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Investigating the Effect of Sustainable Patterns of Iran's Traditional Architecture in Sustainable Development

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Abstract

The valuable experiences of the past have always been the main investment of scientists and inventors in disentangling the problems and move towards a better future, and the inter-generational transmission of past experiences has improved and strengthened the sense of reliance and has created a sustainable identity. Sustainable architecture is one of the most important trends of contemporary architecture. This trend is considered as a logical response to the issues raised in the industrialization era and it results from our ancestors confirmation corresponding with their time features and capabilities. Thus, the concept of sustainability or any other concept that comes in to the literature should be interpreted in accordance with the customs of the country, so that it is possible for society and culture to understand it. In Iranian architecture, stability issues have been associated with aesthetic, cultural and social issues and considering the interaction between these three categories can be a good solution for the design and construction of future buildings. In this article, we describe the logical and indigenous techniques. Given the nature of research in this study, it is discussed in the context of analytical-descriptive and cross sectional studies in bibliotheca. The results suggest that most of the issues raised in modern architecture are in compliance with traditional architecture in different ways and it reflects the true impact of culture, beliefs and traditions of Iranian people on the constructions and architecture of the past. Recreating these principles in accordance with modern architecture will create new approaches in contemporary architecture of Iran.

Keywords: sustainability principles, traditional architecture of Iran, climate, energy

Introduction

Traditional architecture is filled with items, some of which may sometimes be discovered and used. The basis for this mystical architecture is its dynamism and efficiency, a valuable architecture whose fruits are buildings that are immortalized. Sustainable architecture is based on environmental notes and the design and construction with regional materials. Its purpose is to design sustainable buildings with the approach to reduce environmental damages and utilization of renewable energies and nature. Sustainable architecture includes a mixture of aesthetic, environmental, social, political, ethical and stable values. Further, pondering the basis of traditional architecture will reveal the fact that the concept of sustainability is rooted in old methods and ancient cultures and is practiced in order to honor and respect the nature and the environment. Today, the complicated relations between man and his surrounding environment have caused basic changes and transformation and the creation of different functions in the atmosphere of traditional houses. Sustainable architecture is to create coordination and harmony with nature and regional and environmental conditions and at the same time to devise a design that would be responsive to the tastes and the needs of the residents that has always been the basis for the architects' work in the past; but the sudden disruption of this creative trend of architecture and consequently taking faster and easier designs to apply, stressing on the other aspects by modern architecture, have forced us to forget all the environment-friendly methods. Therefore, it is of grave necessity to approach the

history of the architecture of this land with openness and excavation, learn from it and utilize its theoretical backgrounds in today's architecture and construction techniques.

In Heidegger's view, technology is a certain form of connecting and bonding between man and the world. Technology in the past was trying to give order to nature while also keeping and safeguarding it, but today's technology which is established based on the new sciences, it sometimes trying to disturb and conquer nature. New sciences regard nature as a network of calculable forces that provide energy and in this approach, the divine identity and its role as a guide and sign for the correct lifestyle and reaching for the supernatural is neglected. Today's human beings not only have had few developments regarding the understanding of nature's spiritual aspects, but they more often had a downtrend. These two aspects enable us to divide the human's relation with nature into four main different stages (Shojaei, 2014).

In the subject related to sustainable and stable energy and its continuum, sustainable architecture, the fact that buildings should interact with their surrounding context and natural environment has turned into a matter of course. The important subject in this matter is the way this interaction takes place and the methods that are used in recent years and Iranians have enjoyed them with special sets of skills by applying these special necessities in the optimized use of natural resources and energies especially the sun and the wind and the harmony with the region. In this study, the subjects of sustainable development and designing with an approach to the diversity in Iran's traditional architecture, the devised notions applied by the residents of this country for the maximum utilization of natural energies, with the idea that these notions could be sources for inspiration and patterns for future designs are pointed out (Talaei, 2011).

Significance of the study

In accordance with the challenges the world faces today and also the crisis of the lack of identity that has become an epidemic to today's architecture of our country, it is necessity to pay more attention to the ideas, thoughts and traditional buildings construction methods that will cause the safeguarding of the environment and will help create a physical and mental peace of the residents (Qofrani, 1990).

The main challenge facing today's architects in the world is the disruption of the relation between regional architecture and modern demands. It is necessary to analyze the utilized methods in the endemic buildings of each region as a symbol for stable and sustainable solutions and then they should be coordinated with the today's modern concepts and thoughts by the use of technological developments of this age. Now, because the Iranian historical identity (in all of aspects of life, including architecture) is forgotten in the cities of this country, the meaning of being Iranian is seldom found. With regard to this matter, the environment and the energy consumed in the buildings are the significant issues in the cities and villages. Today, because of the modern life standards are followed by everyone, heating welfare through the utilization of non-fossil fuels is not an easy task. Generally, speaking after thousands years of men's encounter with nature, their knowledge of these type of energy is not only insufficient, but also the practical information of "thermophysical" features of construction materials and particles has not evolved yet. In any case, aside from all of these issues, today houses need to be built in the minimum amount of space that would satisfy the welfare needs of human beings in all seasons. With regard to the mentioned matters, the subject of static sustainability in the past is less discussed and the utilization of these patterns can be effective in reaching a structural sustainability in today's houses (Razjoyani, 1997).

With the analysis of Iranian architecture, we will realize that the symbols of the cultural values of the Iranian society are evident in the construction of their residential environments and this construction is an indication of the identity, cultural values and the beliefs of this society in a way

that the Iranian architecture, like the culture of the Iranian society is welcoming and is an inductor of a sense of belonging, the union of the composition and an even unity, the coordination of dimensions with function and structural sustainability (Asghari Moghadam, 2004).

Objectives of the study

Now the time has come to approach Iran's architecture, not only as historical and ancient buildings and sites but as buildings whose undying lively essence can inspire contemporary architects and artists. Therefore, it is necessary to understand Iran's traditional architecture as a mature display of formed sustainable architecture. Also, the analysis of the devised methods in traditional and regional architecture, with the goal to optimize energy consumption especially when the utilization of solely clean natural energies was dispensable, would be of great benefit for today's architects. With the developments of the technology, the practiced methods in the past can be coordinated with the needs and conditions of today and the optimized and effective utilization of clean energies are used for safeguarding the environment (Saremi, 1997).

Research questions

• Is Iran's traditional architecture capable to establish a sustainable architecture and how will it respond to these needs?

• How can the patterns of sustainable architecture be applied in today's residential architecture?

• What is the method through which regional materials and domestic elements are utilized with the aim to optimize energy consumption?

In Iran's traditional architecture, based on its geographical location, ceilings, lowering the exterior surfaces facing the sun, devising parasols in coordination with each region, ventilators and basements, central courtyard, shadowing parapets, windows facing the sun, choosing proper materials for the ceiling, the wall, storerooms, etc. oppose the outside environment so that the best conditions of welfare in the interior is possible without the utilization of complicated energy consuming and polluting devises (Kasmaei, 2003).

The regional approach is one of the several methods presented by sustainable architecture. Paying attention to regional conditions is one of the most important bases of Iranian sustainable architecture, but it does not stop there. Here, a set of different factors like the region, come hand in hand and construct the building's final form in a way that man would feel the presence in a soothing sustainable environment and at same time, in that environment, could receive numerous messages and impulses (Gorji Mahlabani, 2010).

Methodology

The research method in this study is descriptive-analytic with a practical purpose. In this study, in order to collect documented data, books, articles and thesis, the library method are used and in accordance with the research's necessity, field inspection is also utilized. This study first sheds light on the features of the sustainable architecture of the past and then presents methods for improving the sustainability in today's architecture.

Sustainable development

Addressing the comprehensive challenge of sustainable development and security development relies on the utilization of a modern patter in which the people are in the center of the process of development and consequently, the everyday needs of these people's life (consumption) should be satisfied in accordance with a development based on ecological notions and necessities. With regard to the concept of sustainable development as a process which provides the different needs of the present generation, without violating the securing future generations, the utilization of

limited finite resources is of great sensitivity, especially as the behavioral pattern of today's society (especially in Iran) is very distant from the concepts of sustainable development. Here, energy as propellant and operator of today's world and providing it is of a very high significance. The subject of energy is known as the most critical issue in the system of sustainable development. Whereas in Iran, the most amount of the needed energy is provided through non-renewable resources, therefore, the need for a long term program and management of energy securing and consumption is intensely felt (Zandiye, 2010).

In sustainable designing, the quality of the interior spaces of the building becomes of a special significance and reaching high standards of quality, security, welfare and stable sustainability in fact provide the well-being of humans which is among the most important goals of sustainable architecture. Sustainable designing in the field of architecture and urban planning is a method of thinking which its basis is coordination with nature. The utilization of previous experiences in improving architecture quality will be the way through which sustainable designing is reached. Sustainable architecture includes a multi-valued composition from which the aesthetics, environmental, social, political and structural aspects and in a way designing and construction in coordination with the environment can be mentioned.

Iran's tradition and traditional architecture

The bond between man, nature and architecture is the basis for understanding Iran's traditional architecture. In the spiritual view, Iranian man, nature and architecture are in essence based on religion. This concept, has not only given unity and duration to Iran's architecture, but also has been the source of its emotional nature. The principles of Iran's traditional architecture are abstract immaterial concepts whose physical emanation has been different in different time and local conditions. Famous American orientalist, professor Pope, have mentioned durability, persistence, consistency, aesthetics, close attention to beliefs, customs and safeguarding the human essence as the features of Iranian architecture. The principles that are characteristics of Iranian architecture are rooted in its view of the world; a divine view that presents man as God's successor on earth and states his goals in life in spiritual and immaterial aspects in a way that his material life would be a preface to reaching eternal life. The connection between man and the world and nature, is an ideal constructive connection. Among these basics, man's lifestyle and activities on earth, serving God, reformation, obeisance, avoidance of corruption, welfare of the earth, cooperation, cohabitation with nature and avoidance of dissipation are pointed out.

Concepts of sustainability and the architecture of traditional houses

A house is used by a small group of people and its characteristics are the facts that it is "personal" and "private". A house strengthens a person's individuality and creates a smaller world around him or her. Sustainable houses are the ones that are safe, comfortable and flexible, with the capability to coordinate or expand space that is also given attention in details by presenting methods to prevent the pollution of sewage, together with nature and also less need for energy and the utilization of renewable energies. Iran's traditional architecture has several values in different methods of optimized consumption of energy and the ecologic utilization of different types of energies and especially the use of sustainable and harmless energies. All the four philosophical and religious elements of water, air, sun (or fire), and earth have excellent environmental function in Iran's civilization and architecture (Mani, 2010).

In general, the principles of Iranian architecture are the values of Iranian culture which in their turn are inspired by Islamic view of the world and they have no contradictions or confrontations with sustainability, but the contrast of the tradition of Iranian architecture with the set of sustainability principles that ignore the cultural and religious identity of the society should be

looked upon; principles and ideas that encourage the oneness of people's lifestyles all over the world and consider this process as a necessity for development, advancement and entering the group of sustainable countries. Avoidance of vanity (dissipation), use of regional materials, structural sustainability, choice of proper colors and forms, attention to the type and method of the utilization of natural resources, choosing the proper sources of energy, blending the spiritual and the material aspects of life as the basis and a field for the endeavors of men and their consequences, a sense of man's dominance over objects and spaces as a factor for keeping them safe and utilizing them in a better way and also attention to the collective spirit instead of subjectivity and individualism are among the criteria of Iran's sustainable architecture (Shoja, 2004).

Coordination between Iranian traditional architecture and the principles of sustainability

Iranian traditional buildings, based on the principles of sustainable architecture are formed in the way that they would provide the maximum amount of sunlight in the winter and maximum amount of shadow in the summer to provide natural ventilation and to create welfare for their residents.

Principle 1. Saving energy: Iran's traditional architecture is designed and constructed based upon non-fossil fuels and renewable energies.

Principle 2. In coordination with the region: Iran's domestic architecture is in harmony with the region and the devisal of spaces for summer and winter.

Principle 3. Reduction of the utilization of new materials: The best indication of this matter is the utilization of region-based materials in traditional architecture. These materials are renewable and recyclable and these are among the principles of sustainable architecture.

Principle 4. Satisfying the needs of the residents: In traditional architecture, all the actions and designing are ways to achieve the needs and welfare of the residents.

Principle 5. Coordination with the sight: Traditional houses in Iran do not have a harmonious geometry therefore, the architect should try to construct the houses in a way that would coordinate with uneven contexts.

Principle 6. Universality: Iran's traditional architecture tries to save the energy, fossil fuels and non-renewable sources to utilize the renewable sources alternatives like the wind, the sun, etc. Therefore, it can be said that the principle of universality in sustainable architecture which is respect to environment and cultural and regional factors, is applied in Iran's traditional architecture (Qasemi, 2003).

Iran's traditional architecture is among the best examples of sustainable architecture that today's architects, in order to design in these regions, should know these principles and devisal so that they can reach sustainable designs.

Principle 7. Static sustainability: Iran's traditional buildings with structures based on geometry have a great amount of functions. The use of accumulative solid geometries in the heights, like arches, domes and minarets was in a way the only possible method for enduring the brunt and natural forces in its time. Geometry creates an expansive array of beautiful techniques and forms that in coordination with beauty, add to the building's durability.

The spatial hierarchy of traditional buildings of Iran, interchangeable and accumulative sections of the walls, lightening the higher levels and spatial geometrics that different parts become alternatives for their lines find the structural function for enduring the side loads and create a relatively great hardship for the function of the structure which the set of these methods lead to the durability of the building and its sustainability during different centuries (Figure 1).

Figure 1: Lightening the higher levels and spatial geometrics in domes and arches to endure the load

In buildings, the sustainable structure (building) is considered as a part of the sustainable architecture if it is based upon geometrics, through the eyes of the beholder will imply beauty, peace and balance and these lines are in fact paths for the transportation of loads and forces.

Ways for transmission and transformation of energy in regional designing

In architecture, especially the architecture that is in coordination with the region, the ways to transport energy and heat to the inside or outside of the building, require special attention. These methods of energy transportation with regard to the facilities and conditions of each region in an experimental way have always been in the attention of traditional architecture. The most important ways for the transportation and transformation of energy that are the basis for several designing of regional architecture include:

A: Guiding through radiation

B: Guiding through syndromes and transportation

C: Molecular guiding

D: Guiding and circulation through evaporation

Radiation

In order to control the heat of the sun, architects, with the approach to domesticating have devised and utilized different methods and we will discuss them here.

Building houses around a central courtyard in a compressed fashion

In traditional architecture, the summer and winter sides and added parts were all focused around the central courtyard. All the sides are constructed around the courtyard so that diverse interior spaces for receiving the light and the heat of the sun are created. In accordance with the amount of the light and exposition to the sun, different sides of the courtyard can be utilized in different seasons.

Figure 2: Broujerdiha House in Kashan (authors)

Usually, the southern parts, as they have their backs to the sun and the fact that they create the biggest shadows are used in the summer. The northern parts are called winter wings as the residents move to the northern part of the house in winters (Figure 2). In other words, the residents of these houses change their living spaces in coordination with regional changes and seasons.

Use of architectural elements in designing

A: Semi-open space: The semi-open space is connected to the outer wall of the building in a balcony form and has wooden guard and ceiling which on the one side it is in front of a closed space and keeps the closed space behind it and safes from the direct exposition to the sun and on the other side, because of the shadow it creates on the exterior surfaces of the building, it leads to a decrease in the temperature of this wall (Moor, 2003). The utilization of materials with little light and heat capacity in this semi-open space will also minimize the absorption of the sun heat. Wooden balcony is a good example of a semi-open space that on one side is a place for enjoying the pleasurable breeze and wind which leads to the direct and close access to the public space from the private space of the room and on the other side, provides the opportunity for watching the day to day activity in the urban public environment and also the possibility for connecting the rooms from the outside (Figure 3). In a way, it can be said that wooden balconies have provided a chained blending of public and private spaces in the use of the wind and this regional function connects the public life to the private life (Ranjbar, 2010).

Figure 3: Wooden balcony on the outer front (Asadi, 2010)

B: Roofs' parapets: As the buildings' roofs receive the most amount of solar energy in comparison with the other sides of the building, some times in the hot regions of Iran, the height of the roofs' parapets reach 2 meters so that by creating the maximum amount of shadow for the roof, the heat radiation can be minimized (Ghobadian, 1999) (Figure 4).

Figure 4: High and reticular parapet in the back (Asadi, 2010)

C: Sun breaker: Sun breaker was actually filature usually was made above the door and the window which was horizontal sun breaker and was colloquially called a head-shadow and it was used to control the ingression of the sunlight to the inside space (Pirnia, 2006).

Utilization of stucco and lime plastering for the building's coating

This white cover will cause the absorption of minimum amount of sun rays and the temperature of the body of the wall will drop and the transportation of hot temperature to the building will be prevented (Ghayor, 1999). Stucco and lime have some characteristics:

- They are resistant against moisture and do not eroded rapidly (Espiani, 1999).
- Because of their white color, they reflect the sun light and prevent the rise in the temperature of the walls and its transportation to the inside of the building.

Air's syndrome or transportation

The transportation of energy through syndrome and also the creation of air transportation in the building in necessary times have always been in the attention of architects. Iran's traditional architecture, based on experiences, also used this physical property of air in different methods and we will discuss some of them here.

Utilization of single-layered space

Rooms that have view over the courtyard on the one side and to the open space of the outside from the other side and can open in different fronts with the capability to use the transportation of air (Figure 5). Because of the importance of creating air transportation, each space should have a hatch for the air to enter in the pressure area and a hatch for going out from the suction area (Figure 6).

Figure 5: Plan of the operable in different sides (Kasmaei, 2003)

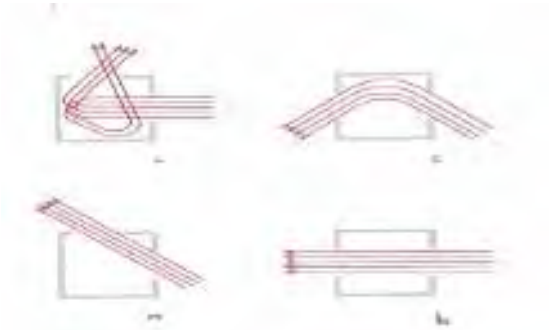

Figure 6: Utilization of windows facing the wind and those back to the wind (confronting each other)

Utilization of architectural elements

A: Central courtyard: In Iran's traditional architecture, the existence of the central courtyard in the heart of the building is done in a way that has led to the better use of air transportation. In each space, by opening the windows to the courtyard, the lateral ventilation and the temperature decrease. On the other hand, the constant placement of full and empty spaces with different intervals causes the formation of the wind through the use of the properties of the shadow and the sun. The

courtyard's confinement causes this open space to operate as a ventilator or interior spaces and leads to the extraction of hot weather (Figure 7). The courtyard is the central core, a space with geometrical order, introverted, independent, vital and central and open to the sky. The dimensions of the courtyard are based on the scale of the land and its dimensions and also in coordination with the number and types of the rooms that are built around it (Ranjbar, 2010).

Courtyards are the central hubs of the houses and are considered as social spaces with an environmental approach. Courtyards are designed in a way to have a narrow form to provide the needed shadow during the days of summer and at the same time, their width are in the dimensions to be capable of receiving sun rays during cold winters (Figure 8). Courtyards, added to their beauty, help create their welfare in space by shadowing and increasing the relative moisture and cooling and evaporation. The temperature (especially in the mornings) is much lower in the central courtyard than above its place and also around the building (Figure 9).

Figure 7: A house's courtyard in Boushehr (Ghayedi, 2010)

Figure 8: The central courtyard of the Kazerooni Seigniory, the current location of Bushehr's Cultural Heritage Organization (Espiani, 1999)

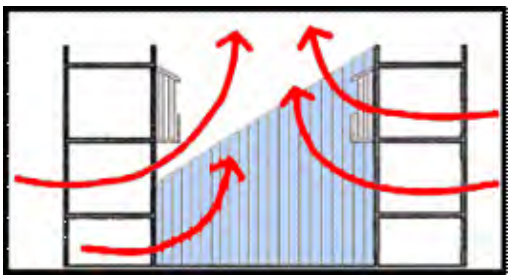

Figure 9: A segment of the central courtyard, the intense confinement causes the formation of shadows and air transportation

B: Balustrade: It is an unconfined space without a ceiling which is devised in different floors so that all around them would be covered by wooden window shades and matted sun shades (Shahin, 2010) (Figure 10). This space, like wooden balconies is located in the top floors but with

the difference that, in contrast with the balustrade, is in the form of a salient entity in the view of the building. Balustrade also plays a connective role between exterior spaces and the rooms and it is also utilized as a temporary seasonal living room (Figure 11). Balustrade can be considered the same as the porch or gallery in Iranian architecture (Raisi, 2007).

Figure 10: Balustrade in the central courtyard of Amirie building, current location of Bushehr Port's Islamic council (Memarian, 1996)

Figure 11: Terrace or balustrade, a semi-open space with ceiling in the upper plan of the buildings (Memarian, 1996)

C: Wooden window shades: The direction and the amount of the air ingression are determined by these shades. To better utilize the air transportation, these window shades are made in a way to be capable of changing the angles of their fins (Figure 12

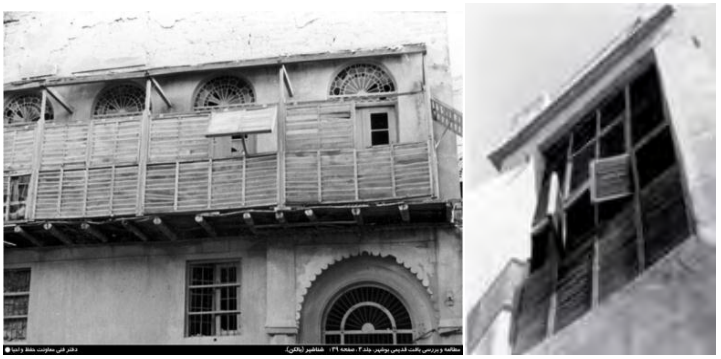

Figure 12: Wooden window shades (Ghayedi, 2013)

D: Aperture: Apertures are devised at the top of the houses entrances and play a role in ventilating and lighting the space behind the entrance. There are several factors in creating these apertures. The aperture plays an important role in ventilating and lighting the space behind the entrance (Figure 13). In the past, usually in the night, a lantern or light was put right behind the aperture so that added to lighting the vestibule, it also shed light in a part of the passage way. The houses apertures were protected by a beautiful metal network of designed fences.

Figure 13: Aperture at the top of the entrance, Figure on the left, Figure on the right (Ranjbar, 2010)

E) Cellar: In Iran's hot regions, there are basements that have a ceiling with a level above the surface of the central courtyard and usually, is located in the summer wing of the house. The windows that are between the surface level of the courtyard and the cellar's ceiling, take the air from the central courtyard to the inside. There are also underground streams or aqueducts that pass through these spaces and cool and moisture them (Figure 14).

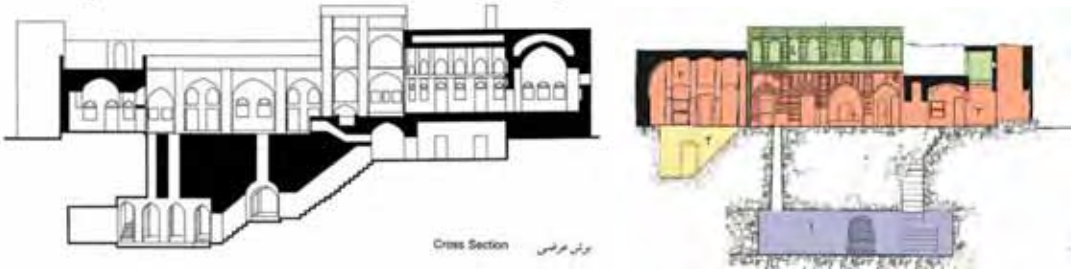

Figure 14: A segment of a Shodan, Figure on the left [19], Figure on the right, a plan of Abdi house in Dezfoul (Samimi Far, 2014)

F) Ceilings above the normal level: Another way for cooling interior spaces is this type of ceiling. It causes the air with the higher temperature to move upward and the air will enter from the openables and a lower level and this leads to the ventilation of air (Mehdi Zadeh Seraj, 2013).

G) Windward: The wind wards are amazing ventilators of air and prominent examples of Iranian traditional architecture with hard climate conditions by natural cooling. In a general categorization, the function of the wind wards can be divided in two ways of creating air transportation:

A: Guiding the air to the inside of the building (when the air flows)

B: Extracting the internal air to the outside (when there is no wind)

The way the windward works is basically based on the fact that the wind blow is used to drive desirable air to the inside of the building and the reflex of this action which is the suction for driving the hot and polluted air to the outside. There are vents that are often built staple to the direction of the wind. When the windward is in the path of a wind, the vents facing the wind are under a positive pressure and on the other hand, when they are in the position where their back is to the wind, negative pressure is generated (Figure 15).

Wind wards do the ventilation process by transporting the flow of desirable air to the inside of the rooms and driving the hot and polluted air to the outside. The form of the wind wards depends on the direction of the wind and usually is very high. Wind wards are not only effective factors in

the sense of welfare and peace, but are also considered as a determining factor in the city's beauty (Figure 6). The utilization of the wind wards and water to cool the buildings not only utilizes and optimizes the consumption of renewable energies and has no environmental pollution, but also are in the direction to reach sustainable urban principles (Lashkari, 2005) (Figure 16).

Figure 15: A reservoir with two pools and seven Yazdi wind wards in Hussein Abad close to the city of Yazd

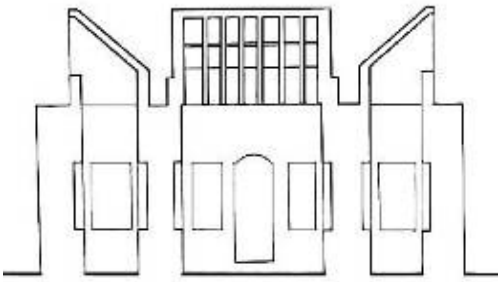

Figure 16: The synoptic schema of the three-sided windward of the house of the barrack's commander in chief, Arg-e Bam (Bahadorinezhad, 2012)

Molecular transportation

Wall's thickness: The thickness of the walls in regions of Iran is about 1 meter. The high special capacity of the bricks causes the heat to stay inside the wall and this means that minor heat changes are not significant. During the nights, the walls lose their heat through transportation and radiation and their temperature during the day is kept at a low level so that they will provide the welfare of the residents. In this way, the soil acts as a heat insulator and because of its high heat capacity, it leads to the independence of the temperature of the inside from that of the outside.

Two factors can be mentioned for the reasons of the thickness of the walls:

A) Reduction of heat transportation from the space outside the houses to the inside and also the increase in the delay for the transported heat;

B) Increase in the durability and solidity of the building.

Double-flake ceilings: Another method for coordinating the hot climate is the double-flake ceiling. The heat capacity of the air is very low and the air between the two flakes acts as a heat insulator and therefore, less heat will be transported to the inside and during the summer, the interior flake will be cooler than the exterior one.

Arch and domes: Another way for reducing the heat absorption by the buildings especially in hot and dry regions of Iran is the utilization of arches and domes. This form not only is in coordination with the available materials and structural logics, but also is a proper choice for the reduction of transported heat because of thermo-physical reasons. First, its convex spherical shape is very desirable for streaming heat radiations and also facilitates the cooling process during the night.

Secondly, during the day and in morning and afternoon time, half of the dome is in the shadow of the other half and this fact plays a vital role in reducing the temperature (Figure 17). Also, the dome-shaped roof, because of its projection, is exposed to the wind and therefore, the heat radiation has less effects on it.

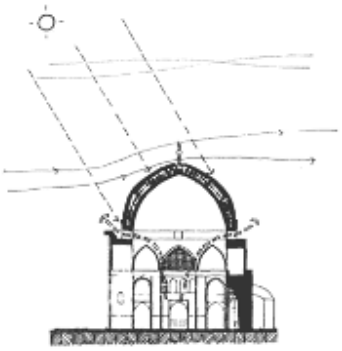

Figure 17: The way arched roof works against the sun rays (Rahim Atani, 2011)

Use of material

A) Wood: In the hot dry regions, it is better to use materials with low heat mass as they do not store heat in themselves. Regionally, the basic problem is the excessive heat and storing the heat for the night is not right. Therefore, wood is the best type of material in these regions because the wood transports the heat very slowly and the heat absorbed during the day stays on the surface of the wood and by the cool wind in the night, the wood loses its heat and consequently the wood is used in the roof, doors and windows (Ghobadian, 1999).

B) Thatch: Thatch is used for the exterior and interior walls of the buildings. This mixture is a suitable cover for keeping the interior space of the building from the intense heat of the summer and the coldness of the winter. The conductivity of the thatch is very low because of its hollowness. Thatch prevents the cracking of the wall and therefore, stops the transportation of intense heat through the cracks to the inside of the building and causes the safety of the building from the intense heat of the summer and the probable coldness of the winter (Espiani, 1999).

C) Bricks: Among the advantages of the bricks, it can be mentioned that because of the thickness of the walls and in some cases, their covers, heat and coldness insulators are made. In contrast, the thick walls of the central courtyard have high special heat capacity and work as stores for heat in which the coldness is saved during the night and during the midday when the weather is hot, this coldness is gradually released. In this way, the thickness of the brick walls causes the insignificance of minor changes in the heat (Zamarshidi, 2012).

Evaporation

Evaporation as one of the ways for transformation, change and transportation of energy and heat has received special attention in regional architecture. The following items can be mentioned as examples:

Waterfronts and fountains: The waterfronts and fountains cause subtlety of the air. In regional architecture the water is used as an important factor for changing, transforming, transporting and saving energy.

Green trees in the central courtyard: With the evaporation of the water by the trees, the relative dampness of the environment will also rise. This matter helps the cooling process of the interior spaces around the central courtyard, as the scientists have stated that evaporation by trees affects the cooling process as much as an air conditioner that has been working for 20 hours for 1 million BTU for 10 regular rooms. On the other hand, the existence of the trees with leaves and

shadow help a great deal in reducing the amount of the surfaces that receive direct sunlight in the courtyard and the neighboring walls. Also, green surfaces by absorbing sun rays prevent the reflection of the rays and the unwanted rise in the heat. Sometimes, these trees also play the role of carminatives. The choice of the type of the ever green trees is also different based on each type of region.

Khishkhan: Khishkhans are cabins that surrounded by straw or tiles and they are sprayed with water so that with the wind, they would suck the cold air to the inside. Even today's air conditioners are nothing but Khishkhans whose winds are artificially made by electricity.

Architectural design and optimization of energy consumption

One of the easiest and cheapest things to do for increasing the productivity of energy in a building is to pay attention to the type of the architectural design of that building in order to reduce energy consumption. This matter has been used in the past by the architects and urban planners in the best way possible. They were used so efficiently that now, when we look at the work that still exists after all these years, we see that without heating or cooling systems and only through the use of the properties of an architectural design, including orientation, coordination, etc, they have been able to provide temperature welfare for their residents.

Some of the studies done in the field of productivity of architectural design for reducing energy consumption in some cold and hot and dry regions in Iran indicate that the potential for energy saving with the help of the architectural design in the city of Tehran for instance is 48 percent and this number for the city of Tabriz is 64 percent. These will cause the sustainability in modern houses (Nasrollaei, 2010) (Figure 18).

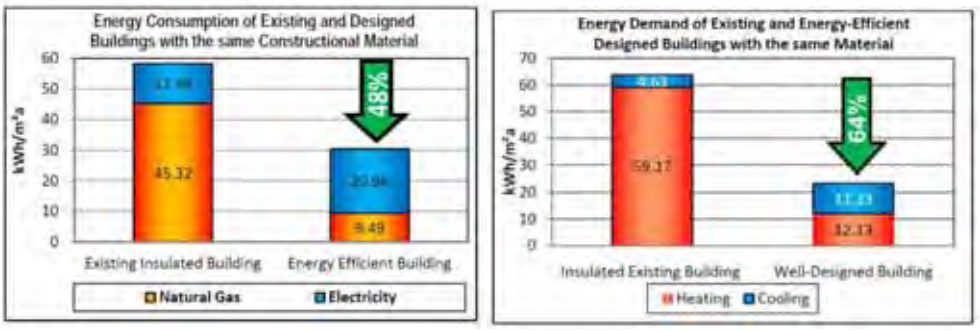

Figure 18: Potential for decreasing energy consumption by architectural design, the one on the right, Tehran and the one on the left, Tabriz

Therefore, with regard to the above mentioned items, paying attention to the region and a proper architecture in coordination with it and the utilization of architectural methods that would decrease energy consumption, should become necessities in architecture and urban planning policies in the country.

The static sustainability principle in Iran's traditional architecture

Analyzing the patterns of sustainable architecture in Iran's traditional architecture is dependent on the correct hierarchy of the buildings structures that have led to their durability until this age. The static sustainability is an important basis in sustainable architecture and through the use of logical methods, added to the durability of the buildings have caused the safeguarding of human lives during the times of their utilization. The most important principles among them are the following:

• The use of changing segments like thick walls in lower floors and reduction of the thickness in the upper floors

• The utilization of intersecting walls in the plan to increase the rigidity and inertia of the building

• The artistic utilization of openables to plasticize the building and prevent friability

• The reduction of the volume in dome covers and arches by creating reticular arches to decrease the earthquake force

• The use of wooden fans to control the buckling of the walls

• The intelligent application of out of focus loads to decrease tensional difficulties (like the structure of the penthouses)

• The use of stair or ziggurat buildings model as supporting structures for high buildings in order to create a soft barrier against the driving loads of the archs, chords and domes (Khaki, 1998).

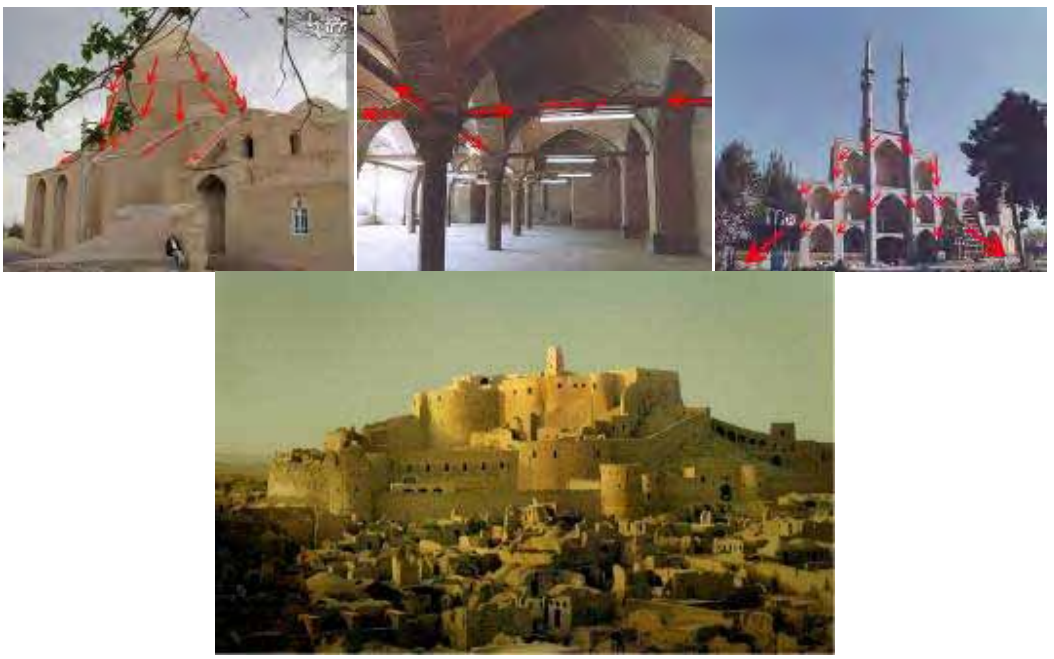

Figure 19: Arg-e Bam, an indicative of the utilization of interchanging segments, lightening in the upper sections of the building and operable in higher levels

Multiple fundamentals of the past's architecture

The subject of the multiple fundamentals in the architecture of the past can be considered as a territory for all the arts, especially poetry, as the verses of Hafiz whose reasons of immortality lies in their interpretabiliy in different times and places and in all circumstances you can open his book and ask for the past, present and the future from the Shirazi poet. The reason for the multiple fundamentals of Hafiz's poetry maybe the fact that his language contained multi folded values and meanings and the composition of these meanings and values in different historical periods created new values. If a work of art had multiple fundamentals, it would have two groups of values. One group is that of the inherent values that are born with the work and the other group is the added values during centuries that are blended with the primary values and have created a work with several fundamentals. In the field of architecture the Sheikh Lotfollah Mosque can be mentioned. In the design for this mosque, masterful architect, Isfahani, have considered some points that are the work's inherent values of the work, such as observing the coordination inside the dome, the proper scale outside the dome, the masterful solution to the rotation from the square to the interior of the

mosque, the very inventive lighting that in a very artistic way, transforms the intense light of the square into the soft light of the dome, etc. Now, in accordance with today's conditions, if we wanted to learn a few lessons from the architecture of Sheikh Lotfollah Mosque, with some attention, added to the points created by the master architect, there are also other things to find that are regarded as the special architectural values of the mosque and cause it to be a work with multiple fundamentals, such as the symbolism of the architecture of the mosque in the conscious use of penthouses that are regular in Iran's architectural traditions and also have proper geometrics and structural basis which can be a lesson for today's architecture to learn or the utilization of special patterns that connects this building to the architecture and patterns of the previous centuries.

Therefore, religious works like poetry can be regarded as eternal, but not other works of architecture. The architecture of a house cannot be regarded as eternal, because according to its nature it is in constant change and renewal (Saremi, 1997).

Conclusion

Together with the attention to the modern issues of architecture about the utilization of new renewable energies, through the use of traditional architecture we can also optimize the energy consumption and reach the decrease needed in environmental pollutions which is one of the main goals of sustainable development. According to the analysis that was done, the following results are obtained:

• Sustainable architecture needs proper regional infrastructure. Even though regional architectures were sustainable in their times, their duplication in our time may not be sustainable, but understanding and analyzing them will lead to reaching proper patterns for sustainable architecture in the same region now.

• The architectural spaces of the past were created by considering all the environmental, social and economic factors that are the three main factors in sustainability. They, added to responsiveness to functional needs and providing the temperature welfare of the residents, consider the social and cultural factors too. Spaces like wooden balconies, terrace, central courtyard and roof tops are indicatives of this matter.

• The culture and customs of the people along with regional matters are the main basis for the formation of architecture and urban planning. Paying attention to the safeguarding of private sanctum, creating a kind of introverted which at the same time is introverted, honesty and sincerity in the architecture of the houses and the coordination in the urban appearance of the texture are all rooted in the culture of the people from that region.

• The least amount of intervention in nature, recycling and lack of the production of sewage and in general, coordination and harmony with nature are among the ancient traditions of the architecture of the past.

Factors that can be utilized in today's architecture"

- The use of natural ventilation and cooling systems
- The proper use of the wind in any region, especially the dominant wind and using it for the ventilation and cooling of the spaces that are frequently used in the summer
- Using materials that are in coordination with the region
- The proper use of water and plants that causes the subtlety of the air
- The proper orientation of the buildings with regard to the movement of the sun in the sky and the optimized consumption of solar energy in different seasons of the year
- The use of the soil's heat capacity in the winter and summer in spaces like basements, cellars and Shodans
- The use of added elements like porch and sun shades

- The use of patio as the central courtyard based on the path of the sun to save the interior heat of the building
- Devising unimportant spaces like storerooms as heat insulators in the walls or the colder parts of the building
- The use of porous materials in the walls that minimize the transportation of the heat to the inside of the building
- The use of waterfronts and fountains that lead to the subtlety of the air
- The utilization of the proper geometrics and structures

Discussing sustainable architecture is not complete without knowing the architecture of the past. An Iranian architect, with the historical experience and collective minds of the architects from his predecessor architects, looks at a building in a comprehensive multi folded way and at the same time avoids all kinds of extravagance and indulgence. In the past, static sustainability and creating a connected environment that is in coordination with the natural phenomena and social and cultural relations between people were relatively easy, but today, technological modern facilities and reflections from the industrialized life have had notable effects on changing the process of the production of architectural spaces and created two eras that are so separate from each other that connecting them seems impossible. What is in the attention of this study is the fact that most of the basics that are presented in sustainable architecture in Iran have been heeded in the traditional old architecture of this country in different regions. These are the same principles that are forgotten in the present time and by recreating them in accordance with contemporary architecture, a new approach in contemporary architecture of Iran will be created.

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