GREEN ARCHITECTURE & ENVIRONMENTAL BENEFITS: A REVIEW WITH REFERENCE TO ENERGY DEFICIENT PAKISTAN

Amina Aslam [1], Shahina Tariq [2] , Waqar A. A. Syed[3], and Syed Shahid Ali [3]*

[1*] Dept. of Earth & Environmental Science, Bahria University, Islamabad

[2] COMSATS Institute of Technology, Islamabad

[3*] Department of Physics, International Islamic University, Islamabad

[3*] Foreign Professor (HEC), International Islamic University, Islamabad

shahid.syed@iiu.edu.pk;

ABSTRACT: With the increasing awareness of environmental problems, people are coming up with new ways to solve or decrease environmental degradation. One of the ideas is of "Green buildings" or broadly speaking "sustainable architecture". Sustainable architecture is a general term that describes environmentally conscious techniques in the field of architecture. This practice has a number of benefits which include environmental, economic, and health and community benefits (USGBC, 2008). The green building design focuses on increasing the efficiency of resources like, energy, water, and building materials, all the while reducing the building impacts on human health and the environment during the lifecycle of a building, through better site use, design, construction, operation, and maintenance and lastly the removal of structures. The basic principles behind sustainable architecture include the concept of optimum size, energy efficient, water conservation, local natural material use, recycling capabilities, and self sufficiency in material used. Such practices ensure minimum material use, reduced energy use and results in reduced wastes. The objectives of the paper were: to review and bring the concept of sustainable architecture into limelight here in Pakistan and to compare global models that can be practicable in terms of meeting the human requirements of housing without making a compromise on the environmental degradation in Pakistan.

Studies in USA showed that green buildings are eco-friendly, healthier, and economical based on energy usage. Green homes proved to reduce energy consumption up to 50%, while carbon dioxide emissions were up to 39% [1]. In another comparative study for consumption of resources, green building designs reduced water use (40%) and solid wastes generation by 70 %. Pakistan is facing a population boom without meeting the requirements of the housing sector due to lack of land, water resources, recycling of solid waste, improper energy use and mal-planning. Green building architecture and it's application in housing sector has a possible solution to overcome water, energy, and waste crises. India faces the similar problem, however, people have been counseled and encouraged to adopt green building practices. According to Confederation of Indian Industry, green buildings in India consume 30 – 50% less energy as compared to conventional buildings. More then 100 buildings have been registered as green buildings in India with more to come. In Pakistan few buildings have been designed and recognized as green architecture, therefore, it is proposed that in order to reduce energy consumption and to meet the ever-growing population housing demand with power, water and solid waste disposal, green architecture provides a solution to this problem that could be eco-friendly and cost effective in the metropolitan cities of Pakistan like Karachi, Lahore, Islamabad/Rawalpindi, Faisalabad and other growing urban areas in Pakistan.

KEYWORDS: Sustainable development, Sustainable architecture, population, housing, resources management.

INTRODUCTION

With the increasing awareness of environmental problems, people are coming up with new ways to solve or decrease environmental degradation. One of the ideas is that of the 'Green building or design'. Before the green building, one must understand the concept behind sustainable architecture. *Sustainable architecture* is a general term that describes environmentally conscious techniques in the field of architecture [1-3]. In a comparative study carried out by EIA (2008) on the impact of U.S. buildings on resources, Green building designs reduced water use by 40% and amount of solid wastes generation by 70 % [1]. Energy usage in green homes was reduced drastically up to 50%, while carbon dioxide emissions up to 39% [1]. According to Confederation of Indian Industry, green buildings in India consume 30 – 50% less energy as compared to conventional buildings. More then 100 buildings have been registered as green buildings in India with more to come [2-3]. Based on this, a green building is an outcome of a design which focuses on increasing the efficiency of resources like, energy, water, and building materials, all the while reducing the building impacts on human health and the environment during the lifecycle of a building, through better site use, design, construction, operation, and maintenance and lastly the removal [4].

A similar concept is that of a natural building, which is usually on a smaller scale and tends to focus on the use of natural materials that are available locally. [5]. When one talks about the sustainable architecture or green building, one should also know the principles of sustainable architecture. The principles are: Small is beautiful; Heat with the sun; Keep your cool; Let nature cool your food; Be energy efficient; Conserve water; Use of local natural

materials; Save the forests; Recycle materials; Build to last; Grow your food and Share the facilities.

These principles are important and should be kept in mind while planning new buildings. The practices involved in building green are about the materials used, reduced energy use and reduced wastes. The benefits extracted according to the USGBC report 2008, sustainable architecture has it benefits, which are categorized as Environmental benefits including an enhancement and protection of ecosystems and biodiversity, improved air and water quality, reduction in solid waste and conservation of natural resources. This translates into economic benefits, including, reduction in operating costs, increase in asset value and profits, improvement in employee productivity and satisfaction and the optimization of life-cycle economic performance. Other health and community related benefits are: an Improved air, thermal, and acoustic environments; enhanced comfort and health; minimum strain on local infrastructure and a contribution to overall quality of life [4].

If one looks at the statistics of the impact of buildings on the environment in United States of America, we can see the difference. According to a report given by EIA in 2008, buildings in United States alone account for 72% of electricity consumption, 39% of energy use, 38% of all carbon dioxide (CO_2) emissions, 40% of raw materials use, 30% of waste output (136 million tons annually), and 14% of potable water consumption. Once the green buildings architecture was adopted, they found out that green buildings reduced the energy use by 24% to 50%, CO_2 emissions by 33% to 39%, Water use by 40% and solid wastes generation by 70% [1-4].

Harvard Business Review conducted feasibility and concluded that, green building installment is not an expensive business but rather requires organizations to follow certain rules of business in selecting sites, environmental impact assessment, cost-benefit analyses, and their management upon completion [2]. According to Confederation of Indian Industry, green buildings in India consume 30 – 50% less energy as compared to conventional buildings. More then 100 buildings have been registered as green buildings in India with more to come [3]. Recently the demand of green buildings in USA has increased over time. The increase in demand is due to unprecedented level of government initiatives, heightened residential demand for green construction, and improvements in the sustainable materials [5-6].

This paper reviews the existing sustainable architecture principles being applied in the Developed countries and proposes a solution to the housing problem while keeping in mind that the environment is not harmed. Furthermore, the objectives of writing this paper are to bring the idea at an educational level and create awareness. Also to introduce the idea in Pakistan, so that it can be practiced at all levels, be it public buildings, office buildings, schools or residences.

GLOBAL MODELS OF GREEN ARCHITECTURE

All over the world different examples are being set up, various practices put in use in order to make life greener and healthier for both the environment and human beings. The real appeal of green buildings lies in their potential to create better building habitats, and to do so by incorporating design features that address health and well being in an integrated manner [3].

Table 1. Potential Links between Green Buildings and Organizational Performance (Source: Heerwagen, 2001)

FINANCIAL OUTCOMES • Reduced resource utilization • Reduced operating/maintenance costs • Reduced risks/avoided costs • Increased overall productivity • Increased resale value of property • Reduced absenteeism	**BUSINESS PROCESS OUTCOMES** • Process innovation • Increased work process efficiency
STAKEHOLDER RELATIONS • Improved public image • Increased ability to sell to pro-environmental customers • Community outreach and education • Improved ability to work with community stakeholders	**HUMAN RESOURCE DEVELOPMENT** • Improved quality of work life • Improved personal productivity • Improved well being • Reduced turnover and increased ability to attract high quality workers

In 2001, a study was conducted which talked about the relationship between the buildings and the well-being of its workers. All over the world, the problem was the same, absentmindedness, and decrease in productivity. According to the study, there is some evidence which links reduced absenteeism and increased productivity in green building. However, very few people understand the link between design features and human outcomes. Building models of health and well-being should integrate the behavioral, social, psychological and mental processes of human beings with building design. Most of these dimensions are being ignored, as today most of the green literature focuses on air quality and physical health of the building, without understanding that prominent features of any building are likely to have their greatest impact on cognitive and psycho-social well-being. Cognitive flow and creativity are associated with positive emotions. It has been observed that green buildings enhance the sense of well-being and create a sense of belonging, which results in increased productivity [3}.

The above theory was tested in an experiment carried out in a building in Netherlands [3]. The key features included good energy efficiency, indoor air quality and day lighting. A restored wetland and a prairie landscape were present on site. As the workers had recently shifted into the new green, the most visible change was that there was no decrease in productivity, which usually happens during the shifting and adjusting to a new building. The three keg indicators of motivation and emotional well being were that the workers 'looked forward to work', 'being in good spirits at work', and being 'excited about work'. Surveys conducted before and after the move showed decrease in fatigue during work. Almost 30% rated the environment to be better, an important factor in psychological and physical comfort. This shows that there is strong evidence that the enhanced habitability is associated with increase in psychological and social well being. Therefore, the hypothesis states that green buildings are better for people because they generate higher quality, healthier, more habitable spaces than comparable standard practice buildings [3-5]. Furthermore, the benefits of green architecture are numerous as depicted in Table 1 [3].

Another study was conducted in Hong Kong in which design considerations for environmental sustainability in high development areas were studied [6]. The study indicated that there is a close relationship between development density and environmental quality. But it is necessary that a study of the development is done in order to decide which form of sustainable development can be done. High density development areas have a number of negative impacts on the urban environment, which include, traffic congestion, pollution problems, heat island effect, and distortion of microclimate. Through the results derived from factor analysis, it was derived that certain designs considerations can be incorporated for sustaining the urban environment. 'Land use planning', 'Quality of life', 'Conservation and preservation', Integrated design', 'Provision of welfare facilities', and 'Conservation of existing properties' were believed to be the significant underlying factors for achieving environmental sustainability of local urban renewable projects [6].

In 2006, a study was conducted in which comparison between green and a non-green building was studied. The result of the study was that the occupants of green building were more satisfied with their indoor environmental quality as compared to non-green building occupants. Common strategies like a good ventilation system and a good lighting system were used in order to make the occupants satisfactory. These strategies were also used to remove indoor pollutants providing a good air quality indoors [7].

A lot of people think that green building is more expensive. A study was conducted which talked about the green building costs and financial benefits. According to the report, green buildings were cheaper in the long run, as they helped conserve energy, reduce water loss, reduced emissions and other wastes. Operation and maintenance costs are also cut down, while also saving on productivity and health benefits. Over all, it has been proved that green buildings are cheaper as compared to conventional buildings [8, 9].

GREEN BUILDING PERFORMANCE TOOL

As the world is advancing day by day, so are the various methods of doing things. Various performance monitoring tools have been in vogue in order to evaluate green buildings and their architecture. One of the checklist based design method is Building Research Establishment Environmental Assessment Method (BREEAM) [10]. The general rating systems focuses on site selection, material used, water consumption, energy needs, indoor environment and any waste generation and its recycling [11]. It is a comprehensive building performance assessment tool being used in various stages of a building life cycle. It is used as benchmark for the building industry in U.K. however, with various changes in the same tool has been adopted by Canada, Australia and several European countries. Soft wares have been launched into the markets which help in assessing, designing, rating the green buildings, clarifying the methods, and merging cultural indicators with architectural designs. BEES is a software which brings forward a powerful way to balance environmental and economic performance of building products. [12-14].

GB Tool is a second generation assessment tool. This tool provides common and verifiable criteria so that people can strive for higher environmental standards. It also provides the basis for making informed design decisions and also providing an objective assessment of the building on the environment [15]. Furthermore, when buildings are assessed, indoor air quality, i.e., light, temperature and humidity, is of prime importance [16-17]. For further evaluation, any contamination used in building material, their life cycle (half life) should be monitored.

CONCLUSION

The earth's environment is going through alarming changes especially due to human intervention, i.e., one of which is the rapid development being done all over the world. Green architecture is a solution to both the need of rapid development and environmental sustainability. All over the world, different practices are being used. In Pakistan, we have been sub-consciously using some sustainable practices for a long time. For example, in the Northern areas, people can't get material to build buildings easily and often recycle material again and again. The buildings are made while keeping in mind the area's topography, which help to reduce the building impact of the environment. On the other hand, some practices need to practiced such as proper sewage treatment and water treatment techniques, which are sustainable and highly recommended for all areas, ranging from small villages to large metropolitan cities. Institutions can start educating people about sustainability and its effects in the long term. Building regulations can be implemented in order to control the rapid and unsustainable growth. Public, institutions, office and residential buildings should be made according to the green principles of architecture.

Green architecture provides a solution to this problem which could be eco-friendly and cost effective in the metropolitan cities of Pakistan like Karachi, Lahore, Islamabad/ Rawalpindi, Faisalabad and other growing urban areas in Pakistan. In order to adopt the practice in Pakistan, one must start at the grass root level. Educating people about the practice should be important and construction companies must be involved in implementing the practice. Students should be educated and should be encouraged to design green buildings and take tests which mark them as green building architects. A rating system should be formed which rates the energy efficiency of the buildings. Countries like USA, China, UK, India, Singapore and many others have various rating systems and are encouraging people to think and build green.

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