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Biophilic Design Research Paper

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ABSTRACT

Biophilic design is a concept used within the construction industry to increase occupant connectivity to nature that influences cognitive functions like stress levels through the direct contact established with nature. This design concept enhances space, air quality and improves mind restoration. This study conducts a structed theoretical framework in order to address the impact and evolution of nature embedded with architecture answering questions like 1) What design strategies can be implemented to influence stress levels and psychological well-being. 2) How biophilic design can contribute to sustainability in the future of architecture. 3) Evolution of biophilic design and how it can be increasingly implemented in buildings such as apartments and communities to enhance aesthetics and cognitive functioning of residents. This paper analyses and reviews the key components of biophilic design by explaining the benefits and limitations arising from implementing this design method in communities in the modern age to achieve the sustainability goal formulated by the UN Sustainable Development Goals. The results from the discussion will summarize the complexity and the broad variety of study involved to implement biophilic design to further sustainability. Additionally, knowledge gaps are identified to advance future research and reflections on biophilic design.

INTRODUCTION

Biophilic design is a type of design that integrates nature into design of buildings by inculcating more space, natural light, better air quality and seeks to heighten the human senses and cognitive functions. It aims to connect the occupants more closely to nature, this concept was first introduced by E.O. Wilson in 1984 in his book Biophilia. The word Biophilia refers to our innate connection with nature it explains why people around the world like walking beside an ocean or engaging themselves in activities that makes them close to nature. He highlighted in this book quoting “the goal is to satisfy this biophilia by creating architecture that is an extension of nature.”

Stephen Kellert is known as the father of biophilic design due to the principles and values established by him. The architects that implement biophilic design into their work focus on the underlying principles of aesthetics, environmental factors, natural shapes and patterns and evolved human being relationships are the factors taken into consideration to bring together modern urban environments with nature. Biophilic design has been in practice from as far back as the Hanging Gardens of Babylon and has evolved further in the near future due to high inclination towards sustainability and preservation of environment. This design method has become a trend that many architects implement in the work they do.

The centrality of technology refers the increased accessibility to make people’s life easier in their place of residence by the use of technology. Technology changes with human beings’ evolution and they use technology to grow and influences changes. Inculcating technology and biophilic design in buildings and communities construction will make the world one step closer to a better world.

The fundamental principles under this design method are environmental features like water, sunlight and

air quality that contribute to the physical space appearing spacious. The current gap identified in biophilic design that this paper addresses is the current knowledge and technology evolvement over the years, Pandemics like COVID 19 heightened the society on emphasizing the need for open spaced architectural buildings with connection to nature. In relation to the paper the increasing need for biophilic design in buildings address these societal issues along with enhancing nature's beauty and embedding plant life with close connection to humans and technological advancements by enlightening the place to make it appealing to residents and people who work.

The evolution of this design over the years has changed thereby addressing the technological changes to be adapted, initially biophilic design aimed at maximizing daylight into buildings the evolution of this to be implemented in buildings requires up to date technology along with this design. This paper seeks to address the gap of not catering to the safety and improving the lives of the people by establishing a close contact to nature and technological advancements not only in residential buildings but also in work places to enhance the place one lives in or works in everyday.

LITERATURE REVIEW

Biophilic design has been increasingly identified by the society as it addresses the ventilation, air quality, enhancing natural light and advocating a personal touch with nature. This is the gap that my paper seeks to address and solve by providing design methods and addressing fundamental principles of biophilic design, The six fundamental principles under this design method are environmental features like water, sunlight and air quality that contribute to the physical space appearing spacious, natural shapes and forms, restorative practices and human-nature relationships to fit the aspects of residence and work place community.

Technological advances being upgraded is crucial to fit the standards and to make it convenient for people. The technological advancements that have been implemented over the years such as use of composite materials and structures to withstand changes in climatic conditions helps advocate use of biophilic design within the construction of a building. A book written by Angela Mattaeva concludes that modern technologies and practices have allowed biophilic design to be inculcated during construction of buildings to foot a deep connection with the natural environment while improving the quality of life. The Pompidou center located in Paris is an example of hi-tech equipment that embodies the ideals of hi-tech architecture. This style of architecture is referred to as 'Bowellism'. This building is adorned for the open space, ventilation, ducts and escalator it advocated in the design while, this building lacks nature elements which gives rise to the implementation of biophilic design to enhance the overall features of the building.

METHODOLOGY

After conducting an interview with Billimoria architects located in India, Bangalore who have been given the title "one of the finest architects in India" it has been observed that the houses and buildings they design has changed over the years due to technological advancements in order to cater to the needs of the clients by making their life easier. Furthermore, it has also been concluded that the importance of inculcating nature within the residential spaces act as a psychological method of releasing stress.

On evaluation and closer study of one of their projects called "Casa Magnifera" one can see the efficient use of open space with trees and shrubs along with high technology with smart light sensors to save energy, electronic device-controlled lighting around the house, passcode protected entrance gate made the residents feel safe and secure. When designing and constructing a building it is crucial to consider the

needs and safety of the client that have been addressed in this house. In the interview it was mentioned that the biophilic element gave the residents a sense of peace and serenity.

Upon conducting a survey based on houses integrated with technology and nature compared with the houses lacking these elements has been observed that the houses with high-tech equipment and nature in their homes gave residents satisfaction and still reside in the house they built consisting these elements. Whereas, the residents without these features sold their houses over a period of time.

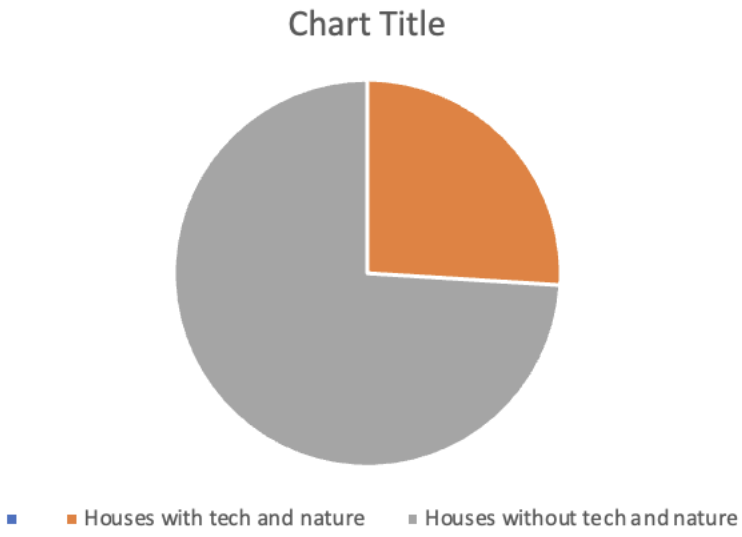
CASE STUDY

A fascinating example of technology integrated with nature is the Apple Park located in Cupertino, California built in 2017 is the corporate headquarters of Apple Inc. in United States. This building is a magnificent piece of architecture as it is entirely powered by renewable energy powered by solar panels running all around the outside generating 17 megawatts of power making it one of the largest solar roofs in the world. This park consists of about 80% of green space embodied with various plants and herb gardens. The landscape of this place was designed by Norman Foster and his partners which took five long years from designing on paper to executing this rich building on land.

The Amazon Spheres is an outstanding integration of nature and technology located in Washington, USA which is the headquarters of Amazon. This design consists of three glass domes enclosed in pentagonal hexecontahedron panels which brings in plenty ventilation and natural light making place appear bigger along with incorporating nature into the built environment highly inspired by biophilic design. This place serves as a magnet to bring people together thereby not only addressing environmental, technological needs but benefiting the society at the same time is what makes this place unique. It is observed that the complex design of the office cannot just be achieved by completely relying on laborers, technology plays an important role in the construction of these shapes and meticulous arrangement of glass panels to provide aesthetic finish. According to Enclos corporation accurate fabrication and laser scanning technology was used for all the frames before welding. The integration of technology use in the construction process and nature within the organization is what makes architectural anomalies stand out and make it a recognizable landmark.

The construction process of the Amazon Spheres included a single steel Catalan sheet which was carefully constructed, using parametric design tools it was replicated cross the entire surface of each sphere. From this we can observe the efficient use of technology that reduces work load by implementing replication of a single sheet across the entire design. The various methods of technology used to minimize work and reduce costs helps architects construct at a low budget along with saving labor costs. Once the model was fully assembled, the geometry was exported to an analysis software with the orientations and member sizes.

If buildings, mainly headquarters for office spaces implemented the strategies of such design practices advocated in Amazon Spheres, Changi Airport, the Bosco Verticale and much more design that combine the use of technology and nature in the construction of buildings it would lead to fast economic growth of the country and create marvellous attractions around the world that would stand in position for a long time.



This pie chart depicts the rate of houses in a community of 77 villas 20 were houses with tech and nature and the rest 57 were houses without tech and nature. It has been seen through the survey that the lives of the people living with tech and nature have been assessed to be happier with an easier and calming environment to live within.

Although, the challenges faced during the construction of the building by using technology can be expensive as accessing high tech equipment to make precise design shapes can be difficult. A lack of knowledge of the right machinery or software use can obstruct the construction of the building, ensuring to hire the right team to tackle software is required. Another obstacle faced with the integration of nature within the buildings is the maintenance and budget constraints of gathering a large amount of plant life can be a hassle. To tackle these challenges a right team fitting each stage of the design process is essential to ensure the project to lead to success. Planning plays a major role as gathering equipment, construction and other factors take a long time and to establish smooth running of operations planning is required.

CONCLUSION

In conclusion, this research paper aims to draw attention to the integration of biophilic design and technology with the construction of buildings where natural elements are intertwined within the buildings to enrich the overall cognitive skills of the residents and improve efficiency with the implementation of technology in the construction process to achieve precision. Overall, this paper provides surveys

conducted on the general public, gathering public opinions on technology inculcation within their homes and surveys conducted with construction managers regarding implementation of technology during construction to reduce labor workload and cut down on production costs to maximize use of resources and give rise to an architectural monument that appeals to residents.

In the future, in this growing world the application of natural elements in buildings is crucial to residents to be in close contact with nature that helps improve cognitive abilities, reduce stress, different and properly constructed environments can build immunity thereby increasing the overall wellness of the residents. The technology aspect helps provide architectural precision in the design and outcome of the building by making each building constructed a tourist attractive location due to the elements of nature and technological advancements heightened.

The use of technology not only in the construction but also implemented in the living space or workplace of residents helps the economy grow. As India is a slow-moving country this execution would help India become an urbanizing country with tourist appealing locations with monumental constructions. This integration does not only help appeal to residents and improve their mental well-being and efficiency of work but also helps expand India as a fast-growing economy.

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