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A Study on the Sustainable Architecture Principles and Solutions to Implement it

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Abstract

Humans seek to create a space where they can find the best solution to fulfill their needs by understanding peace, security, and sense of belonging. In this chain, nature is the integral element and it is the law governing the human life, and this thought has been highly embodied in the Iranian traditional architecture and such great architects as Frank Lloyd Wright has highly considered the relation between architecture and nature. Architecture remains sustainable when it is parallel with the nature not perpendicular to it. Nature is a law with fixed values. A stage must be provided that the humans can continue their efforts for survival in a pure environment because without global environmental security, national and even social security cannot be guaranteed. Respect for the environment and nature and having knowledge about ecology, topography, and climatic conditions are required. So, sustainable design is not a formal style and does not stem from momentary impulses; rather it implies deep concepts that link human, nature, and architecture. By enjoying theoretical findings of sustainable architecture and rich architectural traditions and local urbanization simultaneously, we can step towards improving environmental sustainability instead of uncontrolled expansion of low density cities.

Key words: architecture, sustainable design, executive solutions, sustainable development

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1. Introduction

It is more than three decades that the relation of human with the natural world has become one of the particular and sometimes annoying issues due to occurrence of a wide range of environmental crises. Design of cities and buildings throughout the world has set the stage for either improving or destructing the environment on the earth (Jodat Mohammad Reza, 2001). Raskin writes in the book "The Seven Lamps of Architecture" that the harmonic order existing in the nature can be modeled to achieve growth and development. Morris recommended return to the green space of the suburbs and self – sufficiency and revival of local industries. In one of his eloquent declarations, Latabi has asked architects to value harmony and beauty of the nature. All of these pioneers have used the word nature. After years, other architects like Frank Lloyd Wright, Peter Eisenman, etc. continued and developed beliefs of these pioneers. Architecture has relation with the human and it is also for the human life but unfortunately, today's architecture mainly considers materials aspects of human life.

At the beginning, architecture was a response to a need and took later a creative form. It gradually became a response to all human needs including social and spiritual needs. After living in caves, humans gradually began to build tools and use natural elements particularly fire to fulfill their needs. In this period, humans preferred living by the river and created a particular architecture known as trilithique. Gradually by development of architecture, the necessity of building cities was felt more and the spark for urbanization was provided in this period.

Examples of such needs that have created such a thoughtful architecture are not few. In these examples, although the origin of their emergence is fixed values and the thing that has made these examples as architecture is a sense flown in them, it must be noted that values are not the mere factor forming architecture; rather climate is a very important factor too.

In architecture, human is embodied as an integral element both inside and outside of it and we call a building as architecture when it considers human needs completely. In anthropology, nature is raised as the integral element in relation with the human and in fact, nature is the law governing human life. And nature is not deniable. We are a part of nature and nature is a part of us. But it can be disregarded; an occurrence we have witnessed during the history of architecture. In the history of architecture, we sometimes witness removal of nature and dominance of wisdom over emotion and witness creation of buildings with rough structures (Chicago School) and in a period, we witness emergence of a quite romantic architecture (organic architecture); a thought that has been highly embodied in the Iranian traditional architecture. In this period, we witness efforts of architects for linking buildings with the nature.

Figure 1- sustainable architecture (organic)

In the modern era, this thought has highly drawn the attention of such great architects as Frank Lloyd Wright who states that "no house should be on the hill, rather it must be a part of it and must be originated from it and belong to it so that hill and home will live with each other and anyone is happy for the presence of the other one".

He demonstrates this thought in the falling-water properly. He demonstrates his all love for the nature in the best manner in this eternal work. Here it is talked about the house on the waterfall not the waterfall beneath the house. He always emphasized that "no one can understand the specific beauty of a site as long as I have not made a building in it".

Figure 2- falling-water by Frank Lloyd Wright

He has always shown his attention to the site. This mindset is the same occurrence we witness in the Iranian original architecture embodied in the Iranian houses in the simplest way.

2. Architecture and Environment

Architecture may invent a kind of compatibility and harmony with the surrounding environment. In fact, architecture has tried to define its product within the ecosystem and the building is indeed a part of the ecosystem and moves towards improving it. This thought that designers must consider the way of dealing with the environment is not so much new. The thoughts that appeared idealistic or banal one day now seem extraordinarily in accordance with the requirements and almost vital and it is studied at unprecedented levels of issues related to the environment. Many countries prove their awareness of this matter by reviewing their work and enjoying energy properly by using environmental criteria and adopting accurate decisions (Mackenzie, 1991). With the arrival of 21st century, new interpretations have entered into this issue (architecture and environment). Baubiologie was one of them. It was a movement formed in 1970s in Germany. Its leader was Professor Anton Schneider and it refers to design of buildings that are consistent with the environment sanity. It is also regarded as a incentive for a good physical and spiritual movement by which minimum damage to the environment by the used materials is ensured. This trend permits the house to breath. Professor Schneider regards house as a living organism that can be harmonized with the environment by controlling and regulating its functions continuously.

Architecture and ecology

While "Baubiologie" influences the life style, it has mainly a direct relation with treatment with the environment, people behavior and their life rather than absolute technical studies. The biological architecture is an interdisciplinary philosophy that has a comprehensive relation with the architecture. This movement was started in 1960s since the Netherlands Green Movement. In the Europe, today near 20 percent of new buildings are built by considering some criteria of biological architecture, and Germany, Sweden, and Norway are pioneer in this regard. The biological architecture addresses the relation between nature and architecture, environmental considerations, environment protection, environment engineering, environment psychology, climatic conditions in the building, materials and energy recycling, energy waste prevention, land use planning, considering biological, ecological, economic, social, etc. conditions (Armaghan and Gorji, 2009). Among goals align with the nature in the biological architecture, the following ones can be pointed out.

- Energy preservation
- Harmony with the climate
- Reducing use of new material resources
- Fulfilling human needs
- Attention to the divine eternal resources
- Interrelation of human, nature, and architecture

Architecture may invent a kind of compatibility and harmony with the surrounding environment. In fact, architecture has tried to define its product within the ecosystem, and building is indeed a part of ecosystem and moves towards improving it. Respect for the nature lies in the human essence and such prominent architects as Frank Lloyd Wright were interested in the nature and its beauties. Organic architecture has a background as long as the human history. Anyway with all the respect it has for the surrounding environment, organic architecture cannot fulfill human needs properly; but what about an architecture compatible with the nature? The architecture that neither conceals itself from the viewer's eyes nor impose itself on the nature; the architecture that deals with the nature ecosystem cycle and makes the optimal use of the minimum energy by applying technology; the architecture that uses produced rubbishes to improve the surrounding environment and is sensitive to its relational function with the nature. This architecture is called harmonic architecture because this harmony is further more intelligent, conscious, and useful than organic architecture that does not care about its rubbishes. In these consecutive challenges, the fact that is faded away gradually is the human identity and the environment. Reliance of the 21st century architecture upon the unbridled technology made architecture to play an undeniable role in distorting ecosystem and life cycle and creation of dangerous phenomena such as ozone layer gap, greenhouse gases, and air pollution (Armaghan and Gorji, 2009).

2.1 Sustainable architecture

Sustainable architecture is a macro term that refers to some techniques in designing architecture that is consistent with the environmental attitudes and has been formed with respect to the nature. Sustainable architecture is not a new trend; because it has fundamentally existed in many ancient civilizations and traditional architectures including the

Iranian traditional architecture. Today following negative outcomes of the industrial world, protection of natural resources has been converted into one of the major concerns of the human of the present age. That's why by seeking a way to minimize negative effects of buildings on the environment, sustainable architecture is in fact an effort for consistency with the nature through increasing efficiency and optimizing use of materials, energy, and space development. So in the sustainable architecture, instead of enmity with the nature, energies of the nature are controlled and used in the buildings in the best manner. For example, in a sustainable building, materials are used that not only do not pollute the nature, but also they can return to its cycle. The building that has been built by using its surrounding materials and in a strong way becomes a part of nature. To construct such a building, easy access to the public transportation is considered; because it will minimize use of automobile. Also in the building orientation, the direction of solar radiation is considered aimed at maximizing use of natural light and gaining the free energy (for example, equipping the building with the solar water heater). However, the thing that is important in such buildings is to provide a way for the nature to enter into the building.

2.2 Principles of sustainable architecture

Principle one: energy preservation

Any building must be designed and built in a way that minimizes its need to the fossil fuel as far as possible. No doubt, the necessity of accepting this principle in the past eras is undeniable with regard to the manner of constructions, and probably due to high diversity of new materials and technologies, such a principle has been forgotten in the contemporary era, and this time by using various materials and different combinations of them, buildings change the environment with regard to the needs of users.

Principle two: working with the climate

Buildings must be designed in a way that they can use the climate and local energy resources. The form and manner of building construction and the location of its interior spaces may increase convenience inside the building and simultaneously reduce use of fossil fuel through proper insulation. There two processes have many common points.

The tradition of design with regard to the climate for creating convenience inside the building is not restricted to the heating rules; rather in many climates, architects are obliged to design a cool space for creating proper conditions inside the building. The common solution in the present era, i.e. use of air conditioning system, is only an inefficient process in conflict with the climate and is associated with high energy consumption which is wrong even when energy is cheap and abundant due to the pollution caused by it.

Principle three: reducing use of new resources

Any building must be designed in a way that minimizes use of new resources and creates a resource for creating other constructs at the end of its lifetime. This re-use may be formed by using recycled materials or recycled spaces. In most cases that access to the new resources is minimized, methods are explored that by using them, buildings that have been made for a purpose can be used for other purposes too.

Changes in some old buildings for new uses may bring about specific costs and problems. However, advantages of re-use of these large buildings in an urban space may overcome these problems and costs. Modernization of buildings existing in the small and big cities may

also protect resources used for destructing the buildings and so prevent from destruction of urban environment.

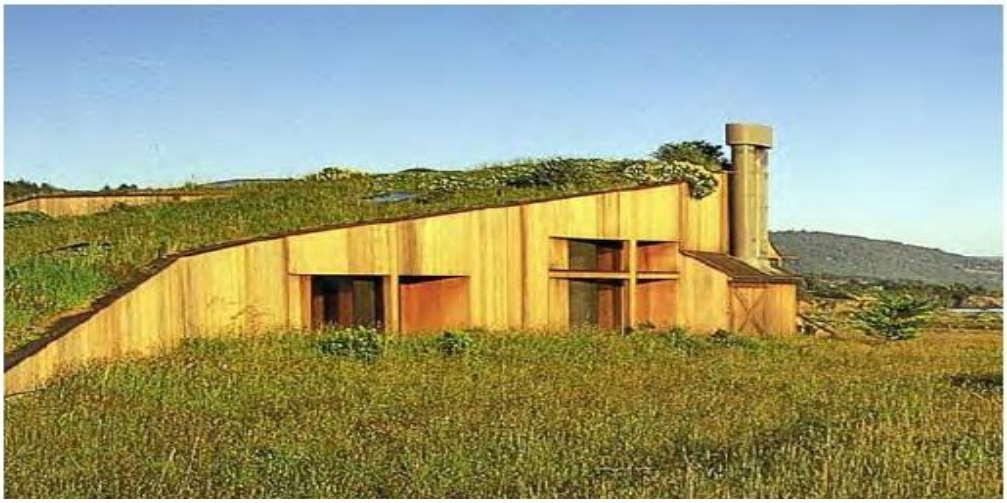

Figure 3- sustainable architecture (organic)

Principle four: respect for the users

All buildings are built by the humans but only in some constructs, the fact of human presence is respected; while in some others, rejecting human dimensions in the construction process is observed. For a professional architect, it is required to consider that safety and health of materials and processes forming the building is important for the whole human society to the extent that is important for the workers or its users. Another form of human participation that warrants attention is positive involvement of users in the process of design and construction. And if it is not applied effectively, an efficient resource will be lost.

Principle five: respect for the site

Glenn Murcutt, the Australian architect states this strange sentence that building must touch the earth lightly. The building that consumes the energy greedily produces pollution and so will never touch the earth lightly. No building can be removed from inside its site and the prior conditions cannot be revived in the site.

While in the urban societies, people have left their local and traditional life for sedentism and architects have entered into the design era, there is still need to temporary constructs for different uses such as exhibition and other cultural activities (such constructs often take the form of Bedouin tents).

Principle six: holism

All principles of sustainable architecture require involvement in a holistic trend for constructing an artificial environment. Finding buildings that have the principles of sustainable architecture altogether is not a simple task because sustainable architecture is not yet known completely. A sustainable architecture must include more than one single building and must include a sustainable form of urban environment. City is beyond a set of buildings;

In fact, it can be regarded as a set of interacting systems; systems for living and disporting that are in the form of built shapes with skeleton. And by an accurate look at these systems, we can draw the image of the future city.

2.3 Compliance of sustainable design with three specific principles

Studying these principles helps the architect to further understand the environment he must design.

Resources economy stage

This principle addresses proper use of non-renewable resources and energies like fossil fuels for reducing consumption on one hand and considers better control and application of natural resources as renewable reserves on the other hand.

Life cycle design stage

The second principle of sustainable architecture is based on this thought or theory that substance is converted from a usable form to another form without damaging its usefulness.

Human design stage

This principle stems from needs required for preserving chain elements of the ecosystem that guarantee human survival. This principle has three strategies namely, protection of natural resources, urban design – site design, and human convenience.

2.4 Desert architecture

Desert architecture is an architecture originated from the heart of desert, originated from desert and its governing values – architecture in desert is sustainable when it does not violate the principles governing the desert. These values and principles are common both in the world architecture and in the Iranian architecture because the nature of desert is identical but the attitudes of architects are different due to existence of different cultures; yet their nature is identical anyway because their nature is nothing but desert.

Stone walls have been put on each other as if a layer of sand has been put on another layer and this is the distance between earth and heaven. It has been inspired by the sand layers moving by wind and this is tangible easily in the building frontage. He has considered both earth and heaven in this work.

Figure 4- Nilsson Art Center (desert purity)

With regard to the strength of desert, the architect has applied some holes in the external wall that draws sun light inside the basement.

3. Sustainable development and architecture

In this global movement, architecture has sought new solutions to fulfill human life consistent with other scholars. It is evident that living, working, disporting, resting, etc. all have been considered by the architects in the designed spaces. Since strengths and weaknesses of a building have a direct impact on the world ecosystem, architects undertake a very sensitive task. Using concepts of sustainability in the architecture has raised a new issue known as "sustainable architecture" or "ecological architecture" or "environmental architecture" that all have an identical concept and imply a type of architecture compatible with the environment.

3.1 Sustainable architecture

We must regard the existing natural resources as a capital and value the resources and profits create by the nature highly. This means that we use our creativity more than natural products in the nature cycle. We create human by architecture. Sustainable architecture describes this fact that we can create what we need by access to natural resources. Those resources are foundation of our world. We create and there are resources that we use to do it. Finally, modern architecture is based on sustainability. Exhaustibility of resources and energy and outcomes of destruction of our natural environment have a great clear impact on our life style and culture. As a logical result, we must apply concepts of sustainability in architecture. We need a long term vision rather than a short term skeletal satisfaction. Economic and artistic viewpoints play an essential role in the development of sustainable architecture.

The concept of sustainable architecture does mainly address increase in the life quality and standard rather than survival. The best concept of sustainable architecture for the architects is to build the artificial environment with regard to increase in the present life quality and removal of future needs. On the other hand, sustainable architecture is consistent with the climate and does not damage its environment. It respects the climate, human, culture, and environment. Buildings designed based on sustainable architecture are flexible contrary to the old buildings. Richards Rodgers states that "like birds that are dressed in their winter feathers, buildings can adapt themselves to new environmental conditions". so, this sensitive form of design has created a successful relation between nature and humans world.

The background of sustainable architecture in Iran is further longer than the West and the Iranian traditional architecture is one of the best examples of sustainable architecture. The Iranian traditional architecture shows specific attention of the Iranians to accurate and effective use of renewable energies in the ancient times. They used very simple but effective methods that have varied in each climate based on weather, cultural, etc. conditions.

3.2 principles of sustainable architecture

Some buildings have features that make them sustainable. The principles observed for classifying a building as a sustainable architecture include:

Principle one- energy preservation: a building must be built in a way that minimizes the building need to fossil fuels.

Principle two- consistency with the climate: a building must be designed in a way that is consistent with the existing climate and energy resources.

Principle three- reducing use of new resources of materials: buildings must be designed in a way that minimizes use of new resources as far as possible and uses them as new resources at the end of their lifetime for building new buildings.
Principle four- harmony with the site: the building must be located on the earth of site gently and have harmony with the surrounding environment.
Principle six- holism: all principles of sustainable architecture must be embodied in a complete process that leads to construction of a healthy environment.

Figure 5- Taliesin West by Frank Lloyd Wright (demonstration of desert sustainable elements)

4. conclusions

Desert in Iran is a treasure of architecture; a treasure whose diamonds have been formed by the Iranian talented artists. Although this architecture has taken a fixed form, multi dimensional function is one of the features of this architecture (house, school, mosque, etc.). however, although these buildings have a fixed form, it must be noted that each one has some values. Principles of tradition and mysticism have played a great role in the formation of the Iranian traditional architecture. The Iranian architecture is like a strong tree with hard roots in an immutable soil (nature does not change). This immutable soil has in fact the same values that are important for the traditional human. The Iranian artist has always been influenced by the Sharia (divine principles). Divine principles are the ones governing the nature; so, the Iranian architecture has stemmed from the nature.
As it was seen, by applying principles of sustainable architecture and harmonizing the architecture with the climate and environment, we can create a convenient space for living and prevent from the environmental pollutions. Also it saves energy. Furthermore, if architecture is consistent with the culture and environment and complies with the valuable models of the Iranian traditional architecture, it will be sustainable and will always preserve

its beauty and efficiency. With regard to the mentioned points, architecture plays a major role in the sustainable development of countries besides such factors as economy, politics, society, culture, and so on.

Among other results of this paper, the following ones can be mentioned:

- Use of new energies and substituting them for non-renewable energies for economic, social, etc. sustainable development.
- Finding new and proper solutions and technologies for using new energies.
- Not destructing the environment and interfering in the environment (nature) by using new energies in different sectors.
- Finding solutions that guarantee proper conditions for the humans and living beings.
- Creating spaces that sustain security, physical health and convenience, mental health, and productivity of the residents.

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