The Effect of Technology on Sustainable Architectural Buildings

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ABSTRACT

Being indispensable for improvement and progress, sustainable architectural development as a process is the base of overcoming environmental shortcomings and enhancement of environmental conditions. Moderate progress must be driven by sustainability especially in under-development countries. Development of sustainable man-made environment is usually considered as sustainable architect. Sustainable architect building is not a new conceptualization of deconstruction or modernism, rather this is the thought process to design architect in harmony with nature. Building and architect are not the whole eco-system, but are small incorporated sections of life cycle. Quality of interior space and people become more significant in design of eco-tech architecture. This paper aims to discover impact of technology on sustainable architect building. As, sustainable architecture building is itself a technology. This study demonstrates the impact of architect on nature. It also highlights the integration of eco-technology designs and sustainable architect.

A literature review was conducted to determine the differences between the focuses and processes in sustainable and conventional construction, the challenges in the sustainable building process. The findings outline the goals of sustainable architect building that includes impact of technology on construction sector especially social and economic impact, use of energy sources (water, energy, etc.), development of green architect industry, and also focuses on three basic principles of sustainable architect building (environment, ecology and energy). Process of sustainable architect building is also explained especially in relation with construction and green environment that deeply depends on public attention and awareness about green architect. Major challenges on impact of technology on sustainable architect design are also discussed that include lack of awareness, education and economical assistances to implement the idea of green technology in architect for sustainable building. These problems are discussed in the context of a construction timeline. One of the project's objectives was to develop and create designs for a range of autonomous eco-buildings by doing research into autonomous eco-building systems and processes in order to identify best practises and low-carbon systems. It looks into the possibilities of non-traditional building processes and materials. The full environmental effect of the design is estimated and compared to industry standards as a consequence of environmental loads occurring during the building's lifetime. The construction includes rainwater collecting, waste treatment, composting toilets, and solar panels. These principles address issues such as interior air quality, the amount of energy necessary to heat and cool buildings, waste management,

long-lasting and "environmentally friendly" construction materials, low-cost housing, and so on. This research paper presents theoretical design to explain the conceptualization of green architect and its relationship with technology. It also demonstrates the practical implications of approach discussed on three buildings; the Seuss Ray building in London, the Hearst building in the United States of America, and The Capital Gate Tower. Eco-friendly technology and vertical architect (green roofs and walls) in construction and designing, benefits such as use of recyclable materials, reduction of material production that can cause negative impact human health, and increased energy efficiency and distribution have been discussed in this paper that contribute in development of eco-friendly or sustainable architect building.

Keywords: Sustainable development, carbon footprint, advance construction design, green architect, sustainable building, eco-friendly technology

Introduction

Life has always been a source of mystery and bountifulness that has intrigued man to discover all aspects of nature. Throughout the history, nature has always been a source of inspiration. To make life beautiful, man has built beautiful design to assist them to bring effectiveness and efficiency in their life by understanding art of architecture and using specific compositions of natural aspects. Understanding oneself needs a true understanding of nature. Environmental pollution has been on the steady rise for decades, with sudden climatic changes and high global warming reported largely due to human activity. With an increase in environmental pollution, the presence of pollutants like $C0_2$ and $S0_4$ in the air is a serious threat towards increment in breathing problems. Environment air quality is influenced by several factors such as building designs, contaminants sources, construction techniques, and respondent activities, which go beyond the limit affect human health adversely, hence the idea of sustainability is inevitable [1]. Sustainable development at present moment is more of a concept, which is used by natural persons and legal entities to make their activities sustainable and efficient such as the use of energy-saving technologies [2]. For sustainable development various definitions haves been put forward but in 1978 during Brundtland conference it was defined as the development that satisfies current needs without compromising the future generations. Sustainable architect is deeply connected with ultimate wellbeing and human survival. It interacts with society hardware, dynamic processes, natural resources and human resources. Sustainable development seeks to build connections between humans and nature welfare and justice and between future and present.

Some of the translational companies especially those listed among 500 companies globally focus on the financial results of sustainable developments rather than social, environmental, ethical, and economic worth in society. But with the new era, business have grown and companies are considering all expenses that are spend in the way of sustainable developments as long-term investment, to secure their competitive future [3]. According to the 1987 Brundtland commission report sustainability is described as “Development that meets present needs without compromising the ability of future generations to full fill their needs” [4]. Rio Earth Summit in 1992, Johannesburg in 2002, and Bali in December 2007 claimed the construction industry as a major source of environmental degradation. Further included that building industry consumes 40% of materials produced by the global economy and releases more than half of the global greenhouse gases, which are detrimental to the environment around [5].

Above discussion were based on the fact to avoid “Energy-wastage” in Architectural Building, which is only possible by maintaining Eco-friendly building designs and by improving energy efficiencies.

The most appropriate ways to maximize building design quality and minimize

environmental impacts are identified by defining sustainable development and planning as a philosophy [6]. Before the manifestation of sustainable community which is to meet peoples demand without damaging the environmental assets, it is integral to build sustainable buildings to measure future consequences as a community [7]. Sustainable design is referred by other terms such as “green architecture”, “climate responsive architecture” and high performance [8]. The fundamental purpose of the aforementioned phrases, it was established, is to apply a single common concept throughout the full construction life cycle, from planning to disposal. The sole cause to bring the idea of sustainable architecture is to make present and future architecture work in harmony with nature. That means to use ambient energy sources to make internal environments and that can be naturally sustained with a period of time. Sustainable architectural design an integrated approach is required with planning of compatible design strategies at the outset. For achievement of a true sustainable architecture, it is mandatory to consider all environmental impacts of building. Environmental loads during the life span of building makes up the total buildings environmental impact [9].

In terms of developing technology, “smart” systems work on information and communication technology (ICT) that allows them to optimize their operation at any point by altering its condition in dynamic environment. The use of artificial intelligence in smart systems creates a constraint in human systems, preventing AI systems from making rapid and accurate decisions [10]. Considering this aspect of AI, “smart building” or more often known as sustainable buildings are performs in optimized way in terms of sustainability, energy, and economic terms through the use of digital and physical infrastructure.

Information and communication system installed in these buildings leads to collection. Processing and production of information that is used in activation of ongoing optimization process with the goal of targeting enhanced operational performance [6].

What distinguishes a "smart building", certainly, achieving a high level of building performance would appear to be a requirement. After all, a building with substandard performance is hardly clever; the crucial performance in the context of energy is energy efficiency or building energy performance. Unfortunately, in the construction industry, the word "energy efficiency" is frequently misunderstood, and low energy consumption is frequently mistaken for great energy efficiency. As a result, improving energy performance is conflated with simply lowering energy use. However, we must analyse the benefits and qualities received from the energy "consumed" in order to appropriately measure performance.

Energy efficiency can be defined as the link between a building's thermal performance and its energy use. Unfortunately, the current legal instruments in place to control building energy efficiency focus primarily on energy demand or consumption, rather than energy efficiency. The Building Energy and Environmental Performance (BEEP) approach developed by the Institute for Buildings and Energy at MIT was used in the context of a research study.

The Graz University of Technology is the first institution to use this approach of evaluation. The true energy efficiency or performance of a building must be determined and then compared to alternative design options or other buildings. Structures. The BEEP approach, which measures the link between the quality of the interior thermal environmental circumstances and the quality of the external thermal environmental conditions, the amount of primary energy needed to establish and maintain these When compared to other ways, this method has a lot of advantages.

In this paper, designs of various autonomous eco-buildings through detail insights of autonomous eco-building systems and techniques for verifying the best ways and compatible systems of building materials with low carbon are considered. This paper demonstrates the building designs operate individually independent that can be a public road with a proper energy supply from renewable sources but autonomous eco-building system owns its own municipal water

system, communication services, electrical power grid, storm drains, gas grids, and it also includes sewage treatment systems. In this paper, these building systems compatible with nature, sustainability is considered first and foremost concern and all sources to reduce carbon level are considered.

The research paper includes two basic parts, a theoretical part dealing with the concept of sustainability and the research that dealt with the concept, and the second part is practical to find out the extent to which the principles of sustainability are applied to three buildings, namely, the Seuss Ray building in London, the Hearst building in the United States of America, and The Capital Gate Tower. The results of these three buildings are compared to find the importance of application of sustainability in building architecture.

Literature Review

Despite the fact that firms have been credited with social functions for many years, it should be recalled that they were only represented by employee benefits. As a result, the current concept of sustainable development did not exist until the 1930s. Cyert and March argued that the theory of the beam of goals is the source of corporate social responsibility. This hypothesis is founded on the reality that each business has its own set of objectives [3]. To achieve the balance, the corporation must plan its actions in accordance with the "beam of aims" idea, which symbolizes a compromise between the interests of various groups inside the company (Gruszecki, 2002; Miron and Petrache, 2012).

It is self-evident that sustainable development is a difficult idea to grasp. It includes not only the company's commercial operations, such as focusing on collecting income, increasing revenues, and so on, but also social, economic, and environmental activities. Rainey (2006) defines "sustainability" as a phenomena in which all activities should be carried out at rates equal to or less than the Earth's natural carrying capacity in order to renew resources and minimise wastes. It should be emphasized that the so-called "Hannover Principles" were formed as a foundation for accomplishing the above-mentioned goals through sustainable development.

Humanity and environment have the right to coexist. The principle's core notion is that mankind, nature, and business are all equal aspects of the world system [4]. Companies, as members of such a system, must alter their attitudes toward the system as a whole, taking into account their responsibilities, which include social, economic, and environmental challenges. As far as ties between spirit and matter go, interdependence and respect are key. These two principles are complementary, particularly in light of the complexity and globalization processes and diversity of modern economic transactions, which include those involving the use of natural resources and disadvantaged workers in developing countries. As a result, they are crucial for businesses seeking to achieve long-term success. Companies must ensure that their economic activities are ecologically friendly and do not pose a threat to human safety and health, taking into consideration existing links between nature and their economic activities [5].

The responsibility for the design's implications. This idea establishes corporate accountability for its decisions, particularly when those decisions have negative consequences. Safe and long-lasting items are created. The goal of introducing such a principle is to incorporate those interests related to community value creation and humanity protection within the structure of corporate interests (Rainey, 2006) [3]. This is one of the most difficult changes for businesses to make, because it involves the development of long-term value, which has little in common with the pursuit of immediate profit at any cost.

The concept of waste is being phased out. One of the most important issues in achieving sustainable development is trash management [7]. As a result, the problem of dealing with wastes should be tackled by paying attention to waste collection, processing, reuse and recycling, as well as waste recovery and disposal.

Design constraints. Companies should keep this notion in mind when developing new products in order to achieve more efficient and effective

production. Following such a principle will enable companies to develop better solutions and become more competitive, not only in terms of meeting customer wants and improving their quality of life, but also in terms of the environment.

Improving things via sharing information. The goal of this approach is to encourage businesses to engage in knowledge production rather than merely consumption. Companies must recognize that they have the foundation on which to generate new ideas, solutions, approaches, techniques, and so on. It should be obvious to them that engaging in such activities can give them a competitive edge by allowing them to tap into their own innovative potential [8].

Methodology:

This research adopts descriptive analytical approach in the theoretical part of the most important principles of sustainability.

Data collection method

Secondary data is collected from different sources to collect information to analyse the approaches adopted by world to study and observe impact of technology on sustainable architect design. Different research papers and articles are selected on basis of keywords match and the best matches are selected to be part of study to be referred. Principles of sustainability are applied on the practical study of application of study approaches on three buildings. As we know, all elements in eco-system co-exist and the ecosystem design lies on co-existence with nature that not just is applicable on natural phenomenon rather allows application of technology on natural designs. This study methodology focuses on basic principles of sustainability adopted by societies to practically let the technology and ecosystem co-exist without any harm to humanity.

Theoretical part

In the literature, the issues of sustainable construction are frequently discussed outside of the context of a building's life cycle. The research looks at the process of designing, bidding, and building a new sustainable building as a timeline, with the purpose of identifying possible challenges and drivers in each phase to ensure a successful sustainable project. It takes into account project managers, who are in charge of leading, managing, and coordinating project teams on a day-to-day basis. They may be in charge of the entire process or only a portion of it, such as the sustainable design or construction phases. Additionally, due to the uniqueness of construction projects, they encounter significant obstacles based on project conditions and locales [9].

The following are the primary areas that were examined:

The concept of sustainability and its link to the construction industry were researched in order to develop the definitions for various common terms in sustainable construction, such as sustainable building and green building.

Focuses and procedures in sustainable and conventional building in order to distinguish the two forms of construction [10].

To establish how much the process of sustainable building and management is taken into consideration in their evaluation, rating techniques are utilised.

Sustainable building issues will be explored during the design and construction phases to identify what barriers and drivers are crucial in the sustainable building process, as well as what challenges there are in designing and constructing a green building.

The roles and responsibilities of project managers in the construction process that may be emphasised due to the problems they face various case studies on the challenges of sustainable construction to identify some examples of each barrier to make them clearer.

The issues identified in the literature review are presented in the context of the sustainable construction process. At the same time, the importance of these concerns in the sustainable construction process, as well as project managers' duties in dealing with these obstacles, are described.

Applied part:

A thorough study of three building is done to analyse the application of technology on sustainable architect design and also to reflect the relationship between concept of green

architect in practical application and in theoretical study of the architectural design. Three architectural buildings in which sustainability principles were applied were selected to compare them to see which buildings got the highest points.

1- The London Seuss-Ray Tower:

The current structure stands on the site of the Millennium Tower design project, which was rejected in 1996 for a variety of reasons, including the scale's improper size and height in the neighbourhood. Skanska " In April 2004, the building was completed and opened. This is 37 storey building that is considered to be mistaken a lot on behalf of architect because it reflects sun rays and rises temperature. This building was made concave and research study showed that there were a lot of other examples which were burnt due to their concave shape, and increased heat. Later on, the rays were spotted at one point to be converted into energy but for long, the real problem was undiscovered. The factor that is considered responsible was the lack of education about architect in UK. Environmentalists have called all such buildings as "death rays" that can be a power source. By using solar power technology heat stored and converted into power.

2- Hearst Tower

Hearst tower is Hearst's global headquarters, which is Platinum LEED certified. Hearst is one of the largest media and information conglomerates in the United States. The 46-story skyscraper, designed by renowned architect Norman Foster and completed in 2006, towers over 600 feet above William Randolph Hearst's 1928 International Magazine Building, which is now a landmark. Hearst Tower's exterior features a revolutionary glass and steel diagrid design that creates a modern aesthetic unlike any other skyscraper in North America, and the Tower emphasizes sustainable design and modern technology from top to bottom. In New York City, Hearst Tower is the first skyscraper to obtain a Gold LEED certification for core and shell and interiors. Hearst Tower was the first building to gain both Gold and Platinum LEED certifications in 2012, when it received a Platinum LEED Rating for Existing Buildings.

3- The Capital Gate Tower

Capital gate tower is a leaning skyscraper of architectural creativity and great engineering located in the Emirate of Abu Dhabi near the National Gallery Center in Abu Dhabi. With a height of 160 meters (520 feet) and a 35-storey tower, it is one of the tallest buildings in the city of Abu Dhabi and the tower tilts an astonishing 18 degrees to the west, four times the degree of inclination of the famous Leaning Tower of Pisa. This building is built in the one of the best architectural design to channel and absorb seismic loading and wind energy. It was completed in 2011 and was built by RMJM, an architectural firm. Its internal diagrid connects it with external diagrid that put all its weight on core that makes it column free building, having 18 degree lean.

The second part is practical to find out the extent to which the principles of sustainability are applied to three buildings, namely, the Seuss Ray building in London, the Hearst building in the United States of America, and The Capital Gate Tower. The results of these three buildings are compared to find the importance of application of sustainability in building architecture.

Objectives	**Seuss-Ray Tower**	**Hearst Tower**	**The Capital Gate Tower**
Material efficiency	60%	80%	77%
Harmony with environment	76%	78%	43%
Energy consumption	100%	100%	100%
Waste reduction.	**12%**	**20%**	11%
Material efficiency	**40%**	**85%**	53%

It is evident from above assessment that Hearst tower took over other two buildings especially in the architectural design and using technology for sustainability development. Benefits assessment and usability of techniques used by buildings make it clear it is direly needed for sustainability to use technology to not just implement sustainable design rather to control it. This use of technology enhances the effectiveness and efficiency of functions performed by companies constructing and designing buildings.

Structural Process

Many new phrases have emerged as a result of the digital revolution, each of which expresses a different facet of change that has become vividly obvious in our daily lives. Digital Forms, Virtual Reality, Artificial Intelligence, and Cyberspace are examples of these words. The word "eco-tech" refers to the interaction between construction technology and environmental sustainability. Eco-Tech architecture is a word used to describe architecture that is concerned with environmental issues and new technology; it is currently one of the most popular types of architecture in the modern day. This field's concerns are reflected in the fields of Sustainable Architecture and High Technology. Renzo Piano, Richard Rogers, and Norman Foster are pioneers in the discipline.

The influence of the digital era's technology revolution on (structural side):

In the discipline of Building Technology, the digital revolution has had an impact on the structural component of architecture. It is evident from the implementation of equipment and methods of implementation that due to use of technology and technical revolution in computer industry, processes have been accelerated that reduce time for functioning and by assisting functions. Though spatial dimensions and composition are challenging for building sustainability but technological advancement has laid a hand in improving effectiveness and efficiency.

Building material

Building materials have exploded as a result of the technological revolution. It has created and produced a variety of contemporary and advanced building materials, both fundamental and complimentary. The artificial intelligence plays a vital part in the technological revolution, whether it is a direct role through different software or an indirect function through production and testing procedures. To support sustainability it is equally significant to develop building material that can cope up with the challenges of building industry and architectural industry in 21st century.

Requirements in terms of social and cultural factors

The United Nations Office for Human Settlements (HABITAT) is particularly committed to opposing the use of the term "sustainable" to characterize the construction activities of countries that are unable to provide healthy and suitable housing for all of their population. At the same time, it is a well-known reality that satisfying that need is hampered by great economic challenges all over the world. Another concern is critics of globalisation's justified fear that a wide range of countries, regions, and cities would lose their identity. Architecture has a critical role in the preservation of identity, which necessitates, in part, the careful maintenance of our monuments as well as the rejection of architecture that has

no message for the mind or no spiritual drive [1].

The significance of project manager's role in sustainable building

Project managers, according to the research, will face a number of challenges when it comes to implementing sustainability into their projects. These issues develop as a result of the added objectives of sustainable construction. Cost, quality, and time are prioritised in traditional building, but resource depletion, environmental degradation, and the production of a healthy built environment are all key issues to consider in sustainable construction [5]. Long-term construction projects become more complicated as a result of these extra factors, which necessitate more difficult-to-measure criteria. Investors are exposed to unforeseen charges and higher investment prices, while intangible advantages pose a substantial difficulty for them at first. Throughout the whole building process, from predesign through bidding and construction, many challenges develop on a regular basis [7].

The deployment of digital technology in implementation methods has aided in the achievement of site safety precautions to a large extent. Most of the implementation of the design shows competition in "beautiful design" and "innovative design".

Design and construction modification under technology

- Implementation cost has been reduced with extensive use of technology in implementation of green architecture.
- Conscious use of technology help in implementation of sustainability.
- Controlled resource consumptions help manging finances at large industrial scale.
- Material of building material has gained superiority that helps to sustain sustainability.
- Recognize that the complete carbon footprint cannot be assessed, and that measurements for parts of the building's existence that have yet to occur will be inaccurate

Business and Sustainable Development

Modern businesses have a responsibility to contribute to the environment and achieve social and ecological goals in addition to financial goals, but we must recognize that firms only modify their strategy when it is truly required. We've been accustomed to seeing corporations adjust their tactics in response to the following worldwide market trends:

• Consumers' values and attitudes are being formed. It is fair to say that customers are sensitive to social injustice. They're also important for businesses' marketing efforts. From the perspective of the consumer, businesses are responsible for any negative repercussions of any acts that are directly or indirectly related to them.

• Global competition is becoming more intense. The need for each corporation to compete not just with national competitors, but also with global competitors, drives them to broaden their strategies and take on greater social, ecological, and environmental responsibilities.

• The value of intangible assets, such as brands, trademarks, and intellectual property, is increasing. Nowadays, all of the aforementioned assets have a big impact on a company's market worth, and as a result, businesses make every effort to improve their image, confidence, or customer relationships, among other things.

• Concerns about the environment Modern human activity endangers the world's ecosystem, and no one can predict the consequences of such irresponsible action. We already face substantial hurdles as a result of rising food, fresh water, and other needs. One of the most important jobs for governments, businesses, and international agencies should be to ensure ecosystem stability.

• Poverty and pessimism are two of the most common problems. Numerous studies show a drop in optimism in all parts of the world as the inequality gap between different social groups widens, resulting in regional instability and, in some cases, military war.

• Global economic stagnation and catastrophe. The recent financial crisis and subsequent economic standstill served as a reminder to businesses that the world is always changing and that there is no safe haven for them unless

they create it. As a result of this reminder, many businesses have begun to take the notion of sustainable development and the imperative of its implementation more seriously.

Recommendation for further research

Because this is a new building technology, there are a lot of opportunities for more study in this field. It's also crucial to think about a green building's whole life cycle and the numerous stakeholders engaged at each step. The following are some of the potential outcomes of this study.

To begin, case studies on project managers' roles in the sustainable construction process should be done to increase the findings' reliabilities and validity. It is also advised that such a case study consider the viewpoints of experienced project managers on the role that they may play throughout the process of sustainable building, from overcoming obstacles to implementing initiatives. It's also a good idea to look into the expectations of other stakeholders about project managers' responsibilities. This study can help project managers gain a more practical understanding of their existing condition in sustainable building projects, as well as chances to strengthen their involvement in areas where it is needed [10].

Second, it will be good to research how to increase the function of project managers in the sustainable building process. This research might focus on the skills that project managers should have in order to be the most effective in their professions and to help them complete their tasks.

Finally, it is suggested that this study be carried out during the post-construction phase in order to develop a thorough list of challenges and the role of facility managers throughout the project lifespan.

Conclusions

In light of the difficulties raised in this research, it is determined that, in conjunction with the advancement of technology, sustainable development may now employ green architecture and eco-tech design to improve residents' well-being and welfare. Green architecture, often known as Ecotech, is one of the components of sustainability that adheres to common principles. One of the most essential variables in the establishment of architectural approaches in different strata is the construction process. We achieve benefits such as energy efficiency, energy distribution, reduced production of materials that are harmful to human health, use of recyclable materials, and detoxification when we use elements of green architecture in designing and construction, such as Eco-tech design and green roofs and walls (vertical architecture). This, in turn, contributes to sustainability in architecture, construction, and design. Green design also attracts public attention to environmental issues, which are addressed in other elements of sustainable construction. As a consequence, the combination of Eco-tech architecture and sustainable development, as a vital challenge, may be extrapolated to result in public order and welfare. In order to accomplish successful design and construction, commitment and expertise should work hand in hand. When these variables are considered, users are provided with an adequate level of mental health (sustainable architecture) and a relaxing environment.

From assessment of companies, their functions and roles played in society, it is the need of time to accomplish functions by using technology in less resources and spending that creates something good for humans. According to modern technology and trends of using technology in all sectors have increased demands of companies to use technology to accomplish tasks like sustainability achievement. This not just enhances consumer confidence over company rather enhances company position in market.

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