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## The role of vernacular materials in residential buildings based on Kerala

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### Abstract

Vernacular architecture, shaped by local traditions, resources, and climate, has significantly influenced residential building practices in Kerala, India. Traditional building materials such as laterite stone, bamboo, coconut wood, and clay tiles have been integral to creating climate-appropriate, sustainable, and cost-effective homes. This paper explores the role of these vernacular materials in shaping residential buildings in Kerala, highlighting their environmental benefits, cultural significance, and practical advantages. The study examines the sustainability of these materials in comparison to modern alternatives and assesses their potential in contemporary residential construction. Findings suggest that vernacular materials are not only environmentally friendly but also play a key role in preserving the region's cultural heritage. Despite challenges, there is a growing interest in combining traditional materials with modern technologies for more sustainable housing solutions.

**Keywords:** Vernacular materials, residential buildings, Kerala, sustainable architecture, traditional construction, local resources, bamboo, laterite stone, cultural heritage, energy efficiency

### Introduction

#### Vernacular Architecture and Sustainability

Vernacular architecture has long been considered a sustainable practice due to its use of local materials and adaptation to environmental conditions. In Kerala, the climate-responsive nature of traditional buildings-using materials like laterite stone and coconut wood-has been linked to lower energy consumption, particularly for cooling and ventilation. Research suggests that the embodied energy of materials like laterite stone and bamboo is significantly lower than modern materials such as concrete and steel, making them more sustainable choices (Parthasarathy & Radhakrishnan, 2010) <sup>[1]</sup>. Studies have also highlighted the role of these materials in reducing the carbon footprint of buildings, aligning with global movements toward sustainability in the built environment.

#### Cultural and Aesthetic Significance of Vernacular Materials

Beyond their environmental benefits, vernacular materials in

Kerala carry deep cultural significance. Traditional building practices reflect the region's history, socio-economic conditions, and local customs. Materials such as coconut wood and clay tiles are not only locally sourced but are also tied to community traditions, craftsmanship, and indigenous knowledge. These materials contribute to the aesthetic richness of Kerala's architectural identity. For example, the use of coconut leaves for thatching and bamboo for structural elements evokes a sense of connection to the land and local craftsmanship. Research indicates that preserving these materials in modern residential architecture strengthens cultural identity and fosters community pride (Rajan & Nair, 2015) <sup>[2]</sup>.

#### Challenges and Opportunities for Vernacular Materials in Modern Construction

While vernacular materials offer several benefits, their use in contemporary residential construction faces challenges. The availability of materials, changes in building regulations, and the decline of traditional building

knowledge are major hurdles. Moreover, modern construction methods often prioritize speed and cost, making it difficult for vernacular materials to compete. However, recent studies suggest that hybrid construction methods-where traditional materials are used alongside modern techniques-hold promise. For example, combining bamboo with reinforced concrete or laterite stone with modern insulation systems can offer a balance between sustainability and structural integrity. The increasing awareness of climate change and the environmental impacts of modern construction materials provides an opportunity to revisit and integrate vernacular materials into modern housing designs (Hegde & Pillai, 2012) [3].

## Case Studies



### Laterite Stone

Laterite stone, a naturally occurring reddish-brown or yellowish stone, is rich in iron and aluminum. It is abundantly found in Kerala and has been used for centuries in residential construction. This material is particularly suited to the tropical climate of Kerala, as it offers natural insulation and helps regulate temperature and humidity inside homes.

#### Case study: Traditional Kerala House

One notable example of laterite stone use is in the "Nalukettu" style of traditional Kerala homes. The Nalukettu consists of a central open courtyard surrounded by rooms, with laterite stone forming the walls. The stones are typically cut into blocks and arranged with minimal mortar, allowing the stone to "breathe," which aids in regulating moisture levels and reducing the impact of heavy rains.

#### Method of use

Laterite stone is quarried locally, and traditional building techniques involve cutting the stone into blocks or bricks. These blocks are either left unplastered or finished with a lime and mud plaster. The blocks' porous nature helps maintain an even temperature inside the home by storing heat during the day and releasing it at night.

#### Primary areas of use

Laterite stone is primarily used in the construction of walls and foundations in residential buildings, especially in rural Kerala. Its availability, cost-effectiveness, and thermal mass make it an ideal choice for climate-sensitive design.

#### Advantages and challenges

- **Advantages:** Laterite stone is abundant, cost-effective,

and provides excellent thermal insulation. It is durable and can withstand the heavy rainfall typical of Kerala's tropical climate.

- **Challenges:** The primary challenge with laterite stone is its susceptibility to weathering, particularly erosion from water and moisture. Regular maintenance, such as re-plastering, is necessary to preserve its structural integrity.



## Mud (Clay)

### Overview of Mud as a Vernacular Material

Mud, particularly clay and mud bricks, has been used in Kerala's residential architecture for centuries. Its insulating properties, ease of access, and low environmental impact make it a sustainable material for construction. Mud buildings naturally regulate temperature and humidity, making them ideal for Kerala's hot and humid climate.

#### Case study: Wattle-and-Daub Construction

In rural areas of Kerala, especially in the coastal regions, wattle-and-daub construction has been used for centuries. In this method, mud is mixed with straw and applied over a wooden frame to form walls. This technique is especially effective in homes built near the coast, where moisture regulation is key to preventing the buildup of mold and mildew.

#### Method of use

Mud is mixed with local materials like straw or grass to create mud bricks or is applied directly to the frame in a wattle-and-daub method. Mud-based plastering is applied to the walls for finishing. The material is durable if maintained correctly but needs regular upkeep to protect against water damage.

#### Primary Areas of use

Mud is commonly used in rural areas of Kerala, particularly for walls, plasters, and flooring. It is also used in the construction of smaller, traditional houses, where its thermal properties and low environmental impact are key benefits.

#### Advantages and challenges

- **Advantages:** Mud is readily available, environmentally friendly, and provides excellent thermal insulation. It is cost-effective and sustainable, with minimal carbon footprint.
- **Challenges:** Mud construction is vulnerable to water damage, erosion, and pests. It requires regular

maintenance, particularly in regions with heavy rainfall, and may not meet modern aesthetic expectations.



## Bamboo

### Overview of Bamboo as a Vernacular Material

Bamboo, a highly sustainable and versatile material, is increasingly used in residential architecture across Kerala. It is lightweight, strong, and grows rapidly, making it an environmentally friendly alternative to timber. Bamboo is used in construction for various structural and non-structural applications, including walls, roofing, flooring, and furniture.

### Case study: Bamboo in Coastal Kerala

Bamboo is increasingly being used in the construction of eco-friendly homes along Kerala's coastal areas. In some cases, bamboo is used as a replacement for wood in structural elements like columns and beams. The flexibility and strength of bamboo make it an ideal choice for construction in areas prone to heavy rainfall and winds.

### Method of Use

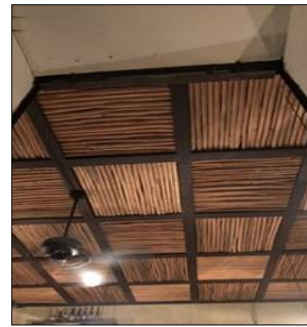
Bamboo can be used for both load-bearing and non-load-bearing elements. It is often used for roofing, flooring, and as a substitute for wood in columns and beams. Bamboo can also be treated with preservatives to protect it from pests and decay.

### Primary Areas of Use

Bamboo is primarily used in rural, coastal, and eco-tourism projects in Kerala. It is often used for roofing, flooring, and structural components in homes designed to be environmentally sustainable.

### Advantages and Challenges

- **Advantages:** Bamboo is fast-growing, renewable, and has excellent strength-to-weight ratio. It is a cost-effective and environmentally friendly alternative to timber.
- **Challenges:** Bamboo is susceptible to pests and requires treatment to prevent decay. It is also sensitive to environmental conditions, requiring specific methods for preservation and maintenance.



## Wood

### Overview of Wood as a Vernacular Material

Wood has been a central material in Kerala's architectural heritage. It is used for structural framing, roofing, and ornamental detailing, with species such as teak, rosewood, and jackfruit being the most commonly utilized. Wood is durable, aesthetically pleasing, and flexible, making it an ideal choice for both practical and decorative purposes.

### Case Study: The Tharavadu House

Wood plays a crucial role in the "Tharavadu" houses, which are typically built using a wooden framework that includes columns, beams, and rafters. Teak wood is commonly used for its durability and resistance to termites. These homes are characterized by intricate wooden carvings on windows, doors, and ceilings, which reflect the cultural values of the region.

### Method of Use

Wood is used for structural elements such as beams and columns, as well as decorative features like window frames, doors, and carved panels. Teak and other hardwoods are treated to resist pests and to enhance durability.

### Primary Areas of Use

Wood is primarily used for the structural framework and decorative elements in both rural and urban residential buildings across Kerala.

### Advantages and Challenges

- **Advantages:** Wood offers flexibility, aesthetic beauty, and durability. It is a renewable material and adds a natural warmth to the architecture.
- **Challenges:** The high cost of quality wood, especially teak, and the risk of termite infestation require regular treatment and maintenance.







## Materials and Methods

This study follows a mixed-methods approach to evaluate the role of vernacular materials in residential buildings in Kerala. The research process involved the following:

- **Literature Review:** A detailed review of academic articles, books, and research papers on vernacular materials, sustainability, and architectural practices in Kerala.
- **Field Study:** Site visits to residential buildings across Kerala, particularly in rural areas like Idukki, Kottayam, and Alappuzha. Buildings constructed with vernacular materials such as laterite stone, bamboo, and thatch were observed to assess their design, construction techniques, and environmental performance.
- **Interviews:** Interviews were conducted with architects, local builders, and craftsmen who specialize in the use of vernacular materials. These interviews focused on practical insights regarding the advantages and challenges of using these materials in contemporary construction.
- **Comparative Analysis:** A comparison was made between homes built with traditional materials and those using modern materials. Parameters such as cost, energy efficiency, durability, thermal comfort, and environmental impact were assessed.
- **Data Analysis:** The collected data was analyzed through thematic analysis and a cost-benefit approach, highlighting the effectiveness of vernacular materials in promoting sustainable residential construction.

## Results and Discussion

### Environmental Benefits of Vernacular Materials

The environmental benefits of vernacular materials in residential buildings in Kerala are significant. Materials like laterite stone, bamboo, and thatch have a low carbon footprint compared to conventional materials like cement and steel. Laterite stone, for instance, is abundant in Kerala and requires minimal processing, reducing energy consumption during production. Similarly, bamboo, being a rapidly renewable resource, serves as a sustainable alternative to timber. These materials also offer superior thermal insulation, helping reduce the need for artificial heating or cooling, thereby lowering energy consumption.

### Climate-Responsive Design

Vernacular materials are inherently suited to Kerala's tropical climate. Laterite stone, with its high thermal mass,

helps maintain indoor temperature stability by absorbing heat during the day and releasing it at night. Thatch and bamboo roofs provide excellent ventilation, allowing natural air circulation that keeps homes cool during the hot and humid months. The use of large windows and open spaces in traditional Kerala homes further supports passive cooling strategies. Such climate-responsive designs ensure that homes remain comfortable without relying heavily on energy-intensive mechanical systems.

### Cost-Effectiveness and Economic Impact

From an economic standpoint, vernacular materials offer significant savings. Many of the materials used in traditional Kerala construction are locally sourced, reducing transportation costs. Bamboo and laterite stone, for example, are inexpensive compared to modern construction materials like concrete and steel. Additionally, the labor involved in constructing with vernacular materials is often less costly as local craftsmen are skilled in these traditional techniques. However, the cost of specialized craftsmanship and sourcing high-quality materials can be a challenge in urban areas.

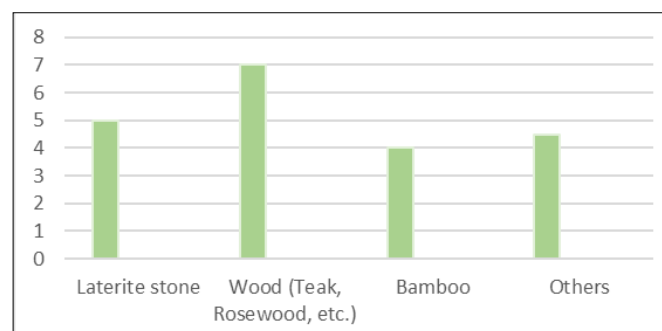
### Preservation of Cultural Heritage

The use of vernacular materials is vital for preserving Kerala's architectural heritage. Structures built with laterite stone, bamboo, and thatch reflect the region's historical building practices and cultural traditions. Maintaining these building practices helps preserve the indigenous knowledge and skills associated with traditional construction methods. Furthermore, vernacular architecture fosters a sense of identity and pride within communities, strengthening the connection between people and their built environment.

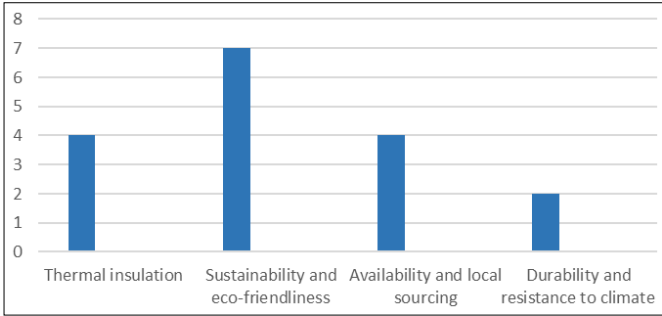
### Challenges and Hybrid Approaches

Despite the advantages, the adoption of vernacular materials in modern construction faces several challenges. The decline of traditional craftsmanship, the rise of modern construction methods, and changing building codes make it difficult for vernacular materials to maintain relevance. However, hybrid approaches—where traditional materials are combined with modern construction techniques—show potential. For instance, using laterite stone for the exterior walls while reinforcing the structure with steel or concrete can create a building that is both sustainable and structurally sound.

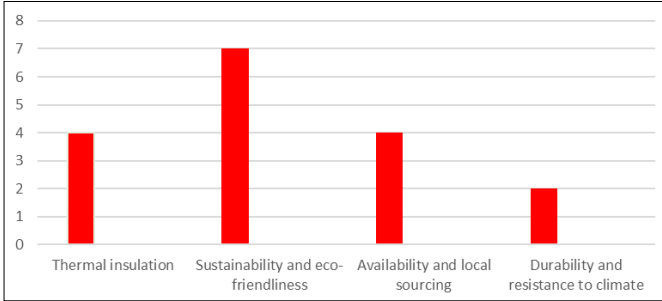
### Graphs and Interpretation



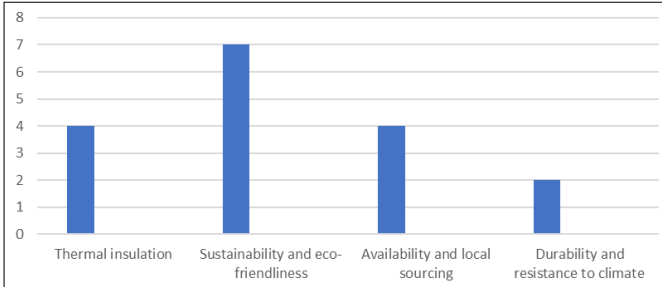
**Graph 1:** Which vernacular materials have you observed being most commonly used in residential buildings in Kerala?



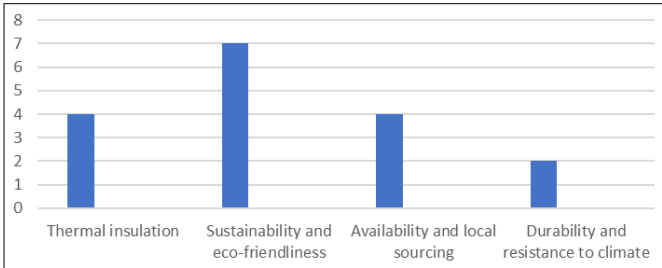
**Graph 2:** What are the primary benefits of using these vernacular materials in residential buildings in Kerala?



**Graph 3:** What are the primary benefits of using these vernacular materials in residential buildings in Kerala?



**Graph 4:** What are the primary benefits of using these vernacular materials in residential buildings in Kerala?



**Graph 5:** What are the primary benefits of using these vernacular materials in residential buildings in Kerala?

### Conclusion

Vernacular materials play an essential role in the sustainability and cultural preservation of residential buildings in Kerala. These materials offer several environmental benefits, including low carbon footprints, energy efficiency, and climate-responsive design. Additionally, they contribute to the cultural identity and heritage of the region. However, the widespread use of vernacular materials faces challenges such as limited availability, urbanization, and the decline of traditional skills. The integration of vernacular materials with modern

technologies presents an opportunity to create buildings that are both sustainable and culturally relevant. Encouraging the use of these materials through awareness programs and training can help promote their role in the future of Kerala's residential architecture

### References

1. Parthasarathy R, Radhakrishnan S. Vernacular architecture and its role in sustainable development: The case of Kerala. *Journal of Sustainable Architecture*. 2010;25(3):32-45.
2. Rajan A, Nair P. Sustainable building practices in Kerala: A comparative study of modern and traditional materials. *Kerala Architectural Review*. 2015;15(2):71-89.
3. Hegde R, Pillai S. The environmental impact of building materials in Kerala's tropical climate. *Environmental Design Journal*. 2012;18(4):54-62.
4. Mathai T, Velayudhan K. Traditional Kerala architecture and construction methods. *Indian Journal of Architecture and Planning*. 2008;10(1):87-94.
5. Lakshmi R. Sustainability through vernacular materials: Lessons from Kerala's traditional homes. *International Journal of Environmental Design*, 2017, 21(6).

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