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RESEARCH PAPER

Paradigm Shift of Construction Techniques from Vernacular to Neo--Vernacular in Villages to Sustain Climate Change

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ABSTRACT

The purpose of the study is to conduct a comparative analysis of traditional and modern architectural approaches in rural communities to identify architectural styles that endure environmental challenges. Climate change is an urgent global challenge that necessitates immediate action to minimize its detrimental effects. The Intergovernmental Panel on Climate Change (IPCC) reported in 2007 highlighted that developing and least developed countries would bear a greater burden from climate change compared to developed countries. This holds true even at the community level, where impoverished individuals suffer the consequences of climatic anomalies due to limited resources and lack of access to information. This study explores the correlation between human habitation and architectural design in rural regions through literature and surveys. The findings offer significant perspectives for fostering sustainable development. A re-embrace of the ethos and design principles of vernacular architecture can guide the creation of more sustainable and adaptive architectural solutions.

KEYWORDS Climate Change, Neo Vernacular, Rural Life, Sustainability, Urban Environment, Vernacular Techniques

Introduction

Rural areas serve as vital components for Pakistan's sustainable environmental and economic progress. The development of villages' demands equal attention compared to urban structures. Given that they contribute to 73 percent of Pakistan's food production, villages play a pivotal role in the nation's economy and food stability. However, they often suffer from neglect and outdated infrastructure. Urban architecture tends to monopolize attention, leaving rural areas overlooked.

Yet, there exist individuals who construct structures devoid of architectural input. These individuals possess the expertise to construct in accordance with local requirements and climate variations. Regrettably, they often remain unrecognized and undervalued. With over 60% of its population residing in rural areas, Pakistan boasts abundant resources to sustain a lifestyle with minimal reliance on external inputs. The dwellings found in rural regions exemplify a lifestyle that thrives without significant dependence on external resources, displaying an alternative way of living. (Thorbeck, 17-Jun-2013)

The development of villages refers to the process of improving the social, economic, and physical conditions of rural communities. This process can take many different forms, depending on the specific context and needs of the village.

One of the key aspects of village development is economic development. It includes initiatives such as promoting agricultural productivity, developing small businesses and micro-enterprises, and attracting investment and tourism to the village. Another important aspect of village development is social development such as improving access to education, healthcare, and basic services such as water and sanitation through natural resources. This can help to improve the quality of life for residents and promote social inclusion and equity. Physical development is also an important aspect of village development. It includes building and maintaining infrastructure, such as roads, water supply, and sanitation facilities. This can also include the construction of housing, community buildings, and other facilities that can improve the living conditions of the residents.

Village Settlement Patterns

Rural communities come in a variety of forms. These are categorized based on their shape, internal structure, and texture of the streets. It can generally be categorized into two groups;

- The Clustered Settlements
- The Distributed Settlements in Rural Communities

Multiple families live close to each other, surrounded by fields and a mix of homes and agricultural buildings. The layout of the village reflects various factors, including;

- Historical Events
- Geographical Features
- Economic Conditions
- Regional Cultural Characteristics

The Rural settlement patterns can be grid-like, compact, linear, or circular.

Land consolidation (Singh & Roberts, , August 2010) and tax assessment are conducted using the Chakbandi method. The Settlement Officer, aided by *patwaris, lambardars*, and formerly **zaildars** (now abolished), oversees the chakbandi process and settlement. In terms of irrigation, chakbandi is a system where each farm (chak) is watered by a branch watercourse fed by a sluice channel from the main canal. The amount of water each chak receives is proportional to its size. A unique chak number is assigned to each continuous block of land irrigated by a specific Rajwaha, also known as an irrigation circle. (Mandal, 1990)

Land consolidation involves the intentional restructuring, realignment, and reordering of land parcels and ownership to enhance the rural infrastructure and meet the environmental and developmental objectives. The process particularly aim to strengthen the agricultural and environmental sustainability.

Village Development

The advancement of rural communities involves enhancing their social, economic, and physical aspects. This progression can manifest in various forms tailored to the specific needs and circumstances of each village. ***Economic development*** stands out as a crucial component, encompassing endeavors like boosting agricultural output, fostering small-scale enterprises, and attracting investments and tourists. These endeavors aim to generate employment opportunities, augment income, and foster economic resilience within the village. ***Social development*** is equally significant,

focusing on enhancing access to education, healthcare, and essential services like clean water and sanitation. This contributes to elevating residents' quality of life, fostering social cohesion, and promoting inclusivity. Additionally, ***physical development*** is crucial, encompassing the construction and maintenance of infrastructure like roads, water supply systems, and sanitation facilities. It also includes the development of housing, communal buildings, and other amenities to improve residents` living standards. (Yousuf, 2011)

Issues

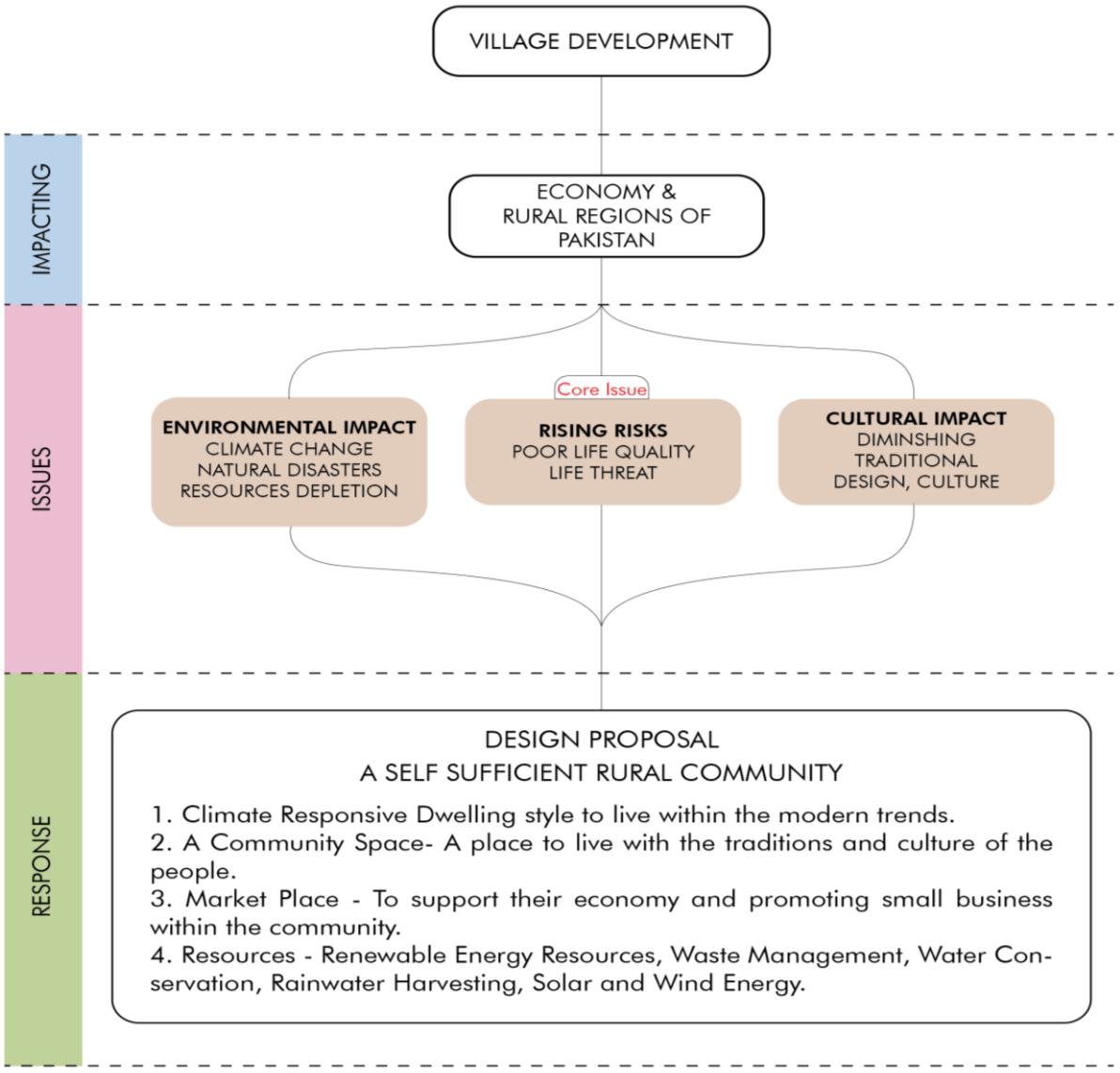


Figure 1Responding to the Impacts of Village Development in Pakistan, 2023 Digital Diagram,

Environmental Risk

The Industrial Revolution transformed human-environment interactions, fostering rapid development that enhanced well-being but also led to resource overexploitation. Urban migration reshaped village construction, but unsustainable practices in material extraction and energy usage exacerbate environmental degradation. Environmental consciousness, starting from actions like recycling and renewable energy adoption, is crucial. Yet, addressing deeper ecological concerns necessitates shifting

mindsets and values towards self-sufficiency, diversity, and holistic environmental approaches. Declining village living standards can stem from factors like resource scarcity, limited economic prospects, and inadequate healthcare and education access. (Rutuja & Utkarsha, 2016).

In the context of village development, ensuring sustainable livelihoods and environmental stewardship is essential for promoting long-term prosperity and well-being. This includes investing in renewable energy infrastructure, implementing eco-friendly farming practices, and fostering community-based initiatives for conservation and sustainable resource management. Ultimately, by embracing principles of deep ecology and adopting holistic approaches to development, villages can become thriving hubs of sustainability, resilience, and harmony with nature.

Literature Review

The idea of a self-reliant community emerges as a solution to safeguarding the environment and ecological systems in the forthcoming era. With the inevitable rise in human population, the demand for natural resources is bound to escalate. Concurrently, social and cultural challenges intersect with population growth, leading to cultural tensions, divergent characteristics, and diverse practices. Alongside self-sufficiency, community cohesion is imperative. Enhancing the welfare of the community can foster a more favorable living environment. (Salman, 2018).

According to the (Oxford, University) a self-sufficient community is described as a group of individuals residing in a particular area, such as a district or city, collectively considered. Self-sufficiency means being able to fulfill one's needs without depending on external sources. Achieving complete independence is difficult. (Wahid, 2012).

It represents progress when environmentally conscious individuals collaborate to exchange skills and knowledge, aiming to coexist independently. A self-sustaining community could initially form in urban settings, starting on a smaller scale. Today, the task of designing a sustainable or self-sufficient home is daunting, given that a dwelling, much like a living organism, interacts with its surroundings, exchanges resources, and operates autonomously, akin to a tree in a field.

A self-reliant residence seamlessly integrates with its surroundings and has the flexibility to adapt to the social, cultural, technological, and economic changes in its environment. (Guallart, 2006). According to the (Oxford, University) collective living refers to a community or society where responsibility, actions, and efforts are shared in everyday life.

The study looked at and derived data from a range of sources in order to access and analyze traditional design, paying particular attention to the local vernacular style and how it has dwindled through time owing to the development of regional architecture. The material reviewed recognizes the distinctive local architectural style and makes improvements to it by incorporating modern elements that will improve village life.

Materials and Methods

A research methodology based on an explanation of rural architecture has been developed. The methodology used in this research included design and Qualitative research techniques.

The initial evaluation of the design was done using qualitative data, which was gathered from books, academic papers, and relevant websites.

Results and Discussion

Vernacular Architecture in Rural Areas

The architectural landscape of rural regions historically exhibits a rich diversity shaped by factors like local climate, geography, culture, and accessible materials. In earlier periods, rural architecture typically embraced simplicity and utility, relying on locally sourced materials like mud, clay, and stone for construction.

As per the Encyclopedia of Vernacular Architecture of the World (Oliver, 1997): Vernacular architecture refers to the homes and other structures constructed by individuals or communities using traditional methods and tailored to suit their environmental surroundings and resource availability. Each form of vernacular architecture is designed with a distinct purpose in mind, reflecting the beliefs, economy, and way of life of the people responsible for its creation.

"*The architecture of the people, and by the people, but not for the people*".

The vernacular style of villages in Pakistan refers to traditional building forms and techniques that have developed over time in response to the local climate, culture, and available materials. This style is characterized by its simplicity, practicality, and its use of local materials and techniques. It is diverse and varies by region. For example; In the hot regions of Pakistan, the vernacular architecture is characterized by the use of sun-dried mud brick, known as "katcha," for construction. The houses are often built with thick walls to protect against the heat and wind and feature large courtyards and verandahs to provide shade. (Kamil Khan, 1985).

Structures offer insight into their surrounding environment, displaying available materials and the prevailing cultural influences at the time of construction. They serve as a narrative of the inhabitants, with stories varying across different regions worldwide. Vernacular architecture, often neglected in contemporary building practices, proves to be a straightforward means of meeting human needs. However, recent rises in energy costs have prompted a renewed interest in this approach. Past examples highlight the energy efficiency and sustainability inherent in such constructions. (Javid Ghanbari & Mahmood, 2014)

Paradigm Shift from Vernacular to Neo Vernacular Architecture:

Addressing the requirements of contemporary living while minimizing environmental repercussions necessitates a shift from traditional vernacular architecture principles towards embracing modern technological advancements in the construction industry. The influence of modernism has led to the obscuring and diminishing of vernacular principles, consequently distancing societies from their regional customs and cultural heritage.

In urban and rural environments alike, buildings are progressively viewed as industrial commodities. This shift in the procurement process for construction has nearly eradicated the traditional artisanship and regional building methods that were once prevalent in rural areas.

Rapid urbanization is encroaching upon entire vernacular villages, concurrent with the migration of inhabitants from traditional rural areas to cities in pursuit of higher-paying and more specialized employment opportunities. The emergence of 'empty villages' underscores the social consequences of the rapid urban-rural transition. To facilitate rural revitalization, a comprehensive style is required urgently to integrate the urban-rural development.

Addressing these challenges involves preserving local vernacular architecture, upholding traditional construction methods, and retaining villages as community hubs. Architects may explore innovative techniques to address these social issues. The movement to safeguard cultural heritage in rural areas has sparked what is known as the "vernacular frenzy." (Turkušić, 2011) The term 'Neo-Vernacular' architecture refers to this approach, which combines vernacular forms, traditional and contemporary construction methods, and materials to safeguard the intangible traditional building skills within communities.

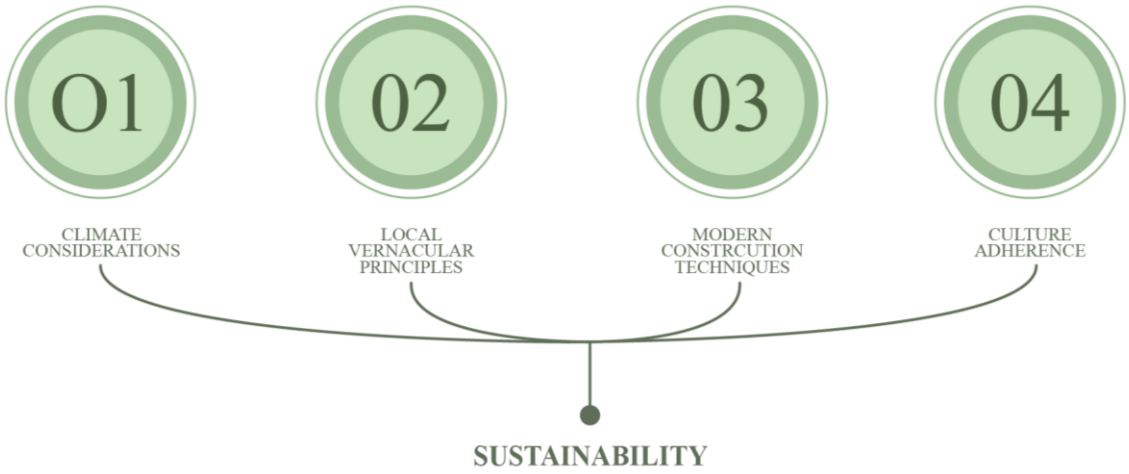


Figure 2 Neo Vernacular Principles leading to Sustainability, Digital Sketch

During the 1960s and 1970s, ***'Neo-Vernacular Architecture'*** gained global prominence. The term "neo" denotes "new," while "vernacular" signifies the use of local resources and techniques in harmony with the environment's resilience.

Neo-Vernacular architecture integrates indigenous customs, contemporary construction techniques, and cultural reverence. Incorporating vernacular elements can foster socio-economic sustainability and create employment opportunities for local artisans. This method offers the most effective means of blending historical traditions with modernity to pave the way for a sustainable future. (Zhao & Greenop 2019).

The ethos of Neo-Vernacular architecture encompasses a mindset geared towards low energy consumption. These structures are engineered to minimize energy usage while maintaining harmony with the surrounding ecosystem. The vernacular elements in such constructions reflect local influence. The objective of Neo-Vernacular design is to blend traditional vernacular aesthetics with contemporary technological awareness. (Morel, 2001)

Why Vernacular to Neo-Vernacular

There are several reasons why this shift is occurring:

Changing lifestyles and needs: As rural communities undergo urbanization, there's a change in people's lifestyles and needs. This shift may lead to a demand for

modern conveniences and technologies that aren't necessarily part of traditional vernacular architecture.

Climate change: The growing impact of climate change has heightened the recognition of the importance of constructing buildings that are both energy-efficient and capable of withstanding extreme weather events. Neo-vernacular architecture offers a solution by integrating contemporary technologies and utilizing locally sourced materials like insulation and solar panels to enhance energy efficiency and resilience in buildings.

Economic factors: The rise of economic development and globalization has spurred an increased preference for buildings that adhere to contemporary design standards and technological advancements. Consequently, traditional vernacular architecture may encounter challenges in remaining competitive within the market.

Preservation of cultural heritage: Neo-vernacular architecture acts as a valuable tool in preserving the cultural legacy of traditional vernacular architecture by adapting it to contemporary requirements and seamlessly incorporating it into emerging developments.

The transition towards neo-vernacular architecture is propelled by a confluence of influences, encompassing evolving lifestyles, climate variability, economic dynamics, and a commitment to cultural conservation. Despite its integration of contemporary features, it remains rooted in the essence of traditional vernacular architecture, which reveres local environment, culture, and climate. This approach fosters a distinct sense of belonging and community identity, tailored to the specific village or regional context. We are attempting to develop is to blend both traditional and modern architecture. Neo-vernacular architecture extend the modern building that incorporates elements of the local vernacular. While still attempting to serve the demands of rural communities, this style of architecture made an effort to be as modest and environmentally friendly as feasible. (Dayaratne, 2018).

Neo-vernacular structures prioritize minimal energy usage, with passive design techniques tailored to the site's specific climatic conditions. Utilizing regional resources minimizes environmental impact during construction, while careful consideration of material type, embodied energy, and operational costs further reduces energy consumption. To preserve natural landscapes, local resources are thoughtfully sourced, and the natural topography informs energy-efficient construction methods. Strategic building orientation optimizes wind and solar energy utilization, guiding placement of fenestration, corridors, and outdoor spaces. Effective ventilation and sun shading techniques are implemented to decrease reliance on mechanical energy.

Vernacular Influence represents a deliberate approach aimed at recreating diverse vernacular forms within contemporary settings. Leveraging modern technology, it constructs classic designs under identical conditions, resulting in a novel interpretation of the past and a more vintage portrayal of the future or current era. In its incorporation of classical elements, neo-vernacular architecture adopts a pluralistic, discerning, and eclectic stance, selecting vernacular features based on their inherent utility and relevance.

Neo-vernacular principles use the most recent technology to combine old design theories with modern requirements since they are consistent with current activities. In order to assure minimal carbon content and embodied energy, modern technology and

old processes are frequently combined. Local craftsmen's involvement in building construction revitalizes the dwindling indigenous construction technique of the distant past. Utilizing regional construction materials imparts a sense of familiarity. (Coch, 1998).

Neo-vernacular architecture strives to achieve a symbiotic relationship between the building and its surroundings, emphasizing integration with the natural environment. The structure exudes a sense of humility, prioritizing the provision of shelter without overshadowing the innate beauty of the surrounding landscape. Through careful consideration of form, materials, and environmental compatibility, it engenders a sense of tranquility and reassurance.

Discussion

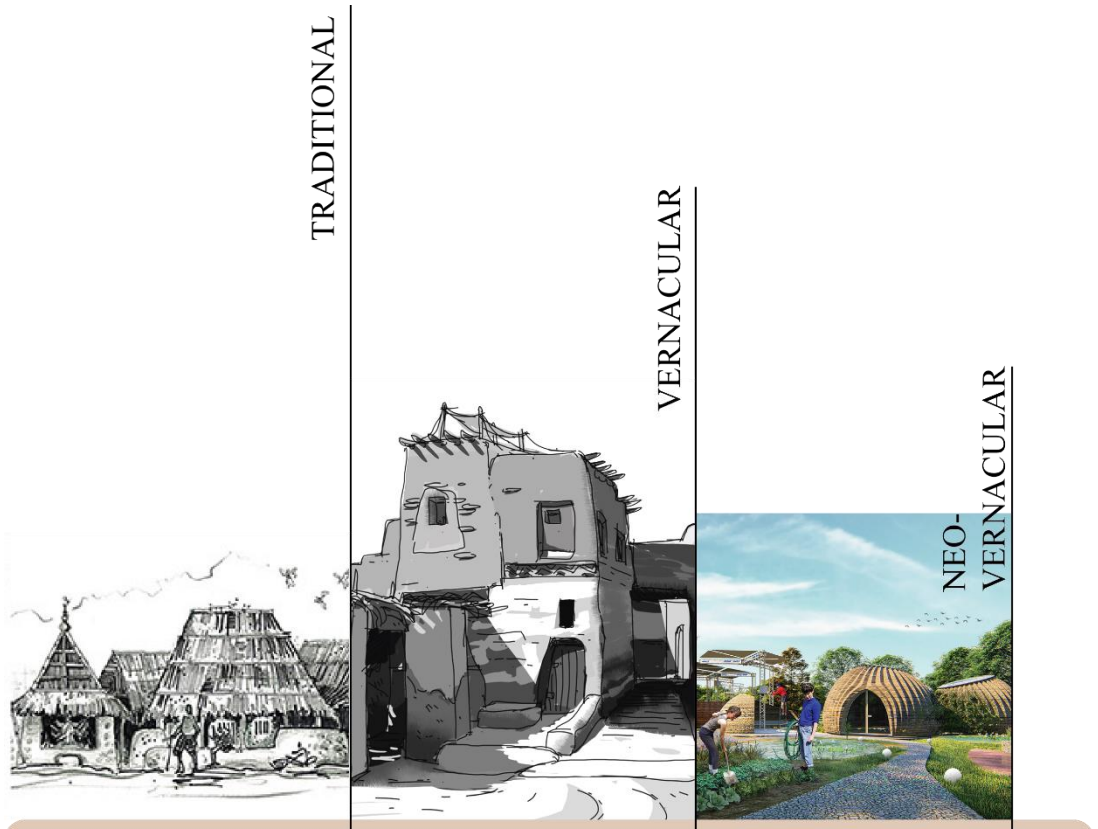
In simple terms, sustainability in architecture refers to how a design or a structure performs toward a location, whether it has a good or bad influence on the environment. The capacity to address the requirements of rural communities while preserving and enhancing the local natural and social resources, while simultaneously fostering economic growth and opportunity, is referred to as sustainability in the development of rural regions.

For a building or urban design to be considered sustainable, it must meet all three elements of sustainability.

1. Sustainability in Climate- Environmental: One of the most widely acknowledged aspects in the realm of construction is a design that demonstrates awareness and responsibility towards its site context, thereby earning recognition for its sustainability in terms of climate and environmental considerations. It involves contemplating how to reflect, execute, and mitigate its climate impact through choices in materiality, resource utilization, and design. Incorporating renewable energy sources is among the strategies falling within this realm.

2. Sustainability in Socio-Cultural: This involves designing concerning the region`s cultural heritage and considering the climate and site characteristics. Utilizing and repurposing locally available resources, such as materials and services, is another aspect of sustainability. Additionally, acknowledging the collective memory of regional heritage and integrating it into architecture that reflects the culture of the building. This component's inclusion in an architectural project can contribute to increased social participation and cohesion.

3. Sustainability in Socio-Economic: It promotes the progress of architectural designs which minimize dependence on external influences. This approach emphasizes maximizing local resources and harnessing collective efforts. By reducing reliance on external factors, such a strategy allows buildings to rely more on local resources and ensures greater longevity. Consequently, this approach bolsters local businesses and enhances the surrounding area's economy. While Neo-Vernacular architecture is known for its durability and simplicity, evolving global trends and increasing demands for essential services have surpassed the capabilities of traditional vernacular design. Nonetheless, there remains a pressing need for architectural styles that prioritize modesty and environmental sustainability.



	TRADITIONAL	VERNACULAR	NEO-VERNACULAR
IDEOLOGY	Formed by traditions inherited from generation to generation, depending on local culture and conditions.	Formed by hereditary traditions but there are influences from both physical and non-physical, forms of development of traditional architecture.	The application of existing architectural elements and then little or much experience of renewal towards a modern work.
PRINCIPLE	Covered by age changes, linked to regional culture, and has strict religious rules and norms.	Develop every time to reflect the environment, culture, and history of the area where the architecture is located. The transformation from a homogeneous cultural situation to a more heterogeneous situation.	Architecture that aims to preserve local elements that have been formed empirically by tradition and develop it into a modern style. Continuation of vernacular architecture.
DESIGN IDEA	More emphasis on facade or form, ornamentation as a necessity	Ornaments are complementary, do not leave local values but able to serve community activities inside	Forms are more modern.

Figure 3 | Difference between the traditional, vernacular and neo vernacular design 2023, Digital Sketch

Building Back Better is a strategy that is frequently use to strengthen community resilience and lessen susceptibility to future catastrophes as well as to address shock-related social, environmental, and economic vulnerabilities. The built environment used in this strategy emphasizes development while preserving local ecology and culture.

Impacted communities have the chance to lower their risk not just from the immediate hazard but also from dangerous climatic conditions by recovering within a BBB framework. The aim of the approach is to implement the ***"building back better"*** strategy within the context of a cultural design movement. This involves revitalizing and reusing traditional (vernacular) design elements that have historically proven successful, alongside modern elements. It's about effectively utilizing inherited traits as a lesson from the past to guide future creations.

Climate Responsive Design Styles

The popularity of courtyard homes as a preferred housing type stems from the combined influences of bioclimatic and socio-cultural factors. Across various geographical regions, architectural styles tend to incorporate this courtyard layout. Additionally, during hot, dry summers, it can be beneficial to sleep on flat roofs, leading to their widespread use. (Bowen, & Yannas, 2013)

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Strategies

Architecture in this context is characterized by compact and large-scale structures, often arranged in a way that they face inwards, creating a sense of enclosure or community within the built environment.

Efforts are made to minimize exposure to the sun's rays from the east and west by reducing the number of surfaces and openings facing those directions. This positioning not only helps in regulating interior temperatures but also allows for the storage and absorption of heat during winter months.

Buildings are closely spaced together in groups to create mutual shading, especially on the east and west sides. This proximity of structures helps in reducing direct sunlight exposure and mitigating heat gain within the built environment.

Thermal barriers, such as non-habitable areas like storerooms or restrooms, are strategically added to the east and west sides of buildings. These barriers act as buffers against heat transfer, helping to maintain comfortable indoor temperatures.

Emphasis is placed on facilitating access to cooling breezes and natural ventilation throughout the built environment. Additionally, efforts are made to ensure adequate natural daylighting within interior spaces, avoiding very large or deep rooms that may hinder the penetration of sunlight.

Internal circulation paths within buildings are designed to be short and efficient, minimizing unnecessary steps. Walls, doors, windows, and outdoor areas are strategically positioned to provide shade and reduce heat gain, contributing to overall thermal comfort.

Architectural features such as colonnades, small enclosed courtyards with arcades, and outdoor spaces for daily activities are integrated into the design of structures. These elements not only enhance aesthetic appeal but also facilitate the ingress of light and air, promoting natural ventilation and creating comfortable living environments.

Courtyards are utilized to provide shade, create pockets of cool air, and offer shelter from hot winds. These open spaces serve as communal areas for relaxation and social interaction, contributing to the overall livability of the built environment.

Maintenance of the exterior areas surrounding buildings is given equal importance as the structures themselves to reduce glare and heat reflection. This holistic approach

to building upkeep helps in preserving the comfort and functionality of the built environment over time. (Bowen, & Yannas, 2013)

Architectural Design:

There is an increasing demand for well-built rural residences in rural areas. Presently, the standard of rural housing has declined due to a neglect of traditional architectural methods and historical knowledge. By examining indigenous dwellings, we can gain insights into the economic and social conditions of the past, tapping into a rich heritage of this land's history and architectural tradition. Indigenous housing demonstrates a profound understanding of environmental possibilities and embraces originality in living spaces. It is crafted in harmony with life's necessities, rather than resisting them or struggling against geographic constraints.

In addition to enhancing the adaptability of residential buildings to environmental and climatic conditions, these concepts and principles also contribute to enhancing the inhabitants' quality of life by enriching the cultural context. Through a simple historical analysis, traditional elements with adverse effects have been identified. In architectural research, typology is a vital tool for identifying and differentiating architectural motifs. In this context, "species" or "type" refers to examples of architectural elements like spaces, structures, decorations, and materials. These examples are identified through collection and categorization processes. Elements are classified based on shared characteristics such as climatic influences, geometric patterns, genetic traits, and other defining features that set them apart within a group.

Considering the aim of typology as a "classification system," it aims to establish clear relationships between different architectural styles, facilitating better understanding, preservation, and exploration of new design techniques. This classification process can enhance our understanding of spatial dynamics and aid in preserving architectural heritage. Rural dwellings, in particular, maintain strong and direct links with the broader culture and lifestyle of the populace. These structures are a testament to the knowledge and skills of individuals who meticulously crafted them and established meaningful connections between them.

Recommendation

To enhance the sustainability and resilience of architectural designs in rural areas the local communities should be engaged in the design and construction process to ensure that the architectural solutions meet their needs and preferences. This can enhance social cohesion and ensure that the buildings are culturally relevant and well-received. The passive design strategies should be implemented that respond to local climatic conditions such as optimizing building orientation, using thermal mass to regulate indoor temperatures, and incorporating natural ventilation systems. The low-energy building practices should be involved to minimize energy consumption. The use of natural lighting, insulation, and other energy-efficient technologies should be involved to reduce the need for artificial heating and cooling. The renewable energy sources such as solar panels and wind turbines should be incorporated into building designs. This will reduce dependence on external energy sources and lower the carbon footprint of the buildings. The locally available building materials and local skilled labor should be used to reduce the transportation and skilled labor costs and it will also support the local economy and preserve the local building skills. The integration of traditional architectural elements and cultural heritage into present-day design will be helpful in the reinterpretation of vernacular architecture reflecting our local identity and

customs. By following these recommendations, architectural designs in rural areas can achieve greater sustainability, resilience, and cultural relevance, ultimately contributing to the well-being of the communities living there.

Conclusion

The philosophy of embracing low-energy practices is inherent in the essence of Neo-Vernacular architecture. These structures are meticulously designed to minimize energy consumption while maintaining harmony with the surrounding ecosystem. The vernacular elements present in such buildings reflect the local cultural influence. The overarching objective of neo-vernacular design is to reintegrate traditional vernacular elements while incorporating modern technological advancements.

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