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Sustainable Architecture in Traditional Houses of Kashan

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Research Article

Abstract

As an environment where a person lives and grows from the beginning of her birth until her human behavior is formed, the house is very important in the affairs of human life and is considered an effective factor in human behavior. On the other hand, the rich culture of Islamic Iran and its architectural symbols in this land, along with the compatibility of that architecture with the nature of our country and its existing climatic conditions, doubles the need for Iranian architecture to respond to the material and spiritual needs of users. Therefore, the need to pay attention to the matter of house building requires that by examining the distinct patterns of desirable traditional housing in Iran, and especially the native housing specific to Kashan city, we can find suitable teachings for the house. According to the conducted research, it can be assumed that by using the mentioned patterns and adapting these patterns to the needs of the contemporary society, a sustainable residential design can be achieved in the city of Kashan. The present research method was to find out the design principles of sustainable houses in Kashan with the approach of recognizing and using the existing valuable models of traditional architecture in the hot and dry climate of Iran. It is considered research. The research method in the current study consists of documentary and library studies and documented survey measures on field research on the famous historical houses of Kashan city. The most important and top design indicators include three criteria with titles; The interaction of the audience with nature, responding to the needs of the audience and adapting to the local culture. By achieving these effective factors and finally setting them as a model, sustainable houses have been designed in the hot and dry climate of Kashan city.

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1. Introduction

The traditional architecture of Iran has strong and fruitful supports from various aspects of sustainability, Iranian art and culture, and it shows a special contribution and value from this art and culture. Examining these features can serve planning, designing and popularizing today's living environment. Residential needs of people in cities, especially traditional cities, today are met independently and without identifying its side effects, especially on the environment (Pakzad, 2007a).

Examining the desert cities of Iran such as Yazd, Kerman and Kashan show that the physical characteristics of the historical and traditional parts of the said cities are significantly consistent with new scientific findings. It also seems that the said environmental harmony is the product of a long process of repeated trial and error that has taken place throughout history and in the course of designing and constructing buildings and urban structures (Meletparast, 2009).

What the architectural culture of the past had in itself as a tradition is today only in the form of an inanimate body of our progress, therefore, today's societies, in pursuit of discovering and using the values of the past, inevitably seek and delve into the unknown and forgotten values in is itself

The sustainability of many traditional buildings in the desert, in terms of cultural, social, economic and environmental, is one of the values that can be generalized in the architecture of desert houses today (Pour Ahmadi, 2013). Studying and investigating traditional architecture in general and architecture of the house in particular shows that the traditional building is formed as a kind of man-made artefact in perfect harmony with the natural environment.

This harmony and compatibility are to the extent that architecture has become a part of the nature of its bed. In addition, considering the importance of preserving the environment and saving energy consumption in the contemporary era, it seems desirable to use traditional design methods. Because historical experience has shown that traditional architecture has been much more successful than contemporary architecture in this field (Akrami and Zare, 2016).

In the past architecture of Iran, the traditional architect was able to use the knowledge and techniques of his time in such a way that the compatibility of art and technology was observed in the best way in all parts of the building. Harmony, stasis and stability at the same time as beauty is one of the wonders of traditional Iranian architecture, which has been achieved with the utmost elegance and balance along with meaningful content in the body of the architectural work. Therefore, what is clear is the need to use modern knowledge and technology by considering the local architectural values of the region in contemporary architecture (Asefi and Imani, 2012).

Iran's traditional architecture in desert areas has strong and fruitful supports from various aspects of sustainability; Examining these features can serve planning, designing and popularizing today's living environment. Residential needs of people in cities, especially traditional cities, are met independently and without identifying its side effects, especially on the environment (Pakzad, 2007).

In order to create a stable and suitable environment for human life, Iran's desert architecture has achieved principles and methods that not only do not cause destruction and damage to the environment; But beyond that, it also plays a role as a factor of perfecting the material. Examining the physical design features of desert architecture and materials and implementation methods shows that in architectural design, in addition to using environmental potentials, it also prevents pollution

and destruction of the environment and is a clear example of sustainable architecture (Pour Ahmadi, 2013).

2. Sustainable Architecture

2.1. Energy Crisis

In the 1970s and after that, environmental problems overshadowed many human activities and caused the field of architectural design to face a tough challenge as one of the effective factors in high energy consumption. Therefore, the issue of preserving the environment, the needs of future generations and the use of free energy, introduced a new concept called "sustainability" in all sciences. Based on the studies, the principles of sustainable architecture have been relatively respected in many native and traditional buildings of our country; Among these, the architecture of rural buildings as a clear example of local orientation, the criteria associated with sustainability such as preserving the environment and the use of beneficial climatic factors inside the building with a view to the formative elements of local architecture such as culture, economy, society And nature has correctly complied (Rezaei, Vathiq, and Moradi, 2014).

In the past, the energy used by mankind was basically renewable. The form and design of the cities was designed based on the existing climate in such a way as to provide maximum use of solar and wind energy for the citizens. This issue is well observed in Iranian cities, especially desert cities. But with the progress of industry and the industrial revolution, the world faced an increase in the demand for fossil fuel consumption, and this has serious consequences such as air pollution in cities, which is a broad term in the health of sustainable architecture that describes techniques in architectural design that are aligned with the attitudes It is ecological and has been formed with the idea of respecting nature. In fact, this architecture is not a new trend, because it has been fundamentally present in many ancient civilizations and traditional architectures, including the traditional architecture of Iran. And the energy crisis has become one of the most important concerns of people in the present age (Rastegar, 2011). The concept of sustainable architecture, whether as the creation of human space and the regulation of the relationship between man and the physical environment, or as the product of this process, is always mixed with the sustainable environment and in a general framework, it can be interpreted as "the creation of a sustainable man-made environment" (Farhoudi, 2007). This architecture has an activity in the direction of restoration, reconstruction and renewal of natural systems and the earth, as well as cautious use of life cycle resources in nature (Soleimani, ,2008). Human life as an organism provides another life" (Aminzadeh, 2003).

Sustainable architecture, architecture compatible with the economic, social and natural environment, is the process of creating a space during which natural resources are minimally damaged during construction and operation. There are three basic principles for sustainability in architecture: resource conservation, which deals with the reduction, reuse and recycling of natural resources used in the building, life cycle design, which is a method for analyzing the building process and it brings up its effects on the environment, and finally human design, which focuses on the interaction between humans and the natural world (Pour Ahmadi, 2003).

According to Pirnia, Iran's art and architecture have long had several principles that are well shown in the examples of this art. Traditional houses also benefited from these principles as an important part of our past architecture. In evaluating the introversion of houses, he cites the absence of gardens and greenery outside the house and believes: "one of the concerns of Iranians in building houses is to create a visual connection between the room and the outside space. Openness,

spaciousness and having a free view are part of Iranian nature, even now it is the same" (Pirnia, 2004a).

2.2. Traditional Values of Iranian Architecture

Introversion: One of the beliefs of Iranian people is personal life and its sanctity, as a result of which the building's organs were organized around one or more courtyards and separated the building from the outside world (Pirnia, 2004). Introversion is a matter of climate and moral and religious meanings, such as being together and tending to inner states or privacy in the interior of the house, are secondary meanings that have contributed to popular beliefs through introversion. Of course, topics such as not paying attention to the appearance and working on the inside originate from religious views. So that the traditional architecture of Iran is very simple on the outside. But inside, it presents a world of richness and beauty (Memarian, 1994).

Considering the division of the building into interior and exterior, another point that can be seen in the establishment of closed spaces; The presence of openings on two fronts is for the spaces located between two courtyards, which, due to the difference in temperature between the shade and the sun, a cool breeze flows from the shade to the sunny front and cools the air (Tabatabai Molazi and Pourmand, 2015).

Wari people: Wari people means observing the fit between building parts and human parts and paying attention to her needs in construction work (Pirnia, 2004).

Flexibility: The concept of flexibility in Iran's traditional houses is defined in three types of diversity (multi-functional spaces), adaptability (seasonal and daily displacement) and changeability (separation and consolidation) (Einifar, 2003).

Economic design: In the traditional consumption system, there is no waste or waste in nature, and the continuous life cycle continues without an element leaving this cycle (Pour Ahmadi, 2013).

Avoiding futility: Islamic culture, by recommending moderation and proper use of God's gifts, has forbidden its followers from doing useless and useless works and from creating technical objects without proper use and degrading human dignity (Pirnia, 2004).

Use of organic materials: Production of building materials and construction materials in traditional buildings has been done with minimum destruction and damage to the environment and with minimum consumption of fossil energy, not creating hard and unabsorbable construction waste in nature. The type of construction materials used in the investigated building is mainly clay and brick, which are generally obtained from the soil resulting from the excavation of the product itself and straw and pickling at the building site, and in combination with other materials, which are also sometimes from agricultural activities, in the matter of construction. have been used. In other words, the supply of materials is all from local sources and they are considered Buma Ward (Pour Ahmadi, 2013).

"The application of local techniques and the use of natural materials often had a relatively simple process and easily met some of the residents' functional needs" (Mohammedzadeh, 2012). It takes its steps to become a body, merges with the earth, receives water from the earth, and after changing its appearance and chemical-physical content, returns it to a different extent, turning to the breeze and turning its back to the winds that bother it. In mixing with nature, it is associated with both obeying nature and benefiting from it (Flamaki, 2006).

Conditions that can be considered as environmental conditions, under the influence of different factors such as radiation intensity, temperature, humidity, wind, covering the body, stopping its activity, etc. contract. A range of thermal comfort means a condition in which a person can feel comfortable while resting in the open air. The meaning of environmental architecture is to focus on

the building's ability to integrate environmental and atmospheric factors and transform them into spatial qualities, comfort and form (Karakhana, Makfi and Sajjadzadeh, 2014).

Geometry is the language of Iranian architecture and it has cast a very bright light on various aspects of Iranian art. Detailed geometrical designs have a simple appearance but a complex inner aspect, and wisdom and planning are used in all of them, and there is no coincidence in them. Geometric patterns establish a link between the earthly order and the cosmic system to enhance the emotional aspect of the viewer. The symbolic aspects of geometry in Iranian architecture reflect the wisdom of the "Great Architect of the World". Geometric patterns are connected with rationality and order while being simple and scattered. They refer to the center of the "ceiling", but you don't see a center... as if all the dispersion and multiplicity are gathered in a hidden order and they manifest themselves in a form every moment and expand spirituality in a mysterious way so that man reaches a position where the eye finds insight and the soul in Search for perfection and walk towards perfection (Pourabdullah, 2013).

Orientation, in old and local buildings, is one of the principles of traditional architecture. This principle depends on various factors including;

1- The movement of the sun and the directions of radiation 6- The direction of the different winds 1- It depends on the condition of the ground and the accessibility of the building. In most traditional houses, the north-south axis is the main axis of the building, and the main living spaces were built on the north and south sides of the yard, and the secondary spaces were built on the east and west sides (Qaim, 2006).

The north-south orientation makes the east and west sides of the house in any of the seasons; Do not have adequate sunlight. Therefore, in order to increase the spatial quality of the eastern and western sides, according to the climate of the region, traditional architects slightly rotated the main axis of the building in relation to the north-south direction.

In this way, different orientations for buildings have emerged. Including; 1-Northeast-Southwest (Raste run) 6-Northwest-Southeast (Esfahani run) (Memarian, 1994).

Light, light and architecture are connected topics. Throughout the past, architects have realized the importance of light in architecture and have invented clever ways to use light in buildings. In Iranian architecture, light is not used in a single way; Rather, it has been used in different ways (Tamizi, 2011).

The efforts and innovations that have taken place during the era to take advantage of natural light are especially visible in the traditional architecture of Iran. Traditional Iranian architects have learned from their experience that if they use ambient light well in architecture, they can turn the simplest forms and precious materials into precious elements and decorations. Iranian architecture is full of the presence of light, so that it can be said that the fabric of traditional buildings is mixed with light.

The yard forms the axis and basis of internal communication of a traditional house. From the perspective of a traditional person with a mystical view; Being the center of the yard in the internal communication of the traditional house means that; Living in a traditional house has a continuous connection with the whole being and the world of nature (Akrami and Zare, 2016).

The yard is one of the most valuable places in organizing the design of houses. In this way, the enclosed spaces of the central courtyard houses have the maximum size. In these houses, all sides around the yard are built to create various internal environments to receive light and heat from the sun, depending on the amount of sunlight, different sides of the yard can be used in different seasons. Usually, the southern parts are used because they are facing the sun and have maximum shade in the summer. The northern parts are also called winter residents because the residents move

to the northern part in winters. In other words, the residents of these houses change their living space in harmony with the regional changes in accordance with the seasons (Rastegar, 2011).

Removing the valuable element of the yard, in the architecture of today's houses, destroys the hierarchy of movement between spaces and distances people from nature. It disrupts the sanctity and psychological security of the home and brings outside problems into the home (Naibi, 2002).

The central courtyard is the most important space of the house, a climatic element and the shaper of the concept of introversion. Therefore, from a spatial point of view, it has a climatic function. But in terms of functionality, it is a traditional human and family behavioral camp. Therefore, the yard has both a cultural role and plays the role of various functions. Among these roles: 1-Vibrant and relaxing environment 6-Light reservoir for indoor spaces 1-Home breathing room 4-Organizing home spaces

1-It is the communication of all spaces with each other (Akrami and Zare, 2016).

The garden pit is a space surrounded by underground rooms, and such a combination creates cool spaces in the underground rooms and causes the air flow to be used in the correct way, and artificial cooling devices are no longer needed, and as a result reduce energy consumption (Khodabakhshi and Mofidi, 2001).

Atmospheric factors and temperature fluctuations have very little effect on underground buildings and they continuously protect the building against these changes like a barrier, and the earth's crust, as a thick thermal insulation, prevents heat transfer into the ground. The deeper the building is from the ground, because there is more soil, the temperature changes are less and from a depth of 8.1 meters, the temperature is almost constant and is equal to the average annual temperature in the space outside that place (Qabadian, 2003).

In Islamic culture, water is mentioned as a symbol of life, heaven, purity and a sign of beauty and prosperity. Although it is sometimes called the main hall of the summer residence, it is specifically an underground area built under the summer residence, and like a porch, it is a semi-open space and often has a pond. In the Abbasid house of Kashan, there are excellent examples of cisterns and cellars (Parsi, 2008).

Cellar, in Kashan, there are many different spaces called cisterns on the ground floor or basement or in the corners. In this city, the deep basements that are built under each face of the building especially for summer residence and often have a torn belly pattern are called cellars (Parsi, 2008).

In Kashan, the spaces of the reservoir and the cellar are usually decorated with Yazdi bands and with plaster or cymbal materials. On the other hand, in Tabriz, brick decorations are very common, especially with colored bricks and the use of complex applications in the center of the space. The most important pattern used in the house pond is the torn belly. Usually, the extension of the windbreaks reaches this space and the passing of the wind over the water of the pond creates a gentle air in this space (Mehri and Zandi, 2013).

The portico is a semi-open and continuous covered space like a corridor. This space is used to create a connection between spaces and it is mostly built around courtyards (on one, two, three and four fronts) or around an extroverted built space (Soltanzadeh, 2005).

Plants, the attention to nature and its elements, especially water and plants, originated from the teachings of Islam and the sayings and traditions of the Holy Prophet (PBUH). The Prophet used to say: Whoever plants a tree, God will reward him with the amount of its fruits.

In the dry areas of the Iranian plateau, the amount of greenness depends on the amount of water and how to access it, so the green space is very influential in the microclimates around the building for the following reasons:

• Effective reduction of direct sunlight and its reflection
• Shading on the roof, walls, windows and yard space
• Reduction of dust around the building
• Focusing the wind flow and increasing its speed in the desired direction
• Increased humidity in dry climates
• Reducing the temperature of the temperature around the building

The ability of plants to moderate temperature changes is one of the important factors for controlling solar energy. The ground that is placed in the shade will absorb the heat a lot. The humidity caused by the plants will reduce the heat and therefore in the surfaces and parts of the building where there is greenery, the cold will remain longer during the day (Sefalai, 2004).

The entrance is also one of the most important parts of a traditional house. In traditional houses, after the entrance door, there is a vestibule, which plays an effective role in creating the hierarchy of entering the house. Next, a narrow and winding corridor connects the vestibule to the courtyard. This entrance hierarchy is built to prevent the nobility from encroaching on the privacy of the house and creating a distance between the living space and the social space outside. Entrance to the yard is generally done from the corners, or a place close to it, so that at the moment of entering from the hallway, a complete view of the yard is not created. Thus, upon entering the house, privacy is more important than ease and speed of movement (Soltanzadeh, 2005).

The front of the house invites entry in all situations, even in the simplest houses. The height of the headboard is either equal to the height of the straw wall or it occupies a part of the height of the wall. The front surface is usually decorated with patterned bricks. Hasti is also made in different shapes. The dimensions of the vestibule have been changed according to the needs of the house. The covering of the vestibule is also diverse, such as: karbandi, Turkin arch, etc., in each of the sides of the vestibule, according to the required function, different elements are considered, such as: the platform, the entrance corridors to the yard, the roof road and the well of the house (Memarian, 1994).

The roof is one of the important factors of heat transfer from the outside to the inside of the building. Because this surface is exposed to direct sunlight almost all day long. Therefore, it transfers a lot of heat to the interior spaces. Therefore, paying attention to the proper design of roofs, especially in hot and dry climates, is one of the main design principles. What we get from the architecture of the past in these areas is the use of vaults and domes, which is one of the main elements in the formation of the architectural identity of hot and dry areas. Due to their special curved shape, these roofs are always in the shade from one direction at different times of the day. As a result, compared to smooth surfaces, they absorb less heat and transfer it to the interior (Kasmai, 2005).

The porch is one of the architectural spaces of Iran that can be seen in most of the traditional houses of Kashan and it is diverse in terms of form, dimensions and location and has many functions. The concept of porch and portico has had deep implications throughout the history of Islam. The porch shows the possibilities of defining and writing the space, and it is the transition space between earthly and temporal factors. From the metaphysical point of view, the porch itself can be considered as the soul, which walks between the garden or yard as the soul and the room as the body (Ardalan and Bakhtiar, 2003).

The porch is very useful in hot seasons and many functions such as eating, sleeping, working at home, etc. take place in it. It also moderates the air in the rooms behind it in hot seasons. And in terms of climate, it has many values (Mahmoudi, 2005).

Badgir (wind-catcher) is one of the architectural elements that was built with a climatic approach in the native architecture of hot and dry and hot and humid regions of Iran and stands out in the form of a vertical channel in some cities. The architecture of wind deflectors and their performance, which have been effective in the natural cooling of buildings in these areas, shows the genius of the architects who played a role in their design and construction. Badgir has always been defined as a traditional structure for ventilation, which has been seen throughout the Middle East from Pakistan to North Africa with different names and forms (Yarshater, 1989). One of the characteristics of dealing with nature in desert houses is the use of It is a wind breaker. This important and beautiful element directs the right wind into the house in the hot season and makes the house cooler (Memarian, 1994).

The wind deflector works in such a way that it catches the desired wind and directs it into the main rooms of the building, water storage or cellar. Some wind deflectors cool the inside of the building only by moving air, and some others do this both by moving air and by evaporation, so that the air flow after entering the building through a small stone basin and the fountain is passed and then it is directed to other rooms. The room under the wind deflector where the pond and the fountain are located is in the form of an octagon and there are many doors in it. Whenever there is a need to cool a certain room, in between those rooms and the vestibule room under the wind deflector are opened (Qabadian, 2003).

Kitchens, in traditional houses, are mainly located in the corners of the main yard or in the basement. Sometimes the kitchen has its own courtyard. One of the reasons for the kitchen being far away from the central and main yard is the type of fuel and the cooking method. In the second place, there was a lack of facilities such as a hood, gas stove, suitable fuel, etc., which caused these spaces to be polluted and lacking in proper appearance. In contemporary housing design, it is desirable to place the kitchen in the space between the private space and the reception space, so that it is possible to provide services to both spaces (Akrami, 2013).

Types of rooms in traditional Iranian houses; Three-door room: working room, sleeping room, breakfast room (winter room)

The five-door room: the meeting of the household and guests, the dining room of the household (wintering)

Big Ursi room (Tehran): guest house, dining room, gathering house of elders (wintering)

Tanbi room: the bedroom and rest room located between the hall and the wind tower (summer house).

Upstairs room: bedroom and work (winter room)

The earring room: bedroom, privacy and library

House seat: a room that does not have a door or window to the yard and there is a seat in it (Memarian, 1994).

Decorations, not so long ago in all the cities, most of the buildings were built with raw clay, plaster and straw, and these materials surprisingly fit the Iranian life and have surprises in it. Straw is combined with tiles, wood or stone and similar materials in the form of pleasant proportions, and Iranian architects have taken help from them to decorate buildings. Introducing the cultural heritage and national and Islamic arts entrusted to our society by the past is one of our national and patriotic honors. From the beginning of his work and from the time of using brick, which is considered as one of the primary building materials, the Iranian artist created the most beautiful designs and designs when creating walls and covering domes and creating earrings, moqrans and arches and in the process of its evolution with Chinese knot, flower-making, knot-making and brickwork have created unique masterpieces. When using plaster, he created a unique world by creating stucco with

geometric, plant, animal, and human motifs, and when using wood for windows and doors, he used arts such as inlay, mesh, mosaic, carving, inlaying, and painting. Wood has created an incredible miracle. To decorate the building, he has taken help from one-color, seven-color, pearl, gold, or glass and mirror tiles in various shapes and sizes and presented a world full of beauty and creativity. The splendor and beauty of Iranian architecture, especially in the Islamic period, depends on its decorations. These decorations have been popular in all Islamic eras and have progressed in all eras with the facilities of those times. The remaining buildings from the Islamic era have various decorations that show the importance of this art in different periods. Architectural decorations by Iranians have been a major artistic development and in many Islamic countries, buildings with different decorations have been made by Iranian artists (Masoodi Gokani, and Houshmanpour, 2012).

3. Case Example of Kashan Traditional Houses

3.1. Isfahanians

A combination of a large courtyard with two spatial complexes on its two sides, a small courtyard is also located in the middle of the northern complex of the building, which has an extended portico on both its southern and eastern sides. This part can be considered the outer space of the house. The second spatial complex of the house is located on the south front of the main courtyard. This complex has ponds with semi-open space and at the level of the yard. Shahneshi is located in the south of Hozkhaneh and a little above its level. A continuous portico surrounds the main yard and in the middle of the main yard of the house there is a pond with two long and large gardens on both sides of it, which emphasizes the axis of the yard. There is another courtyard in the eastern corner of the building, which is connected to the main courtyard. The existence of these two courtyards with two sets of space is such that they can be considered the interior and exterior of the house (Soltanzadeh, 2005).

Fig 1 Isfahanian house (source: Namnak.com)

3.2. Bakuchi

This building includes a rectangular courtyard and two space complexes on its north and south fronts. The most important spatial complex of the house is located on its northern front. This front has a backyard in the shape of eight and a half eight in its middle. There is currently no roof space on the south side of the main courtyard, the remaining works show that the buildings in this part have been destroyed. Ventilation is located in this complex, which is effective in conditioning the air in the pond. The eastern and western fronts of the main courtyard have facade walls with similar

divisions, and the lower floor includes sunken arches and several service spaces. It is possible to enter the house from its northern side (Soltanzadeh, 2005).

Fig 2 Bakuchi house, (source: Namnak.com)

3.3. Boroujerdis

This building is basically internal and external. The outer part has an elongated courtyard, at both ends of which there are two important spatial complexes, which are higher than the other two fronts. The southern front of the courtyard is the most important part of the house and consists of a large and high hall in the shape of an eight and a half eight and rooms around and on two floors surrounding the hall. The front porch of this part stands out with a prominent and long view in front of the magnificent volume of the ceiling of the hall. A collection of these elements with two windmills located on both sides add to the splendor of this view. The complex located on the northern front has a five-door hall with a throne, which has a moonlight in front of it and a windmill can be seen behind it. There are three rooms and service spaces on the eastern front.

On the opposite front, only arches similar to the front facade can be seen. The entrance of the house includes a porch with a yazdibandi roof and plaster decorations (Soltanzadeh, 2005).

Fig 3 Boroujerdi house (source: Namnak.com)

4. Research Methodology

The current research is considered to be an applied research in terms of its purpose. Considering the breadth of content in the theoretical foundations section, he saw a significant part of the research in the theoretical framework. It should be noted that the main goal of this research is the development of applied knowledge in a specific subject and it is an attempt to objectify the existing knowledge in a practical way. Therefore, this research is placed in the category of applied research, and special attention has been paid to the theories and theoretical foundations of traditional Iranian architecture, in order to inspire and return to the rich culture of our country, Iran. In the following, in line with the purpose of the research, it is oriented in a practical way.

In terms of what it is and its nature, this research is in the qualitative-quantitative type and in the category of causality with research on case samples. Since the collection of data in its library type is completely organized and classified, the main bases of research in terms of nature can be called qualitative, causal, case and historical.

In the first stage, information was collected using a library method from reliable sources related to the research and its theoretical foundations. categorized and the appropriate orientation was provided to achieve the desired propositions and in line with the purpose of the research. Now, the structure of data collection is defined in a specific classification in a library method. The studies and investigation of the background of the research, in a form completely in line with the main subject of the research, relying on reasoning and logical structures, approach the results of the research step by step. In this part of the research, it is tried to avoid personal interpretations and viewpoints and by referring to the available reliable sources, to make sufficient arguments to advance the issue.

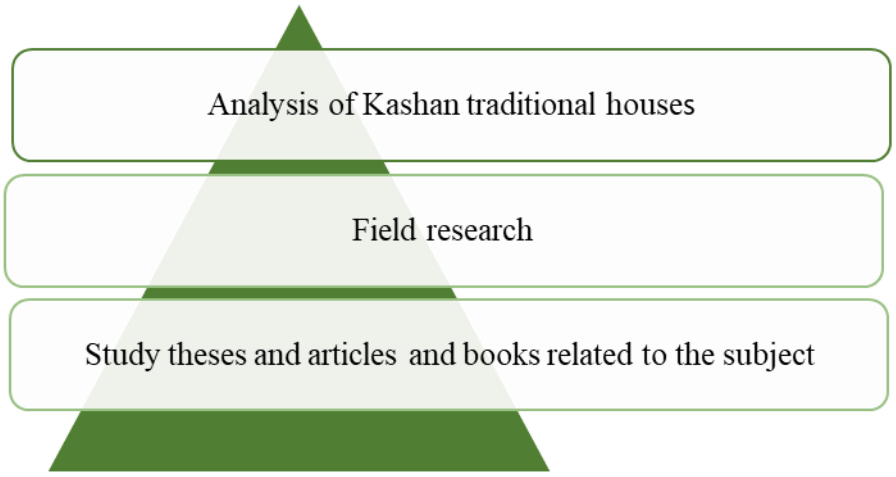

Fig 4 Information collection tool

Data analysis is a multi-step process in which the data obtained through the use of collection tools are summarized, coded and categorized... and finally processed to establish the context of analyzes and communication between them. This data is provided. In this process, the data is refined both conceptually and experimentally, and then we obtain components so that the optimal design can be carried out.

Table 1 Data analysis

Stability components	Physical components	Social components
* Harmony of the body with the climate * Environmental protection	* Suitability to the needs * The use of canvas materials	* Culture * Respect for the user * Flexibility

Table 2 Social components

Social components		
Findings	Solution	
Flexibility	The multi-functionality of spaces	
	Considering flexible or programmable spaces	
	Types of spatial qualities (open, semi-open and closed)	
Respect for the user	Responding to performance	
	Suitable spaces for the type of activity	
	Preservation of privacy and comfort and mental security and provision of comfortable conditions in terms of climate	
	Creating relaxation through connection with natural factors such as green plants, water, natural breeze and light	
	Sunshine, beauty and eye-catching building	
	Attention to the human scale in the dimensions of spaces	
	Reducing construction and repair costs according to the type of materials and labor	
Cultural	Identity through the ability to match one's perception of space with one's cultural background	
	Matching the body and function of the building with the culture and behavior of people	
	Coordination of the building with the neighbors	

Physical components		
Findings	Solution	
Suitability to needs	Maximum use of minimum space, taking into account all the needs of the consumer	
	Coordination between the sizes and scale of the spaces with their function and the number of consumers	
	Design and construction with a long service life	
	Standardization in constructions using appropriate modules and foundations	
The use of canvas materials	Using suitable materials available in the region as a result of minimizing transportation costs and the possibility of building renovation and maintenance at a low cost	
	Not destroying or harming the environment by using renewable materials	
	Using materials and materials that have the ability to return to the natural cycle	
Data collection and description	Research problem	Providing practical solutions in the process of sustainable development. Hence, the main goal in expanding the meaning of traditional houses in hot and dry climates
	Research questions	How to design residential houses in Kashan city by considering the principles of sustainable architecture?
	Previous studies	Studying the examples of articles about sustainable architecture and traditional houses in hot and dry climates

	Default formation	By designing a residential complex in a hot and dry climate, considering sustainability in traditional buildings and achieving sustainable architecture.
	Collecting data	Library Studies Field studies
Analysis and evaluation	Data collection	Effective physical components in the architectural stability of houses in hot and dry regions

Analysis and evaluation	Data collection	Identifying effective factors in sustainability Identifying how to use effective factors in sustainability in the design of traditional houses

Table 3 Main factors according to contemporary experts

Dependent variable	Proposition	Independent variable
Use of air flow	Garden pit reduces heat exchange and improves air flow	Garden pit
Introversion and harmony with the climate	The central courtyard shapes the concept of introversion and is a climate element.	Central courtyard
Traditional housing	Traditional housing responds to functional needs and conforms to local culture	Cultural and climate
Access space	Hierarchy of access is a factor in the formation of the old residential context.	Hierarchy
Sustainable Architecture	Sustainable architecture is the creation of human space and the understanding of the relationship between man and nature.	Relationship between man and the physical environment
Traditional house	In traditional houses the lifestyle is in harmony with the shape of the building	Adapting lifestyles to climatic conditions

5. Conclusion

Desert areas and the edge of the desert have special environmental and climatic characteristics, and the traditional houses of such areas are located and built based on special principles and in accordance with environmental conditions and ecological nuances. The idea of saving energy in construction, using natural materials (such as soil, stone, wood, clay, etc.), paying attention to the energy required to maintain and regulate environmental conditions with the appropriate design of empty and full spaces (on a small and large scale) The correct orientation of buildings, the use of suitable construction technology using natural energy and the minimization of fossil energy are examples of desert architecture and urban planning.

Desert buildings are considered dynamic buildings because they meet their needs for water and energy in their site, and they are not only compatible with their site and climate, but also contribute to environmental changes. They work without pollution. and they do not produce any type of waste that is not useful for other types of construction processes or that cannot be directly consumed in

the environment. It provides the health and happiness of the residents in an integrated ecosystem and improves the environmental qualities. Sustainable architecture is the creation of human space and the understanding of the relationship between man and nature. Identity in traditional houses is achieved by the multi-dimensional function. Traditional housing responds to functional needs and conforms to local culture. According to the results paying attention to the needs of the audience identity in traditional houses and maintaining the relationship between man and nature are very important factors that must be observed in the architectural design of houses in hot and dry climates.

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