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Integrating Biophilic Design and Sustainability in Contemporary India: A Comprehensive Exploration

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Abstract: *The current trajectory of architectural development is experiencing a transformative paradigm, driven by the convergence of biophilic design and sustainability principles. This research delves into the deliberate incorporation of natural elements, including indoor flora, organic materials, abundant illumination, and expansive outdoor views, which defines the essence of biophilic design. This meticulous integration establishes a symbiotic relationship between individuals and nature, forming the basis for environments designed to foster tranquility and positively impact both physical and mental well-being. Concurrently, sustainable architecture systematically constructs buildings that adhere to a prolonged ecological equilibrium. By employing eco-friendly materials and incorporating energy-efficient technologies, these designs strive to minimize resource depletion and mitigate environmental impact. The resulting amalgamation of architectural expertise, biophilic design, and sustainability surpasses the mere physical presence of structures. It represents an artistic fusion, harmonizing form, function, and significance within the framework of constructed spaces.*

This fusion creates spaces where man-made structures seamlessly blend with the natural surroundings, presenting aesthetically pleasing and functionally superior realms that prioritize occupant well-being while demonstrating an unwavering commitment to environmental stewardship. The resonance of this synthesis echoes in the establishment of harmonious habitats, where the fabric of human-made structures seamlessly intertwines with the intrinsic elements of nature. These aesthetically pleasing and utilitarian spaces not only elevate the human experiential environment but also underscore a steadfast dedication to environmental conservation.

The paper delves into the significance of this synthesis in shaping harmonious habitats that contribute to the well-being of occupants and the sustainable coexistence of architectural structures within the broader ecological context. The amalgamation of architecture, biophilic design, and sustainability creates harmonious habitats prioritizing well-being and environmental stewardship. This synthesis shapes environments fostering human wellness and sustainable coexistence.

Keywords: biophilic design , sustainability, human centric, natural materials and patterns

I. INTRODUCTION

Biophilic design, a foundational principle in contemporary architecture, is imbued with the deliberate intention of integrating To improve general well-being, include natural elements into developed surroundings. This design philosophy is characterized by the incorporation of indoor vegetation, utilization of natural materials, abundant natural light, and strategic vistas of the outdoors. By mimicking natural patterns, textures, and introducing water elements, biophilic design seeks to establish a profound connection between individuals and nature, fostering a sense of tranquility and positively impacting both physical and mental health.

In tandem with biophilic design, sustainable architecture emerges as a pivotal discipline in the construction domain. This methodology is rooted in the meticulous planning and construction of structures that prioritize long-term ecological equilibrium, diminish resource consumption, and minimize environmental impact. Sustainable architecture

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entails the utilization of eco-friendly materials, waste reduction through thoughtful design, and the incorporation of energy-efficient technologies. The main goal is to construct structures that support the built and natural ecosystems coexisting in harmony, meeting the requirements of the present while preserving the capacity of future generations to satisfy their own. The essence of architecture extends beyond mere physical construction, encapsulating the intentional fusion of form, function, and meaning within a built environment. It is an artful amalgamation of functionality, aesthetics, and cultural context, crafting environments that are not only secure but also inspire emotions and cultivate a harmonious relationship between individuals and their surroundings. Architecture, as a profound language, invites human interaction and enrichment through the purposeful arrangement of materials, conveying narratives, ideals, and aspirations.

The synthesis of architecture, biophilic design, and sustainability represents a delicate and intentional endeavor to create constructed habitats that seamlessly blend human-made structures with natural elements. This artistic pursuit involves the incorporation of biophilic features such as natural light, vegetation, and access to the outdoors, prioritizing the well-being of occupants. Simultaneously, energy-efficient designs, eco-friendly materials, and sustainable construction methods are employed to minimize environmental impact. This harmonious integration of ideas culminates in aesthetically pleasing and functional spaces that elevate the human experience while demonstrating a commitment to both personal comfort and environmental conservation.

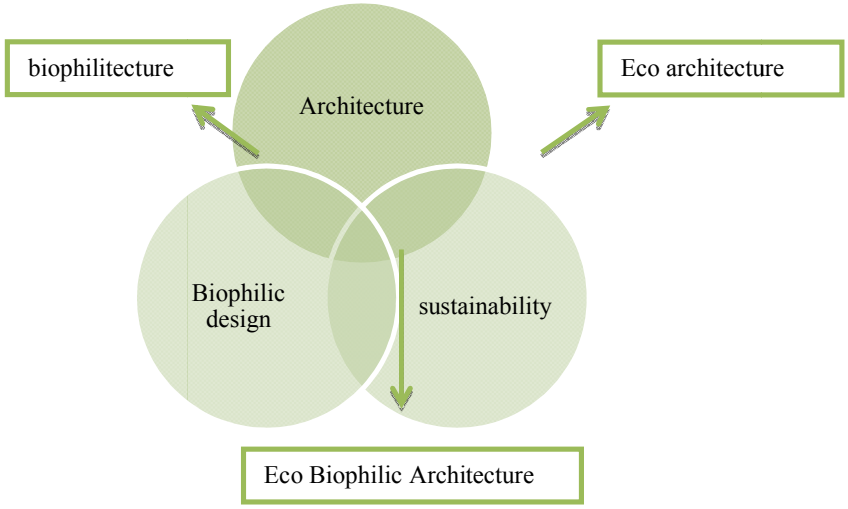

Fig.1: Synergy connection between architecture, biophilic design, sustainability

II. REVIEW OF LITERATURE

Architecture

Architecture in buildings is the amalgamation of artistic expression, engineering precision, and functional design principles. It encompasses the strategic organization of spaces to optimize functionality, considering factors such as user experience, flow, and intended purpose, whether residential, commercial, institutional, or cultural.

Material selection is a critical aspect, with architects carefully choosing materials based on criteria like durability, sustainability, and cost. The aesthetic dimension is equally important, as buildings aim to be visually striking and harmonious. Inspiration can be drawn from historical styles, cultural traditions, and contemporary trends, contributing to a structure's identity.

Cultural and historical context are integral considerations, as buildings often reflect the values and aspirations of a society. Architects may incorporate elements that celebrate local heritage or respond to specific cultural contexts, contributing to a sense of place and identity. In essence, architecture in buildings is a dynamic field that harmonizes functional requirements, spatial organization, materiality, aesthetics, and cultural relevance to create enriching built environments.

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Elements Of Architecture

1. **Form and Shape**
2. Building Orientation
3. Passive Ventilation
4. Sustainable Materials
5. Natural light
6. Green Building
7. Site Design
8. **Aesthetic**
9. Texture and color
10. Thermal Mass

Architectural design encompasses critical elements shaping the built environment. Form and shape influence aesthetics and functionality, while building orientation optimizes energy efficiency aligned with solar and wind patterns. Passive ventilation enhances air quality, relying less on mechanical systems. Sustainable materials minimize ecological impact, and embracing natural light improves energy efficiency. Green building integrates ecological considerations and resource conservation. Site design considers environmental impact and harmony, with aesthetic criteria focusing on visual appeal. Texture and color enrich the sensory experience, and thermal mass regulates internal temperatures. These elements contribute to a holistic and sustainable spatial development approach, addressing aesthetic, functional, and environmental goals with precision.

Biophilic design

Biophilic design is a architectural theme which seeks to enhance human well – being by blending nature into built structure and built environment. Now a days connection of human to natural world and conservation of it has become a huge part. this approach of biophilic design creates a optimism between human and nature.

The aim of biophilic design is to enhance the connection between humans and nature, promote wellness, alleviate stress, and improve productivity in diverse environments. Biophilic design optimizes exposure to natural light for functionality and circadian rhythm stimulation, resulting in improved health. Combining water features, nature-inspired forms and multi-sensory experiences further promotes a holistic and immersive environment.

Elements Of Biophilic design

1. Views of Nature
2. Biomorphic Forms
3. Indoor , outdoor Plants
4. Natural Materials
5. Thermal Comfort
6. Window Views
7. Patterns Inspired by Nature
8. Connection to Nature
9. Natural Textures
10. Human centric

Biophilic design integrates nature-centric elements into architectural and interior spaces to enhance human well-being and establish a tangible connection with the natural environment. It involves strategic placement of windows to optimize nature views, incorporation of biomorphic forms for organic aesthetics, and integration of indoor plants to improve air quality. Natural materials like wood and stone are used for tactile appeal, while thermal comfort and natural light optimization are prioritized. Patterns inspired by nature, such as fractals, are employed for visual appeal and calming effects, fostering a connection with the outdoors. Natural textures heighten sensory experiences, and a human-centric approach ensures designs cater to individual well-being. Ultimately, biophilic design aims to create environments that support physical, mental, and emotional health by seamlessly blending the rejuvenating qualities of nature into our built surroundings.

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Sustainability

Sustainability empitomizes a design ethos which is committed to ecological responsibility and resource efficiency throughout the construction and operational phase of building. Fundamentally, it endeavors to mitigate the environmental impact associated with the built environment, ensuring the fulfillment of present requirements without jeopardizing the capacity of succeeding generations to meet their own needs.

The pursuit of sustainability in architecture encompasses a comprehensive strategy involving energy efficiency through technologies like solar panels and meticulous insulation, conscientious material selection focusing on recycling and minimal carbon footprints, water conservation measures, and strategic site planning that safeguards natural habitats.

Furthermore, sustainable architecture underscores the importance of adaptability, waste minimization, and the creation of indoor environments conducive to well-being. Through the integration of these principles, sustainable architecture not only addresses environmental considerations but also advances the endurance, versatility, and overall welfare of both the constructed environment and its inhabitants.

Elements of Sustainability

1. Energy Efficiency
2. Solar panels
3. Green Roof Systems
4. Low-impact Construction
5. Eco-friendly HVAC Systems
6. Social Sustainability
7. Sustainable Transport
8. Biodiversity Conservation
9. Eco-friendly Technologies
10. Sustainable Urban Planning

Sustainability encompasses energy efficiency, utilizing resources optimally while minimizing waste and environmental impact. Solar panels capture renewable energy from the sun, contributing to clean power generation, while green roof systems enhance insulation and combat urban heat islands by cultivating vegetation atop buildings. Low-impact construction prioritizes eco-conscious materials and practices to minimize environmental disruption. Eco-friendly HVAC systems employ energy-efficient technologies for heating, ventilation, and air conditioning. Social sustainability fosters inclusive community practices, while sustainable transport options reduce carbon emissions. Biodiversity conservation protects diverse ecosystems, and eco-friendly technologies innovate to minimize environmental harm. Sustainable urban planning integrates environmentally conscious design and infrastructure, fostering resilient and livable communities. These elements collectively promote a harmonious balance between human activities and the environment.

Interconnected Synergy: Architecture, Biophilic Design, and Sustainability

Table no.1

NO.	*Architecture*	*Biophilic design*	*Sustainability*
1	Building Orientation	Views of Nature	Energy Efficiency
2	**Form**	Biomorphic Forms	Solar panels
3	Passive Ventilation	Indoor , outdoor Plants	Green Roof Systems
4	Sustainable Materials	Natural Materials	Low-impact Construction
5	Thermal Mass	Thermal Comfort	Eco-friendly HVAC Systems
6	Natural light	Window Views	Social Sustainability
7	Green Building	Patterns Inspired by Nature	Sustainable Transport
8	Site Design	Connection to Nature	Biodiversity Conservation

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9	Texture and color	Natural Textures	Eco-friendly Technologies
10	**Aesthetic**	Blending of nature	Sustainable Urban Planning

Conclusion: The confluence of architecture, biophilic design, and sustainability marks the advent of a promising epoch characterized by integrated synergy that transcends conventional demarcations. This trinity of principles offers a blueprint for the creation of built environments that transcend conventional boundaries, fostering a harmonious coexistence with the natural world. The seamless integration of architectural design with biophilic elements not only enhances the aesthetic appeal of spaces but also establishes a profound connection with nature, promoting individual well-being and ecological balance.

Incorporating sustainability principles into architecture and design promotes responsible construction methods, resource efficiency, and environmental consciousness. This integration enriches our surroundings aesthetically, while also addressing the urgent need for resilient and regenerative spaces. By embracing this approach, we can create functional, aesthetically pleasing environments that contribute to environmental stewardship and human well-being, advancing towards a more sustainable future.

Every architectural element presented in **Table No. 1** demonstrates direct or indirect interconnection with one another. This intricate web of relationships reflects a continuous interdependence among the elements, thereby engendering a profound conceptual synergy. The connections observed underscore the intricate and essential dependencies existing between these architectural components. This mutual reliance serves to cultivate a cohesive and integrated conceptual framework within the field of architecture.

III. CASE STUDY

Case study 1 : The titan integrity plus Bengaluru

Fig. 2 :*The titan integrity plus Bengaluru campus view*

- Architects: Mind space
- Area: 390000 ft²
- Year: 2017
- Type : office building

Biophilic Design Features:

- ***Green Spaces:*** The campus design integrates gardens, courtyards, and rooftop gardens to provide employees with a more comfortable workplace, incorporating elements of nature into the surroundings.
- ***Natural Light:*** Skylights and large windows are strategically utilized to optimize natural light within the office building. The orientation of the building ensures longer sides face North-South, allowing for glare-free natural light and promoting a healthier interior climate. The design also includes a bio lake around which the office building and ancillaries are situated.
- ***Water Features:*** Water elements, such as fountains and ponds, are integrated into the design to induce a calming effect and foster a sense of connectivity with nature. A bio lake is proposed towards the eastern side of the site, creating a picturesque setting surrounded by lush greenery and the soothing sounds of nature.

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- ***Natural Materials:*** The use of natural materials, including wood, stones, and plants, is incorporated into the workspace design and decor, contributing to a more organic and nature-inspired environment.
- ***Living Walls:*** Green walls or vertical plants are installed within the structure to enhance air quality and provide an aesthetically pleasing atmosphere. The building's western wall, colored green, serves the dual purpose of shading usable areas from intense western light and creating a green buffer zone.
- ***Flexible Outdoor Spaces:*** Outdoor workspaces and breakout areas are provided for employees to work or relax in an outdoor setting. Common areas are designed to be open and non-air conditioned, promoting a more natural and refreshing environment.
- ***Views of Nature:*** The building is strategically designed to offer views of surrounding greenery, parks, or other natural elements, ensuring that employees have access to visually pleasing and calming surroundings.
- ***Natural Patterns and Textures:*** Design elements incorporating patterns and textures inspired by nature are employed to create a more organic and calming atmosphere within the workspace.
- ***Air Quality Improvement:*** Systems are implemented to enhance indoor air quality through the use of plants or advanced ventilation systems. The bio lake and green terraces contribute to creating an adequate micro-climate, cooling the hot wind passing over the bio lake.
- ***Form :***organic form of structure is constructed along the bio-lake.

Sustainability measures:

- ***Energy Efficiency:*** Implementation of energy-efficient lighting systems, appliances, and HVAC systems. Integration of renewable energy sources like solar panels and wind turbines. Adoption of a two/three-stage air conditioning system to minimize energy consumption by 30% compared to conventional AC. Utilization of highly energy-efficient HVLS fans, consuming only 20 Watts but providing 200% more air volume than a 60 W domestic ceiling fan. Solar panels strategically placed above the terrace and service yard to generate on-site energy, meeting 25% of the energy requirement.
- ***Green Building Design and Certification:*** The 'Integrity' campus, which is certified as a LEED Platinum building by the US Green Building Council, has a unique organic form with its natural stone-clad architecture.
- ***Sustainable Site Planning:*** Preservation of existing trees and planting 411 new trees. Creation of temporary sedimentation tanks and soil erosion channels on-site. Protection and preservation of high soil fertility during construction.
- ***Water Management:*** 59.45% reduction in building water use through water-efficient low flow fixtures. 62% reduction in landscape water demand using highly efficient drip and sprinkler irrigation systems. Reduction in construction water usage.
- ***Energy Optimization & Occupant Comfort:***60.96% of habitable spaces designed for daylight, meeting National Building Code standards. Inclusion of occupancy sensors in meeting rooms. Digital timer control for 100% of outdoor lighting.
- ***Low Energy Materials:***83.5% of materials for false ceiling, wall paneling, internal partitioning, and in-built furniture are low energy. Use of AAC blocks for construction, containing 68% fly ash by volume.
- ***Resource Management:*** Reprocessing waste storage room for recyclable waste collection. Diversion of over 85.2% of construction waste for recycling. Procurement of materials within a 400-mile radius (33%).Utilization of materials with recycled content (20.48% of total material cost).Use of 2.56% materials from rapidly renewable sources.
- ***Indoor Environment Quality:*** Provision of ventilation rates exceeding ASHRAE standards. Entire building designated as non-smoking. HVAC system designed to meet ASHRAE 62.1-2007 standards. Use of Low VOC paints, adhesives, and composite wood without urea-formaldehyde. Compliance with ASHRAE Standard 55-2004 for mechanically ventilated and conditioned spaces. More than 93% of regularly occupied areas provide views of the exterior.
- ***Landscape:*** Ground-hugging design for a closer connection to nature. Incorporation of a bio lake and green terraces for a micro-climate. Fifty-five percent of the exposed roof area covered with roof gardens, reducing heat gain.

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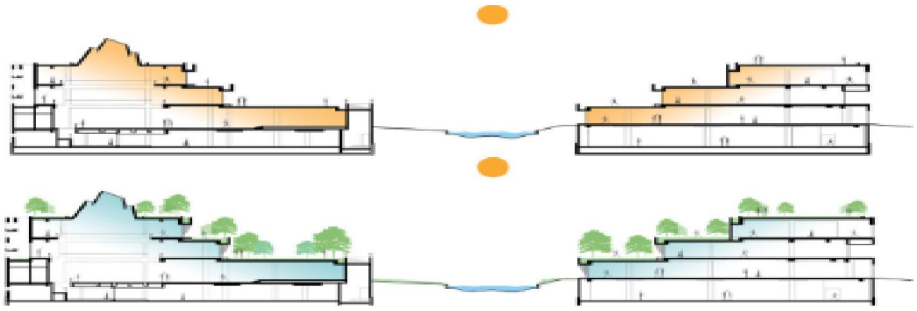

Fig. 3 :*The titan integrity plus Bengaluru campus section*

Case study 2 : CII Sohrabji Godrej Green Business Centre, Hyderabad

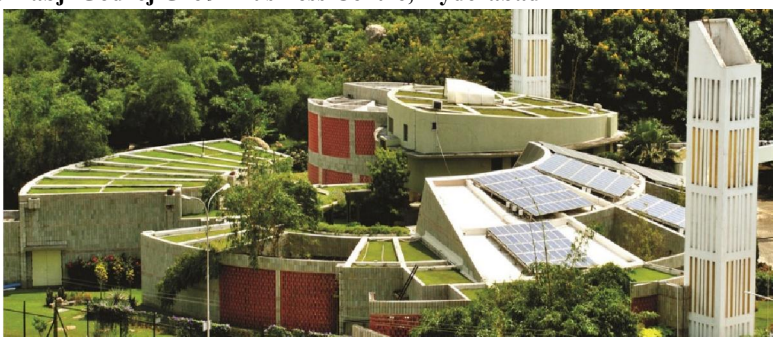

Fig. 4 :CII Sohrabji Godrej Green Business Centre, Hyderabadview

- Architect: Ar. Karan Grover
- Location: Hyderabad
- Site Area: 4.5 acres
- Built-up Area: 1,858.06 m²
- Year: 2004
- Building Types: Corporate office building

Biophilic Design Features:

- **Green Walls and Roofs:** Adding living vegetation to walls and roofs may enhance air quality, act as insulation, and provide an aesthetically pleasing natural setting.
- **Natural Lighting:** Making the most of natural light via well-planned windows, skylights, jalisand open areas lowers the need for artificial lighting and improves inhabitants' well-being in general.
- **Courtyards and Gardens:** Adding indoor courtyards and gardens to a structure or its surrounds gives residents access to the outdoors, which helps them unwind and reduce stress.
- **Use of organic Materials :usage of natural resources as a plywood substitute, such as bagasse, which is the leftover material after sugarcane harvest, compressed into boards. To enhance indoor air quality, low volatile organic compound (VOC) paints and varnishes, adhesives, sealants, and carpets were employed.**
- **outside Spaces**: Creating outside work rooms or recreation areas can provide staff members or guests the chance to spend downtime in nature.
- **Sustainable Landscaping**: Using native plants and eco-friendly landscaping techniques can help maintain the site's ecological sustainability.
- **Form** :Circular Shape Deliberately designed for optimal natural ventilation by directing prevailing winds.

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Fig. 5 :CII Sohrabji Godrej Green Business Centre, Hyderabadview

Sustainability measures:

- **Green Building Design and Certification:** This work of architecture has established the standard for passive architectural design worldwide. When it opened, the CII-Sohrabji Godrej Green Business Center (GBC) was the first structure outside of the US to get a LEED platinum certification. The building recycles everything within and doesn't release any garbage. One may say that solely recycled materials are used in construction.
- **Renewable Energy Integration** The center vigorously advocates for the utilization of renewable energy resources, including geothermal, wind, and solar power. Their integration of solar panels, wind turbines, and geothermal systems exemplifies the ability of buildings to produce renewable energy on their own.
- **Energy Efficiency Practices**: An essential element of green design is energy efficiency. In order to use less energy, the center places a strong emphasis on efficient insulation, heating, cooling, and making the most of natural lighting.
- **Water Conservation**: Sustainable development depends on water conservation. The center seeks to reduce water use, protect this limited resource, and encourage environmental consciousness. Since that water and energy consumption are interdependent, their actions also have a direct influence on energy conservation.
- **Biodiversity and Green Spaces**: It's likely that the CII-Sohrabji Godrej Green Business Centre's architecture makes use of natural vegetation, green areas, and biodiversity-friendly elements. These green areas promote general wellbeing, a healthier atmosphere, and better air quality.

Fig. 6 :CII Sohrabji Godrej Green Business Centre, Hyderabad biophilicfeature (jali)

A comparative analysis of the case studies is conducted based on both shared and distinct biophilic and sustainable features.

Outlining shared Biophilic Features:

Table no. 2

No.	*Biophilic Features*	*Titan Integrity Campus*	*CII Sohrabji Godrej Green Business Centre*
1	Indoor Plants	lush green atriums with indoor plants strewn all around the work environment	Potted plants and green walls in public places and work spaces

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2	Natural Light	To achieve maximum efficiency in natural light, use large windows, skylights, light wells, and open floor designs.	Day lighting strategies, ample windows with shading devices to control glare
3	Outdoor Spaces	Landscaped courtyards, gardens, and green spaces for relaxation and meetings	Rooftop gardens, outdoor seating areas, and landscaped terraces
4	Water Features	Reflecting pools, fountains, and rainwater harvesting systems	Water bodies integrated with landscaping, rainwater harvesting for irrigation
5	Biophilic Art	Nature-inspired artwork, murals, and sculptures throughout the campus	Art installations depicting natural scenes, green-themed artwork
6	Natural Materials	Wood finishes, stone elements, and earthy textures in interior design	Use of sustainable materials like bamboo, reclaimed wood, and natural stone
7	Views of Nature	Offices and meeting spaces designed to offer views of surrounding greenery	Floor-to-ceiling windows providing views of landscaped areas and greenery
8	Bioclimatic Design	Passive ventilation systems, shading devices, and green roofs for thermal comfort	Energy-efficient design with passive cooling strategies and green building technologies

Outlining distinct Biophilic Features:

Table no. 3

No.	***Biophilic Features***	***Titan Integrity Campus***	***CII Sohrabji Godrej Green Business Centre***
1	*Vertical Gardens*	Incorporates vertical gardens on exterior and interior walls	Doesn't feature extensive use of vertical gardens but focuses on green walls
2	*Biodiversity Conservation*	Emphasizes on-site biodiversity conservation initiatives	Less emphasis on on-site biodiversity conservation, focuses more on sustainable building practices
3	*Water Recycling Systems*	Features advanced water recycling systems for onsite use	Focuses more on rainwater harvesting for irrigation rather than extensive water recycling
4	*Wildlife Habitats*	Design includes specific habitats for local wildlife	Doesn't have dedicated habitats but integrates landscaping to support local biodiversity
5	*Interactive Nature Trails*	Offers interactive nature trails for employees and visitors	Doesn't have designated nature trails but provides outdoor spaces for relaxation and contemplation
6	*Bird-Friendly Design*	Incorporates bird-friendly design elements and features	Doesn't specifically highlight bird-friendly design but may integrate bird-friendly landscaping

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Outlining shared sustainable measures :

Table no. 4

No.	*sustainable measures*	*Titan Integrity Campus*	*CII Sohrabji Godrej Green Business Centre*
1	*Green Building Certification*	LEED Platinum	LEED Platinum
2	*Energy Efficiency*	High-efficiency lighting and HVAC systems, Use of natural day lighting strategies.	Energy-efficient lighting and HVAC systems, Integration of renewable energy sources
3	*Water Conservation*	Rainwater harvesting systems, Grey water recycling systems, Low-flow plumbing fixtures.	Rainwater harvesting systems ,Grey water recycling systems, Low-flow plumbing fixtures.
4	*Sustainable Materials*	Use of locally sourced and recycled materials, Incorporation of rapidly renewable materials, Low VOC (volatile organic compound) paints.	Use of sustainable and eco-friendly materials, Minimization of construction waste.
5	*Green Roof/Garden*	Rooftop gardens for insulation and biodiversity, Helps reduce urban heat island effect	Rooftop gardens for insulation and biodiversity, Contributes to air quality improvement.
6	*Waste Management*	Comprehensive waste segregation and recycling, Composting of organic waste, Reduction of single-use plastics.	Comprehensive waste segregation and recycling, Composting of organic waste, Reduction of single-use plastics.
7	*Transportation*	Encouragement of carpooling and use of public transport, Electric vehicle charging stations	Provision of bicycle racks and shower facilities for cyclists, Encouragement of eco-friendly commuting

Outlining distinct sustainable measures :

Table no. 5

No.	**Sustainable measures**	**Titan Integrity Campus**	**CII Sohrabji Godrej Green Business Centre**
1	Solar Power Generation	On-site solar panels for renewable energy, Solar water heating systems, Solar-powered outdoor lighting,	Extensive rooftop solar power generation, Solar-powered street lighting.
2	Green Building Design	Passive solar design for natural heating/cooling, Integration of green spaces within buildings, Building orientation for optimal sunlight exposure.	Bioclimatic architecture for energy efficiency, Use of sustainable building materials, Low-E glass windows for insulation.
3	Water Management	Innovative water-efficient	Advanced water recycling and

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	System	landscaping, Stormwater management systems, Use of drip irrigation for landscaping.	treatment, Wastewater treatment for reuse, Dual plumbing systems for greywater reuse.
4	Biodiversity Conservation	Preservation of existing green spaces, Creation of wildlife habitats within the campus, Implementation of bird-friendly building design.	Native plant landscaping for biodiversity, Butterfly gardens and bird nesting sites, Butterfly-friendly landscaping.

IV. CONCLUSION

The synergy between *biophilic design and sustainability* is a transformative force in contemporary architecture, yielding designs that prioritize human well-being while championing environmental conservation. In parallel, sustainability principles provide a robust framework for realizing the goals of biophilic design while simultaneously ensuring responsible stewardship of natural resources. This approach encourages the deliberate incorporation of indoor flora, organic materials, and abundant natural light, creating spaces that not only enhance human health and well-being but also cultivate an awareness of ecological interconnectedness.

4.1 Strong matches (Solutions) between these

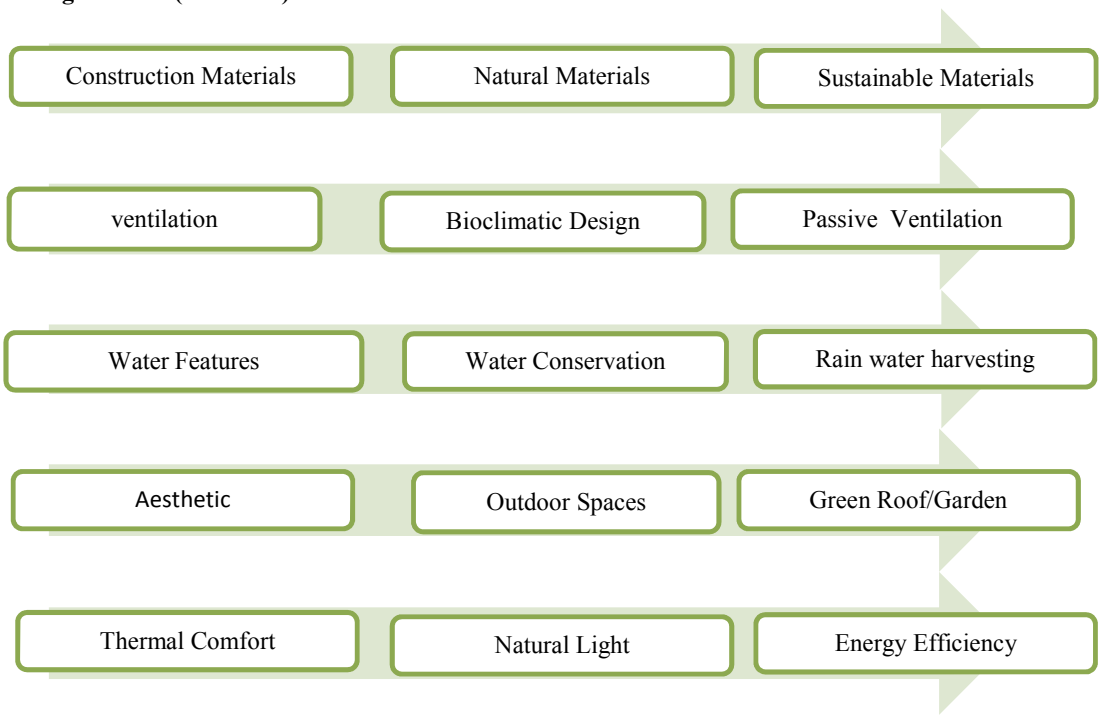

Fig. 7 :conclusion (Strong matches)

By advocating for eco-friendly materials, energy-efficient technologies, and mindful resource consumption, sustainable architecture reinforces the ethos of biophilic design by facilitating the harmonious coexistence of human-made structures and the natural environment. This symbiotic relationship between biophilic design and sustainability not only results in human-centric designs that seamlessly blend with nature but also contributes to the preservation of ecosystems, ultimately paving the way for a more sustainable and resilient built environment. biophilic design connects human with nature and sustainable design save nature and future for human responsive design.

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REFERENCES

[1]. https://archestudy.com/titan-integrity-campus-bangalore/
[2]. https://www.archdaily.com/908221/titan-integrity-campus-mindspace
[3]. https://www.re-thinkingthefuture.com/case-studies/a4417-cii-sohrabji-godrej-green-business-centre-by-karan-grover-and-associates-first-leed-platinum-certified-building-in-india/
[4]. https://archestudy.com/when-architecture-meets-technology-cii-sohrabji-godrej-green-business-centre-hyderabad/
[5]. Ar. Manjiri Patil- Mohabansi, Prof. Jasmine Kohli, Ar. Ankit Mohabansi, "Application of Biophilic Design in Architecture,"www.irjet.net(International Research Journal of Engineering and Technology (IRJET)),Volume: 10 Issue: 05 | May 2023.
[6]. Sahar Ismail Mohamed Abdel Hady, Activating biophilic design patterns as a sustainable landscape approach, Hady Journal of Engineering and Applied Science (2021) 68:46.

APPENDICES

Appendix A :data collection
Appendix B :data Analysis
Fig. 1Synergy connection between architecture, biophilic design ,sustainability
Appendix C :literature review / Experiment details
Table no. 1: Interconnected Synergy: Architecture, Biophilic Design, and Sustainability
Appendix D :Case study
Case study 1 : The titan integrity plus Bengaluru
Fig. 2 :The titan integrity plus Bengaluru campus view
Fig. 3 :The titan integrity plus Bengaluru campus section
Case study 2 :CII Sohrabji Godrej Green Business Centre, Hyderabad
Fig. 4 :CII Sohrabji Godrej Green Business Centre, Hyderabadview
Fig. 5 :CII Sohrabji Godrej Green Business Centre, Hyderabadview
Fig. 6 :CII Sohrabji Godrej Green Business Centre, Hyderabad biophilicfeature (jali)
Appendix E :Case study (data table) A comparative analysis of the case studies is conducted based on both shared and distinct biophilic and sustainable features.
Table no. 2 :Outlining shared Biophilic Features
Table no. 3 : Outlining distinct Biophilic Features
Table no. 4:Outlining shared sustainable measures
Table no. 5: Outlining distinct sustainable measures
Appendix F :Output and results
Fig. 7 :Conclusion (Strong matches)