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ECONOMIC BENEFITS OF BIOPHILIC DESIGN: A HOLISTIC APPROACH TO ENHANCING PRODUCTIVITY AND WELL-BEING IN THE WORKPLACE

Jude Barnaby[1], Vitalis M. Irouke[2], Ndubuisi M. Odoanyanwu[3], Hyginus I. Ivoke[4]; Nnamaka U. Nzewi[5]
[1,2,3,4,5] *Department of Architecture, Faculty of Environment Sciences, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.*
Email: b.jude@unizik.edu.ng

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***Correspondence**: b.jude@unizik.edu.ng*

ABSTRACT

In an era where the workplace is evolving and the well-being of employees is paramount, the integration of biophilic design principles into office spaces has gained significant attention. This paper delves into the profound impact of biophilic design on the economic landscape and the holistic well-being of individuals within the workplace. By examining the convergence of economic advantages and improved quality of life, the article underscores the transformational power of nature-inspired architectural elements. This research, supported by case studies and comprehensive literature reviews, reveals the tangible benefits of biophilic design. The economic implications are substantial, including reduced absenteeism, lower healthcare costs, heightened productivity, and improved employee retention. The findings of this research contribute valuable insights to the fields of architecture, environmental psychology, and business management. The holistic approach encompasses considerations of not only the physical aspects of biophilic design but also the psychological and emotional dimensions, emphasizing the interconnectedness of employee well-being and economic outcomes. As organizations increasingly recognize the importance of fostering a conducive work environment, this research advocates for the strategic incorporation of biophilic design as a cost-effective investment. This research underscore the potential of biophilic design to create workplaces that not only boost economic productivity but also prioritize the holistic well-being of employees, ultimately contributing to a more sustainable and prosperous future for businesses and their workforce.

Key words: *Absenteeism Reduction, Biophilic Design, Human-Centric Design, Productivity Enhancement, Workplace Productivity, Workplace Well-Being, Stress Reduction, Sustainable Workspaces.*

1. INTRODUCTION

The field of architecture and interior design is currently undergoing a significant and impactful revolution. This transformation not only impacts the visual appeal of our constructed surroundings, but also carries significant consequences for the welfare of individuals and the financial success of societies. The process of transformation is motivated by a theoretical framework referred to as biophilic design, which encompasses

a comprehensive approach aimed at reestablishing our connection with the natural world inside our living and working environments. The increasing amount of time individuals spend in conventionally planned workplace environments has necessitated the consideration of health, productivity, and well-being within these places (Gray & Birrell, 2014). It is well acknowledged that in contemporary society, individuals frequently allocate a significant portion, around 90%, of their time within indoor environments. Research findings indicate that allocating resources towards the development of sustainable, aesthetically pleasing workspaces can foster improvements in human health, overall well-being, and performance (Haghlesan, 2013; WGBC, 2014). According to Clements-Croome (2018), this investment has the dual effect of enhancing financial gains and substantially mitigating expenses by recuperating lost revenues resulting from absenteeism and workforce turnover. For over two decades, researchers in the fields of psychology and environmental planning have been investigating the impact of the natural environment on individuals' health. Numerous scholarly studies have extensively examined the correlation between nature, specifically sunshine and plants, and its potential impact on human well-being (Kaplan and Kaplan, 1989; Kellert and Heerwagen, 2008; Browning, Ryan and Clancy, 2014). The primary objective of biophilic design is to optimize the overall well-being of individuals by promoting and nurturing the relationship between humans and the natural world inside contemporary constructed spaces (Ryan et al., 2014). Despite the availability of factual data, there has been a sluggish response from governments and company owners due to their perception of biophilia as an arcane or fanciful concept.

In light of the discernible advantageous effects on the well-being and efficiency of employees, organizations worldwide are now exploring strategies to adopt environmentally sustainable practices inside their workplace premises (Scott, 2015). According to Davidson's (2015) findings, the integration of natural components into work environments has been shown to enhance workplace productivity by 6%, while also contributing to a 15% rise in employee well-being and creativity. Previous studies have consistently demonstrated that the presence of a natural view from the window of an office or work space has a significant impact on employees' mental well-being. Specifically, such views have been found to decrease levels of sadness and frustration, while simultaneously increasing job satisfaction, patience, enthusiasm, and contentment (Fjeld et al., 1989; Wood, 2006). In addition, there exists a correlation between the quantity of indoor plants located near an individual's workstation and their level of productivity (Planet, 2015; 2016). Despite the persuasive nature of these measurements, it is puzzling that the majority of corporate companies do not provide these basic conveniences. In accordance with the research conducted by Davidson (2015), it is evident that a significant proportion of office workers, namely 47 percent, reported a lack of access to natural light in their work environments. Furthermore, the study also revealed that 58 percent of these individuals did not have the presence of any plants within their line of sight.

The interaction between humans and nature has been found to have several advantages, and a substantial amount of study has been conducted in the last 30 years to support these assertions. Several studies have identified various benefits associated with engaging in certain activities. Berman et al. (2008), Cha (2015), Dannenberg et al. (2011), Lewis (1973, 1995, 1996), Relf (1992), Shanahan et al. (2016), Ulrich (1993, 2000a, 200b), Ulrich & Parsons (1992), and Verderber (1986) have reported gains such as stress reduction, improved mental acuity, enhanced creativity, healing effects, attention

restoration, and the development of perceptual and expressive skills. According to Elings (2006), there is a lack of available knowledge about the interactions between individuals and plants, as well as the underlying processes of nature therapy. Furthermore, it is worth noting that prior investigations have yielded subpar evidence-based research as a result of the methodological constraints inherent in their research design. The concept of biophilic design encompasses various elements, including but not limited to, the integration of indoor and outdoor spaces, utilization of natural ventilation and materials, incorporation of plants, maximization of natural lighting, provision of views to the external environment, restoration of landscapes, creation of courtyards, implementation of natural landscaping, inclusion of water features, and utilization of interior designs that emulate the shapes and forms observed in nature (Kellert, 2005, 2013).

According to the research conducted by biologist Wilson (1975, 1984) at Harvard University, there exists an inherent inclination among humans towards nature. In developed nations, individuals typically allocate over 90% of their time within constructed settings, predominantly urban areas (Kellert, 2012; Kellert and Heerwagen, 2008). Artificial environments sometimes lack opportunities for direct engagement with natural elements or adherence to design principles inspired by nature. The concept of biophilic design aims to optimize human well-being by promoting a harmonious relationship between individuals and the natural world within contemporary architectural and urban settings. Burchett et al. (2010) conducted innovative study to investigate the long-lasting impact of plants and nature on the emotional states of those occupying buildings. The research conducted by the authors was pioneering in nature, since it was the initial empirical investigation to employ globally approved psychological measures in order to assess the possible affordances associated with indoor plants. According to a study conducted by the US Environmental Protection Agency in 2000, there is a substantial correlation between worker productivity and the presence of plants. Additionally, a study by Dannenberg et al in 2011 found that the presence of plants in buildings can also contribute to a reduction in negative mood states and anxiety among residents. According to Burchett et al. (2010), the presence of potted plants in interior environments has the potential to boost the quality of air for those occupying buildings. Notably, their study found that the inclusion of a single plant at a workspace may have a substantial positive impact on the morale of staff members, while also promoting their overall well-being and performance. Barnaby et al (2023) aver that being surrounded by natural elements, such as plants, water features, or natural materials, can evoke a sense of calmness, improve concentration, and enhance cognitive function.

In addition, the ground breaking study conducted by Burchett et al. (2010) examined the advantages of using indoor potted plants as a means of mitigating air pollution. Plants have been found to have a significant role in reducing the release of volatile organic compounds (VOCs) from plastic or synthetic materials, including furnishings, furniture, and equipment such as computers and photocopiers. Additionally, plants also contribute to the mitigation of carbon dioxide (CO2) emissions resulting from human respiration. A direct correlation has been established between air quality and improved cardiovascular health and mental sharpness (US Environmental Protection Agency, 2003; Gray, 2017). The inclusion of green spaces in workplaces is gaining support from existing research, and the two-year collaborative project between Western Sydney University (Western) and Brookfield Multiplex (BM) was based on these factors.

1.1 Objective

This paper delves into the profound impact of biophilic design on the economic landscape and the holistic wellbeing of individuals within the workplace. Specifically, it seeks to:

1 examine the convergence of economic advantages and improved quality of life, thereby underscoring the transformational power of nature-inspired architectural elements.

2. METHODOLOGY

Qualitative research methodology was used in this study; it involved combining the power of case studies and comprehensive literature reviews. Case studies aided in the exploration of real-world applications of biophilic design in diverse workplace settings. On the other hand too, extensive literature reviews made allowance for the synthetization and analyzes of a vast body of existing knowledge, drawing upon research studies, reports, and expert insights. By integrating the findings of both case studies and literature reviews, a comprehensive and well-rounded perspective on the economic advantages of biophilic design in the contemporary workplace as well as its potential to create holistic improvements in both productivity and well-being was gained.

3. ANALYSIS AND DISCUSSIONS

3.1 From Biophilia to Biophilic Design

Erich Fromm, a psychologist, was the first to coin the term BIOPHILIA in 1964, the Harvard biologist Edward Wilson later put the term into use in his book "Biophilia" published in 1984. While Fromm used the word to describe the innate human tendency to seek connections with nature and other living beings, Wilson on the other hand expanded on this concept, defining biophilia as the instinctive bond between humans and the natural world. This concept has gained significant attention in several academic disciplines, including psychology, biology, and environmental studies. According to Wilson's definition in 1984, the term "biophilia" originates from the Greek word, which signifies an affectionate inclination towards nature (Browning et al., 2012). Fundamentally, the notion of biophilia is uncomplicated and posits that people possess an inherent inclination to connect with and engage with natural systems and phenomena. The observed phenomenon can be attributed to the process of human evolution. According to Kellert, Heerwagen, and Mador (2008), the inclination of humans to seek connection with nature is inherently ingrained in their biology, as it has been found to significantly contribute to the improvement of their physical, emotional, and cognitive well-being. This reliance on interactions with the natural environment is a reflection of the evolutionary history of humans, who have predominantly evolved in natural settings rather than artificial or constructed environments. Humans have just recently, during the past several millennia, initiated a process of distancing ourselves from our innate environment. Throughout the vast majority of our species' existence, the biological evolution of humans has mostly occurred as a consequence of adaptive reactions to natural settings. These habitats encompassed various elements, including light, sound, color, wind, water, flora, and landscapes (Kellert & Calabrese, 2015). In recent decades, there has been a growing

interest in investigating the potential physical and emotional impacts of human disconnection from outside and natural surroundings. Undoubtedly, considering that our presence in the constructed environment represents a mere 1% of the entirety of human history, it is challenging to establish a high degree of assurance regarding the biological impacts of this transformation, both in the past and in the future.

The integration of the biophilia hypothesis, along with the documented positive physiological impacts on the human body and brain resulting from exposure to nature, has prompted numerous suggestions regarding the potential application of biophilia in various domains of the constructed environment and human existence. These proposals aim to enhance health, well-being, and productivity. The concept of integrating people with the natural environment within built structures has been referred to as BIOPHILIC DESIGN. The purpose of this study is not to provide an exhaustive account of the many techniques for integrating biophilic design features into buildings. However, a concise summary of its primary classifications should enhance comprehension of the idea and its potential applications in the workplace. The categorization of many patterns of biophilic design has been undertaken by numerous scholars, this has led to the evolution of the three main categories of Biophilic Design as reported by Browning et al. (2014), in "14 Patterns of Biophilic Design" published by Terrapin Bright Green.

3.1.1 Nature in Space: this encompasses the incorporation of natural elements indoors, such as water features, plants, courtyards, dynamic lighting, and natural ventilation. Additionally, it involves enabling occupants to establish a connection with the outdoor environment from within, often achieved through the provision of glass views or access to fresh air through operable windows or doors.



Figure 1: An office space depicting Nature in Space

Source: www.archdaily.com/985534/biophilic-offices-landscape-and-the-working-environment 2023

3.1.2 Natural Analogues: Also known as indirect experiences with nature, refer to instances where individuals encounter nature in a manner that is neither direct nor immediate. This involves the utilization of organic materials and architectural designs or artistic elements that depict or mimic the patterns and forms observed in the natural world. These natural counterparts have the ability to evoke similar favorable physiological reactions as direct engagement with the natural environment.



Figure 2: An interior space depicting Natural Analogues

Source: www.pubs.royle.com/publication/?i=659700&article_id=3670470&view=articleBrowser 2023

3.1.3 Nature of the Space or the way in which Spaces are configured: The configuration of spaces, as well as the inherent characteristics of such spaces, can elicit specific responses in individuals due to their biological adaptation to particular types of landscapes. According to existing research, the ideal environmental conditions for human beings are those that resemble the savanna, characterized by open landscapes interspersed with clusters of trees. Such surroundings offer individuals both a "prospect," which refers to the ability to have expansive views of various settings, and a "refuge," which pertains to areas that evoke feelings of safety and security (Browning et al., 2014).



Figure 3: An outdoor office environment depicting Nature of the Space

Sourcee: www.fulgararchitects.com/trends/biophilic-design-to-optimize-your-workplace-for-people-and-nature2023

3.1.2 Biophilic Design, Productivity and Wellbeing in the Work Place

It is important to acknowledge that a considerable body of research has been undertaken to investigate the impact of windows and views of nature in hospital rooms. These studies have consistently demonstrated a correlation between such environmental factors and reduced patient recovery times and medication requirements. Consequently, hospitals have experienced cost reductions and an increased capacity to serve a larger number of patients (Clark and Chatto, 2014). In recent times, researchers have begun investigations into the potential application of biophilia in the workplace and the potential advantages that may be derived from integrating biophilic design aspects into office environments. The incorporation of biophilic design into workplace environments has been rapidly recognized as a genuine and possibly substantial commercial opportunity. Multiple factors related to employee behavior contribute to the elevated expenses associated with staff management. Illustrations of this concept include absenteeism, which refers to the frequency at which individuals are missing from their workplace, as well presenteeism, which pertains to the frequency at which employees are physically present but fail to fulfill their responsibilities owing to factors such as lack of concentration, exhaustion, sickness, or unpleasant emotional state. According to Browning et al. (2012), the expenses associated with unproductive workers may be attributed to absenteeism, which accounts for 2.7% of expenditures, and presenteeism, which accounts for 1.3% of expenditures. While it is generally acknowledged that a certain degree of absence is considered normal in the workplace, scholars have put up the hypothesis that a significant portion of the existing absenteeism rates might be reduced by implementing biophilic enhancements in the work environment.

The primary components that contribute to the biophilic effect may be categorized into eight distinct areas, namely light, color, gravity, fractals, curves, detail, water, and life.

The term "light" pertains to the necessity of exposure to natural sunshine. Furthermore, the presence of natural light is crucial for the process of three-dimensional vision and depth perception. Receptors transmit visual stimuli to the brain, establishing a direct connection with our emotional responses. Similarly, the human brain tends to link gray and colorless stimuli with unpleasant feelings, so potentially impairing our cognitive performance and hindering our capacity to function well. Gravity is the phenomenon that governs the equilibrium between all things. In natural structures, heavier parts tend to occupy lower positions, whereas lighter elements are typically found at higher elevations. Fractals are defined as intricate systems that encompass geometric structures. The pleasant response of humans towards fractals can be attributed to the shared structural features that exist between fractals and the human body. Curves encompass the many forms of curvilinear shapes that are observed in the natural world, evoking sensory responses related to curves and symmetry. The intricate patterns found in the veins of stones or the growth rings of trees are the specific features that humans naturally like to observe. Water symbolizes humanity's innate want for proximity and visual perception, owing to its inherent therapeutic characteristics. The concept of life encompasses our inherent connection with natural entities, hence embodying the comprehensive essence of biophilia (Salingaros, 2018). The fundamental principle for achieving a satisfactory existence is in the mitigation of stress. Developing a relationship with the natural world can make a substantial contribution in this regard. The presence of natural components within the workplace environment has been found to positively impact employee well-being, hence enhancing productivity levels. For instance, when an individual gazes through a window, their degree of stress aligns with that of the natural environment. The presence of natural hues, such as green, blue, and brown, tends to induce a sense of comfort among employees, while the color gray typically elicits the opposite effect.



Figure 4: A typical Biophilic Office

Source: www.goodearthplants.com/quiet-down-workplace-distractions-plants-increase-productivity2023

Likewise, the incorporation of real plants and greenery into workplace settings also yields favorable effects on employees' overall welfare. The presence of ample lighting and a generous amount of space also contributes to the enhancement of workers' overall sense of satisfaction and contentment. Conversely, it is not surprising that surroundings lacking in spaciousness have a detrimental impact on individuals' well-being (Velarde, Fry & Tveit, 2007). The implementation of fundamental biophilic concepts in 1987 at the ING Bank building in Amsterdam resulted in a notable 15% reduction in workday loss. Similarly, Perakende had a significant rise in its earnings, estimated at around 40%, as a result of using comparable measures. According to Trenddesk (2013), the implementation of an energy system resulted in savings of up to 2.6 million dollars' worth of energy. Furthermore, this energy system achieved a return on investment within a period of three months. According to a study carried out at the University of Texas, the incorporation of indoor plants has been found to have a dual effect of diminishing worker stress levels and enhancing job performance by a notable margin of 12 percent (Trenddesk, 2013). The Selgas Cano Architectural Office, situated in Madrid, is a prominent exemplar of biophilic design, characterized by its prime location amidst natural surroundings. The employees are situated along a substantial windowsill inside a work setting that is encompassed by natural elements. The utilization of a curved window, measuring 2 cm in thickness, facilitates the alignment of the northern wall with the longitudinal axis of the structure. In contrast, the southern wall is composed of 11 layers of glass, constructed from fiberglass and polyester materials. This design effectively mitigates the risk of direct sunlight exposure and overheating for office workers. The hinged aperture is affixed to a pulley system that is weighted, enabling the regulation of natural ventilation to different extents (Şenozan, 2018).

Biophilic design in work spaces has been found to have two major effects: productivity and creativity. This implies that it has a substantial role in enhancing both worker productivity and well-being, hence establishing a positive correlation between emotional state and productivity. A research undertaken in both the United Kingdom and the Netherlands has established a correlation between biophilic design and productivity. In the study entitled "Comparative Advantages of Environmentally Sustainable and Conventional Office Spaces: Insights from Three Field Experiments," the researchers investigated two distinct cohorts of employees characterized by varying degrees of exposure to natural environments. The findings indicate that there was a significant increase in productivity, amounting to 15%, among employees whose workspaces were adorned with plants over a span of three months (Nieuwenhuis, Knight, Postmes, Haslam, 2014: 210). Another study conducted in 1993, involving a sample size of 1,200 office workers, revealed that individuals who had the opportunity to observe natural elements through their windows tended to exhibit lower levels of dissatisfaction and higher levels of motivation towards their work. A research conducted by The Rocky Mountain Institute in 1994 revealed that the implementation of energy-efficient systems for lighting, heating, and cooling has been shown to have a positive impact on worker productivity, reducing absenteeism rates, and enhancing the overall quality of output. According to Cramer and Browning (2008), there was a notable boost in productivity as a direct consequence of this design modification, ranging between 6% and 16%.

Recent research have further shown that exposure to nature can lead to enhancements and recovery of cognitive abilities. These findings provide support for the proposition that there is a correlation between biophilia and heightened productivity in professional settings. The "Attention Restoration Theory (ART)" was formulated by environmental psychologists Rachel and Stephen Kaplan. According to this theory, individuals' perceived or direct exposure to nature has the potential to enhance their capacity to recuperate and redirect their cognitive faculties following a period of hard activity. In the study conducted by the Kaplans, participants were presented with visuals depicting either rural or urban environments subsequent to engaging in a cognitively challenging activity. Upon analyzing the photos for a duration of several minutes, it was seen that those who were exposed to photographs depicting natural landscapes had quicker reaction times, a higher number of accurate replies, and superior overall memory retrieval compared to individuals who were exposed to images portraying urban environments. Additional evidence to corroborate this study was presented through the utilization of an "Eye Position Detector System." Through the application of this instrument, it was ascertained that the frequency of fixations made by the eye was significantly reduced when individuals were exposed to nature imagery in comparison to urban landscapes. According to researchers, a reduction in the number of eye fixations corresponds to a decrease in the obstruction of neural pathways leading to the brain. Consequently, the cognitive load on the brain is reduced while processing natural imagery. The collective findings of these research demonstrate that exposure to nature and environmental imagery can alleviate cognitive strain and perhaps enhance employees' cognitive performance and productivity. Consequently, the concept of biophilic design emerges as a pertinent subject for deliberation among employers and building proprietors (Nature-Based Design: The New Green, 2013).

In 2013, a research was conducted with the objective of investigating the potential impact of the quantity of natural sunshine in the workplace on the sleep habits of employees. The personnel were divided into two groups, with one group allocated to work in windowless work spaces and the other group assigned to work in offices that had windows. Individuals who were employed in office environments equipped with windows were subjected to a much higher level of natural daylight exposure, amounting to a 173% increase. Furthermore, these individuals reported an average increase in nightly sleep duration of around 47 minutes in comparison to their counterparts who did not have access to windows (Cheung et al. 2013). The impact of sleep on an individual's daily and long-term productivity and well-being is considerable. The physiological advantages of biophilia, such as enhancing sleep quantity and quality, lowering stress levels and heart rate, and boosting cognitive function, are particularly significant when examining employee health and productivity.



Figure 5: A naturally lit office space

Source: https://www.designcurial.com/news/lighting-the-biophilic-office-building-research-establishment-7161279/ 2023

Individuals who are employed in office environments that do not have access to natural light tend to adorn their workspaces with a greater emphasis on window-related decorations compared to those who work in buildings that do have windows. The rationale for this proposition is that employees endeavor to overcome the absence of natural elements (Heerwagen & Orians, 1986). Likewise, the absence of windows in a workplace, an overabundance of gray hues, and/or a dearth of vegetation and/or other components from nature likewise exert detrimental effects on creativity and creative productivity. On the contrary, the inclusion of elements such as plants and sunshine inside workplace environments has been found to result in a 15% increase in the overall happiness levels of workers, a 15% boost in their creative capabilities, and a 6% enhancement in their productivity.

4. CONCLUSION AND RECOMMENDATIONS

The exploration of the economic benefits of biophilic design in the workplace, as presented in this study underscores the transformative potential of nature-inspired architectural elements. Biophilic design is not merely an aesthetic trend; it represents a holistic approach that has far-reaching implications for organizations, their employees, and the bottom line. By incorporating natural elements into the built environment, businesses can create spaces that foster a sense of well-being and inspire higher levels of productivity. This research, incorporating both qualitative case studies and comprehensive literature reviews, has demonstrated the profound impact of biophilic design on multiple

fronts. Employees in biophilic workspaces report reduced stress, increased creativity, and enhanced job satisfaction. These effects translate into tangible economic benefits, such as reduced absenteeism, lower healthcare costs, and heightened productivity. Moreover, our findings reveal that the upfront investments in biophilic design often yield significant returns, with evidence suggesting that a holistic approach to well-being can positively influence the overall performance and profitability of organizations.As businesses continue to grapple with the evolving nature of work and a growing emphasis on employee well-being, biophilic design emerges as an essential element in the pursuit of success. This research supports the notion that the fusion of nature, economics, and human experience in the workplace is not just a luxury but a strategic imperative. It has the potential to redefine how we perceive productivity and well-being, reshaping the future of work. The economic benefits of biophilic design are no longer concealed; they are a vibrant reality that beckons organizations to embrace a holistic approach to enhancing their employees' lives and, in doing so, achieving greater economic prosperity.

In light of this research, the following recommendations are offered to organizations seeking to harness the potential of biophilic design for economic and holistic well-being advantages:

1. Strategic Adoption of Biophilic Design: Organizations should recognize biophilic design as a strategic choice rather than a mere trend. A comprehensive approach to implementing nature-inspired elements in the workplace, such as greenery, natural light, and access to outdoor spaces, can yield long-term benefits for both employees and the organization.

2. Customization to Organizational Culture: It is vital to tailor biophilic design to the unique culture and needs of the organization. Understanding the preferences and requirements of employees will enable the creation of spaces that resonate with the workforce.

3. Invest in Professional Consultation: Seek the expertise of architects, designers, and environmental psychologists who specialize in biophilic design. Their guidance can ensure that biophilic elements are integrated effectively, maximizing their impact.

4. Measure and Monitor Outcomes: Establish performance metrics to evaluate the impact of biophilic design on productivity and well-being. Regularly assess key indicators, such as reduced absenteeism, improved job satisfaction, and enhanced productivity, to quantify the return on investment.

5. Promote Employee Engagement: Involve employees in the design process and encourage their participation in maintaining biophilic elements. Employees who feel a sense of ownership are more likely to benefit from and appreciate the workplace changes.

6. Share Success Stories: Share stories and testimonies from employees who have experienced the benefits of biophilic design. These narratives can serve as powerful motivators for other organizations considering similar changes.

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