Original Article

The Importance Of Sustainable Development With Ecological Design And Architecture

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Abstract

Sustainable development is defined as a development that meets the present needs without compromising the ability of future generations to meet their needs. The extant study examined the importance of sustainable development using ecological design and architecture. The research method was descriptive-analytical using bibliographic sources. This study provided various strategic rituals, strategies, and solutions to realize sustainable development. The first principle is about using vital human and natural (energy, water, and substances) resources in a way they also remain for future generations. The resources must be consumed accurately to realize the mentioned principle in the first step. The resources must be used in the second step so that the remained resources can be recycled in the life cycle, and contamination of waste is minimized. The dominant feature of the sustainability viewpoint is its "holism" and "integrity" considering three basic subjects of economy, human society and culture, and environment. Sustainability sees the mentioned dimensions not individually but considers the interaction between these factors. On the other hand, ecological design principles assume that the building is a small part of the surrounding environment that should perform as a part of the ecosystem and be placed in the life cycle. As the consumer of ecological design, man must consider their impacts on the ecology to reduce the negative effects of construction and compromise by identifying the ecological footprint.

Keywords: Sustainable Development, Ecological Architecture, Environment, Ecosystem.

INTRODUCTION

Since construction or building is the second industry of the world after agriculture, the concept of survival and maintenance of biotic systems and ecological design was manifested in the framework of agriculture and urban development. Buildings indeed cause severe damage to biotic systems and the earth. The smoke emitted by material factories in megacities accounts for higher air pollution than car pollution. The mentioned smoke has led to a heat island. The Eco design Foundation was established in 1991 by Tony Fry to manage the environmental crisis. The topic "ecologic design" was raised, followed by two fundamental evolutions at the international level: the oil crisis of 1976 and protests of the green peace group and environment proponents against industrial development, which led to earth pollution and environmental destruction. Therefore, an architect should design some systems that coexist and are compatible with biotic system processes. These systems should minimize the failure rate in biotic systems and use renewables cautiously.

The history of ecological design and the movement of preserving the environment and the biotic system goes back to the 19th century, and John Ruskin and William Morris were pioneers of the green design movement. They introduced some design principles, including attention to biotic systems, consistency between building, climate, and site, reduction of energy consumption by using natural energy, meeting residents' needs, etc., that have been expressed in different statements and used by ecologic designers. Many architects worldwide have cooperated with engineers to design and construct eco-friendly buildings and biotic systems. Some groups work in this context, including the International Energy Agency, Global Renewable Energy Network, and some professors of Oxford Brookes University that search for the use of renewables in the building.

On the other hand, sustainable development does not simply cover environmental protection. In contrast, sustainable development included a new notion of economic growth, contributing to well-being and opportunities for all people worldwide. It is not fair that a minor group destroys the natural resources and capacities in the world to achieve personal interests. Sustainable development is a process in which economic, financial, commercial, energy, agricultural, industrial, and other policies are designed to indicate a concise development that is

economically, socially, and ecologically sustainable. Sustainable development means sufficient education, health, population, and energy investment while no social debt is created for future generations. The subject we know is indeed the subset of sustainable development and synthesis obtained after numerous actions in the thought and practice with the following features of the classic era at the end of the second millennium. This subject will provide some solutions at the beginning of the third millennium.

Some strategic methods, solutions, and strategies have been provided to realize "sustainable development." The first principle is about using vital human and natural (energy, water, and substances) resources in a way that they also remain for future generations. The resources must be consumed accurately to realize the mentioned principle in the first step. The resources must be used in the second step so that the remained resources can be recycled in the life cycle and contamination of waste is minimized. The dominant feature of the sustainability viewpoint is its "holism" and "integrity," considering three primary subjects economy, human society and culture, and environment. The decision in this field will be more reliable if they get closer to the shared area of the three abovementioned dimensions (Ahmadi, 2003).

Many architects worldwide have cooperated with engineers to design and construct eco-friendly buildings and biotic systems. Some groups work in this context, including the International Energy Agency, Global Renewable Energy Network, and some professors of Oxford Brookes University that search for the use of renewables in the building. "Anyway, the starting point when a building turns into an outstanding architectural work is the character of the place. This is always applicable for place and building," Frank Lloyd Wright states. This is the logical reaction in today's modern world that has found ecological design in architecture to maintain the life cycle of ecosystems through life environment study. Many countries and international organizations have considered ecological design seriously, and many people tend to underpin green life methods in their environments. Accordingly, the extant study examines the importance of sustainable development using ecological design and architecture.

Sustainable development

The concept of sustainable development, composed of two words, "development" and "sustainable," indicates that the development, which attracted industrial humans over decades, caused hazardous consequences for humans and their living environments leading to unsustainability and annihilation. The situation continued until man understood this unsustainability and found that they should look for a sustainable development that ensures a healthy life for them and future generations. The main objective of sustainable development is meeting basic needs, improving and promoting the standard of living, managing the ecosystems very well, and providing a safe and blissful future. "Sustainable development is a development that meets present needs without considering the ability of future generations to meet their needs." The mentioned definition has been formulated by the World Commission of Environment and Development (WCED).

In this definition, the word "development" implies two essential aspects of the theory. Firstly, this is a holistic and absolute discipline that is not just confined to a few numbers but applies to the whole world and all individuals and everything in it in the present and future. Secondly, there is no specific goal, but development continuity is the goal of development.

Sustainable development is a development that meets present needs without compromising the ability of future generations to meet their needs.

Design and ecology are not usually discussed from the viewpoint of cultural policies; therefore, developing a beneficial cultural discussion for both of them is challenging. The general art theories include artistic-ecological contexts of cities, squares, and parks. However, sustainability can be associated with society, the economy, and global technologies. Nature-inspired art and architecture are more robust to compete with other social-cultural systems. In this case, "sustainable design" can provide another prospect that allows eco aesthetics to gradually grow as a new back or movement in architecture. For instance, "green" can appear as a solid cultural force beyond social and technological assumptions. The challenge for architects is to create more beauty with fewer interventions, which is indeed imagined that nature is our home's courtyard. Hence, this book emphasizes ecological and low-energy design, and sustainability is embedded in cultural and technological concepts (Aminzadeh, 2003).

Ecological design and architecture

Ecology studies the mutual effect of living organisms and their surrounding environment. An environment consists of physical features that include biotic and abiotic factors. Therefore, ecology is a broad discipline comprising numerous small disciplines, such as ecophysiology, that examines how the physiological performance of living organisms affects their mutual effect on the environment.

The ecological design usually provides multi-functional solutions. Human causes various forms of problems in nature through interferences and subsequent pressures. People may deplete, alter, or add to the resources or ecosystems of the world at both global and regional levels. Ecological design methods tend to minimize the harmful effect of human beings (built structures) on nature.

Ecological design points out that all designs and sketches have global influence since ecosystems are interrelated and consume renewable resources to the extent that is less than the natural potential to renovate these resources. Therefore, ecosystems use the maximum efficiency of non-renewable resources.

Ecological architecture mainly deals with how ecological features affect buildings, their occupants, and the environment. This term is used as a framework to describe the multi-step design of ecological buildings and the harmony between them and nature (Soflaee, 2006).

Sustainable architecture should be an activity that repairs, renovates, and renews the natural systems and land and carefully uses life cycle resources in nature and land (Aminzadeh, 2003). Sustainable and ecological architecture considers architecture as a living organism to provide an appropriate environment for the life of a human as another living organism. Hence, sustainable architecture pays attention to the environmental identity of the built space. Although ecological architecture is one of the most high-tech methods for design and implementation, it is interconnected with traditional architectural principles. Hence, one can pursue a profound revision and recognition of traditional architecture and translate it into contemporary language and expression to create organic and living architecture and meet the current needs of society (Aminzadeh, 2003). Despite the sustainable architecture and green architecture that are global concepts, they are environmental notions too. This concept includes joint and universal conditions while showing a specific concept in each social-cultural situation. In this perspective, solutions are provided for global issues (e.g., pollution and climate change) and local environmental problems (e.g., protecting water and soil and reviving small cities), considering sustainability. The scenario of how users use the space and subsequent internal heat produced by internal parameters influences the users' comfort. The mentioned scenarios include users' residence patterns (permanent, temporary, etc.), residence periods (daily, seasonally, etc.), building use hours, various uses between different spaces over time (transition, developable), and the number of users. The parameters mentioned directly impact the internal heat created by users (the heat caused by fuel and construction), artificial lighting, and electric devices. For the past three decades, scholars have looked for some energies that do not cause pollution in the urban environment, change in climate, and harm to the environment. They also looked for renewable energies. To do this, they found that optimization and energy-saving solutions could be used.

On the other hand, climate and environmental specifications could be considered in designing the built environment to minimize energy consumption. The climate and environmental factors must be considered in the proper planning and locating of buildings and land use patterns. Infrastructural systems should be considered to achieve efficient energy consumption in cities. Unlike renewable energies, fossil energies are not free. It is possible to achieve social health, economic improvement, and better environmental status by creating suitable culture and understanding of environmental hazards caused by fossil fuels, using available and modern technology and renewables in buildings and cities (Ghalenoie, 2011).

Sustainable design is a kind of interference with the environment that tries to invent solutions matched with environmental, social, and economic goals to achieve equilibrium through the holistic and integrated view. In this case, sustainable design can provide a superior quality of life for the present generation and a suitable heritage for future generations (Ahmadi, 2003). Because the environmental condition is the primary concern in sustainability, sustainable environmental design is a type of approach towards the design product which maximizes the inner features of the context and environmental circumstances while minimizing the adverse conditions caused by the construction.

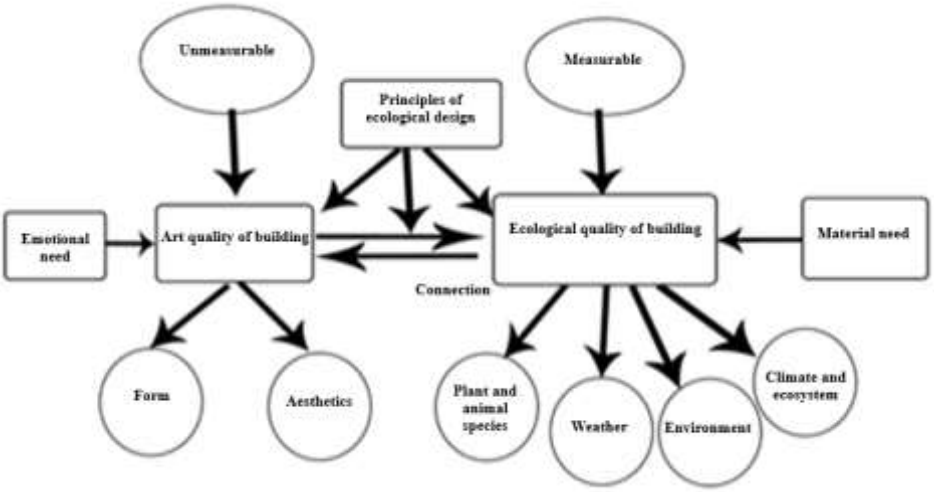

Figure 1. Design based on the ecological principles

Ecological elements should be selected from natural land resources with the minimum process. These elements must be recoverable, recyclable, and clean with low energy consumption (Attmann, 2013).

Materials and technologies must be made of substances with low emission and non-polluting materials with low-production pressures. The ecological materials must facilitate reducing pollution emissions caused by building maintenance. The ecological materials must not be composed of toxic chemical materials. These materials directly limit some components that have materials depleting the ozone layer of the atmosphere causing ecological damages or health risks, including mercury and halogen elements.

The ecological elements must prevent the ozone-depleting materials, such as hydrochlorofluorocarbons (HCFC) and Hydrobromofluoro carbon (HCFC), and use renewable energies (e.g., wind power, solar energy, biotic materials, hydrogen energy, biotic fuels) to reduce the use of natural resources and cut the emission and loss. Now, clean technologies compete with their conventional counterparts by creating less carbon and more advantages, such as cost and utility.

Materials and technology must be chosen from natural resources with less processed land. These materials are more suitable due to their renewability, less energy consumption, and lower risk of chemical disease during their life cycles. Those elements that reduce the use of raw materials should be selected in eco-friendly buildings. The reason is mainly related to resource storage. The first choice must include materials that are approved engineeringly and prepared from renewable resources.

The materials and technologies that reduce the required energy for drilling, production, construction, building, and destruction activities include materials that are reused or returned to the cycle before or after consumption. The mentioned materials should be chosen for green buildings. Because local elements do not need shipment over long distances and service, these products naturally need low energy. Hence, great attention should be paid to the elements that save energy by reducing the pressure of heating and cooling and conserving energy.

The elements that use suggested renewable energy resources instead of fossil fuels and electricity prepared in traditional methods are not ecologically useful. Renewable materials must be selected from natural resources produced with rapid growth. These materials decrease the CO_2 emission network through their lifecycle and have many economic resources.

The reversible construction materials in green buildings will return to the cycle, simply alleviating energy loss, pollution, and consumption since these materials derived from nature (such as plants and minerals) are readily decomposed by microorganisms and return to their natural place over time. These materials have not been converted to separate materials. Natural biomaterials, such as tile, brick, straw, and other additives like polymers and bio-reversible coverings, must be introduced as a choice for construction materials.

Landscaping and building are constructed integrally in ecological design, which increases the visual beauty of cities. This design is formed based on the underlying principles, including:

Reduction in car users, dense buildings, public thoroughfare, and use of sunlight-dependent active and inactive energy in insulated buildings have prevented the destruction of energy resources in cities.

The entrance of green space into cities for shading and increasing air quality, the design of green roofs and green

paths, and the reduction of pedestrian pavement have alleviated the impact of the heat island.
It is possible to decrease the pollution rate on earth and ensure ecosystem survival by controlling pollution sources, adjusting the disposal of liquids and sewages, and finding a suitable option to make pollution bearable.
Other options include the return of rainwater to the ground (pavements can be permeable), the use of plants inside the site that require less irrigation, and the consumption of recycled water.
It is possible to protect the life of wild animals by supporting and preserving the living place of wild animals and designing green parks, such as South Florida, where shrub plants are planted for this purpose.
Battle McCarthy points to the following tips regarding the mentioned triple goals of sustainable architecture, including environmental, social, and economic goals (Figure 2).
Environmental goals: creating a superior environmental quality, reuse potential, removal of waste and garbage, using low-transformative materials, recycling materials, recycling water from wastewater, and eliminating the emission of pollutants.
Economic goals: creating superior values, minimizing the current costs, reducing energy consumption, providing flawless solutions and methods for easy production, and forward-looking solutions.
Social goals: security, confirmability, recruiting quality, and eliminating energy poverty.

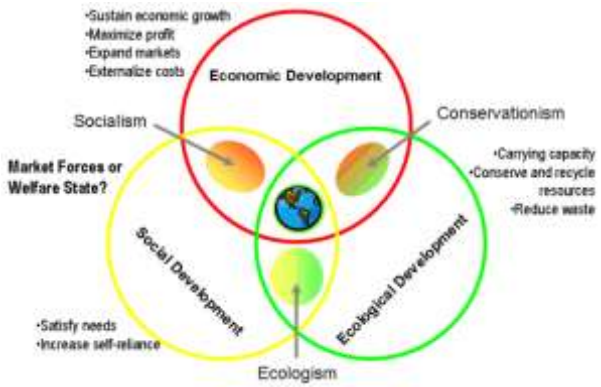

Figure 2. Sustainability's triple dimensions

Sustainable buildings have a minimum harmful effect on the construction and natural environment based on the buildings, adjacent buildings, wider areas, and global situation. Sustainable buildings can be defined as construction methods to create proper conditions, including economy, society, and environmental performance. Therefore, reasonable use of natural resources and suitable handling of buildings' capital help to protect rare resources, reduce fuel consumption (preserving and maintaining energy), and improve environmental circumstances.
Sustainable building considers the full life cycle of the building, environmental quality, functional quality, and future values. A sustainable building can be a construction practice and an attempt to achieve accurate quality (including the role of the economy, society, and environment) in a broad context. The objective of sustainable building design is to use resources and energy available in the environment efficiently. This objective is pursued based on the principles below:

- Minimize the consumption of non-renewable resources
- Expand the natural environment
- Eliminate or minimize the toxic compounds

A sustainable structure is the subset of sustainable design, a sustainable development category. A sustainable structure is a structure that effectively integrates the low-energy design with materials that have a minimum environmental effect on production, consumption, and ecological diversity.
Sustainable environmental design is a kind of design that create a balance between the built environment, consumed energy, and ecology. Recognition of sustainable design place is considered with place recognition since we can live in a place without destroying it if we are sensitive to the subtle spatial issues of that place. Place recognition, such as the light direction in a building, improves design and contributes to environmental conservation and easier access. The relationship with nature can be considered more naturally in the site design,

the city, or the environment. The nature-friendly design indicates a return to environmental life, and the effects of this design lead to the presence of natural space. No loss exists in recognition of natural processes in nature. The production of an organism provides food for another organism. In other words, natural systems have closed cycles. When we work on living processes, we respect the species' needs and bring the design to life through a design within the natural cycle.

Nature as a guide to ecological design

Architecture is inspired by nature coexisting with it. A person who works in architecture considers nature conservation through architecture as a crucial case. The reason is that old architecture was based on some principles that older adults adhered to. “Architecture is the art of erecting and decorating building by humans… so that its image and view give strength and pleasure to the mental health of humans and emphasize the beauty and usefulness of spiritual aspects and viewpoints rather than the function and beauty” John Ruskin states in his book “The Seven Lamps of Architecture.” According to this definition, architecture influences human mental health, indicating an essential point since the spirit and soul of a human are inherently interested in nature. Therefore, the mental health of humans depends on this inherent willingness. In the opinion of Ruskin, architecture can play a vital role in this case.

Some architects decided to use natural materials and local or indigenous methods to create a link and harmony between humans and the natural environment through architectural space. Write, and Hassan Fathi can be named as such architects. After the energy crisis, the harmony between architecture space and the natural environment received significant attention, and tech architectures, considered since the 1990s, were replaced with eco-tech architecture (Soltanzadeh, 2003). The inspiring nature is informative and an outstanding context for comparison. Nature can be used as a sample at different levels. Organic forms are generally more practical than human-built forms (Paplicki, 2003).

Ecological principles must be used in different methods to learn from nature. Nature is not neutral but has its specific rules and procedures. Darwin's theory allows us to find an essential solution for the evolutionary trend of species and their dependence on the residence place. Other theories analyze the genetic codes for human life. Human owns this knowledge during their lives but rarely implement the fundamental rules of nature to achieve architectural design. The linear thought of preconstruction and factory-based methods is preferred over organic design. Our buildings are increasingly multiplied based on the other buildings. In the case of main cities, it can be stated that our buildings are destroying marine coral reefs, and pollution, global warming, mindless repetition, and garbage will finally destroy everything beautiful and pleasant (Edwards, 2010).

Nature has used some patterns and systems that are useful for the design of buildings. The ecological design is an attempt that linearly regulates these systems. Architects usually use underlying formulas. The measured lifespan allows the building to embed natural systems in itself. A comparison between the design of buildings (spaces) and cities (dwellings) can exist. Learning from nature can help to understand the mutual action of energy and water resources, used materials, garbage, pollution, and known pollutants (Edwards, 2010).

Table 1. Case studies

Row		
1	**California Academy of Sciences**	

2	**Eden Project**	

Conclusion

It is important to design buildings based on ecological features since these actions affect the environment in the present time but also influence future generations leading to survival and sustainability of the environment for them. Although all attempts for green design of buildings in the present time cannot cover all ecologic goals (due to lack of technology and other factors), anticipations help to overcome the disagreements. The primary condition for ecosystem sustainability is to maintain its integrity and holiness because this case allows overcoming the pressures caused by the human, making it remain dynamic and productive biotically. In other words, ecological design can be helpful and productive with nature, renovating, repairing, and renewing natural systems. All designs created in the ecologic system should be able to predict the future. For instance, a building must be designed to consider the reuse of the building and its components. Therefore, ecological design relates the built system and its users to the living world. Ecology creates internal communication and creative harmony that entirely contradicts artificial or built boundaries. Therefore, the ecological design must be considered a holistic relationship that includes accurate management of energy and materials used in the built system consistent with the world's living ecosystems. This attitude influences the attempts pursued to reduce the manipulation of ecosystems. On the other hand, this attitude contributes to the optimal use of nature.

Moreover, the mentioned attitude does not have a short-term goal covering the lifecycle, including its primary resources. This collection is dynamic and beyond time. Ecological design aims to protect natural ecosystems in green design to reduce the damages caused by design using the advantages of nature in the design. The ecological design respects the reversible nature, environment, and its borders, considers the importance of the biodiversity of species, contributes to the survival of the species lifecycle, and repairs and retains the ecosystems. The ecological design assumes that all designs and sketches have global impacts because ecosystems are interrelated. This design uses renewable energies less than the threshold of its renovation by nature. Therefore, the ecological design uses the maximum efficiency of non-renewable resources. The spread of the culture of respecting the environment and protecting the ecological identity of the area through natural energy control and use leads to energy saving. However, the ecological design must know that it cannot renovate the complexity of nature entirely and partially.

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