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INTEGRATING THE BIOPHILIA PHYSIOGNOMIES IN THE CONTEXT OF NEOM SMART CITY IN SAUDI ARABIA

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ABSTRACT

Motives: As the number of research studies of people in urban areas grows in terms of the criteria impacting the health and effectiveness of individuals, the detrimental effects caused by living apart from natural elements become more visible. There is inadequate data for a program that integrates both biophilic design and smart cities tactics. Smart city concerned about energy and resource utilization and utilize digital technologies to adjust resource consumption. It seldom discusses environmental sustainability. However, the biophilic design seeks to provide people with better life quality through a functional interconnection with nature. Digital expertise may prompt biophilic retorts via simulated methods.
Aim: The study reconnoiters the significance of the biophilic ideologies to the city's development. It integrates biophilic urban design in Neom city to overcome gaps in ecosystems' health associated with traditional urban design.
Result: The study proposes integrating biophilic elements at small and large scales. It explains each element within proposed projects and examples of Neom city's design schemes to incubate these elements.

Keywords: biophilia, biophilic patterns, Neom city, urban design

INTRODUCTION

A significant quantity of works has been issued on the basics of shaping the metropolises. The influential writer Kevin Lynch in his book "The Image of the City", emphasizes the five main elements that form the visual perception of the city (Lynch, 1960). Gordon Cullen (2012) endorses the townscape visual image in his book "Concise of Townscape". Bentley et al. (1985), in their book "Responsive Environments", addresses the seven principal features of successful urban spaces. Sitte (2016), in the book "City Planning According to Artistic Principles", speculates urban design in ecology, urbanism, and infrastructure. Frederick Law Olmsted fetched the landscape near the urban people once he planned the Central Park of New York in 1857 (Amat et al., 2020). The American psychologist Jane Jacobs (2000), in her book "The Death and Life of Great American Cities", inspects the city as ecosystems, mixed-used growths, bottom-up city planning, and local economy. Furthermore, Jen Gehl (2013), in his book "Cities for People", proposed philosophies in scheming excellence in urban places.

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The literature advocates the notion of Biophilia that connects nature to humans was recognized a long time ago. Biophilia's origin relates to Erick Fromm's book "The Anatomy of Human Destructiveness" (1973), which defined Biophilia as "the passionate love of life and of all that is alive" (Downton et al., 2016). Hence, since Wilson's introduction in 1984, the Biophilia approach has become a powerful mode to comprehend and test the bonds and linkages between humans and their surrounding ecosystem, including species and living systems (Wilson, 1984).

The biophilia theory has been evolved in the notion of Biophilic Design endorsed by Kellert et al. (2011), then clarified by other writers such as Beatley in his book "Biophilic Cities" (2011). Since then, it has been the benchmark of "an emerging design principle capable of considering the multi-dimensional and interdependent complexities of urban systems and infrastructure, including stormwater management, electricity demand, urban heat island mitigation, air pollution, food production, biodiversity preservation, congestion management, and placemaking" (Reeve et al., 2013). The value behind Biophilia is the knowledge of generating a human-made built environment stimulated by nature to endure the culture-nature connections of a person with the environment (Kellert, 2003, 2012a, 2016; Kellert & Wilson, 1993; Kellert & Heerwagen, 2007; Kellert & Finnegan, 2011; Kellert et al., 2011). There are rising indications that connect physical and mental health benefits to green natural elements (Beatley, 2013). Hitherto noted that Biophilia re-creates the Connection between natural features and the people in the built environment (Amat et al., 2020).

On the other side, the smart city's term was initiated in 1994 (Dameri & Cocchia, 2013). Technology, institutions, and individuals were identified for a smart city project (Nam & Pardo, 2011). The smart cities approach uses Technology to adjust resource utilization and to decrease costs. It rarely refers explicitly to ecological sustainability or mentions the necessity to retain the life quality of other inhabitants of the urban environment other than humans. On the contrary, biophilic design regards complete acknowledgment of Biophilia as crucial to enhance people's quality of life. It essentially involves a functional interdependency connection along with all the nature other than humans.

This paper seeks the integration of the Biophilia physiognomies within Neom city in Saudi Arabia. To achieve that, firstly, it addresses the characteristics of the Neom smart megacity in Saudi Arabia. Secondly, it reconnoiters the significance of Biophilic patterns and ideologies to the city's development by highlighting and integrating biophilic patterns in the city's urban design to overcome the ecosystems' health and well-being gaps. The author adopted and modified the biophilic checklist from Beatley (2011) and Downton et al. (2016). Then, the checklist was used as the benchmark to explore Neom city's potentials to integrate the biophilic urban design approach. This is an input of the author to rejoin communities with nature and living elements in Neom and other Saudi Arabian cities. In addition, the author provides some biophilic physiognomies and presents examples of the design schemes of development that can accommodate the author's proposal. The results of the schemes might validate biophilic design elements. The proposal highlights introducing aspects of biophilic design at both micro and macro scales in the city. Finally, there is no previous endeavor, as yet, to inspect similar connections of Biophilia to the design in Saudi Arabian cities.

BIOPHILIA IN URBAN DESIGN

Kellert (2015) outlined the experiences and attributes of biophilic design. He categorized them into the direct and indirect experiences of nature and the experience of space and place. Table 1 lists the details of these three categories.

Biophilia supports the cohesive Connection between urban settings and nature for motives of emotional well-being and ecological appropriateness. "Over thousands of generations, the mind evolved within a ripening culture, creating itself out of symbols and tools, and genetic advantage accrued from planned modifications of the environment.

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Table 1. Experiences and attributes of biophilic design

Direct experience of na ture	Indirect experience of nature	Experience of space and place
Air	Images of nature	Prospects and refuge
Light	Natural materials and colors	Organized complexity
Water	Simulating natural light and air	Integration of parts to the whole
Plants	Naturalistic shapes and forms	Transitional spaces
Animals	Evoking nature	Mobility and wayfinding
Weather	Information richness	Cultural and ecological attachment to place
Natural landscapes and ecosystems	Natural geometry	
Fire	Biomimicry	

Source: Kellert (2015).

The unique operations of the brain are the result of natural selection operating through the filter of culture. They have suspended us between the two antipodal ideas of nature and machine, forest and city, the natural and artifactual, relentlessly seeking, in the words of the geographer Yi-Fu Tuan, an equilibrium not of this world" (Wilson, 1984).

"The concept of Biophilia can permeate every facet of planning and design, celebrating the regional landscape, ecological restoration, appropriate horticulture, and buildings that reach out and interact with the landscape. This approach will allow us to create landscape designs that are far more beautiful, complex, and engaging than traditional or sustainable landscape architecture". The integration of green spaces in urban areas has brought a series of retorts from pocket parks to greater community spaces. Necessities for open spaces have become elegant in several city planning settings. However, the motives for combining parts of nature have fluctuated from striving objectives of generating city lungs to securing exercise spaces to thoughts around enhancing neighborhood esthetics or diminishing the pictorial influence of built form (Downton et al., 2016).

Fourteen patterns of Biophilic Design were proposed by Browning et al. (2014). Those patterns connect human biology and nature to the built environment's design. In addition, they offer means to comprehend design prospects and opportunities for utilizing design to enhance health and well-being at the personal and community levels. The Biophilic patterns have been developed through experimental evidence and multidisciplinary studies and analysis in various reviewed articles and books (Ryan et al., 2014).

A supplementary pattern was needed to tackle virtual biophilic impacts. The 15th pattern in Table 2 (in Italic) was proposed after research on underground railway stations by Downton et al. (2016). This pattern recognizes artificial visual Connectivity to copy natural components, living organisms, and biological activities. This pattern might add to the psychological health and well-being of the users. Models involve human-made skies and the rendering of nature via virtual reality, involving animatronics.

Table 2. The (14+1) Patterns of Biophilic design

Biophilic Design Principles	**Patterns of Biophilic Design**		
	Nature in the Space	Natural Analogues	Nature of the Space
Design Narratives	Visual Connection with nature	Biomorphic forms and patterns	Prospect
	Virtual Connection with nature	Material connection with nature	Refuge
	Non-Visual Connection with nature	Complexity and order	Mystery
	Non-Rhythmic sensory stimuli		Risk and peril
	Thermal and airflow variability		
	Presence of water		
	Dynamic and diffuse light		
	Connection with natural system		

Source: Browning et al. (2014), Downton et al. (2016).

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The supplementary pattern has positive physiological and psychological impacts such as reducing stress, blood pressure, heart rate, and other intellectual developments through mental engagement and attention, feelings, attitudes, and overall happiness (Downton et al., 2016).

The patterns turned out to be the agenda for the design in the built environment. However, there is a misunderstanding on a biophilic design by individuals who imagine it merely brings plant life into the built environment (Downton et al., 2017).

SMART BIOPHILIC CITY

The idea of a smart city is a petition to the intelligence, rational and systematized. It is a digital process for observation, measurement, and examination. It has measurable, practical outcomes to enhance the performance of energy, transportation, water intake, and criminality ratios. Therefore, the theory attracts supporters of computer-operated systems.

There have been several schemes of the smart city worldwide in the last six decades. Most of these projects are in Europe, the USA, South Korea, Japan, Brazil, Emirates, and recently Neom in Saudi Arabia, as was initiated in 2017 (Altahtooh, 2019). The word smart city was initially applied in 1994 and is yet equivocal (Dameri & Cocchia, 2013). Nam and Pardo (2011) identified three features for a smart city project: Technology, institutions, and people. Mcfedries (2014) outlined a smart city as a technological foundation and application. In contrast, Yuan and Li (2014) found the smart city to seek excellence through signs of progress. The European Cities Project established a six-axis prototype as a smart city plan (Giffinger et al., 2007). Table 3 shows the model's components.

Built on 600 ha of reclaimed land, about 56 km from the South's capital Seoul, the Songdo district is the greatest private real estate development, Figure 1. The district was planned to have 80,000 apartments, 5,000,000 m^2 of office space, and 900,000 m^2 of retail space (McNeill, 2009). The Songdo International Business District was to promote green and low-carbon growth. As a result, the nation launched over

Table 3. The six-axis model of smart city

Smart Mobility	Smart Environment	Smart Living
ICT Infrastructure	Pollution	Housing quality
Sustainable and safe transportation system	Environmental Protection	Education facilities
Smart People	**Smart Economy**	**Smart Governance**
Participation in public life	Productivity	Public and social service
Flexibility	Entrepreneurship	

Source: Altahtooh (2019).

80% of the total earmarked for green investment. The Songdo IBD is being developed as a smart, sustainable city with more than 40% of its area reserved for green space, including the park of 40 ha, numerous charging stations for electric vehicles, and a waste collection system that eliminates the need for trash trucks. Also, it is the first district in Korea to have all of its major buildings on par or beyond LEED's requirements (Lobo, 2013). Information technology networks and computers have been connected to houses, streets, and offices as part of a wide area network (Independent, 2009). Sensors gather information on water flow and energy use (Williamson, 2013). The water pipes prevent wasting drinkable water in showers and toilets. Songdo IBD typically has wide roads and 26 km of bicycling lanes, and wide walkways. The district is served by buses and Incheon Metro Line, with seven stations with interior sky-lit vistas (Lobo, 2014).

Smart city plans always suggest enhancing people's quality of life. They hardly cite the necessity to sustain the life quality for other inhabitants or living systems in the environment (Altahtooh, 2019). Smart city plans incorporate observing techniques that utilize algorithms to detect illegal actions in cities and warn law enforcement or defense facilities. Variably, smart city technologies are advertised on the foundation of worries about private safety. The notion of a smart biophilic city is new. According to Beatley (2011), "A Biophilic city is a city that seeks to foster a closeness to nature – it protects and nurtures what it has and actively restores and repairs the nature that exists

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while finding new and creative ways to insert and inject nature into the streets, buildings and urban living environments". There is inadequate data for a program that integrates both biophilic design and smart cities tactics. Sustainability is generally described under the smart city agenda regarding energy and resource utilization. For example, it utilizes digital technologies to cut expenses and adjust resource consumption, to compromise its use for upcoming generations. However, it seldom discusses environmental sustainability clearly. However, biophilic design involves ample acknowledgment of Biophilia as critical to providing people with better life quality. It also stresses preserving other living systems in a healthful status; it efficiently entails a functional interconnection with all the natural features that are not humans (Downton et al., 2016)

The biophilic design responses differently to create a natural environment that minimizes criminal activities trends. The green spaces always present chances for the city residents to gather and develop cohesion and trust. This is an indication that nature has significant humanizing roles (Beatley & Newman, 2013). Kuo and Sullivan reported that criminality levels are lesser in public housing projects with larger green areas (Downton et al., 2016). Digital expertise may prompt biophilic retorts via simulated methods. Hence, there is no clash between biophilic agendas and smart cities. Beatley (2011) discussed precedents for successfully implementing the biophilic design process and encouraged applying the biophilia theory at an urban scale. Biophilic urbanism deals with a broad scope of environmental issues; Table 4 summarises the strategies of biophilic urbanism.

Fig. 1. The Songdo International Business District
Source: Google (2021a).

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Table 4. Strategies of biophilic urbanism

Strategies	Actions
Changing roads and pavement	Adding permeable and high albedo values of pavement materials, bioretention zones, urban trees, and forest such as street trees, transfer of empty roads and structure to parkland, green streets, and supporting alternate transportation to lower motorway infrastructure
Merging green areas into the built environment	Involving biodiversity passages, green streets and alleyways, land improvement to enrich biodiversity shelters and passageways, green walls, green roofs, city plantations, and urban agriculture, and built wetlands
Climatic control in and out of buildings	Incorporating shading trees, vegetated areas to diminish reflection such as lawns and gardens, green walls, green roofs, and indoor vegetation
Alleviating heat island Effect	Comprising urban parks, street trees, green walls, and green roofs
Improving carbon emission Reductions	Involving soil organic carbon, carbon impounding by shading trees, decrease greenhouse gas emissions by shading trees, green walls and roofs, and mangroves
Improving water cycle Managing	Incorporating green walls and roofs, detention and retention ponds and lakes, built wetlands, providing daylight, and restoring of creeks and water streams, sidewalk and roadside gardens, vegetated swales, infiltration trenches and soak ways, and infiltration basins and swales

Source: own preparation based on Reeve et al. (2011).

NEOM CITY

Neom is a gigantic region being established on the red sea of Saudi Arabia. It stretches across the shared borders with Egypt and Jordon to convert Saudi Arabia into a pioneering industry and technology value chain model. It presents exceptional expectations for leisure tourism. Additionally, residential projects will be promoted to international, regional, and local investors. Construction activities were anticipated to be finalized in 2020. It was planned to offer a modern urban model and create innovative economic zones and a revolutionary society based on livability. The city's financial possibilities emphasize 16 divisions: Energy, water, food, manufacturing, entertainment, media, fashion, culture, biotech, digital Technology, mobility, sport, tourism construction, health and well-being, education, and livability services (Hassan, 2019).

Although the smart city agenda aims partially to create environments that encourage human well-being, smart cities have yet to launch a system of measurement for their living mechanisms as healthful essentials for that well-being. The biophilic design may provide useful strategies to secure these nutritional elements in the smart city through daily human contact with nature (Downton et al., 2016). This contact catalyzes humans to evolve as an interdependent and interconnected part of wider nature and life forms (Beatley, 2011). This link is demarcated by Kellert and Wilson (1993) as "innately emotional affiliation of human beings to other living organisms. Innate means hereditary and hence part of ultimate human nature". Wilson's exploration and perspective on the linkage between esthetics and the natural environment back to the earliest Greeks when ambiguities of sacred proportion and geometry were dominant. Therefore, Wilson reinvigorated this concept of nature and esthetics with a shell of analytical support for its legitimacy (Downton et al., 2016).

Given that the economic motive is the main basis for establishing the city of Neom and because the current study works to encourage and integrate Biophilia in this complex economic entity and system. The study needs to prove that Biophilia is not like a utopia or calls for Connection and integration with ecosystems and the spread of green culture while neglecting the importance of the economic aspect. It is helpful to cite examples of case studies. Examples of economic benefits identified in the literature review are listed in Table 5.

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Table 5. Case studies of biophilic elements applications and their benefits

Biophilic elements	Project	Location	Benefits
Street trees	24,000 public street trees	Davis community in California, USA	The project provided comprehensive financial and social benefits. Achievement of 1.2 million USD as a net annual environmental and property value benefit. The benefit to cost ratio reached 3.8:1.11
Shade trees	Installing eight large and eight small shade trees	Residential houses in California, USA	The project reduced cooling energy consumption by 30%, which was 4 kWh/day
Park	Conversion of a parking and railyard area into the world's largest green roof on an area of around 10 ha	Chicago's Millennium Park, USA	The project has turned Millennium Park into a place for tourism and recreation, musical events, and cultural articulation. The assets value of 490 million USD of the project has heightened adjacent land prices by a sum of 1.4 billion USD and boosted tourism incomes by 2.6 billion USD
Green walls	Installing a green wall on the external walls	Tokyo, Beijing, Canada	The project reduced the indoor temperatures in buildings by 10°C in Tokyo. A 28% reduction in cooling energy was achieved in Beijing, while a 23% reduction was recorded in Canada
Indoor plantation			It enhances the environment by eliminating pollutants and reducing indoor CO_2 concentration, reducing illness, and sick leaves, improves worker satisfaction, creativity, productivity, ability to do tasks, and attentiveness. People employed in plants environments demonstrate decreased levels of anxiety (37% lower), depression (58% lower), anger (44% lower), confusion (30% lower), fatigue (38% lower), stress (50% lower), and overall negativity (65% lower)
Vertical and rooftop gardens	372 m^2 garden cultivated with fruits, herbs, and vegetables on the hotel's rooftop garden.	Fairmont Royal York hotel. Canada, Singapore, Hawaii, Dallas, San Francisco, and Washington DC	The project provided a wide variety of fresh produce and bees. Its benefits included saving in cost and energy, fresher produce, and better flavors
Greening, Connectivity, stormwater management	Alleyways were transformed into recreational parks in poor neighborhoods: use bioswales and pervious pavements. Improve lighting	Los Angeles, California & Melbourne, Australia	The project encouraged walking and cycling, improved Connectivity, water quality, and supply, lessened urban temperatures, improved biodiversity, and lower crime rates

Source: own preparation based on Reeve et al. (2011).

BIOPHILIC POTENTIALS IN NEOM CITY: THE PROPOSAL

There are some efforts to encapsulate features, characteristics, and biophilic design patterns in a formulated way (Downton et al., 2016). Beatley (2011) describes biophilic urban design features at different ranges and levels. They start at the single building; Block; Street; Neighborhood; Community, and finally, Region. Downton et al. (2016) added a primary class, "small individual intervention", and added more elements in Table 6. In this paper, the author adopted the Tables from Beatley (2011) and Downton et al. (2016) and modified them as the benchmark to explore Neom city's potentials to integrate the biophilic urban design approach. This is an input of the author to rejoin communities with nature and living elements in Neom and other Saudi Arabian cities. The author

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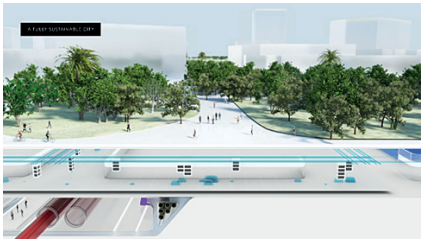
Table 6. Biophilic design inclined archetypes in Neom city

Scale	Biophilic Design Element	Explanation	Neom City proposed projects	Examples of Neom city's design schemes that can integrate biophilic strategies
1	2	3	4	5
Small Intervention	Urban Wetland	Incorporate stormwater and wastewater capture and treatment	Institutional buildings, shopping centers	
	Vertical Green Wall	Incorporating vines and trellises	Airports, clubhouses	
	Sundial/shading/ light/patterns		Malls, office buildings, corporation	
Building	Green Roof and Gardens		Hospitals, residential towers atrium, hotels Penthouses	
	Internal plants and vegetations	Aquaponics	Universities, Research centers, Commercial pockets	
	Sky Gardens and Green Atria		Central parks, courtyards	
	Green Walls		Apartment buildings, Villas	
	Daylit/ventilate Interior Spaces	Utilizing natural daylight and ventilation in buildings	Back yards shopping centers	
	Patterns, Forms, Images, and Effects			
Block	Green Courtyards	Connectivity within green spaces and greenways	Apartments Courtyard	
	Clustered Housing around Green Areas			
	Native Species Yards and Spaces	Community info centers offering expertise on indigenous species and the natural environment	Natural Garden	
Street	Green Streets	Street trees and street canopies might include planting fresh produce	Main spine	
	Sidewalk Gardens	Green sidewalks (rather than pavement)	Secondary streets	
	Urban Trees			

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cont. Table 6

1	2	3	4	5
	Virtual trees and water elements	In underground street networks and stations		
	Low Impact Development (LID) Sustainable Urban Drainage Systems (SUDS) Water Sensitive Urban Design (WSUD)	Swales (rather than traditional stormwater conduits), Running water (incorporating water collection and storage, and evaporative cooling), Urban built wetlands (integrating stormwater and wastewater collection and treatment)	Parks	
	Edible Landscaping	Vegetable gardens and community gardens	Local courtyards	
	High Permeability	Green sidewalks (rather than pavement)		
Neighborhood	Stream Daylighting &Restoration	Uncovering piped or under landscapes or roads waterways	Water paths and creeks	
	Urban Forests	Connectivity within green spaces and greenways	City parks and forest	
	Ecology Parks & Gardens	Connected by wildlife corridors	Central parks	
	Community Gardens	Greening verging strips might include food production	District parks	
	Neighborhood Parks	Connected by wildlife corridors	Neighborhood clusters	
	Greening grey fields and Brownfields	Shopping centers greening (Benefiting from boosted sales in greened commercial areas)	Malls and shopping areas	
	WSUD/SuDS/LID		City Park Water Reuse	
Community	Urban Creeks and Riparian Areas			
	Urban Ecological Networks	Establishing wildlife passageways alongside infrastructure corridors such as roadways		
	Green Schools		District Commons	
	City Tree Canopy		District Commons	

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cont. Table 6

1	2	3	4	5
	Ecology Parks & Gardens	Connected by wildlife corridors		
	Community Forest and Community Orchards	Connectivity within green spaces and greenways	District Commons	
	Greening Utility Corridors	Establishing wildlife passageways alongside infrastructure corridors such as roadways		
	WSUD/SuDS/LID		University Projects	
	Destination Parks and Venues	Connectivity within green spaces and greenways	University Projects	
	Playspaces		Street Parkland Playground & Children's Garden, Nature scape	
	Car Parking Areas	Green roofs, Connectivity within green spaces and greenways	University, Underground Parking Area, roofplaza, and gardens	
Region	River Systems and Floodplains	Creating storm/sea buffer zones with vegetation	Water Park	
	Riparian Systems		Wetlands	
	WSUD/SuDS/LID		Water recycling	
	Regional Greenspace Systems	Connectivity within green spaces and greenways		
	Greening Major Transport Corridors	Establishing wildlife passageways alongside infrastructure corridors such as roadways	LinearParks	

Source: own preparation, the first and second left columns combined from Beatley (2011) and Downton et al. (2016). Images from Google (2021b).

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provides some biophilic physiognomies proposed to be integrated into the city and presents examples of the design schemes of development that can accommodate the author's proposal. The schemes listed in the Table have not deliberately articulated biophilic design intention; though, their results might validate biophilic design elements. Examples of minor single biophilic design infills can give unforeseen living features in omnipresent hardscape settings and show the capability to combine Biophilia in tough urban circumstances. Various biophilic design developments at the building scale and growing technical works have verified the manifold advantages of offering biophilic design aspects for workforce efficiency and confidence. Several streetscapes appear due to instinctive biophilic inclinations by planting street edges and contiguous spaces with vegetation that could be ornamental, indigenous, and fruitful. Several of these cases are solid models of biophilic positive results. Perhaps, streetscape models near cars are biophilic because they purposely generate safe and sound open-air accessibility for people and other species. In general, biophilic design is coextensive with long-recognized objectives of the specialties and applications of ecological planning and landscape architecture.

CONCLUSIONS

Biophilic Design is further regarding renovating human linkage to natural surroundings than it is just about embracing a brand-new approach for creating our built environment.

Consequently, its achievement will involve a basic turn in social awareness that precedes a different ethos of accountability for compassion and connection with our planet. A biophilic design method can propose significant societal and psychological advantages to citizens and practical and economic benefits to metropolises. To encourage a methodology between Biophilia and urban design, three factors are emphasized: natural features, biological science, and the built environment.

The time is ready for incorporating the Biophilic urban design in Neom smart city in Saudi Arabia. Biophilia can enhance all city settings. The element of the smart city outline is to improve well-being, and Biophilia has demonstrated positive health development. Components of the urban natural environment should be constructed to enrich human life as nature strives to endure. In some Neom locations, Biophilia could be induced by high-tech rather than natural methods. The city can profit from integrating biophilic design due to the strong preference for technical invention and their emphasis on a valuable measurement system.

Although there is little emphasis regarding the biological priorities of sustainability in a typical smart city, including the attributes of contemporary urbanism in smart cities would be necessary. It can be accelerated by implanting a biophilia spirit in the design development. Biophilic design is relevant to humanities on health and well-being. Endocrinology, neurosciences, and many disciplines have scientifically certified the optimistic psychophysiological and intellectual advantages of Biophilia in design.

The partnership among nations is necessary to accelerate information-distributing on the study, strategy update, biophilic development, and smart-invention. In addition, this collaboration will support cities in becoming sustainable and resilient and add to a new economic mechanism to boost technologies, smarter urban structures, and biophilic urban environments.

It is well established that biophilic design's success is more closely linked to conscientious users' practices than to the city or building's smart and intelligent structures. But, of course, with the users' sense of confidence, approval, and satisfaction, it is possible to steer their actions in the desired direction. In this sense, the biophilia hypothesis in urban design and architecture introduces a space where designers must now think carefully.

Finally, biophilic design is not about creating green walls and roofs and water-sensitive urban innovation to the built environment. Instead, it has

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been proved that there are various economic benefits from the projects that adopt the biophilic approach. The application of principles of Biophilia is not dependent on the economic efficiency of the society or the state. It can be applied on the micro-level in a specific building or small residential space. Its scope of application can also be expanded to reach large projects and cities' macro level. Considering its feasibility in multiple aspects, it is suitable for application in various developing or developed countries, encouraging cities to take advantage of this complexity of benefits related to humans, ecosystems, built environment, and economy. The large strategy "14+1 Patterns" offers a pragmatic standard upon which urban designers and projects in the built environment can follow to create healthy places for both humans and living systems.

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