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Traditional Architecture: Indigenous Pathway to Climate Resilience

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Abstract

Climate change has become a significant global concern of the modern era. It has contributed significantly to the loss of ecology and biodiversity across the globe. The search for combat measures has led to the revival of Traditional Ecological Knowledge (TEK) in the pockets of the world. TEK has garnered greater attention across the globe as a sustainable tool that aids climate resilience efforts. Though India possesses a rich repository of indigenous knowledge associated to nature, environment and ecology, is significantly impacted by rising global temperature harming and obstructing the everyday life of citizens. This paper attempts to analyse the sustainable features embedded in the TEK of India with respect to its indigenous architecture and bring to light its various sustainable elements.

Through secondary literature review and largely theoretical study, this paper highlights the rich indigenous knowledge systems in Indian vernacular architecture and highlights the prevalence of sustainable elements embedded in the system by by analysing ancient texts such as the Shilpasastra, Vastusastra and various ancient construction over centuries and across empires. This paper argues that Indian vernacular architecture embodies the adaptive sustainable principles that continue to be relevant in the national efforts to combat climate change. Through practical policy recommendation, it attempts to integrate such knowledge systems into modern planning frameworks to contribute positively to environmentally responsive and culturally rooted development strategies.

Keywords: Traditional Ecological Knowledge, Climate Change, Vernacular architecture, Sustainability, Indigenous Knowledge, Indian Knowledge System

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Introduction

The term Traditional Ecological Knowledge also referred to as Indigenous knowledge, lacks a definitive definition. The term traditional is commonly used in formal texts to refer to a long-established custom or belief that has been passed from one generation to another (Oxford University Press, n.d). It is also understood to be cumulative and adaptive to change over time (Nakashima 1998). UNESCO (n.d.) defines culture as the distinct spiritual, material, intellectual, and emotional features characterizing a society. It can be derived from this definition that, Indigenous knowledge forms a significant part of any culture's intellectual capital. Of the various subsets of indigenous knowledge, Traditional Ecological Knowledge (TEK) has garnered much attention from scholars. TEK has been defined as an aggregate of practices and beliefs shaped through adaptive processes which have been passed from one generation to another (Berkes, 2017). This transmitted knowledge provides a plethora of information regarding the ways in which living beings interact with one another and their environment. TEK has also been identified as inseparable from indigenous identity and society (Diver, 2017).

People depended on their immediate environment for survival. Hence, there was a strong incentive for them to use environmental resources sustainably. As a result, a cumulative body of knowledge was generated that emphasised not harming the environment (Sioui et al., 2022). The sustainable nature and features of TEK have contributed to it being included at varying levels in combat against climate change. While TEK has been considered environmentally sustainable key to protect the biodiversity (Priyadarshini & Abhilash, 2019), TEK itself is at the risk of becoming obsolete in the modern world. The pace of climate change is understood because of this (Nakashima et al., 2012). This research ruminates how the gradual erasure of TEK from modern architecture has influenced growing climate change.

Data sourced from NITI Aayog's dashboard (2025) show that both the number of high rise buildings and energy consumption in southern India are on the rise and that, while the national average of per capita electricity consumption in India is at 1,331 Kwh, per capita energy consumption in south India ranges from 1,768 Kwh in Tamil Nadu to 2,349 Kwh per capita in Telangana. The increase in energy consumption has been attributed to the increasing use of cooling systems such as Air conditioners and coolers. The growing heat coincides with the timeline of the rising number of Highrise buildings. Thus, the impending link between reduction in traditional architectural practices and increasing heat becomes the crux of this paper's research.

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Research Questions

1. What are some of the characteristic features of Indian architecture? How environmentally sustainable are they?

2. Has there been an erosion of traditional architecture across the subcontinent that has significantly influenced or aggravated climate change?Can the inclusion of traditional architecture in modern construction aid in climate change combat efforts?

Methodology

This paper is an interdisciplinary and analytical study of traditional architecture as an indigenous pathway to climate resilience. The study employs thematic exploration through peer-reviewed journals, books and historical texts to understand the inherent sustainable nature of India's architecture and introduce the same as a tool to combat climate change in the subcontinent. Through Interlinking areas of study such as Architecture, Environmental studies and Climate studies, the paper focuses on recognizing recurring patterns of climate sustainability embedded in Indian architecture. Secondary data sources on Traditional Ecological knowledge and Indian vernacular architecture become the foundation of the study. Additionally, case studies on Indian architecture from multiple sources are consulted in the study.

Scope and Limitations

The scope of the study is broadly examining Traditional architectural practices of the Indian subcontinent and their climate resilient nature. The analysis is principally reliant on secondary data sourced from scholarly works, historical records, and documented case studies. The research lacks primary case studies, field visits, and quantitative analysis of energy efficiencies. The lack of subject expertise combined with limited financial resources and agencies poses a limitation to conducting any laboratory or field research. While the study attempts to build a link between traditional architecture and sustainability, the paper does not empirically quantify energy efficiency or climate responsiveness. Nevertheless, the study's objective to frame indigenous architecture as a relevant solution in present day's climate discourse remains intact. The study aims to inform policy discussions on the relevance of indigenous architecture as a climate response tool and revive indigenous architectural practices to reverse climate change.

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Literature review

Traditional architecture, with its profound connection to traditional environments and cultural narratives, inherently embodies principles of sustainability (Xu, 2024). Sustainable architecture is gaining popularity among the public and architects alike. Coincidentally, Traditional architecture from various parts of the world has also been increasingly recognised as ecologically sustainable.

Eiraji and Namdar (2011) conducted extensive research on the Iranian traditional architecture and recognised a wide range of systems developed across the nation early on to combat varying climatic conditions. From hot and dry climate to cold and arid, Iranian traditional architecture varied to adapt to the area's unique climatic features. In Turkey, efforts are underway to revive traditional architecture by identifying and analysing the traditional designing strategies which utilise the natural environment to create efficient and sustainable building (Sözer & Bekele, 2018).

Similarly, the traditional Igala architecture practiced in Nigeria exemplifies sustainability through energy and resource efficient, passive solar techniques and environmental conservation strategies (Henry Emusa & Amanyi, 2023). African traditional architecture, though considered primitive due to reduced use of modern technology as commonly seen in the modern architecture, is essentially sustainable and has evolved culturally to suit the people (Ejiga et al., 2012). More sympathetic to the environment, traditional African architecture maintains a high level of internal thermal comfort, regardless of prevailing solar radiation outside (Ejiga et al., 2012b).

In the central region of Saudi Arabia, tradition of earth architecture that is unique in style, culture and sustainability includes the use of local materials to build homes that fitted the environmental and cultural conditions (Mortada, 2016). Indian civilization also has a long history of traditional architecture aligned with the principles of sustainability. More than mere aesthetics, these designs served as energy efficient features affecting indoor thermal comfort and conditions (Chandel et al., 2016). Climate - responsive designs are built using local and sustainable materials. They include sophisticated designs like courtyards, clusters, wind towers, roof terraces, and *jaalis* (stone lattices) for effective climate control (Jadhav, 2007).

The sustainable character of traditional architecture is not restricted to one country or continent but is a recurring pattern that can be observed across the globe. Climate responsiveness with emphasis on adaptability, energy efficiency, sustainability, locally sourced materials and thermal comfort becomes the hallmark of any traditional architecture. Over the years, the world has witnessed a slow demise of traditional architecture as modern architecture grows in popularity. The growth of modern architecture also coincides with the rise of global warming and climate change. While traditional architecture has been increasingly recognised as environmentally sustainable, the steady decline of traditional architecture is yet to be recognised as a cause for increasing global warming and climate change.

Evolution of Indian traditional architecture

The Indian subcontinent lacks a singular traditional architectural practice. A variety of architectural practices have developed across the country. Its diversified socio-cultural, traditional, religious background and most importantly, climatic variations lay the foundation for this development (Bera, 2020). Landscape, sea, climate and more importantly, history has played a pivotal role in the evolution of traditional architecture of India (Thapar, 2012). The Indian subcontinent has witnessed diverse civilisations and dynasties in power. Each of these civilisations and powers have left a lasting imprint on the art and architecture of their respective regions. Understanding these civilisations and ruling powers can help in shaping a better understanding of India's traditional architecture (Kadian & Bhandral, 2023a).

Shilpasastra and Vastusastra : Codified knowledge of ancient Architecture

Indian architecture did not evolve through a process of trial and error. Rather, rich knowledge systems were codified and passed down through generations. The most prominent scriptures laying down the indigenous architectural knowledge of India are Shilpasastra and Vastusastra. These ancient texts functioned as great repositories of traditional ecological knowledge, analysing in detail, principles related to site selection, material selection, ventilation, etc. (Acharya, 1934). Creating a harmonious relationship between the surrounding nature and human-made environment was the foundation of the text (Dagens, 1994). Rather than viewing nature through mere aesthetics lenses, these texts emphasised the importance of their preservation. The Shilpasastra is an amalgamation of 63 volumes in

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which Manasara[2], Mayamata[3] and Samarangana Sutradhara[4] emphasised on climate responsive construction. Region-specific guidelines with regards to solar movements, wind directions, and rainfall patterns can be found in these volumes (Kramrisch, 1946a). Design elements such as open courtyards, wall thickness and even roofing systems were hence, not products of the architect's aesthetic senses but a deliberate strategy employed to enhance climate assimilation, natural ventilation and comfort. Owing to this indigenous knowledge, traditional architecture was able to reduce dependence on artificial cooling system. These texts hence, bring to light the very sophisticated understanding of thermal cooling and passive climate control that prevailed in the subcontinent long before the advent of modern sustainability discourses.

The Shilpasastra offered a theoretical framework that was not rigid in nature. It had a significant scope for contextual and regional adaptation. Thus, it accounted for the regional variation and allowed the architecture to evolve in response to India's diverse climatic zones. This flexibility sowed seeds for the rising number of regional variations in architecture. For

[2] More literally 'by the sages known as Mānasāra' (literally essence of measurement), i.e., by those who specialize in mensuration or measuring which is a very important feature of the science of architecture. The term *mānasāra* has been used in three different senses: (i) as a generic name of architects, (ii) as the title of the treatise, and (iii) as the individual name of its author or compiler, *cf*. chapter XIXX, concluding lines, chapter XXXIII, 2, LXVIII, 11, chapter LXIX, 216. As the possible name of an architect it is mentioned in the Holal inscription (Epigraphist's Report, 1914-15, p. 90) and the *Agni-purāṇa* (chapter XLII, 127), and as the name of a king in the *Daśa-kumāra-carita* (eel. Kale, pp. 4, 12, 43). For more details see the writer's *Indian Architecture*, pp. 2, 3,4. [Source: https://www.wisdomlib.org/hinduism/book/manasara-english-translation/d/doc421043.html#:~:text=Footnotes%20and%20references:,2%2C%203%2C4.]

[3] Mayamata is considered an abridged version of Manasara by many scholars. However, a careful examination of its contents reveal that both in the precise grammatical language and specific contents, Mayamata differs from Manasara. While Manasara uses Sanskrit in an un-grammatical context, Mayamata uses grammatically correct representation, indicating that this is a later work. Also, Manasara is conspicuous by lack of discussion on Vimana (gopuram or temple towers). It merely uses the term Amalaka (ripe gooseberry) to describe Vimana. Mayamata on the other hand, pays considerable attention to construction of Vimana (calls it Prasada), indicating thereby a distinct South Indian or Dravidian flavor. We observe that the temple towers in North India and South India are distinctly different in their architectural style.

[4] This work is by King Bhoja (1000-1055 AD) who ruled parts of Central India in what is now Madhya Pradesh. Bhoja was a great warrier, philosopher and a keen architect. He also authored Sringara-Prakasa and Saraswathi-Kanthabharana, both much acclaimed for their literary merits. Bhoja built the lake at Bhopal, so massive and a life-giver to the region that a proverb is still in vogue saying *Tala to Bhopala Tala, aur sub talaiya*. Apart from precise architectural details about civil and religious works, Bhoja was especially noted for the art of building embankments to artificial lakes that have stood the test of time. His style was even emulated by Maharaja Raj Singh of Sissodiya dynasty built the Rajasamudra Lake at Rajsamand in Rajasthan.

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example, the courtyard centric designs of the tropical regions in contrast to the thicker stone structures in the arid regions. Though the term was yet to be coined, traditional practices of architecture as prescribed in the Vastusastra and Shilpasastra were anchored in the principles of sustainability (Kramrish, 1946b).

Indus valley civilisation (2800 BC - 1900 BC)

The Indus valley civilisation also referred to as the Harappan civilisation flourished in the banks of the river Indus from 2800 BC (Vahia, 2007). Evidence traced from the excavation sights show that even the civilisation had extensive town planning and water management systems. Evidence suggested that baked bricks of uniform built were used extensively to build multi-story buildings with intricate patterns and designs (Kadian & Bhandral, 2023b). The civilization also had a sophisticated system of drainage, with evidence of covered drains and public baths (Kadian & Bhandral, 2023c).

> "The patterns of settlements drew from the behavior of rivers which provided flood plain ecology, regional trade over rivers, favorable climate for daily life, access to trade routes and natural resources etc." (Miller, 1985).

Jain architecture (300 BC to 1700 CE)

Jainism was established as a religion by Mahavira, the 24th *Tirthankara (*Long, 2013). *Ahimsa* ie, non-violence which was a cornerstone of janinism extended beyond humans and animals to the environment as well. Stemming from the belief that harmony between living creatures and environment was essential for the well-being of both, Jainism encouraged its followers to adopt a lifestyle of simplicity and sustainability, and to minimize their impact on the environment (Kadian & Bhandral, 2023d). Jain architecture reflects these very principles. Designed to be energy efficient, the jain architecture ensured maximisation of natural light and air circulation through effective use of *jaalis* (perforated stone screens) and strategically placed windows (de Mallmann, 1954). Builders used locally sourced granite, marble, or sandstone. Hence, these constructions lacked strong carbon footprints and thereby requiring minimal maintenance. Dilwara temple at Mount Abu in Rajasthan, is a striking example of sustainable and environmentally inclined Jain architecture.

Buddhist Architecture (300 BC to 1200 CE)

Siddartha Gauthama developed Buddhism which flourished in the 3rd century (Keown, 2012). Most architectural relics associated with Buddhism were built to

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commemorate significant events of Buddha's life (birth, enlightenment, death etc.) (Deva,1974). The Buddhist architecture in India reflects an intricate relationship with the environment, showcasing sustainability, harmony, and reverence for nature (Sharma, 2024). Rather than dominating or upsetting the ecosystem, Buddhist architecture took special care to get itself integrated with the surroundings, for example,

> “Many Buddhist monasteries were established in or near sacred groves which became centers of biodiversity. These groves were often protected by religious beliefs, serving as sanctuaries for flora and fauna. This approach resonates with modern conservation efforts, highlighting the foresight of ancient practices” (Sharma, 2024).

Maurya Architecture (550 BCE to 320 CE)

The Mauryan empire is one of the most powerful empires of ancient India. The art and architecture of the Mauryan period depicted detailed carvings of human and animal figures (Kadian & Bhandral, 2023e). Ray (1977) suggests that animals were used in carvings not for mere aesthetic purposes but as symbolic figures. For example, he noted that elephants are used in Mauryan art to depict linear rhythm and flowing plasticity. The plethora of animal carvings found in Mauryan architecture, and the symbolic meaning attached to them emphasises primarily the volume of biodiversity within the state and a cooperative synergy between the life of humans and animals. The Mauryan empire has also left behind long standing architectural relics such as Ashokan Pillars, Pataliputra palace etc. Of these, Ashokan pillars adorned with inscriptions and carvings is considered the most longstanding example of Mauryan architectural prowess. Many of these pillars stand tall even today in Haryana, Uttar Pradesh, Delhi, Madhya Pradesh and Bihar. This is a testament by itself regarding the quality of indigenous materials used (Sandstone, timber, clay etc.).

Magadh served as the grain bowl of Bihar during the Mauryan empire. However, modern abortive irrigation practices had turned the area into an arid uncultivable land, prompting many farmers to abandon agriculture in the region. Presently, attempts are underway to revive the traditional irrigation channels across Magadh set up by the Mauryan empire to restore irrigation facilities (Pathak, 2018). This revival underscores how long-term sustainability of public infrastructure was of relevance even in the Mauryan Empire.

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Mughal Architecture (16th to 19th Century CE)

Mughals made marble architecture a defining feature of their construction in India. While native to Indian regions such as Makrana, Rajasthan, marbles were utilized by the mughals to showcase imperial grandeur. Mughals used red sand stone and intricate marble designs in their monuments, enhancing both structural strength and visual elegance. This contrasted with the eco-logic of Indian traditional architecture which up until this point, sought sustainability and thermal comfort from indigenous materials (Koch, 1991). This is not to say Mughal architecture was unsustainable. Charbagh gardens, according to Ali (2013), functioned as micro-climate management systems that reduced heat in the surrounding areas. Similarly, open courtyard and step wells serve both ornamental and climate regulating functions. The domed roof, a hallmark of Mughal architecture, was not only pleasing due to their geometric and symmetric appearance, but they also played a key role providing thermal comfort as it provided more surface area for the hot air from within to rise. Mughal monuments such as the Taj Mahal, Humayun Tomb etc. are intact today with very little to no modern engineering intervention. However, this era marked a crossroad: ecological sustainability reduced in importance and in contrast, monumentalism and grandeur rose to precedence.

Colonial Architecture

The earliest influence of colonial architecture can be seen in India through the churches. Gothic and neo-classic style of architecture was introduced to India during this time. Over the years, British architecture evolved in ways to include Indian and Islamic artistic elements to itself. This new style that emerged as a part of the confluence was called the Indo-Saracenic style of architecture. Red sandstones, arches, long pillars and corridors became the hallmark of Indo-Saracenic architecture. Public buildings built during the British era often included these elements. The Victoria memorial in Kolkata, Gate way of India in Mumbai etc are striking examples of this integrated art style (Metcalf, 1989). The colonial architecture offset traditional architectural practices as they did not rely purely on locally sourced material. Given the naval strength of the British and the vast expanse of their colony, it was convenient for them to import building materials from other parts of the world to India. In this way, the aesthetic appeal of the building took precedence over the climate-adjustive nature of the building. While high ceilings and long varandas accommodate passive cooling, the tendency to prioritize grandeur and visual appeal resulted in sustainability quotients being overridden. By attempting to replicate European architectural features on Indian soil, they

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failed to realise the necessity to adapt architecture to the local ecology and environment.

South Indian Architecture and Sustainability

While architecture across the subcontinent exhibits ecological sensitivity, South India presents a particularly rich case of climate-responsive design due to its tropical environment and dynastic innovations. Dravidian architecture of southern India emerged and developed from the temples of the region which doubled as both places of worship and ecological hubs. Unlike the dynasties of the North who introduced new styles of architecture, the development of the traditional architecture in southern India catered to the local climatic conditions while simultaneously ensuring continuity of previous ruler's aesthetic elements. The region was ruled by Pallavas, Cholas, Pandya and later by the rulers of Vijayanagar, who all left lasting impressions not only through the grandeur of construction but also through engineering and climate responsive elements. Hence, the evolution of South Indian traditional architecture is rooted in sustainability, both in terms of preserving surrounding ecology and cultural traditions.

Governed by tropical climate, the southern plateau of India experiences both hot as well as humid climates mingled with strong rains. Hence, passive cooling, natural ventilation, and thermal insulation systems were necessary to ensure a pleasant climate indoors. The *naalukettu* houses in Kerala with the open courtyard at the center of the house accommodate this very purpose. The open courtyards allow the hot air to rise to the top, letting cool air from the surrounding take its place. Making the interior cooler in comparison to the outside. The *Chettinaadu* mansions from Tamil Nadu also depict a similar sensitivity to climate (Susilo & I.W, 2007). Lime plastered walls and high ceilings of these mansions accommodate heat sensitivity and passive cooling. Their deep verandas and ornate courtyards allow the houses to maintain pleasant temperatures even during harsh summers. In Karnataka, sloped roofs with Mangalore tiles allow for rainwater to flow to the ground. In the drier regions of Andhra Pradesh and Telangana, the architecture elements were modified to suit the microclimate of the region. Mud and lime were used more extensively in these regions to protect against harsh sun during the day and release warmth at night.

This climate-responsive form of architecture also appears in the temples of the South. Delving deeper into the history of South Indian architecture leads us to the temple architecture of notably, the *Cholas*. The *Cholas* followed the legacy of dravidian architecture envisaged by the Pallavas while adding their own classical elements to the same. Brihadeeshwara temple

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of Tamil Nadu built by Raja Raja Chola is considered the most magnificent symbol of Dravidian art and architecture. Built using quarried granite and large rocks (measuring up to 80 tonnes) transported from neighboring states, the carbon footprints of the temple are negligible relative to the size of the construction. More notable though, is the use of dry masonry. The entire temple, including the 80 tonne dome that rests above the Garbhagriha of the temple, was entirely constructed and connected through an interlocking system without any binding agent such as lime or cement (Deeksha & Behera, 2022). While the construction technique is yet to be decoded entirely, studying the same would provide invaluable knowledge and aid the engineering efforts to reduce life-cycle emissions in modern constructions thereby, making them more sustainable.

Key Features and Sustainability Quotient of Indian Traditional Architecture

The inquest of Indian traditional architecture reveals the recurring pattern of sustainability as the keystone of its design principles. Across regions and climatic zones, buildings were constructed with aesthetic nuances while maintaining harmony with nature. Indigenous knowledge, particularly those identified from ancient texts such as Vastusastra and Shilpasastra offer boundless guidance on making constructions environmentally inclined.

In Southern India, these principles are more evident. The traditional *Naalukettu* and Chettinad Mansions with their open courtyards, deep verandas and high ceilings regulate indoor temperature and airflow naturally. Such designs help reduce dependence on artificial climate regulators such as air conditioners and heaters, highlighting a sophisticated understanding of climate responsive construction and passive cooling. Dating further back, the Chola temples built in dry masonry and interlocking granite systems illustrate the long-term durability that can be achieved without exploiting or harming the surrounding. Similarly, principles of sustainability appear adapted to cultural and regional contexts across the subcontinent. Jaalis of Jain architecture, durability of Ashokan pillars, Climate regulating Charbagh gardens of Mughals etc. showcase a seamless blend of aesthetics and climate adaptive nature of traditional construction.

The following elements form the foundation of vernacular architecture being sustainable in India:

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- ***Use of Native Resources:*** Traditional architecture primarily relies on locally sourced materials such as mud, lime, timber and clay tiles. This contributed significantly to sustainability by ensuring compatibility between building materials and local climate. Natural insulating properties of indigenous material were also utilised to regulate indoor temperature leading to reduced reliance on artificial sources to control indoor climate. Additionally, reliance on native resources contributed to the strengthening of local economies and knowledge systems by encouraging traditional methods of construction and reducing carbon footprints created through transportation. For example, the Dilwara Temple in Rajastan was built entirely from marbles and sand stones available within the region.
- ***Designs that are climate sensitive:*** Across the subcontinent, the precedence of climate sensitive architecture can be traced across generations and empires. Sloped roofs, open courtyards, high ceilings, and gardens were incorporated into the architecture to add both splendor and practicality. Building orientation, including the thickness of the walls, were adapted to the regional climatic conditions such as heat, humidity, rainfall, and wind patterns. Intentional designs allow for full utilisation of daylight and natural ventilation, allowing the buildings to respond to climatic variations with minimal energy consumption. *Naalukettu* Houses of Kerala, Charbagh gardens of Mughals and *Chettinadu* Mansions are examples for the same.
- ***Provisions that minimise resource need:*** Traditional architecture reduces extensive dependence and usage of natural resources. Rainwater harvesting systems, stepwells, and efficient drainage networks contributed to conservation of available water resources. They also ensured optimal water availability even during dry seasons. Hence, through efficiency, over consumption and wastage were both curtailed. For example, Rani Ki Vav in was desiged as a water harvestment and conservaion tank in Patan, Gujarat to reduce dependence on monsoon for water in 11^{th} century AD by King Bhimdev I (UNESCO, 2014).
- ***Passive thermal regulation systems:*** Jaalis and Long verandas accommodate passive cooling by utilising the stack effect and heat dissipation, allowing hot air to escape and cooler air to remain indoors. Such a system ensures thermal comfort without reliance on energy - intensive appliances.
    - ***Dry construction:*** The application of dry masonry as seen in Brihadeeshwara

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temple is the epitome of low carbon engineering. This means of construction serves two sustainable purposes. Firstly, it enables the expansion of the material without crackingand ensures the recyclability of the structure at the end of its life cycle. Additionally, dry masonry enables the structure to last for centuries prioritizing engineering precision over material consumption.

- ***Symbiotic site planning:*** Symbiotic here, refers to the harmony between man-made environment and natural ecology. Previously, settlements were designed around nature to not disrupt ecological balance. Assigning a symbolic spiritual meaning to aspects of nature for example, sacred groves, temple tanks etc. accommodated preservation of biodiversity through religious practices. Site selection followed the Vastu principles of slope and soil quality, ensuring that construction did not disrupt natural watersheds. In hilly regions like the Himalayas, houses were built on south-facing slopes to maximize winter sun (passive solar gain), while in the plains, settlements were clustered to create mutual shading, and significantly reducing the "Urban Heat Island" effect long before the term was coined. The sacred grooves called *Kaavu* in Kerala, serve the sae purpose.

Overall, Indian traditional architecture demonstrates that sustainability was not optional. It was intended and embedded into the system intentionally. These architectural features reflect a deliberate effort to balance human needs with the surrounding environmental conditions. Their adaptability and resource efficiency showcase the enduring legacy of environmental intelligence and sustainability. Recognising these features leads to greater appreciation of traditional ecological knowledge of the subcontinent, revival of which can be beneficial in the combat against climate change.

Policy Recommendations

From the above discourse, it is ascertained that Traditional Architecture across the Indian subcontinent is inherently climate - responsive and environmentally sustainable. The systematic revival and conscious integration of indigenous architectural practices ca, to a significant extent, contribute and aid national and international efforts of combat the rising climate challenges. In this context, the following policy interventions are recommended:

- ***Revival of TEK:*** Rather than treating indigenous architectural practices as cultural relics, they must be formally recognised as climate adaptation resources. Government institutions must take conscious efforts to map regional indigenous building techniques across the regions of the state. They must be systematically documented and digitized to both preserve and propagate indigenous knowledge. Workshops must be organised at community level by including local craftsmen, artisans and masons to accommodate intergenerational knowledge transfer and prevent further erosion.

- ***Inclusion of TEK in academic curriculum:*** Educational institutions play a crucial role in preserving indigenous knowledge. TEK must be systematically included in university and professional training curriculum by incorporating modules on vernacular designs. Such curriculum reform will ensure that future professionals such as architects, engineers, planners, and policy makers are equipped to apply traditional knowledge within modern developmental frameworks. This integration would effectively be bridging the divide between indigenous practices and sustainable development.
- ***Financial incentives for accommodating TEK in modern constructions:*** Economic limitations often pose a barrier to adopting traditional construction practices. Targeted financial incentives such as tax rebates, construction subsidies, Low-interest green loans and benefits for builders, engineers and developers who incorporate climate responsive indigenous elements to their projects can drastically accelerate the adoption of climate resilient traditional practices and low - carbon building practices across the subcontinent.
- ***Revival and integration of traditional water and landscape management system:*** As early as Harapan civilization, Indian subcontinent has a sophisticated water and landscape management system complete with temple tanks, harvesting systems and stepwells. Integration of these traditional practices is vital to modern day urban and city planning to ensure water security in densely populated regions. By reviving traditional water conservation infrastructure, policy makers can effectively recharge ground water and reduce vulnerability to floods. Incorporating green corridors such as sacred groves can also help mitigate urban heat island effect.

Conclusion

This paper explored whether the degradation of traditional architectural practices in the Indian subcontinent has had any impact on the current climate issues. The degradation of indigenous climate-responsive architectural practices over the years by the unsustainable modern architectural practices has had an increased impact on the rising heat island effects

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in urban areas. The degradation of indigenous architectural practices has not only led to the loss of cultural heritage but has also impacted the indigenous climate adaptation practices that were developed over the years. The degradation of Traditional Ecological Knowledge has made the built environment more vulnerable to climate change instead of mitigating it. However, the results also shed light on the viable and low-carbon solutions provided by traditional architecture to enhance climate resilience in both rural and urban settings. The indigenous building methods, such as the traditional water management systems of stepwells and temple tanks, provide resilient approaches to mitigate overconsumption and enhance environmental sustainability. The revival and incorporation of these very same principles into modern development policies can, therefore, provide a viable climate adaptation strategy while also enhancing energy security and urban resilience.

Going beyond its domestic applications, India also has the potential to utilise its indigenous sustainability practices as a strategic resource in global climate politics. By leveraging its vast repository of sustainable architectural knowledge through global cooperation, regional partnerships, and multilateral climate agreements, India can help enhance adaptation capacity in climate-vulnerable regions, particularly in the global South. Such global diplomatic efforts, informed by Vernacular knowledge, not only enhance India's strategic soft power but also make the country a normative leader in sustainable development and climate resilience. In an age where climate change increasingly converges with global stability and security, the revival of traditional ecological knowledge, therefore, presents itself not only as an imperative for environmental sustainability but also as a strategic opportunity. Thus, TEK serves a purpose beyond that of being a mere heritage system. It presents itself as a forward looking, future-oriented solution capable of building ecologically resilient built environments in an era of growing climate challenges.

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