

Indian Traditional Knowledge and Its Integration with Modern Time Architecture

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Abstract:

Indian traditional knowledge, with its rich history and deep cultural roots, offers a wealth of wisdom that spans architecture, urban planning, sustainability, and design. The integration of traditional Indian architectural principles with modern architectural practices presents a unique opportunity to create sustainable, culturally sensitive, and contextually relevant buildings and urban spaces. Indian traditional architecture emphasizes harmony with nature, the use of local materials, efficient ventilation, daylight optimization, and intricate designs that reflect cultural values and beliefs. Vastu Shastra, the ancient science of architecture, plays a significant role in this context, promoting balance and energy flow within spaces. Additionally, regional architecture styles, such as those from Rajasthan, Kerala, and Bengal, showcase how local climate, geography, and culture shape construction methods and spatial organization.

Modern architecture, driven by technological advancements, seeks to address the needs of urbanization, population growth, and environmental concerns. However, the rapid development often overlooks the importance of sustainable design and cultural identity. By blending traditional knowledge with modern technology, architects can create more holistic designs that not only meet the demands of contemporary society but also foster a deeper connection with the environment and community. This integration involves adopting principles such as passive cooling, water conservation, and the use of renewable materials while embracing digital tools for precise design and construction techniques.

This paper explores the intersection of Indian traditional knowledge and modern architecture, highlighting case studies where this integration has been successfully achieved. It examines how elements of traditional architecture can enhance modern designs, offering a balanced approach to sustainability, aesthetics, and functionality in the 21st century. By reflecting on the potential for collaboration between the two realms, the paper seeks to offer a vision for future architecture that is both forward-thinking and grounded in India's rich architectural heritage.

Résumé :

Le savoir traditionnel indien, avec sa riche histoire et ses profondes racines culturelles, offre une mine de sagesse qui englobe l'architecture, l'urbanisme, la durabilité et le design. L'intégration des principes

architecturaux traditionnels indiens avec les pratiques architecturales modernes présente une opportunité unique de créer des bâtiments et des espaces urbains durables, culturellement sensibles et contextuellement pertinents. L'architecture traditionnelle indienne met l'accent sur l'harmonie avec la nature, l'utilisation de matériaux locaux, une ventilation efficace, l'optimisation de la lumière naturelle et des conceptions complexes qui reflètent les valeurs et croyances culturelles. Le Vastu Shastra, la science ancienne de l'architecture, joue un rôle important dans ce contexte, favorisant l'équilibre et la circulation de l'énergie au sein des espaces. De plus, les styles architecturaux régionaux, tels que ceux du Rajasthan, du Kerala et du Bengale, montrent comment le climat local, la géographie et la culture influencent les méthodes de construction et l'organisation spatiale.

L'architecture moderne, guidée par les avancées technologiques, cherche à répondre aux besoins de l'urbanisation, de la croissance démographique et des préoccupations environnementales. Cependant, le développement rapide néglige souvent l'importance du design durable et de l'identité culturelle. En combinant les connaissances traditionnelles avec la technologie moderne, les architectes peuvent créer des conceptions plus holistiques qui non seulement répondent aux exigences de la société contemporaine, mais favorisent également une connexion plus profonde avec l'environnement et la communauté. Cette intégration implique l'adoption de principes tels que le refroidissement passif, la conservation de l'eau et l'utilisation de matériaux renouvelables tout en embrassant les outils numériques pour des conceptions et techniques de construction précises.

Ce document explore l'intersection du savoir traditionnel indien et de l'architecture moderne, mettant en lumière des études de cas où cette intégration a été réalisée avec succès. Il examine comment les éléments de l'architecture traditionnelle peuvent améliorer les conceptions modernes, offrant une approche équilibrée de la durabilité, de l'esthétique et de la fonctionnalité au XXIe siècle. En réfléchissant sur le potentiel de collaboration entre ces deux domaines, le document cherche à offrir une vision pour une architecture future à la fois avant-gardiste et enracinée dans le riche patrimoine architectural de l'Inde.

Introduction

Architecture serves as a reflection of cultural ethos, historical progress, and societal aspirations. In India, traditional knowledge in architecture has evolved over centuries, deeply rooted in the principles of sustainability, functionality, and harmony with nature. This body of knowledge, often encapsulated in texts like *Vastu Shastra* and *Shilpa Shastra*, provides a wealth of insights into building techniques, spatial design, and urban planning. Indian traditional architecture exemplifies the seamless integration of form, function, and spirituality, as seen in timeless structures like temples, stepwells, forts, and ancient urban layouts.

In the contemporary era, modern architecture is often characterized by its emphasis on technology, efficiency, and aesthetics. However, challenges such as climate change, resource depletion, and loss of cultural identity have spurred a re-evaluation of traditional practices. Indian traditional knowledge offers solutions that are not only environmentally sustainable but also culturally resonant. The courtyards for natural ventilation, water harvesting systems in stepwells, and the use of local materials in ancient structures hold valuable lessons for addressing modern architectural challenges.

The objective of this research is to explore the synergies between Indian traditional knowledge and modern architectural practices. It seeks to identify how ancient principles can be integrated with contemporary techniques to create designs that are sustainable, functional, and culturally meaningful. By bridging the gap between tradition and modernity, this study aims to contribute to a holistic architectural approach that honors the past while addressing the demands of the future.

Historical Context of Indian Traditional Knowledge in Architecture

India's architectural heritage is a testament to its advanced traditional knowledge systems, deeply interwoven with the cultural, spiritual, and environmental ethos of its time. Ancient Indian architecture not only showcased exceptional craftsmanship but also embodied principles of sustainability, functionality, and harmony with nature. This legacy is evident in the architectural marvels that have withstood the test of time, inspiring modern practices while preserving cultural identity.

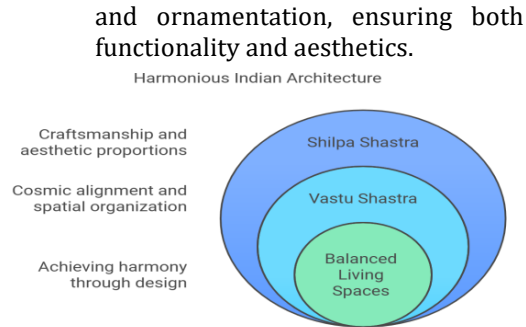
Architectural Marvels of Ancient India

- **Mohenjo-Daro and the Indus Valley Civilization:** One of the earliest examples of urban planning, Mohenjo-Daro reflects the advanced engineering skills of the Indus Valley Civilization. Features such as standardized brick sizes, a sophisticated drainage system, and public baths highlight an emphasis on hygiene, functionality, and community living.
- **Temples: The Brihadeeswarar Temple:** Built during the Chola dynasty, the Brihadeeswarar Temple in Tamil Nadu is a masterpiece of Dravidian architecture. Its towering *vimana* (temple tower), intricate carvings, and alignment with celestial bodies reveal the deep integration of geometry, astronomy, and artistry in traditional Indian architecture.
- **Forts and Palaces:** Forts like the Mehrangarh Fort in Jodhpur and palaces such as Jaipur's City Palace showcase the strategic brilliance and aesthetic sophistication of Indian architecture. These structures were designed to optimize defense while incorporating elements of beauty, symmetry, and comfort.
- **Havelis and Stepwells:** Traditional havelis in Rajasthan and Gujarat exemplify climate-responsive architecture, using courtyards, thick walls, and jharokhas (overhanging enclosed balconies) to combat extreme temperatures. Similarly, stepwells like Rani Ki Vav in Patan demonstrate ingenuity in water management combined with ornamental beauty.

Philosophies of Vastu Shastra and Shilpa Shastra

Indian traditional architecture was guided by ancient texts such as *Vastu Shastra* and *Shilpa Shastra*, which codified principles of design and construction.

- **Vastu Shastra** emphasized the alignment of structures with natural elements and cosmic energy to ensure balance and well-being. It provided guidelines for site selection, spatial organization, and the orientation of buildings.
- **Shilpa Shastra** detailed the craftsmanship and sculptural techniques that defined Indian architecture. It laid out precise rules for proportions, material selection,



These philosophies ensured that buildings were not only utilitarian but also aligned with the spiritual and environmental principles of their time.

Role of Nature, Geometry, and Symbolism

Nature played a central role in Indian traditional architecture. Buildings were often designed to harmonize with the surrounding environment, incorporating features such as courtyards for ventilation, water bodies for cooling, and gardens for aesthetics.

- **Geometry:** Mathematical precision was a hallmark of traditional architecture. Proportions derived from sacred geometry were used to achieve symmetry and harmony. For instance, the layout of temples often followed the *mandala*, a geometric blueprint symbolizing the universe.
- **Symbolism:** Architectural elements were imbued with spiritual and cultural significance. Temples represented the cosmic axis, while carvings and motifs depicted mythological themes and natural elements, creating a profound connection between the built environment and human consciousness.

This historical context underscores the richness of Indian traditional knowledge in architecture, offering lessons in sustainability, resilience, and cultural continuity that remain relevant to modern architectural challenges.

Core Principles of Indian Traditional Knowledge

Indian traditional knowledge in architecture is a repository of principles that reflect a deep understanding of ecology, culture, and human needs. These core principles not only made traditional structures enduring and functional but also ensured they harmonized with their environment and societal context.

Sustainability:

Sustainability was an intrinsic aspect of traditional Indian architecture, evident in the materials and methods used.

- **Use of Local Materials:** Buildings were constructed with materials readily available in the region, such as sandstone in Rajasthan, wood in Kerala, and terracotta in Bengal. This reduced the ecological footprint and ensured the structures were well-suited to local climatic conditions.
- **Passive Cooling Systems:** Structures like stepwells (e.g., Rani Ki Vav) and courtyard homes used natural cooling mechanisms, relying on airflow, water bodies, and shaded areas to maintain a comfortable indoor environment without external energy sources.

Harmony with Nature

Indian traditional architecture emphasized a symbiotic relationship with the environment.

- **Natural Ventilation and Sunlight:** Designs incorporated features like jaalis (perforated screens), open courtyards, and strategically placed windows to ensure adequate airflow and natural lighting, minimizing energy dependency.
- **Landscape Integration:** Gardens and water features were integral to traditional layouts, as seen in Mughal gardens, which combined aesthetics with functionality to manage temperature and enhance the quality of living spaces.

Social and Cultural Integration

Buildings were designed to facilitate community life and cultural practices.

- **Community Spaces:** Structures like stepwells, public squares, and temple courtyards served as hubs for social interaction, festivals, and gatherings, fostering a sense of community.
- **Ritualistic and Functional Designs:** Temples and public buildings were constructed to accommodate both spiritual rituals and practical needs. The mandapa (pillared halls) in temples, for instance, served as spaces for congregational activities.

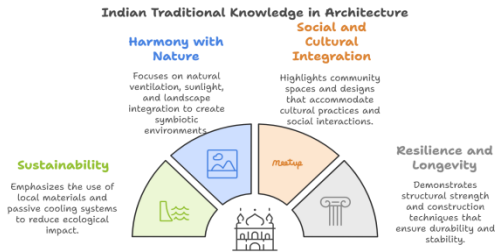
Resilience and Longevity

Durability was a hallmark of traditional Indian architecture, with many ancient structures still standing today.

- **Structural Strength:** Monuments like the Sanchi Stupa and Iron Pillar of Delhi exemplify engineering excellence. The

use of load-bearing techniques and dome structures enhanced stability and longevity.

- Construction Techniques: Lime mortar, interlocking stones, and precise measurements ensured robustness, enabling these structures to withstand natural and man-made adversities.



Aspects of Modern Architecture

Modern architecture has emerged as a response to the rapid technological advancements, urbanization, and globalization of the 20th and 21st centuries. It is characterized by innovation, efficiency, and adaptability.

Characteristics of Modern Architecture

- Innovation and Technology: The use of advanced materials like reinforced concrete, glass, and steel, along with technologies such as 3D printing and AI-assisted design, has revolutionized architectural possibilities.
- Globalization: Modern architecture reflects global influences, often blending styles and techniques from different regions to create unique designs.

Key Challenges in Modern Urban Designs

Despite its achievements, modern architecture faces significant challenges:

- Sustainability: The dependence on energy-intensive materials and the environmental impact of urban sprawl necessitates more eco-friendly approaches.
- Resource Efficiency: Modern urban designs must address the scarcity of land, water, and energy while accommodating growing populations.
- Cultural Identity: The rise of uniform, globalized designs often lead to a loss of regional and cultural distinctiveness.

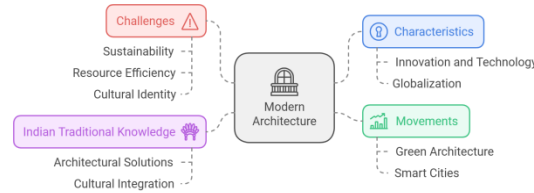
Popular Movements in Modern Architecture

- Green Architecture: A movement focusing on sustainable materials, energy-efficient systems, and eco-

friendly designs. Examples include solar-powered buildings and vertical gardens.

- Smart Cities: Urban planning initiatives that integrate technology, sustainability, and efficient resource management to create livable and resilient cities.

The intersection of these modern challenges and movements with Indian traditional knowledge offers an opportunity to create architectural solutions that are both innovative and deeply rooted in cultural and ecological wisdom.



Points of Convergence: Indian Traditional Knowledge and Modern Architecture

The integration of Indian traditional knowledge (ITK) with modern architecture offers innovative solutions to contemporary challenges while preserving cultural heritage. By aligning sustainable practices, design efficiency, cultural revivalism, and technological advancements, this convergence paves the way for architecture that is both forward-thinking and deeply rooted in traditional wisdom.

Sustainable Practices

- Revival of Mud and Brick Construction: Modern eco-homes increasingly use materials like compressed earth blocks and locally sourced clay, echoing ancient techniques. These materials are cost-effective, thermally efficient, and environmentally sustainable, making them ideal for green architecture.
- Ancient Water Management Systems in Urban Planning: Traditional water systems such as stepwells, tanks, and canals are inspiring modern urban water management. Techniques like rainwater harvesting, which were integral to ancient Indian settlements, are being adapted for contemporary urban layouts to address water scarcity and manage resources sustainably.

Design Efficiency

- Courtyard Concepts in Modern Housing: The use of central courtyards, a hallmark of traditional Indian homes, is being revived in modern housing designs to

enhance natural ventilation and cooling. Courtyards reduce energy dependence by creating airflow patterns that regulate indoor temperatures naturally.

- **Natural Light and Airflow in Green Buildings:** Inspired by features like jaalis (perforated screens) and open layouts, modern green buildings incorporate design elements that maximize the use of daylight and encourage airflow. This not only reduces electricity consumption but also creates healthier living spaces.

Cultural Revivalism

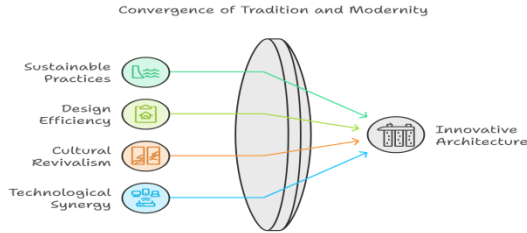
- **Incorporation of Traditional Motifs and Aesthetics:** Modern architecture often draws upon Indian traditional motifs, patterns, and symbols to create culturally resonant designs. Whether in luxury hotels or contemporary public spaces, these elements evoke a sense of place and identity.
- **Revival of Regional Architectural Styles:** The adaptation of vernacular styles in urban and commercial architecture is gaining momentum. For example, resorts and boutique hotels increasingly integrate regional aesthetics such as the earthy tones of Rajasthan’s desert architecture or the wooden structures of Kerala, blending cultural heritage with modern amenities.

Technological Synergy

- **Digitization of Architectural Texts:** Ancient texts like Vastu Shastra are being digitized and studied using modern technology, enabling architects to reinterpret traditional principles for contemporary use. This process ensures the preservation and accessibility of this knowledge.
- **3D Modeling for Heritage Structures:** Advanced technologies like 3D modeling and Building Information Modeling (BIM) are used to analyze, restore, and adapt heritage structures for modern purposes. For instance, ancient forts and palaces are being repurposed as hotels and museums, maintaining their historical essence while serving modern functions.

The convergence of ITK and modern architecture demonstrates that innovation need not come at the cost of tradition. By incorporating the time-tested principles of traditional Indian architecture into contemporary designs, we can address global

challenges like sustainability, urbanization, and cultural homogenization while celebrating India's rich architectural heritage.



Case Studies

The application of Indian traditional knowledge in modern architecture has led to innovative designs that are both functional and culturally significant. These case studies exemplify how ITK principles are adapted to contemporary contexts, ensuring sustainability, aesthetic value, and user comfort.

1. Jaipur’s Modern Heritage Hotels

Jaipur’s heritage hotels, such as the Rambagh Palace and Samode Haveli, showcase a seamless integration of traditional aesthetics with modern amenities.

- **Design Integration:** These structures preserve the grandeur of Rajasthani architecture, characterized by intricate jaalis, frescoed walls, and expansive courtyards. The preservation of arches, domes, and chhatris (elevated pavilions) ensures a cultural continuity that resonates with local traditions.
- **Modern Adaptations:** To meet contemporary standards, these hotels incorporate modern amenities such as climate control, advanced plumbing systems, and luxury interiors without compromising their historical essence. For instance, courtyards are repurposed as open dining areas, while baoris (stepwells) serve as pools or decorative features.
- **Sustainability:** Many heritage hotels employ eco-friendly practices, including rainwater harvesting and the use of solar energy, reflecting the sustainable ethos of traditional Rajasthani architecture.



2. Indian Institute of Management (IIM) Bangalore

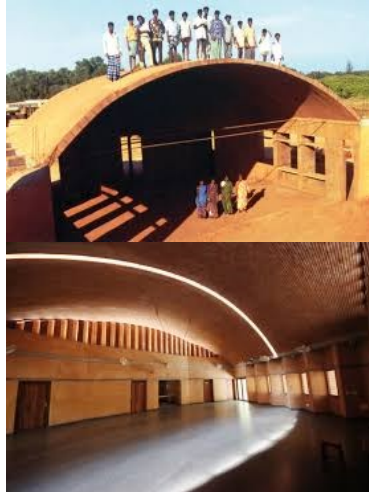
Designed by Pritzker Prize-winning architect B.V. Doshi, IIM Bangalore is a landmark example of blending ITK with modernism.

- **Traditional Elements:** The campus design draws inspiration from traditional Indian stepwells and courtyards, creating spaces that encourage interaction and movement. The use of stone in construction aligns with the local context and climatic conditions, ensuring durability and natural cooling.
- **Spatial Design:** The open corridors, large courtyards, and interconnected pathways mimic traditional Indian towns, fostering a sense of community and collaboration. These elements also facilitate natural ventilation and light, reducing dependence on artificial energy sources.
- **Modern Functionality:** Despite its traditional influences, the campus incorporates state-of-the-art facilities, creating a functional and sustainable educational environment.

3. Auroville Earth Institute

Located in Tamil Nadu, the Auroville Earth Institute is a global leader in sustainable architecture inspired by traditional Indian building practices.

- **Sustainable Practices:** The institute uses compressed stabilized earth blocks (CSEB), a modern adaptation of traditional mud bricks. This method is cost-effective, environmentally friendly, and highly durable.
- **Community-Centric Design:** Projects by the institute often incorporate courtyards, open spaces, and water features, reflecting ITK's emphasis on harmony with nature and communal living.
- **Knowledge Revival:** The institute conducts workshops and research to promote the use of traditional techniques in contemporary architecture, ensuring that these practices are adapted to modern needs without losing their essence.
- **Global Impact:** Beyond India, the institute has influenced sustainable architectural practices worldwide, demonstrating the scalability and adaptability of ITK principles.



These case studies highlight the potential of ITK to enrich modern architectural practices. By combining traditional wisdom with contemporary technology, they provide a model for designing spaces that are sustainable, culturally meaningful, and attuned to human needs.

Challenges in Integration

Despite the evident benefits of integrating Indian traditional knowledge (ITK) with modern architecture, several challenges hinder seamless implementation. These barriers arise from the complexities of balancing traditional principles with contemporary demands, economic constraints, and the rapid urbanization of modern cities.

Balancing Tradition with Modern Functionality

- **Design Conflicts:** Traditional designs often prioritize aesthetic and cultural elements that may not align with the functional requirements of modern buildings, such as high-rise structures and compact urban layouts.
- **User Expectations:** Modern users demand conveniences like advanced HVAC systems and cutting-edge technology, which can be challenging to incorporate into traditional frameworks without diluting their essence.

Addressing the Economic Feasibility of Traditional Techniques

- **Cost Concerns:** While ITK emphasizes sustainable and local materials, the expertise required to implement traditional techniques, such as stone masonry or lime plastering, can increase costs in the short term.

- Skilled Labor Shortage: Craftsmen skilled in traditional methods are dwindling, leading to higher costs and reduced accessibility.

Adapting ITK to Modern Urban Landscapes

- Space Constraints: Urban areas often lack the space to implement traditional elements like courtyards and water bodies, which are integral to ITK.
- Regulatory Challenges: Modern building codes and regulations may not always accommodate traditional designs, creating hurdles for architects and developers.
- Cultural Dilution: The homogenization of urban designs under globalization risks sidelining the unique features of ITK, leading to a loss of cultural identity.

Future Prospects

Overcoming these challenges requires a proactive approach that blends research, education, policy-making, and interdisciplinary collaboration. By fostering an environment conducive to innovation and cultural revival, ITK can find its rightful place in modern architectural practices.

Role of Research and Education in Reviving ITK

- Academic Programs: Introducing courses on ITK in architecture and design schools can help future architects understand and adapt traditional principles.
- Documentation and Preservation: Research initiatives should focus on documenting traditional techniques and their scientific basis, ensuring they are preserved for future generations.
- Technological Integration: Research on integrating ITK with technologies like AI and BIM (Building Information Modeling) can make traditional practices more adaptable to contemporary needs.

Policy Interventions for Promoting Traditional Knowledge in Urban Planning

- Incentives for Traditional Practices: Governments can provide subsidies or tax benefits for projects that incorporate ITK principles, encouraging developers to adopt sustainable and culturally aligned practices.
- Guidelines and Standards: Updating building codes to include ITK-friendly regulations can streamline its integration into urban landscapes.

- Public Awareness Campaigns: Highlighting the benefits of ITK through public projects and awareness campaigns can foster community support for such initiatives.

Encouraging Collaborations Between Architects, Historians, and Technologists

- Interdisciplinary Projects: Collaborative efforts among architects, historians, and technologists can yield innovative solutions that combine traditional aesthetics with modern functionality.
- Skill Development Programs: Training programs for craftsmen and architects can bridge the gap between traditional techniques and contemporary applications.
- Global Partnerships: Collaborating with international organizations can showcase ITK's relevance and scalability, inspiring global architectural movements.

By addressing these challenges and embracing forward-looking strategies, ITK can significantly contribute to modern architecture, fostering designs that are sustainable, culturally rich, and innovative. This integration has the potential to redefine contemporary architectural paradigms, creating spaces that honor the past while building a sustainable future.

Conclusion

The integration of Indian traditional knowledge (ITK) with modern architecture offers a unique opportunity to address some of the most pressing challenges in contemporary design. From sustainability to cultural preservation and innovation, ITK provides time-tested solutions that are both environmentally responsible and deeply rooted in India's rich cultural heritage. By incorporating traditional materials, building techniques, and design philosophies, modern architecture can move towards more sustainable, efficient, and contextually relevant practices.

Sustainability, a key principle of ITK, can significantly influence contemporary urban design by promoting the use of local materials, passive cooling systems, and water management techniques. These practices not only reduce environmental impact but also offer economically feasible solutions to the modern world's resource challenges. The revival of traditional systems such as rainwater harvesting and earth-based

construction methods demonstrates how ancient wisdom can contribute to addressing global issues like climate change and urbanization.

Cultural preservation is another critical aspect that ITK brings to modern architecture. By incorporating traditional motifs, regional styles, and indigenous building practices, contemporary designs can foster a sense of identity and continuity. This cultural revival helps to counterbalance the growing trend of globalized, homogeneous architecture, ensuring that new buildings reflect the history, values, and aspirations of the communities they serve.

Moreover, the potential for innovation lies in the fusion of traditional knowledge with modern technological advancements. Digital tools such as 3D modeling and AI-assisted design allow architects to reimagine ancient techniques and adapt them for future use. Through this synergy, ITK can guide the creation of spaces that are not only functional and aesthetically appealing but also deeply connected to the environment and local context.

In conclusion, the integration of Indian traditional knowledge with modern architectural practices offers a harmonious and holistic approach to contemporary challenges. It encourages designs that are sustainable, culturally enriched, and innovative, ultimately fostering built environments that reflect the wisdom of the past while embracing the possibilities of the future. Through this convergence, architecture can evolve in a way that respects and revitalizes its heritage while addressing the needs and aspirations of the modern world.

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