

Compatibility of Hospitals with the Principles of Sustainable Architecture (Case Study: Tabriz)

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Abstract: The utilization of sustainable architecture for hospitals is of utmost importance because they are regarded as one of the greatest pollutants of the urban areas. The excess of energy use and the incompatibility of structures with the environment, has made the need to the sustainable architecture in to a great challenge. Sustainable architecture has a high position among the experts. The aim of this study is to examine how hospitals in Tabriz are compatible with the sustainable architecture. This study has made use of descriptive and then analytic method. The sources and data in this research has been compiled according to the reliable sources and documentations as well as expert's opinions. Sustainable architecture tries to minimize the building impacts on environment, and emphasizes on the three principles of water, energy and materials.

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1. Introduction

Since fifty years ago world diverse knowledge, in addition to recent scientific explorations, has intended to find solutions to reduce pollution, energy consumption and after all the use of natural resources. Architecture, also, is not an exception, but it is more than other sciences environmentally friendly. It tries to establish a close and healthy relationship between man and nature. Nowadays, in addition to the continuation of physical life, the most ultimate goal of different communities is to procure or to give continuity to a sustainable development by the help of which financial, political and expansion capabilities, implementation of the plans or national aspirations are accomplished. Sustainable architecture is a thoughtful reaction against the issues of the Industry Age which is the result of profound recognition of the surroundings. Sustainable architecture is a method of designing dealing with reducing the non-renewable resources consumption and optimization of the renewable resources consumption. It remarks what is required for survival can be obtained from the environment. The consciously use of the resources considering next generation's quality of life determines man's attitude to the world. Sustainable architecture, in addition, is responsive to the environmental and local circumstances and endeavors in reducing construction impact on environment.

Three fundamental steps should be considered to achieve sustainable structures: First, appropriate productivity of energy. Second, cutting energy use to save the environment. Third, establishing balance between the energy required and environmental systems. Medical services have been one of the necessities in hygiene and treatment since the

beginning of human existence. Considering the trend of increasing population, meeting hygiene regulations by the public, and advance in medicine and the technological development of medicine engineering, design and construction of a hospital have priority in the urban planning. A Hospital is an institution, constructed and outfit, for diagnosing and healing the diseases and injuries both through medicine and surgery, hospitalizing the patients during these stages.

Hospitals are considered to be the most significant constructions. Due to the quiddity of their performance, their role in health of the society, increasing necessity in building these structures and expansion of these institutions in developing countries, hospitals need to be designed innovatively. "The iterance of the hospital industry on the sustainable design has been seriously examined since the year 2000, and hospital designers have attentively taken the Green Hospital into consideration since the year mentioned above."

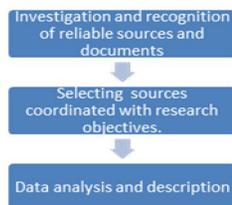
There are two basic factors in buildings sustainability, optimization of energy consumption and their adaptability to the environment. To achieve sustainability, the designers have to meet the regulations in building structures. Architectural design, on the other hand, will be efficient in case it is effective on treatment because hospitals are treatment and performance based. To maximize the quality of hospitals in Tabriz, the designers have to meet the regulations and the constituents of sustainable architecture.

2. Methods

This research in regard to research performing process is qualitative and in regard to goal is Case

Study and then analytical, and in regard to the results is developing. Library and digital studies have been used for gathering information from reliable sources and documents (diagram 1).

Diagram 1- Data collection process



Sustainable Architecture

Population growth, technology, man's need for the nature to satisfy all his needs and consequently the incompatibility of all these with the environment have made a change in the natural circumstances of the world and have left destructive impacts on nature. Some of these impacts are to be mentioned as global warming by the emission of greenhouse gases, air pollution, water pollution, earth pollution, threat to the renewable and non-renewable resources, increase in waste and the extinction of plants and animals.

"Sustainable development" involves in the appropriate productivity of the natural resources, a change in man's attitude towards nature and a serious revision in the production and consumption role model.

"Sustainability, according to Brandt land, means satisfying the current generation's needs without sacrificing the future generation's capability in meeting their needs by this generation. In this definition two key concepts of providence and saving the resources are comprehensible. That is to say, this generation has got to pass the earth on thoroughly uncontaminated to the next generation. To conserve the resources, it is essential that this generation protect the whole renewable and non-renewable resources.

Another definition includes that "sustainable development is the one improving human health and ecological systems for a long time. This definition lays stress on a constant process of moving towards healthier communities and a wholesome nature. Considering the above mentioned definitions for sustainability, presenting constituents for the sustainable structures is the following step. Sustainable structures are those which bear the least negative impact on the natural environment and the surrounding building on the local, regional and global scale. The aim of these structures is to maximize the quality of economical, social and environmental performances. Logical consumption of natural resources and appropriate structural management reduces rare resources consumption, energy and hence maximizes the quality of environment (diagram 1). In these

constructions quality, future and environment need to be noticed.

- Maximizing the quality of indoor environment means maximizing the quality of residential spaces and of materials.

- Foresightedness means optimization of energy resources consumption, water, earth, and appropriate productivity of them, most important, saving them in such a manner that in utilizing renewable energies it needs new technology in housing. On the other hand, optimization of energy consumption in the buildings is a basic and necessary step towards sustainable- energy buildings.

- Structures in harmony with the environment are usually recognized as those designed and performed according to the process of "Green Building Challenge ". Green Architecture, definitely, is itself a kind of sustainable architecture, the only difference is, however, that in the Green Architecture the Eco climatic factors are more emphasized.

It is to mention that structures are outlined into 3 groups as far as the sustainability is concerned:

1- Energy-efficient Buildings

Special calculations of energy show the amount of energy required for a building. Knowing this, energy consumption can be saved to the extent required. This is economically practical, too.

2- Buildings harmonious with the environment

Reducing energy consumption and the pollution, focusing on the way of generating and consuming energy lead to conserving the environment.

3- Sustainable Buildings

The aim of sustainable buildings is the optimization of energy consumption and conservation of the environment. In conclusion, to achieve a sustainable building, it has to be energy-efficient and harmonious with the environment.

3.1 Indexes in Building Sustainability

Over the last few years various indexes for the building sustainability assessment has been presented such as GBT, LEED, CES ..., BREEAM. We will deal with the ecosystems services criteria in this study.

Using the ecosystems services (which include the following in buildings: materials produced, waste absorption and climatic principles taken from the ecosystem) as a base, to evaluate the building sustainability we can determine two following indexes. The first index (IBS) depends on the amount the ecosystems services used in production and construction operation, which is presented through area /year. In the second index (IES) the area of land devoted to the project is important; the minimum occupancy of land per unit (usually hectare) is called the building environmental efficiency.

3.2 The Index of Building Sustainability (IBS)

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IBS is the index of building sustainability assessed annually on the basis of occupancy. Number 1 indicates the site capacity, while number 0/5 indicates the utilization of half capacity of ecosystem and 1/5 indicates the utilization more than the site capacity.(diagram2)



3.3 Index of Efficiency in Sustainability (IES)

IES is the index of Efficiency in sustainability assessed on the basis of the area of land required for a sustainable building. This index evaluates the area of land on the basis of hectare. To achieve a sustainable building, construction must be utilized as an opportunity for rebuilding the ecosystem, which leads in an increase in the site productivity and reducing the assessed impacts under the title IBS.

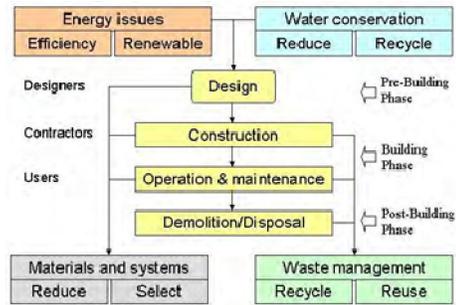
3.3.1 Objectives of Sustainable Buildings

Considering the optimization of energy use and of the resources, in such a manner that create minimal pollution and be environmentally friendly, are the main objectives of sustainable buildings. They can be outlined into 5 categories as below:

- 1- Appropriate productivity
- 2- Efficient energy

- 3- The pollution prevention
 - 4- Harmonizing with the environment
 - 5- Coherent and systematic approaches
- (Olgyay, 2004, p. 390) (diagram3).

Diagram3. Objectives of Sustainable Buildings



Designers must meet all the above mentioned objectives during the architectural design process (design–construction–operation and maintenance, and demolition) so that a favorite conclusion in sustainable architecture is achieved.

3.4 Principles of Sustainable Architecture

Sustainable design indicates an attitude towards architecture which demonstrates several main points(Table1).

Table1. Resource according to the review and processing of author’s research

Objectives in Sustainable architecture	Solutions	Architecture practical solutions
Appropriate productivity	Efficiency in energy and resources	- Upgrading or replacing building coverage. - The prevention of heat loss in heat source providing automation and control system.
Efficient energy		-Heat exchange in whole or part of thermal resources. - Improvement of construction equipments. -Architectural design compatible with the climate. -The use of energy production equipments compatible with environment.
The pollution prevention	Hazardous materials control & removal	-Prevent form emission of gases to warm the earth, Ozone depleting substances, solid wastes and sewages.
Harmonizing with the environment	The use of renewable biological materials	-Design of eco building and its correct orientation (the use of passive solar energy and light of day) - The integration of photovoltaic system and active solar energy in the building. - Storing long and short term energy (storing thermal energy in underground). - Space heating via thermal pumps based on renewable sources and wastes heat. - Heat recycling from sewerage system (ventilation and air conditioning systems). -Separation of wastes (collection, use or reuse them). - Water management (including water saving equipments, water treatment, sewage and rainwater reusing).
Coherent and systematic approaches	Increasing the efficiency of materials and structures.	-Consumption with regard to energy resources, water, materials. - Reduce the effects of pollution on the surrounding buildings - Increase the quality of indoor environment including thermal comfort, lighting, acoustic, air quality and ventilation consist of: building consistency, control, performances, flowing.

4. Findings

A Study on the Sustainability of Hospitals in Tabriz

Sustainable hospitals, correspondent with the Green Architecture, don't have their special and prominent position in Iran. However, according to the International Environment Organization announcement, Milad Hospital in Tehran, Shafa Hospital in Semnan, Takestan in Qazvin and Imam-Khomeini in Arak has been declared as Green Hospitals and they all successfully honored by certificates. Studies show that several low-level criteria for sustainable design in these hospitals have been observed, such as the use of solid waste repellent and refinery system, the whole use of it for the irrigation of hospital's green spaces, adequate management of hospital wastes, adequate design and positioning of

kiln incinerators in site in such a way that creates minimal pollution for the environment, and also structural operations to reduce energy use and fuel in buildings. However, it should be noted that sustainability and its relation to the patients and staff satisfaction have not closely been considered in country's hospital construction. Ostad Aali-Nasab Hospital of Tabriz is also installing these systems. (Standard, 2008, p. 21)

According to the studies, to determine the sustainability and unsustainability of hospitals of Tabriz their constituents of sustainability must be evaluated. The following table is the result of studies on sustainable architecture which indicates their sustainability (Table2).

Table2. Resource according to the review and processing of author's research

Principles and solutions of sustainable architecture					
Hospitals	Energy efficiency	Appropriate productivity	Pollution prevention	Harmonizing with the environment	Coherent and systematic approaches
	* Energy and resources efficiency		Hazardous materials control & removal	The use of renewable biological materials	Increase the efficiency of material and structure
Ostad Ali Nasab Hospital	-Improvement of thermal equipment -Improvement of construction equipments -Architectural design compatible with the climate		- Burning the solid and pathogenic wastes through kiln incinerator. -The use of urban sewage.	-	-Reduce the effects of pollution on the surrounding buildings. - The quality of indoor environment including thermal comfort, lighting, acoustic, air quality and ventilation. - Consumption due to energy resources, water and materials.
Imam-Khomeini Hospital	-Upgrading or replacing building coverage. - Improvement of construction equipments.		- Burning the solid and pathogenic wastes through kiln incinerator. -The use of urban sewage.	-	- Reduce the effects of pollution on the surrounding buildings.
Bababaghi Hospital	-		- Burning the solid and pathogenic wastes through kiln incinerator.	-	-
29 Bahman Hospital	- The prevention of heat loss in heat source providing automation and control system for improving construction equipments. - An attempt to increase the suitable thermal productivity.		- Burning the solid and pathogenic wastes through kiln incinerator. -The use of urban sewage.	-	-Reduce the effects of pollution on the surrounding buildings. - The quality of indoor environment including thermal comfort, lighting, acoustic, air quality and ventilation.
Razi Hospital	- The prevention of heat loss in heat source providing automation and control system for improving construction equipments.		- Burning the solid and pathogenic wastes through kiln incinerator.	-	-Reduce the effects of pollution on the surrounding buildings. - Increase the quality of indoor environment including thermal comfort, lighting, acoustic, air quality and ventilation.
Zakaria Hospital	- Improvement of construction equipments. - The prevention of heat loss in heat source providing automation and control system.		- Burning the solid and pathogenic wastes through kiln incinerator. -The use of urban sewage.	-	-Reduce the effects of pollution on the surrounding buildings. - Increase the quality of indoor environment including thermal comfort, lighting, acoustic, air

				quality and ventilation.
Shafa Hospital	- The prevention of heat loss in heat source providing automation and control system.	- Burning the solid and pathogenic wastes through kiln incinerator. -The use of urban sewage.	-	-Reduce the effects of pollution on the surrounding buildings.
Shams Hospital	-Upgrading building coverage - The prevention of heat loss in heat source providing automation and control system for improving construction equipments.	- Burning the solid and pathogenic wastes through kiln incinerator.	-	-Reduce the effects of pollution on the surrounding buildings. - Increase the quality of indoor environment including thermal comfort, lighting, acoustic, air quality and ventilation.
Shohada Hospital	-Upgrading building coverage - The prevention of heat loss in heat source providing automation and control system for improving construction equipments.	- Burning the solid and pathogenic wastes through kiln incinerator.	-	-Reduce the effects of pollution on the surrounding buildings. - Increase the quality of indoor environment including thermal comfort, lighting, acoustic, air quality and ventilation.

5. Conclusion

A sustainable development is one that lasts for a long period of time with no harm to the environment. Serious inclination of countries towards sustainable development and improvement of life circumstances have created an upthrust in the construction industry in the developed countries. In the developed countries the required sustainability are provided for the hospitals such as efficient-energy buildings, appropriate productivity of energy, pollution prevention, harmony with the environment and coherent and systematic approaches to achieve sustainability; and from the early stages of design, construction of hospitals, maintenance, productivity, operation and maintenance and demolition, and energy use is cut through the building management system (BMS); As regards to the factors mentioned above studies show that hospitals of Tabriz can not be called as sustainable buildings. However, some of the most recently built hospitals like Aali-Nasab and Shams hospitals have attempted to observe a number of sustainable architecture indexes.

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