden Chaharbagh (or four-garden) and says that in the system of establishment, two axes perpendicular to each other divide the garden into four main parts. This is while Daneshdoost considers the Iranian garden as a combination of lines and main axes that divide the garden space into four sections. Generally, if there are no philosophical principles, namely, unity, identity, authenticity, honesty, and practical principles of scale, including proportion, infinite regression, composition, and equilibrium that are inextricably linked, the architecture cannot be examined (Sharghi *et al*., 2020).

The main features of buildings constructed on the basis of fractal geometry and patterns are:

Flexibility to climatic conditions, cultural and functional issues, innovation, producing positive feedback, feeding on negative feedback from natural systems, definable and recognizable in the overall design and unpredictable in details, most mediated by the surrounding environment, maximum use of natural elements and textures, paying attention to all scales of design, productive and continuous information taking into account the user's perceptual capacity, the use of symbols, signs and impressions, the ability to create memories and enable the observers to forget (The power of creation and elimination of information (Sharghi *et al*., 2020).

The art of Iranian gardening has been applied in such a way that the most prominent of these has been the idea of Chaharbagh and the enclosure of the mansion (architecture) with the garden and the prominent geometry. In such a garden, a sacred outline of the walls or the interior of the garden kept everything in balance and marked a rectangular space that was divided into four sections by water canals or corridors. The term "Chaharbagh" taken from Old Persian, was used for this design and is still being used in contemporary Persian (Sharghi *et al*., 2020).

It is important to understand the effective and shaping principles of these lines and forms, emphasize on the meaning rather than appearance, and apply the principles that guarantee growth, life of organisms, and evolution in the environment. Undoubtedly, using a visual conceptions of nature in architecture cannot give it meaning and identity. Therefore, the presence of the spirit of nature in architecture gives it manifestation and development (Sharghi *et al*., 2020).

In fact, the unity of plurality in the architecture of Golshan Garden illustrates its fractal geometry along with its totality from one part to another. The simple fractal form cannot have any added value to today's architecture with a superficial imitation. By knowing and understanding the fractals, it is possible to create quality Iranian gardens that meet the new human needs (Sharghi *et al*., 2020).

The Iranian garden, especially Tabas Golshan Garden, has many concepts that still have much to discuss and can guide us in designing today's gardens, because its principles have been used by many architects and designers in a variety of different ways and approaches.

The structural system of Tabas Golshan Garden has symmetry, rotation, proportion, regeneration, centeredness, multiplicity, conceptualism, and symbolism features in both details and decorations. Furthermore, the results of investigating the irrigation and vegetation systems of Golshan Garden showed the characteristics of symmetry, proportion, multiplicity, symbolism, and esthetics. By comparing the features of fractal geometry and the geometry of Golshan Garden, four common features of self-similarity, small scale, non-integer dimension, and iteration were found. Studies show that the geometry of Golshan

Garden and the fractal geometry have both natural origins.

On the other hand, there is balance in nature and the structural, irrigation and vegetation systems of Golshan Garden are also in balance, indicating that its geometry is taken from fractal naturalistic geometry (Sharghi *et al*., 2020).

The artist's intention is to transform the hidden geometry of the universe into explicit geometry. In Iranian culture, human and nature does not separate together, due to both are signs and symbols of God. Therefore, Iranian architecture and art appear to be highly naturalistic. In fact, it can be said that the overall purpose of designing an Iranian garden is to achieve a communion with nature that exists as an attraction in the human essence (Sharghi *et al*., 2020).

The results show that using features, such as self-similarity, small scale, non-integer dimension, and iteration derived from nature, as well as using the form. For example, pentagons, as frequently seen in nature and able to provide those features, can be considered as the principles of fractal architecture design in Iranian gardens, such as Tabas Golshan Garden.

Fractal geometry is evident in diverse and self-consistent spaces, as well as the spatial typology of Golshan Garden. The designers of the Golshan Garden have derived fractals from self-similarities of nature and have found this geometry a way of expressing the whole in detail and the detail in the whole (Sharghi *et al*., 2020).

It investigates Golshan Garden by expressing its features (rotation, egalitarianism, introversion, centeredness, symmetry, and multiplicity) in Iranian landscaping, while fractal geometry has features, including non-linearity, irregularity, imperfection and non-Euclidean geometry, chaos, and special rules, representing its naturalistic aspect along with the lack of rest and relation of geometries (Kohnehshahri and Atashinbar. 2023).

It is found from the study that if the Iranian garden has fractal features in structural, vegetative, irrigation, and functional systems, it can be extended to the whole garden.

Tabas Golshan Garden, as an example of an Iranian garden, represents fractal architecture design with all the features of fractal geometry and inspired by nature, as well as benefiting from geometric flexibility, definable and recognizable throughout the design, and using a form, such as the pentagon found in nature (Kohnehshahri and Atashinbar, 2023).

In general, understanding the nature, essence, and operation of a compound leads to unity. To achieve this unity and to obtain a single overall result, it is essential to know the components and integrate them correctly into the architectural requirements that have been best demonstrated in the systems forming Tabas Golshan Garden. In this way, the clarity of the architect's concept and purpose is essential, because full awareness of the concept of work that must be done and an accurate understanding of the purpose is the basis of the architectural work to achieve the desired unity (Sharghi *et al*., 2020).

Summary of Tabas Golshan Garden of Fractal Geometry

1. The components of Tabas Golshan Garden geometry indicate the features of fractal geometry, including self-similarity, small scale, non-integer dimension, and iteration.
2. There are patterns of fractal geometry in the Iranian garden; if it's structural, irrigation, vegetation, and functional systems are derived from fractal geometry.
3. Tabas Golshan Garden reflects features of fractal geometry in terms of the features of its constituent systems (Sharghi *et al*., 2020).
4. The space-time approach is a four-dimensional continuum that combines three dimensions of space with the time dimension. Tabas Golshan Garden has time continuity in this regard. In other words, it can be said that this garden represents stability in obtaining fractal features in the 4^{th} dimension of its nature.
5. Tabas Golshan Garden indicates features of flexibility against climatic conditions, cultural, and functional issues. In this garden, along with being innovative, identifiable, and understandable in plan, while the details, with maximum use of natural elements, materials, and textures, are unpredictable. In Tabas Golshan Garden, all features, such as attention to all designing scales, use of symbols, signs, and indications, and the ability to create memories, are reflected in fractal geometry.

6. Beyond the unique geometry of Tabas Golshan Garden in different dimensions, other concepts and features, such as conceptualism, symbolism, and multiplicity, are also observed, which need more investigations (Sharghi *et al*., 2020).

THE USE OF GREEN ARCHITECTURE IN URBAN LIFE

Green architecture (sustainable architecture) describes architectural designing techniques that are in line with environmental attitudes and is shaped by the idea of respect for nature.

Green architecture is not a new trend, as it has been fundamentally present in ancient civilizations and traditional architecture, including the traditional architecture of Iran. Its prominent and systematic examples can be seen in Feng Shui science.

Today, in the face of the negative outcomes of the industrialized world (such as the increasing pollution of the air and the environment, the reduction of natural resources, and the energy crisis), the preservation and sustainability of the world's natural resources have become one of the most important concerns (Bathaei, 2018).

Green architecture is designed to minimize the negative effects of industrial materials on the environment by increasing the efficiency and optimizing the use of them. With the progress of human life, environmental degradation continues, and the biological balance of the environment is disturbed. These environments should exist in the lives of humans and in the current urban texture as forest and national parks with a sustainable approach. All these points occur when the level of the general culture of society increases and the members of the modern society themselves reduce the environmental degradation factors. In this situation, it is essential to build parks in accordance with sustainability principles in today's societies to speed up this process [Table 1] (Bathaei, 2018).

PERSIAN GARDEN SUSTAINABILITY

The background of design in Iran shows that with the approach of sustainability, Persian gardens, buildings, and landscapes were designed to be most adapted to the dry and semi-arid climate of Iran [Figure 14]. Inappropriate conditions in the environment and natural resources have led the Iranian to the management of resources and solutions that are consistent with nature. These solutions, such as building "Ganat", building gardens in ditches, using rainwater, building water storage, and designing beautiful gardens (Bathaei, 2018) [Figure 14].

In Iran, achieving sustainability should be planned based on the culture and climate of the region. For this reason, due to the harmony between sustainable architecture and Iranian architecture, the Persian Garden is a typical indicator of sustainability that has the best relationship between nature and artifact space (Bathaei, 2018).

Also, the use of clean and indigenous resources and energies, without destroying nature, will bring ultimate calmness and comfort to humans. Features and characteristics of sustainable architecture and its adaptation to Iranian gardening, including items, such as:

1. Energy Conservation: Persian Garden is based on the principles of native architecture, and the climate-cultural and renewable energy sources create a desirable environment for humans. (Bathaei, 2018) [Figure 15].
2. Climate: In the Persian Garden, the climatic and natural elements are used with respect.
3. Renewable Energy Use: Designing of the buildings (Pavilion) in the Persian Garden are based on using renewable energies, such as Solar and Wind powers. (such as "Shazdeh e Mahan", Kerman city, Iran). (Bathaei, 2018).
4. Respecting users: The geometry applied to the Persian Garden is a four-dimensional geometry. This is the geometry that the human mind can

Table 1: Sustainability criteria in the environmental sector (Bathaei, 2018)

Objectives of sustainable development	Objectives of sustainable development sustainability criteria
Healthy environment	• Protecting natural habitats • Protecting existing green belt • Reusing land • Reducing light and sound pollution • Protecting quality agricultural land areas • Protecting water and its quality • Protecting landscape and view • Protecting cultural heritage • Protecting and promoting specifications of settlements

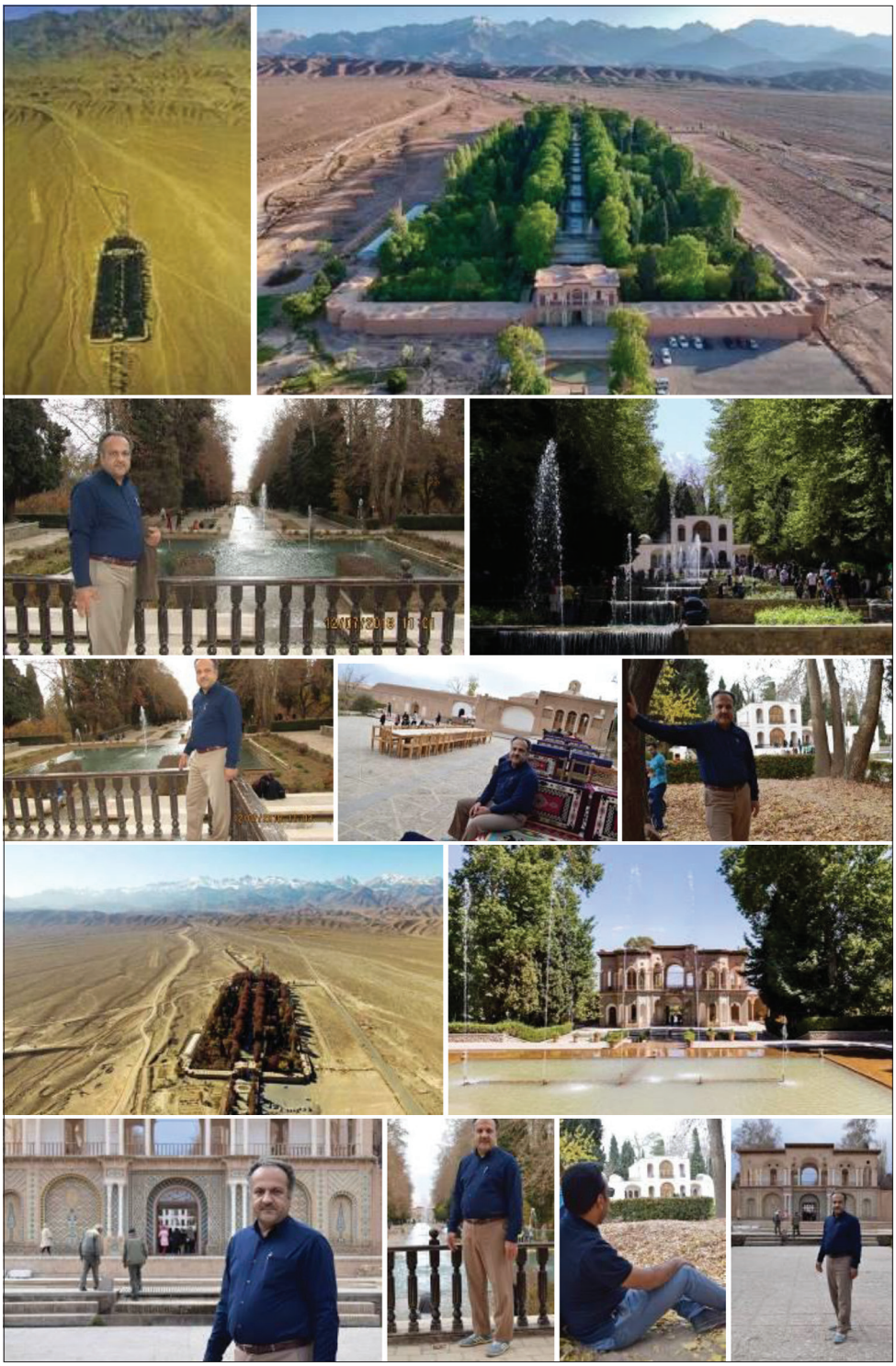

Figure 14: "Shazdeh e Mahan" Garden, Kerman city, south east of Iran. some buildings, etc., in this garden, and its entrance gate, pavilion, pool, trees, etc. (Pictures by author. 2018–2022)

easily understand. (such as Golshan" Garden, Tabas city, Iran).

5. Holism: There is complete harmony in the relationship between human and nature. The garden reflects the order of nature and the world in its regular form, such as: The use of native plants, storage and reproduction of floods and other natural resources, infrastructure conjunction with the appropriate technology, preservation of the life cycle, and wildlife conservation (Bathaei, 2018) [Figure 15].

PERSIAN GARDENS FOR SUSTAINABILITY OF URBAN SPACES AND PARKS

The hallmark of cities in the third millennium is planning and designing in accordance with the nature and principles of sustainable development. Therefore, the necessity of introducing ecological issues in contemporary cities is perceived to be tangible. These ecological issues are embodied in concepts, such as sustainable development, ecological city, and ecological and sustainable parks. The symbol of sustainable urban development is the construction of urban parks consistent with ecological and sustainable indicators. As the population is growing, more communities are looking for spaces that are beautiful and sustainable. For this reason, sustainable parks are much more attracting (Bathaei, 2018).

Compliance of Persian Garden with Sustainable Parks

1. The sustainable park can have straight-line geometry, curved, or natural. Persian Garden also has straight-line geometry in accordance with nature [Figure 17]. (such as“Fin” Garden, Kashan city, and Golshan” Garden, Tabas city, Iran). (Bathaei, 2018).
2. The sustainable park connects components of the outer spaces in a way that they provide intelligible networks for living organisms and natural systems. In the Persian Garden, the spaces are interrelated and there is no separation. Furthermore, all the components are connected to each other [Figure 17]. (Such as “Narenjestan” Garden, Shiraz city).
3. The Sustainable Park is trying to provide an old view of the city as a garden. The Persian garden is a symbol of originality, civilization, and a historical document of the country.
4. Sustainable urban parks can reduce adverse effects, such as air pollution and traffic noise. These parks are self-sustaining. The native plant species are planted. It is not recommended to plant foreign ones. The spaces inside the garden are well separated from the outside of the garden [Figure 17]. (Such as Golshan” Garden, Tabas city, Iran) (Bathaei, 2018).
5. In a sustainable park, flowers often have therapeutic properties. They also produce grain for birds living in the area. They also have an ornamental aspect for users and their audience. In the Persian Garden, the flowers are not used just only as beautiful plants, but also have applications, such as therapy, color production, etc. (Bathaei, 2018).
6. In the sustainable park, floods and waterfalls are collected, stored, and refined to be used in streams or pools. In the Persian Garden, the irrigation system has been rolled around the entire garden, preventing flooding. To irrigate the garden in this system, splits are available at specific locations for each plot [Figure 17]. (Bathaei, 2018).

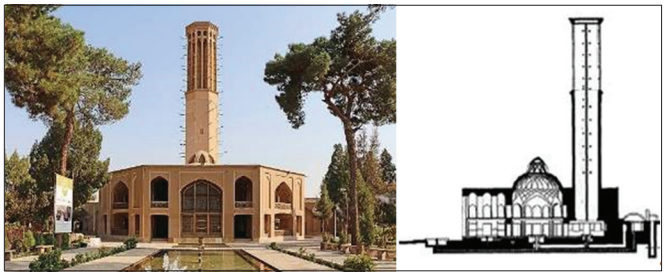

Figure 15: Section of pavilion. “Dolat Abbad” Garden, a historical garden in Yazd, the center of Iran

Figure 16: Tabas Unesco Global Geopark Museum in Golshan Garden in the town of Tabas, South Khorasan province, south east of Iran (Pictures by author, Spring 2023 and Summer 2025)

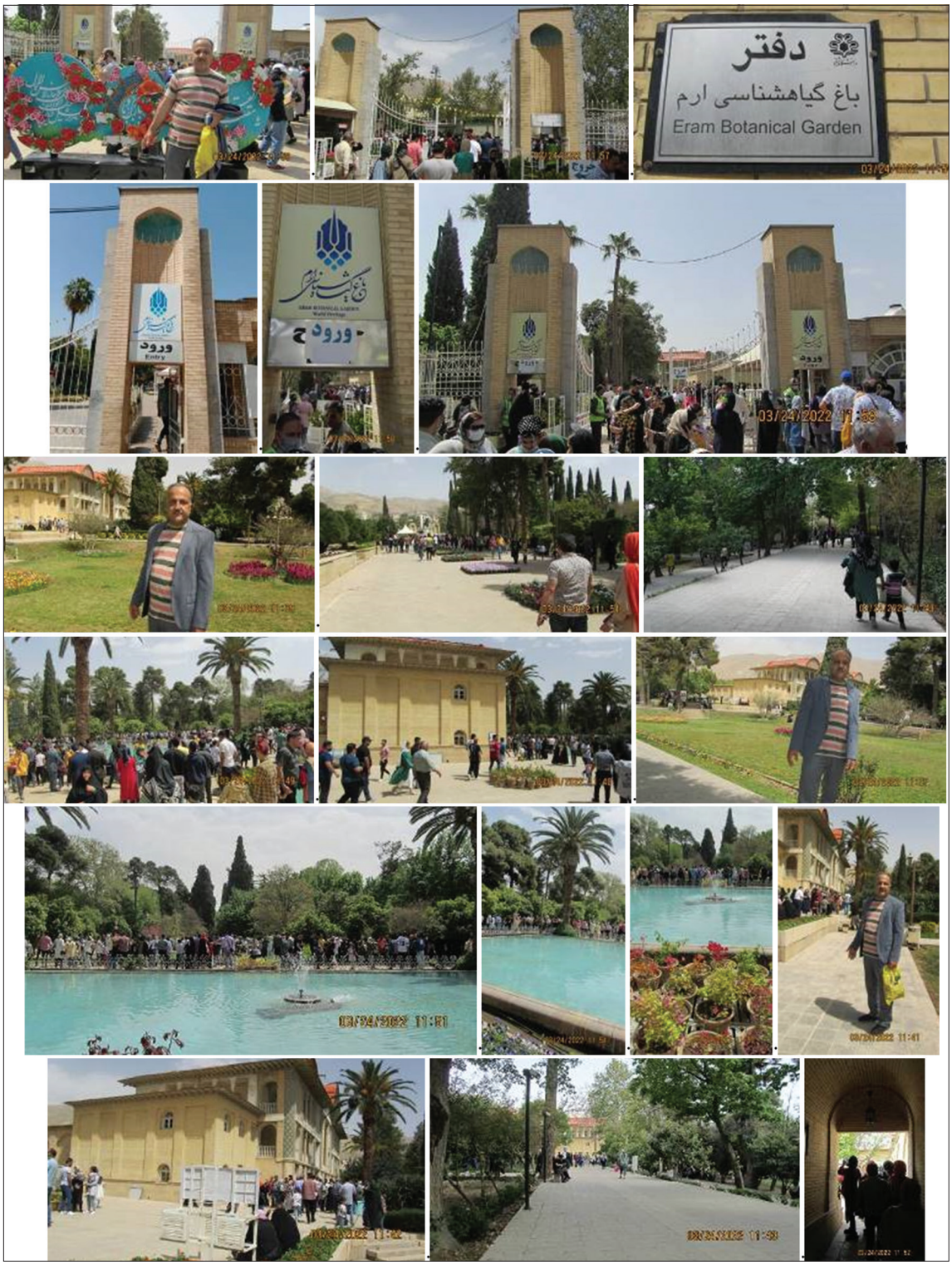

Figure 17: Eram Garden, Shiraz city, south west of Iran. And its pavilion, pools, and streets, etc. This complex was registered as a national heritage of Iran (Pictures by author, 2022

7. In a sustainable park, buildings are placed in a way that are close to paths, bike paths, and roads. These buildings are designed to use the sun's thermal energy, natural ventilation, and natural light of day. Furthermore, all used materials are native. In the Persian Garden, the passage of water from the inside of the pavilion and the connection between the interior and exterior of the buildings cause natural air conditioning. (such as "Fin" Garden, Kashan city and Golshan

Figure 18: Author book covers and two of its translated versions, etc., – from six translated versions – that were published at 2025, and most of the text of this article was obtained from it (Reference number 10)

Garden, Tabas city, Iran) (Bathaei, 2018).

8. In the sustainable park, restaurants serve organic meals from the vegetables planted in the park. In the Persian Garden, the fruit trees and vegetables are planted in there.
9. In these parks, the parking lots are minimized and, where necessary, penetrating materials are used. These materials absorb rainwater and prevent water flows to the surface. Grains and gravel are used in passages. In the Persian Garden, in the passages, gravel and soft soil are used to make it easier for people to pass, and the plants grow there easily (Bathaei, 2018).
10. In these parks, thought, sports, the appreciation of nature, culture, and art become very noticeable. Persian Garden is also a place of thought, privacy, relaxation, and security (Bathaei, 2018) [Figure 17].

As showed in Table 1 - for sustainability criteria in the environmental sector (Bathaei, 2018), Persian gardens can provide healthy environment for achieving objectives of Sustainable Development Criteria- as mentioned in this article as following items such as:

- Protecting natural habitats,
- Protecting existing green belt,
- Reusing land
- Reducing light and sound pollution
- Protecting quality agricultural land areas
- Protecting water and its quality
- Protecting landscape and view
- Protecting cultural heritage

-Protecting and promoting specifications of settlements.

ENVIRONMENTAL SUSTAINABILITY, URBAN HEAT ISLAND (UHI) EFFECT, AND ROLE OF THE PARKS

Sustainability is a set of environmental, economic, and social conditions in which everyone in society has the ability and opportunity to maintain and improve their standard of living indefinitely without damaging the quantity, quality, or availability of natural resources and ecosystems (Bathaei, 2021).

Environmental sustainability is defined as responsible interaction with the environment to avoid depletion or degradation of natural resources and allow for long-term environmental quality. The practice of environmental sustainability helps to ensure that the needs of today's population are met without jeopardizing the ability of future generations to meet their needs.

The United States Environmental Protection Agency defines green building as environmentally responsible and resource-efficient building throughout its life-cycle from siting to design, construction, operation, maintenance, and deconstruction (Bathaei, 2021).

The difference in air temperature between developed and undeveloped areas is explained by the UHI effect. Flat dark surfaces, such as roadways, parking lots, and tarred rooftops absorb and retain solar radiation during the day, then radiate the heat back into the air at night. Communities may value views of natural settings (e.g., bodies of water, mountains, parks, forests) or manmade structures (e.g., iconic/historic buildings, avenues, skylines). A project must consider its relationship to the viewing public and the community feature (Bathaei, 2021).

Public amenities can be in urban or natural settings and may include, but are not limited to, parks, plazas, trails, playgrounds, recreational facilities, and wildlife refuges. Enhancing public space can also include beautification of streets, sidewalks, or right-of-ways. For natural settings, such as parks and wildlife refuges, "public" refers to space accessible for human recreation and enjoyment. A green roof can be as simple as a 2-inch (5 cm) covering of hardy, alpine-like groundcover, generally termed an "extensive" system, or as complex as a fully accessible park complete with trees, called an "intensive" system. Green roofs provide many of the same benefits that trees and other ground-level vegetation provide. Green roofs have an advantage, though, in that they can be used in dense, built-up areas that may not have space for planting at the ground level (Bathaei, 2021).

Nishimura, *et al*. demonstrated that a water pond in a park reduced the air temperatures on its leeward side by 1–2°C. When waterfalls and fountains were added, air temperature reductions of up to 4–5°C were measured at a distance of approximately 10 m on the leeward side of the pond.

Xu *et al*. observed the influence of a water body on thermal comfort on very hot days in the World Expo garden. Their results showed that the water body effectively improves human comfort in the littoral zone. An area 10–20 m from the water's edge showed the greatest improvement in thermal comfort.

Hathway and Sharples found a mean daytime cooling of over 1.5°C above a river in spring, based on a field survey (As quoted in: Bathaei, 2021).

They contribute to reduce surface roughness and ambient temperature, increase evapotranspiration, and enhance human health and comfort. They can be everything from Urban Forestry (city parks and traditional streetscapes, such as trees and planters) to more modern adaptations, such as Green Roofs, and Vertical Gardens (Green Walls).

The use of trees and vegetation in the urban environment brings many benefits, including lower energy use, reduced air pollution and greenhouse gas emissions, protection from harmful exposure to ultraviolet rays, decreased stormwater runoff, potentially reduced pavement maintenance, and other quality-of-life benefits (Bathaei, 2021).

CONCLUSION

The Iranian garden, with its brilliant history as one of the best landscape models, is a result of the productive interaction of the Iranian man with nature (Sharghi *et al*., 2020).

Experiences, when are written and documented, can turn into knowledge and expand human sciences (Joudavi, 2017).

Ecotourism must be marketing of Iran's target

villages and towns for tourism along with mountaineering, desert tourism, etc. (Barjasteh Askari *et al*., 2016).

Sustainability is not a common concept to all societies and cultures. In fact, any society should achieve a definition of sustainability in relation to its culture, civilization, and the specific environmental conditions in which exist. Considering the existing environmental potential as well as Iran's ancient history of gardening, it is hoped that environmental and landscape designers keep with the principles of sustainability in planning and designing.

The rehabilitation of Persian gardens, along with respect for the principles of sustainability and consistent with sustainable urban planning, can play an important role in the development of urban green spaces and, consequently, sustainable urban development (Bathaei, 2018).

Hence, with due observance to the concept of sustainability theoretically and practically, and considering human needs in all physical and metaphysical dimensions, Persian Garden is seeking to meet human needs.

Finally, it can be said that the Persian Garden can be known as a wise relationship of human and the heavenly nature. Recognizing the secrets and mysteries of this relationship is possible in a systematic approach through the identification of Iranian traditional culture (Bathaei, 2018).

In Iranian culture, the garden is a landscape; in other words, a Persian garden is a phenomenon derived from the interaction between the Iranian mind and nature that puts the audience on a specific path to interpret the environment; therefore, this phenomenon underwent some physical changes from pre-Islam to the Qajar period, which was accompanied by the entry of Western colonizers, but its meaning remained constant for the Iranian audience (Sadafi Kohnehshahri and Atashinbar, 2023).

To achieve comprehensive urban sustainability, all dimensions should be studied and analyzed in interaction with each other. The sustainable development and urban sustainability have a process concept, which is running at the end of the city as a result of a systematic approach, and with considering various capacities of the city. Hence, city sustainability requires sustainable elements in different dimensions to ensure its sustainability in addition to establishing relationship with the elements in the urban system (Bathaei, 2018).

Geometry, while being abstract, is the most important language through which the architect creates specific spatial qualities.

It investigates Golshan Garden by expressing its features (rotation, egalitarianism, introversion, centeredness, symmetry, and multiplicity) in Iranian landscaping, while fractal geometry has features, including non-linearity, irregularity, imperfection, and non-Euclidean geometry, chaos, and special rules, representing its naturalistic aspect along with the lack of rest and relation of geometries (Sharghi *et al*., 2020).

Tabas Golshan Garden, as an example of an Iranian garden are interpreted and compared with fractal geometry to explain the external validity.

If the Iranian garden has fractal features in structural, vegetative, irrigation, and functional systems, it can be extended to the whole garden.

Tabas Golshan Garden, as an example of an Iranian garden, represents fractal architecture design with all the features of fractal geometry and inspired by the nature as well as benefiting from geometric flexibility, definable and recognizable throughout the design, and using a form, such as the pentagon found in nature (Sharghi *et al*., 2020).

If the Iranian garden has fractal features in structural, vegetative, irrigation, and functional systems, it can be extended to the whole garden.

Tabas Golshan Garden, as an example of an Iranian garden, represents fractal architecture design with all the features of fractal geometry and inspired by the nature as well as benefiting from geometric flexibility, definable and recognizable throughout the design, and using a form, such as the pentagon found in nature (Sharghi *et al*., 2020).

The Golshan Garden, the most important government garden in Tabas, has only a transom. Inside the garden, there are not any other monuments. The garden was built by Mir Hossein Khan, appointed by Nader Shah as the third governor of Tabas. Mir Hossein Khan donated this garden and many properties to charity in the letter prepared in 1218 AH. This work was recognized as a national monument of Iran on December 20, 1976. This garden is designed based on the pattern of Chaharbagh (four sections), where two streams meet each other. The primary architect of the garden has designed its Green Nature in the form of a chessboard by using different types of

trees. This garden is almost square, about 7 acres. Based on the geometric information of the garden and its characterizations, the Golshan garden is categorized as a Persian garden. An important feature of this garden is the water running through this arid and rainless area. In Persian tradition, a tree is the symbol of freshness, tranquility, and beauty.

The plant, the earth, the water, and the architectural components are the four elements forming the body of the garden. Available studies have focused on the architectural components (construction materials) and water, and the subject of the plants has been poorly understood. Even less has been documented on Tabas' garden. As some trees of this garden have vanished over time, our knowledge about this garden is scanty (Ghasemi and Golzar, 2018).

The vegetation examined in this garden indicates an increase in planting inappropriate trees and seasonal flowers haphazardly. Therefore, in answering the question of why the productive landscape can be seen in different gardens, such as productive, formal, and designed, we can highlight multi-dimensional features and the multifaceted merits of this type of landscaping and underline its association with cultural, environmental, and cultural contexts and economic concerns.

Examining the planting pattern in the Golshan Garden shows that the productive plants outnumber the decorative ones. The combination of productive and unproductive trees in Iranian gardens improves both quality and esthetic aspects of the landscape. It also reveals the multifunctional nature of the plants and a productive plant system. In fact, the productive landscape as a part of the native landscaping can contribute to production and decoration. It also serves as a platform for strolling and supporting traditional local culture and traditional agriculture (Ghasemi and Golzar, 2018).

The concept of productive landscape is not limited to the selection of productive plants and is closely tied up with cultural and native components in the planning and design of Iranian gardens. Furthermore, the function of this landscape approach is not restricted to agriculture, fruit production, or the creation of visual diversity in the landscape (Ghasemi and Golzar, 2018).

In fact, the use of a wide variety of plants from productive to unproductive, from a seasonal to a perennial, forms a multi-functional landscape which generates income, entrepreneurship, and self-sufficiency. Such a landscape can be characterized as healing, beautiful, safe, and ecological, and an optimal (Ghasemi and Golzar, 2018).

Although the condition of the region has influenced the diversity of cold or warm- climate plant species in the Golshan Gar den, planting design by non-specialists often has expedited this change and caused serious disturbance to planting order (Ghasemi and Golzar, 2018).

Based on the obtained results, the health status of public places and mosques in Tabas is in moderate condition. Regarding the importance of the cleanness of public places and mosques in the Islamic religion, it is expected to adopt essential measures to promote the instruments and tools, and servants' personal health (Barjasteh Askari *et al*., 2016).

APPENDIX

(a) complementary field research pictures of the author in the domain of this book in Iran at 2022. Including: Eram Botanical Garden, Shiraz city, south west of Iran. Moreover, its pavilion, pools, and streets, etc. This complex was registered as a national heritage of Iran.

Figure 17: Eram Garden, Shiraz city, south west of Iran. And its pavilion, pools, and streets, etc. This complex was registered as a national heritage of Iran (pictures by author, 2022)

(Eram Garden is a historic Persian garden in Shiraz, Iran. It belonged to the leaders of the Qashqai tribe before being confiscated by the central government. The garden, and the building within it, are located at the northern shore of the Khoshk River in the Fars province. Both the building and the garden were built during the middle of the 13th century by the Ilkhanate or a paramount chief of the Qashqai tribes of Pars. The original layout of the garden, however, with its quadripartite Persian paradise garden structure, was most likely laid in the 11th century by the Seljuqs, and was then referred to as Bāgh-e Shāh and was much less complicated or ornamental. Eram Garden is located in one of the best neighborhoods of Shiraz. You might be a little far away from the city center, but there is easy access to other attractions, such as Chamran Boulevard, Afif Abad Garden, and Quran Gate.

(b) Furthermore, this article is an abbreviation and a short communication of the author's book that published at 2025. This book is translated into six languages and all of these translated versions are available on www.amazon.com and other international academic websites, etc. (Reference number 10).

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