

Sustainable strategies in Iranian houses

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Abstract: Traditional Iranian architecture especially houses have unique characteristics, while considering aesthetic issues and environmental conservation have been responsive to climate requirements for each region. Techniques and rules used in this architecture clearly have in themselves many new concepts in sustainable architecture arena. This paper studies these sustainable concepts in the architecture of Iranian houses. This research is qualitative, descriptive and then analytic in regard to research performing process. Investigating and selecting the bases and concepts are based on library and documentation methods. This research results show that sustainability can be promoted in environmental, economic, social and architectural dimensions considering to indigenous and local sustainable values.

[Shadi Babaei, Nasim Fazeli, Behnam Ghasemzadeh. **Sustainable strategies in Iranian houses.** *Life Sci J* 2012;9(3):2576-2580] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 373

Keywords: Sustainable architecture, Iranian houses, Iranian architecture, traditional architecture

1. Introduction

A glance at the architecture of Iranian houses at least in past fifty years indicates that the solutions and architectural spaces which over the centuries had permanent presence have been eliminated and supposed to be inefficient. These solutions not only promoted physical and functional aspects of architecture but also equipped with advanced technology of that time by consistency with environmental and climate conditions and utilizing renewable energies and in their lines.

In the discussion of sustainable development and following it sustainable architecture, it is obvious that each building should interact with its surrounded natural environment. The controversial and significant part is how to interact and the type of considered measures. This is exactly something that was exploited years ago by Iranian people with especial skill. They have benefited from it by performing technologies and especial rules in regard to optimal use of energies and natural resources particularly solar and wind energies; and coordinating with regional climate. But unfortunately, today it is forgotten and destroyed. These measures are not only evident in environmental but also in social and economic dimensions (Zandieh and Parvardinejad, 2010).

Therefore, sustainable architecture helps to create a healthy environment based on resource efficiency, conservation of non-renewable resources, reducing consumption of renewable energies and quality promotion of life and human health.

“Evaluation of traditional solutions in local architecture precedes the development of mechanical solutions in order to accept or remedy these

methodologies to preserve from modern sophisticated requirements... This process should be based on new progresses acquired in humanities, physics as well as in sciences such as material technology, physics, aerodynamics, meteorology and physiology” (Hassan Fathi, 1986).

So first, in this research the principles of sustainable architecture and then climate techniques used in architecture of Iranian traditional houses have been specifically studied. The existence of spaces such as particular residential spaces for summer and winter, optimal use of wind and solar energy and soil thermal capacity are significant characteristics of houses in different regions of Iran. In this research, it has been attempted briefly to investigate some elements and techniques used in construction and architecture of Iranian traditional houses.

2. Methods

This research is qualitative in regard to performance process, applied in regard to research results, retrospective in time of research conducting, descriptive in research objective and then field study in regard to its analysis (diagram 1). Books, reliable journals and sites have been used for obtaining optimum results and providing appropriate answers to the questions. Finally, it has been attempted to totalize and analyze the obtained materials by field visiting of available facilities and giving case examples of different types of housing.

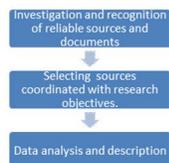
3. Research Questions

3.1 To utilize the greatest advantage from sun rotation in different seasons and the existing wind in each climate, how should be climate

indicators of each region and buildings orientation?

- 3.2 What sustainable elements were effective and important for using optimal construction model of Iranian housing?

Diagram 1- Data collection process



4. Research Objectives

- 4.1 Identifying the factors is effective on shaping the architecture of Iranian houses.
4.2 The elements and techniques have been used in architecture of Iranian traditional houses.

5. Theoretical bases of research

5.1. Principles of sustainable architecture

For classifying a building in the category of sustainable buildings, some principles should be observed as follows:

- The first principle: Energy Conservation
- The second principle: Climate coordination
- The third principle: To reduce use of new resources
- The fourth principle: To meet residents needs
- The fifth principle: Coordination with site
- The sixth principle: Generalization (Ghiasvand, 2006)

5.2 Climate techniques for traditional Iranian houses

5.2.1 House architecture in Iran

Nearly 9000 years pass from the time that human select sedentary in Iranian plateau (Adib et al, 2005). Iran with its cultural and geographical characteristics is among the countries which have been able to create various architectures over history. Even, this diversity is also observable in geographical segmentations of a limited region. For example, a large variety of residential architecture in green areas of Gilan province or residential architecture in Iran desert of Natanz Abyaneh well presents this issue (Memarian, 2008). Various factors such as topography, climate characteristics, economic capabilities, livelihood, water resources and other factors have caused to emerge different residential tissues in Iran in regard to physical formation. This specific geographical and climate position along with the intelligence of the ancients in utilizing natural energies like wind and solar energy whether in scorching desert or in humid areas of the country together have caused to emerge this unique architecture. But it is observed that today people of

this land with negligence and a foreign model are constructing instable buildings (Zandieh and Parvardinejad, 2010).

5.2.2 Four seasons housing

The optimization of energy consumption in residential buildings is the design of four seasons housing, the most obvious form of traditional buildings in consistency with climate which have been made in hot and dry regions as central courtyard and completely introverted.

These buildings have particular residential spaces for summer and winter that are the best forms and possible combinations of components in a building for climate modification. Thus, north and sunny side of courtyard which was warmer, was used in winter and was famous as particular residential space for winter. Vice versa, south side of courtyard and back to the sun was used in summer and known as particular residential space for summer (Ghobadian, 2008).

There were below windcatcher spaces and throne room which had higher elevation and lighter volume than particular residential space for winter. This was because of using wind, air conditioning and better air circulation; and cooling this space in summer. Particular residential space for winter consists of three-door room, five-door room and a space that its coherent is cut off in the corners.

It also settled on the main axis and two communication spaces which can be corridor and the upstairs in two sides of the saloon consist of three-door, sash or Tehrani and two-door room. For more sunlight, the windows were often constructed from large sashes and intricate mirror decorations such as very complex mirror works are seen inside central spaces due to the closed space (Zandieh and Parvardinejad, 2010).

5.2.3 Introspection

Work on the appearance was avoided and instead work on the inside and internal estates has also been drawn in this arena by some acquaintances with architecture, as far as Iranian architecture is not seen from exterior façade something more than mud but inside has a beautiful world; and so it is called introverted architecture.

5.2.4 Characteristics of introverted houses:

- 1- Lack of direct visual connection between the spaces within and outside urban areas.
- 2- The elements such as central courtyard or covered platforms have organized different spaces such that the openings are opened to the side of these elements.

The discussion on lack of direct visual connection with urban areas can be investigated from two cultural and climate views (Memarian, 2002).

5.2.5 Extraversion

Extroverted typology is related to a type of housing architecture with the characteristics such as having direct visual and physical connection with outside space of the house, no courtyard, extending the height and spatial organization than other space like facing porch (Memarial, 2002).

5.2.6 House orientation

The use of resources and natural energies is one of construction principles and spatial organization in traditional complexes. For example, old houses in tissues of the desert are located in direction of Mecca (except when there is annoying wind). This orientation has created climate conditions in design of biological spaces to place summer spaces and winter rooms logically in proper position. Proper orientation in addition to protecting residents against direct heat of the sun; prevents from improper winds (Asadpour, 2006).

Three existing orientations in traditional Iranian buildings are: order (northeast-southwest), Esfahan (northwest-southeast) and Kerman (eastern-western) indicated the best establishment orientation in any climate. Order orientation has included central cities like Tehran, Yazd, Jahrom and Tabriz in northwestern of Iran, Isfahan orientation has included Isfahan, Shiraz and finally Kerman orientation has included Kerman, Hamadan, cities in western Azarbijan, Khoy (Pirnia, 2003).

5.2.7 Diving in the soil deep

Diving in the soil deep and constructing the spaces in underground to use soil heat capacity in different seasons of the year is another climate techniques. Construction of such spaces is only prohibited in the areas with high soil moisture such as the areas in Caspian Sea margin (Zandieh and Parvardinejad, 2010).

5.2.8 Green area

Gardens and low water usage trees while providing shade, playing the role in production and creating beauty compensate lack of humidity in the environment. These green surfaces prevent re-reflection of beams and unwanted increase in heat by absorbing solar radiation beams (Asadpour, 2006). These trees sometimes play the role of windward. Selecting evergreen or deciduous tree is different depending on climate type.

5.2.9 Use of appropriate materials

One of the climate tricks in residential architecture of Iran is use of local materials with adequate thermal capacity due to climate. So, not only the materials appropriate to any climate have been used but also side costs such as transportation costs saved. Typical samples are the use of wood in northern area of the country and the use of soil, clay and brick in central and desert areas which are well evident (Zandieh and Parvardinejad, 2010).

5.2.10 Insulation in traditional architecture

From ancient times, by insulation and the use of available construction materials and also reducing and increasing walls thickness; Iranians have constructed their houses such that they require the minimum heating and cooling and it is the manifestation of ancient Iranian civilization. Insulation in summer causes less heat enters into the building and in winter prevents heat leaving from and cooling the building. In traditional architecture of Iran, the insulation has a specific importance. So that, in this architecture there is no roof covering whether flat or curved that is not double-layer. In addition to lighten the covering, the transmission of outer heat into the building has been prevented by this method (Pirnia, 2003).

5.2.11 The role of water in traditional architecture

One of the important constituent elements of Iranian traditional courtyards is the existence of water and pool (Toofan, 2006). Water pond in the middle of the yard, in the basements and the use of water in the spaces like spring house for softening the air, creating appropriate visual vision and sometimes the sound of water using fountains and waterfalls; and instill sense of calm are the small samples of using water in residential houses. For instance, evaporation in hot and dry climate can reduce temperature. In aspect of architecture and its relationship with water, Zoroastrians marked four sides of an open sacred area which was a land in rectangular shape and was called "Pavy" then read a special prayer for getting out demon's soul and cleansing it with holy water (Nayebi, 2002, 45).

6. Results

One of the important and effective factors in shaping the architecture in an area is climate. Synchronizing with new world architecture and applying new energies in the building and constructing in coordination with climate can save energy and reduce environmental pollutions. Besides of these, applying valuable templates of traditional architecture is also very important. Some of these templates have been mentioned in the following:

6.1 Use of natural ventilation system

In traditional Iranian architecture, ventilating and cooling the environment particularly in hot and dry climate and rotating the air and leaving moisture out in humid climate has been important. Creating and use of the windwards, a large window facing the courtyard, a hole in small dimension in the ceiling in addition to light entry; have been responsible for leaving hot air out and sometimes in larger dimensions as patios and windows below the ceiling displayed in hot and dry climate. Among the above mentioned, ventilation in humid climate for air

circulation and leaving moisture out in dominant wind direction by non condensation constructing of building, allowing air circulation within buildings and also embedding proper opening have been important.

6.2 Correct use and utilization of the wind of any climate in the ventilation

The rotation of the building in proper winds direction or opposite direction of the annoying winds and making windcatcher one or more ways in proper winds direction and preventing the entry of annoying winds (when winds carrying sand in the deserts) show the correct use of wind by ancients. Therefore, building orientation, proper use of wind and air circulation in many ancient traditional houses have had a useful and effective assistance for ventilation of the house and heating interior spaces in different seasons.

6.3 Use of proper materials available in each area

Use of proper materials available in each area, does not have any reason except their proper functioning in each region's climate. Besides, use of materials available in any climate and area for reducing transportation costs which in its turn requires energy consumption and their availability are very important. Use of wood in forest area, stone in mountain area and brick in desert area is a reason for this claim.

6.4 Use of indigenous materials consistent with climate

Use of indigenous materials consistent with climate in each area not only emphasize on reducing transportation costs and saving energy consumption but also is completely consistent with its climatic environment and is flexible against environmental factors. As it was noted, use of brick in hot and dry climate (due to the considered thermal capacity) and stone in cold climate compare to humid climate and use of wood (due to high-humidity environment) are quite apparent. So that, flexibility of each of these materials against climatic actions and reactions has included proper responds.

6.5 Proper use of water and plants

Proper use of water and plants together for creating a pleasant environment and perspective; is one of the most important principles in Iranian architecture. In addition to making the supposition of like heaven space, these factors are important in having an important role in regulating environmental conditions inside the building and softening environmental and regional air. Planting vegetations appropriate to regional climate, planting evergreen and deciduous trees commitment to shade or sunlight in different seasons and creating diversity and color in the space; prove the intelligent use of plants by ancients.

6.6 Proper orientation of buildings according to the sun movement

One of the construction principles in traditional complexes of Iran is proper orientation of buildings according to the sun movement in the sky and optimal use of solar thermal energy in different seasons of the year. In traditional Iranian buildings, three order orientations (northeast-southwest), Isfahan (northwest-southeast) and Kerman (eastern-western) indicate the best side of building establishment in any climate.

6.7 Use of soil thermal capacity in winter and summer

Since, the earth is almost an unlimited thermal source, soil thermal capacity is used in winter and summer in the spaces such as basements, cellars and shovadans. Its heat storage capacity rate provides this possibility to be used for seasonal heat storage. Soil temperature at depth below 6m., is almost stable and equal to annual average of surface temperature. The existence of summery and wintery spaces, use of earth depth and life in soil depth has had positive consequences.

6.8 Use of additional elements

Use of additional elements such as porches and canopies along with vertical or horizontal sunlight controller blades, curtains, and latticed windows with colored glasses are the ways to control the depth and amount of sunlight into the building in summer and winter based on resident needs to solar energy. While, the proper angle of solar radiation in winter makes the penetration of sunlight possible into the building in the best way.

6.9 Use of walls thickness

Walls thickness and the materials used in it were made using materials thermal capacity depending on climate and residents needs to variable cooling and heating. Making two layer roofs whether flat, curve or steep was helped to control the rate of sunheat received through the roof creating a kind of insulation by air trapped between two shells; and choosing the appropriate materials besides their thickness have been a complete insulation against climatic factors.

6.10 Climate preparations in coordination with culture, tradition and beliefs

Each region of Iran has its own regional customs and traditions; and coordination of climate preparations with special culture and traditions of each region besides religious beliefs are very important. For example, the coordination of people culture in desert regions with condensed housing tissue and their introverted architecture compare to people from north territory with their non-dense and open housing tissue for air conditioning and moisture disposal in this region can be noted; and some

examples of architecture in west region cold with limited and small openings can also be mentioned.

7. Conclusion

By examining and comparing main components of sustainability with the architecture of traditional houses, it was clarified that the architecture of these houses are in full compliance with the principles of sustainable architecture. Lack of attention to sustainability foundations of traditional Iranian architecture and the factors affecting on it; have shown an unstable condition in existing architectural structure. Forgotten solutions in design of sustainable residential space should be identified and updated regarding to available technology and used in design of buildings. Sustainable strategies which gained from simultaneous intelligent design of climate and architecture are valuable from aspect of sustainability. In fact, the ecology of building emphasizes on its ability to combine with climatic factors and transform it into spatial qualities and comfort form. Using these strategies and solutions in architecture not only is a major step toward sustainable development but also will largely restore and strengthen the lost architectural and urban native structures.

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References

1. Shakeri-Zadeh Abyaneh, Abbas, Mesgari Hooshyar, Sara and Miri, Hasan, Recognition of house in Abyaneh, journal of housing and rural environment, No. 131, autumn 2010.
2. Toofan, Sahar, Recognition of role of water in courtyard of traditional Iranian houses, journal of Bagh-i-Nazar, No.6, third year, Mar.
3. Nayebe, Fereshte, courtyard in courtyard, Nezhat publication, Iran, Tehran.
4. Soltanzadeh, Hossein, Input spaces in traditional Iranian architecture, second edition, 2006, published by department of cultural studies.
5. Pirnia, Karim, Familiarity with Iran Islamic architecture, published by University of Science and Technology, seventh edition, 2004.
6. Memarian, Gholam Hossein, Familiarity with Iran residential architecture introverted typology, Soroush Danesh Publication, 2009.
7. Asadpour, Ali, Sustainability patterns in Iran desert architecture, Our magazin, No. 25, 2007.
8. Adibzadeh, Bahman, Razjooyan, Mahmood, Mostafavi, Fatemeh and Riazi, Mohammad Reza, House in Iran, civil and urban development company of Iran publication, first edition, 2006, Tehran.
9. Ghobadian, Vahid, Climate survey of traditional Iranian buildings, Tehran university publication, fifth edition, 2009, Tehran.
10. Zandieh, Mahdi and Parvardinejad, Samira, Sustainable development and its concept in Iran residential architecture, journal of housing and rural environment, 2011.
11. Fathy, H., 1986. Natural Energy and Vernacular Architecture, The university of Chicago Press, Chicago.
12. Ghiasvand, Javad, The interaction of architecture and new energies (sustainable), journal of Rah va Sakhteman, No.38, 2007.

1/26/2012