



Evaluation of strategies for sustainable design in therapeutic buildings (green hospital)

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Abstract:

Background: Sustainable architecture that is actually a subset of sustainable development perhaps is one of the most important contemporary flows taken into account that is a logical reaction to the problems of the industrial age. Accordingly, the issues raised in this paper is based on the concepts of sustainable development. Due to lack of energy and natural resources, environmental problems, climate change and air pollutions in cities and urbanization, a sustainable architecture should be created by using the 3 ways (Reduce, Reuse and Recycle). Because of the high consumption of resources and energy and the production of hazardous and toxic wastes and psychological crises of treatment, Hospitals are the first priority to convert them to sustainable hospitals. application of green principles, reduction of waste production and recycling, reducing energy consumption, reuse of resources and maximize patient interaction with nature are the main principles of sustainable green architecture. The aim of this study was to evaluate, analyze and provide general principles on sustainable development, sustainable design and its bases in healthcare buildings. Finally, sustainable design strategies on Green Hospital parameters is described.

Methods: A descriptive-analytic method of research was used in this study. The librarian method was applied for data collection and field survey method by note-taking. Questions were asked regarding parameters of a green hospital, and several variables were taken into consideration. Factors impacting sustainable architecture were also analyzed.

Results: sustainable architecture is an approach to a sustainable environment, therefore ecological, economic, social and cultural aspects all need to be taken into consideration before establishing a green hospital, and it can be applied in 3 main stages: construction, maintenance and destruction.

Conclusion: The results of this study showed that inadequate attention to environmental protection strategies, lack of adequate training in the field of environment, improper management of wastes and inadequate allocation of funds for wastewater management and air emissions are the most important obstacles to achieving green hospital.

Keywords: Green Hospital, sustainable design, sustainable development, healthcare building.



Introduction

According to the United Nations Population Fund over the last 70 years, the world's population has tripled. Now the world's population is increasing by 75 million people annually and projected world population in 2050 estimated to have been between 7.9 to 10.9 billion (Dehghani Bidgoli et al, 2008).

This statistic indicates the inadequacy of the resources available in the future. In an era when the accelerated energy crisis will destroy the available resources, especially fossil energy, Renewable and healthy resources such as water are serious need for continuity of life (Sedaghati and Tayyeb Ghasemi, 2014). Developing countries have access to a variety of new energy sources which are essential for economic development results of a new research has shown that there is a direct relationship between a country's level of development and energy consumption.

In Iran, with the growth of population there is an increasing need for energy and limited resources on one hand and the need to keep environment healthy and protect it on the other hand, has doubled the necessity and importance of using new (such as wind energy, solar energy, hydropower, geothermal, etc.). (Management Group of Semnan Province consumed electricity distribution Company, 2012) According to the hospital, as one of the sources of air pollution and the environment, and considering the final mission of it in health care and improve patients should perform the whole design of health setting based on principles of sustainability to the energy savings possible and in the least amount of damage environment. (Litkohy, 2011). As a result of this approach, reducing negative effects on the environment of the hospital building, improve performance, reduce energy costs in medical and hospital factors are on the high sustainable architecture design priority (Guenther et al, 2008).

1. Records Research

Duputie in his study entitled "road to greener hospital, after the implementation of environmental management systems in hospitals" found this method as an efficient way to reduce the environmental impact and cost reduction in energy consumption by 20 percent and water consumption by 15 percent. (Duputie, 2002). Ferenc, in a study titled "Towards greener" in the United States hospitals concluded that the designing hospital for being greener is one of the appropriate methods of reducing costs and improving hospital environment for patients and staff (Ferenc, 2010). In a study Carpenter investigate the relationship between environmental sustainability and green hospitals in the United States concluded that the first and most important motivation for the move towards green hospital standards have been energy savings (Carpenter, 2010). This is despite the fact that, in order to improve the quality of the environment, the International Organization for Standardization in 1996 created a set of standards known as ISO 14000, which encompasses several consultative documents in connection with environmental management systems, environmental monitoring, performance evaluation of environmental, ecological labeling, life cycle assessment and environmental aspects (Tan, 2005).

Zahedi and Rahmati (2007) recommended in a study to evaluate the effectiveness of environmental management in hospitals in Tehran, by using of the ISO 14000 standard and paid more attention to their compliance with the standards. Markann et al (2009) also studied the plan setting in conjunction with sustainable hospitals and concluded that this program only applies if the health and environment come together (Taleshi et al, 2014).

2. Research Methodology

Data collection methods: Since research methodology is always related to research subject, with respect to this research, two main methods were used to collect information:

1. Documentary method
2. Survey method



Research Method: The research method used in this research was descriptive-analytic and method of data collection and field survey is a librarian. The researchers note taking has used most of its tools.

2.1 Research Questions

In order to accomplish this study, first, questions were raised related to the subject and the research was expanded on these questions. These questions are as follows:

- What is sustainable designing and its characteristics?
- What are parameters of Green Hospital?
- How do hospital referrals impact green environment?
- What are the strategies for accessing the sustainable hospital?

2.2 Variables

Variables in the form of a conceptual model and description of how to assess and measure the variables are as follows:

A - The main dependent measures:

Hospitals, offices

B - Independent variables include:

Sustainable design, sustainable architecture.

3. Sustainable Development

3-1-Terminology and Definitions

According to the definition by the World Commission on Environment and Development, sustainable development estimate the needs of the present generation without compromising the ability of future generations to meet their own needs (united nations,1987). Sustainable as describing the development, is a condition in which the desirability and existing facilities don't decrease over time and driven from the word Sostenerere to mean keeping alive or that advocate or implies long-term durability (Zahedy and Najafi, 2005).

Stability in the broad sense refers the ability of the community, the environment or the continuation of current each system function in the indefinite future, without being forced to depend on analysis of the system resources or because of excessive burden on them pulled weak (Salehi Amiri et al, 2012).

The emergence of the concept of sustainability took place in the 1970s and in the Limits to Growth book was mentioned in 1973 that word (support, keeping alive sustain: stability, continuity of life sustainable). After that development as the ultimate goal of modernism caused a variety of problems, sustainable development was proposed as a revised reform to criticize modernism perspective (the man as predominant the nature and has the right to intervene and use it) create a new vision where nature dominates his life as a bed (Rahbar Sabbaghi, 2014). Another important aspect in the 70s was the emergence of green political and non-political groups in the West.

The group noted that current technology is environmentally destructive. Increasing the factories and industrial products, emissions and toxic, destroying forests and grasslands, and ultimately increase the exploitation of natural resources, ecosystems sterilized the Earth. (Qobadian, 2013).

3-2 Foundations of sustainable development

In general, sustainable development has the main three factors:

- A) Sustainability of populations and ecosystems resources that caused productivity is achieved.
- B) Sustainable abundance of individual species in ecosystems and biodiversity to human exploitation and, more generally, human intervention
- C) Sustainable economic development without destroying resources for future generations.



Figure 1: The field of sustainability

3-3. Factors Affecting Sustainable architecture

An essential condition to achieve environmental sustainability establishes dynamic balance between different systems environment. Accordingly, the "stable environment" can be qualified as follows:

1- From the perspective of ecology: In a sustainable environment, biological systems operation and their health sustaining and improving the environment. These main functions for human activities include: producing oxygen and absorbing carbon dioxide, absorb waste and pollution, adjusting the environmental conditions (temperature during and measuring humidity) renewable natural resources, food production and raw material products, manufacturing products, providing comfort and physical and psychological health.

2- Perspective-from social, cultural: the stable environment, a balanced coexistence between human society and the natural environment has been established to benefit both socially and economically. Hence, in this environment able to take advantage of satisfying conditions over time (present and future, in terms of capacity and environmental license for the greatest possible range provided)in such an environment, in order to achieve collective benefit backgrounds, and experiences followed paths which features cultural and ecological development sites have been used.

3- From an economic perspective: in a stable environment, economic development activities in the development of human society and ensuring fair and equitable benefit every single human population leads about potential ecological environment. This means causing less damage to the natural and cultural environment, biological resources, resulting in using optimal and efficient of them. Therefore, development of systems and processes in the environment as a natural system has features such as flexibility , compatibility and flexibility, the ability to regenerate and reuse (recovery of) productivity and diversity (pluralism) (Ebrahimi, 2010).

"Sustainable architecture "as a approach to make the sustainable environment" is based on context sensitive architecture". Today, the so-called sustainable architecture used for a wide range of critical approaches to the medium.

In sustainable architecture is tried in the three stage of construction, occupancy and demolition of the building, environmental issues are observed (Figure 2). Native and natural materials used in the construction phase. For example, the grill stone, brick in the desert and wood in the forest, including suitable materials for the construction of sustainable landscape. The reason is that the manufacturing process for these materials to become building materials is scarce and to carry the materials to the building site will not be costs and energy consumption.



In the residence stage, we try to minimize the energy requirements of clean, use renewable energy sources such as sun, wind or biogas instead of fossil energy .So in the sustainable architecture using of fossil fuels as much as possible. One of the problems of this century is the limited fresh water sources and the increasing need for human to it. Therefore, this vital material must be used accurately and informed minimum of waste.

Therefore, the first by using the new equipment should reduce its consumption. Use and store rain water and water well and purification stressed that sustainable architecture is in place. As well as the reuse of water used for watering gardens or washing facilities are recommended. Reduce and reuse of waste source or waste separation and disposal, is the other cases in which considered sustainable architecture. Today, in Western countries, and to some extent in our country, materials such as paper, cardboard, glass, plastic and metals from waste separated at source and any of the above materials to be sent to the factory converting to new products. The demolition of the building, trying to have building materials such as brick, stone or beam reused and recycled waste and buried properly (Qobadian, 1393)



Figure 2: Triple stages of environmental sustainability (Source: Qobadian, 2009).



4. Green hospital

4.1. Terminology and definitions.

Hospitals around the world are trying to maintain high standards of quality for innovation in patient care. In implementing this innovation, hospitals affect on the natural environment, thus the strategy has been to reduce the harm to the patient and the surrounding communities and the natural environment, hospital administrators and formulate management plans in the field of energy conservation, proper disposal of medical waste and safe medication management, (Reller, 2008). These programs that are called "green hospital" has been introduced.

Hospitals, are the part of the large public buildings that consume large amounts of resources and produce large volumes of waste thus be In the main priority of sustainable design (standard green hospitals, 2008).

Spending long hours in health environments for patients, visitors and staff, is stressful experiences. Any attempt to reduce the tension, positive effect on the healing process and increase the quality of these spaces and to access to green spaces and natural landscapes, can help to reduce stress and improve patients more effectively. Familiar with the principles of architecture of the Green Hospitals according to the above statistics in the field of hospital construction in the country and discuss modeling in energy consumption and protect the environment looks necessary.

For this purpose, establishing a foundation of basic education in the field of sustainable architecture and designing medical centers and on academic and professional levels to creating this new approach is needed in the country. The cost of hospital statistics estimated 1 to 7 percent more than conventional hospital building. But the higher initial cost should be considered as an investment in long-term returns and also increase the efficiency of medical centers.

Green Hospital consume 30% less energy and lead to better view in the treatment of patients and shortens the duration of hospitalization. The quality of the indoor environment can affect the absorption of these centers that all these cases should be considered (Bonda and Sosnowichik, 2006).

4-2- Parameters of Green Hospital

In general, any factor that reduces water and energy consumption, environmental emissions and waste reuse and recycling of materials and components as well as hospital and provide stability can be considered as factors in the hospital. Taleshi (2013) has provided in their research, 10 Green Hospital parameters the following as (Table1).

Table1: standard variables Green Hospital (Source: Taleshi, 1392).

row	Green Hospital components
1	Environmental management system
2	Lab Management, laundry and kitchen
3	Solid waste management
4	Energy Management
5	Hazardous and infectious waste management
6	Water management
7	Wastewater management
8	Managing emissions
9	Climbing out of the water
10	Materials management and purchasing preferred form of environmental



4-3- Green design solutions for hospitals

In addition related to solutions specific climate to each town or village, in building hospital, (such as proper orientation of buildings according to the productivity of climatic factors such as sun, wind and rain, use or non-use of natural ventilation, the use of intensive or extensive plans the use of materials with appropriate heat capacity and thermal insulation climate, the use of tents or radiation paragraph, use flat or sloped roof, etc.) that requires writing a separate article and extended and detailed descriptions.

Procedures and guidelines relating to the maintenance of the hospital and its sustainability are provided the lowest consumption and reuse and recycling. For this purpose, generally available and implemented strategies: existing the apparent control over all systems and personnel training is necessary in to guarantee the specified performance of buildings (PRP Architects, 2008).

4-3-1. Management of energy resources

Based on experience, the issue of energy efficiency and sustainable actions for the removal of the high cost, in many developments have been neglected. To achieve carbon-free and reach the hospitals, the matter should be considered highly. So at the beginning of the project should use some strategies for efficiency energy and taking action and in the final stage of the renewable options, the most efficient way to meet the needs and demands of cost and in a long time help (Olfat et al, 1393).

Due to the effects of climate change, is sensible now and in the future, avoid excessive heating has become an important topic. Technologies and low-carbon or no-carbon or renewable technologies, including solar, water, heating and photovoltaic cells that require for the roof and enough space slope effective performance. Micro pneumatic turbines can be efficient in rural areas, but their potential performance should also be tested to be accurate in urban areas.

4-3-2. Water Resources Management

Should also take measures to reduce water consumption in line with the disability and care needs of the users considered. It seems most appropriate to use recycled rainwater to be considered in the joint space, personal gray water systems (water) can be considered for all rooms. Rainwater pipes can be used to collect rainwater for garden irrigation. In order to reduce green roofs and rainwater should also be considered foreign permeable pay (PRP Architects, 2008).

4-3-3. Materials, waste and hospital waste

Perform a series of planning to sabotage, to enhance the reuse of materials used in the previous site, the new development is essential. The selection of materials should be considered in the environmental impact and rated qualitatively graded materials (A to D), or re-used and recycled, or locally supplied wood or from a specific source are prioritize (PRP Architects, 2008).

Due to the use of foreign production sites and reduce its losses during the construction phase is important. The initial collaboration between client, designer and contractor, is key to efficient design in the use of resources and reducing waste is (PRP Architects, 2008).

4-3-4. Interior design and decoration

A component of user satisfaction is its natural environment of the medical center. Due to the late 1800s, treatment facilities and many medical centers use plant therapy as a means of improving the lives of patients have used. Indoor plants to reduce stress and help hasten healing. Having potted plants in every room, pleasant atmosphere and the Atrium hospital in the central parts of the hospital addition to the entry of natural daylight, can provide the appropriate waiting area. Research conducted



in the field of nursing, health management and psychology show that the hospital environment is often sick with stress. This anxiety leads to cognitive dysfunction, depression, restlessness and high blood pressure. In reaction such as excessive fear, isolation, increased dependency creates.

The protests behavior occurs in hospitals that focuses on the treatment and the space they don't design this kind of centers like the house as intimate atmosphere. While the comprehensive approach to design, in addition to the Medicare and Medicaid Services, the mental health and psychological care and hospitalization at the same time and continuing treatment in patients encouraged to interact with elements such as green space, landscape and weather. (Mo'tamedi and Charejoo, 2014).

4-3-5. Development and environment

In selecting the location of the hospital should be given to the patient's psychological and physical characteristics and margins Quiet (Comfort Audio), plenty of sun light, ventilation, fresh air, see (visual comfort), convenient transportation and green facilities and provide full service for estimating the need for hospitalization (Olfat et al, 2014).

The external environment can create opportunities for people close to nature, the environment is a place for patients, so they can breathe the fresh air, interact with nature and, in various activities such as walking outside and interact with each other to participate. Design wise the external environment not only allows patients to exercise in outer space but also the provide opportunity to relax, chat, sun, enjoy the benefit of the aesthetics. Asked to provide entertainment for patients and small groups, must sit space to plan properly taken into account. These spaces are generally in front of large trees, public buildings, water systems, bridges and trail of foreign uniforms for different patients and to discuss them fall (Xue and Ma, 2013).

5- Conclusion

Hospitals and treatment centers because of high energy consumption and resources as well as the production of toxic and hazardous waste, and facing and accepting the physical and mental illness and the treatment process and so on, are highly sensitive to sustainability and sustainable design.

For this reason, Green Hospital standards in sustainable management and cost savings are especially important for hospitals. The results of this study showed that inadequate attention to environmental protection strategies, lack of adequate training in the field of environment, improper management of wastes and inadequate allocation of funds for wastewater management and air emissions are the most important obstacles to achieving green hospital. It is recommended that the establishment of continuing education courses and related environmental issues among all employees and managers of educational hospitals to promote environmental awareness rises and Management strategy using various models and implementing them, in order to achieve green standard hospital managerial priority of the hospital. (Taleshi, 2014). Table 2 summarizes the approaches taken from green hospital.

Table 2: Sustainable hospital design solutions (source: the author).

Green Hospital	1- energy	Renewable resources and technologies such as geothermal, wind and water, zero carbon, zero waste, clean and non-polluting heating systems, audits and reduce consumption, prevent energy waste and reuse it.
	2- water	Reduce consumption, use of rainwater, gray water use, and green roof.
	3- Materials, scrap and waste	Recycled materials, without the use of toxic chemicals, using natural and recyclable materials, waste separation, waste reduction and reuse, material standards and quality labels.



	4- Design and Decoration	Herbal therapy, a combination of natural and synthetic judicial, natural light, natural draft and ventilation systems, according to local sights.
	5- Development and Environment	Integrating the environment and the building of the hospital in a moderate way, designing spaces for relaxation at the site, according to the wind, shade and natural light, the aesthetics, design and construction of spaces for social interaction.

PS:

1. All actions that can be in terms of disease, whether physical or mental, in order to restore former health and eliminate the factors influencing the decline in average life span, by providing increased life expectancy.

2. Green and Healthy Hospitals, a hospital that sustained people's health by reducing environmental impacts and promote the removal of its portion in the burden of disease, (Ministry of Health, Treatment and Medical Education).

3. One of the most important ways that is common in many countries like United states, France , England and Japan is division of the same species of construction materials using different threads rate to a range of economic, energy, comfort, consumption, etc. Consumer and that the certification is carried out according to the total scores. The use of materials quality label close to A and above, the use of recycled materials or topics examined in this certification are indigenous. (For further reading see: Gazzeh, 2010).

Unfortunately, this issue has been neglected in our country and Iran is one of the few countries that does not have a system for grading and certification of green buildings.

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