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Principles of Sustainability in Vernacular Architecture: Case of Kanalkadu

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Abstract:
Vernacular architecture is a product of man's ingenuity applied towards maximizing available resources to create the most socially, environmentally, and economically sustainable architectural response to the given context. Owing to globalization and other driving forces, traditional building practices are gradually being replaced by more generic solutions that use 'modern' materials and methods that lack the accumulated knowledge and sensitivity gained over years of practice and perfection in a specific region.
Study and documentation of vernacular architecture can help capture these invaluable lessons before they are lost to eternity. Insights thus gained can help in creating more appropriate solutions to meet the growing demand for housing in developing countries like India. In this paper, we present the principles of sustainable architecture that have been part of the traditional building practices in Kanalkadu, a hill-side village in Tamil Nadu.

Keywords: *Rural settlements, Rural life in Tamil Nadu, Place and culture, Socio-cultural aspects of space*

Introduction:

Vernacular architecture refers to the distinct way of building that has been practiced and developed over time by 'non-expert' locals to meet their own local needs and values (Engin et al, 2007, Philokypou, M et al. 2021). Based on the knowledge that is gained through trial-and-error, passed from one generation to another as building traditions – vernacular architecture is often the fittest solution for a given context as approached from multiple aspects such as environmental, social and economics. (Helena, C 1998, Sayigh, A & Marafia, H 1998, Oliver, P 2006).
The variety in the vernacular architectural responses across the globe are are a reflection of the variations in climate, topography, culture, economics, material availability, technology, etc. (Engin et al, 2007). However, under the growing influence of globalization and related trends, traditional vernacular characteristics are on the decline in most parts of the world – rural India included. Traditional building practices are being replaced by generic solutions that tend to homogenize the image of rural settlements, causing them to lose their distinct identity. They make use of modern solutions that lack the sensitivity and responsiveness to socio-environmental factors that are ingrained in vernacular architecture.
As we stand in the brink of losing these repositories of indigenous knowledge vernacular architecture has gained more relevance than ever in a world that is increasingly aware of the demerits of modern technology in construction. Studies in vernacular architecture can therefore be of great use in capturing these invaluable lessons in sustainability that can then be applied towards creating more socially, environmentally, and economically sustainable solutions in architecture to meet the growing housing demands in developing countries such as India without incurring the larger environmental costs associated with modern materials methods.
In this paper, we discuss the results of a study undertaken by a group of undergraduate architecture students from Anna University, Chennai, as part of the second-year Rural Habitat Design Studio, 2023. The key objective of the study was to understand the principles of sustainability encapsulated in the vernacular architecture of Kanalkadu – a hill-side village in Tamil Nadu.

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About the Study Area: Kanalkadu, Tamil Nadu

Kanalkadu is a rural settlement, located in the hilly regions of the Kodaikanal block in the Dindigul district of Tamil Nadu – between the elevations of 1110m and 1141m above mean sea level. The climate in these parts was found to be ideally suited for coffee and pepper production by the British who went on to establish many plantations of coffee and pepper in these regions.

It is said that the settlement Kanalkadu came into existence when a few families of bonded labourers brought in from the plains to work in the British plantations retreated into the forests and made it their home by clearing the *'nerinjimullu'* plants. The settlement has eventually grown to its current population of 441 people and 147 households with the arrival of more families over time.

Even today, majority of the households at least partly depend on these plantations for their livelihood. Other occupations include animal rearing, honey collection, shopkeeping, driving, housekeeping, sweeping, construction work, some of which are seasonal.

Principles of Sustainability learnt from the Vernacular Architecture of Kanalkadu

Sustainable development is defined as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED 1987)." To achieve sustainability in architecture, it is essential that the three pillars of sustainability, i.e., environmental, social, and economic, and the inter-relationships between them must be duly considered and addressed.

Environmental sustainability focuses on the conservation of natural resources including land, water, and sources of energy, and preserving the planet for the future generations of human beings to thrive and evolve. Economic sustainability is focused on conserving man's ability to meet his current economic needs while ensuring that his ability to meet his future economic needs are not compromised. Social sustainability focuses on the social factors that promote human well-being, comfort, safety, interaction, and inclusivity.

In this paper, we present the five principles of sustainability that have traditionally been applied to the vernacular architecture of Kanalkadu. Data was collected using a combination of field study methods which included the case study of select samples of traditional houses, surveys, photo-documentation, and participant observation.

Principle 1: Use of local materials and skills

The study revealed that over 50% of existing buildings in Kanalkadu, which includes the houses, the Government school and post office, are built using traditional materials such as mud, stone, tile, and thatch, which are locally sourced. It is typical for these houses to be self-built or built by the 'non-expert' members of the community.

Sourcing materials and labour locally helps in the reduction of transportation and labour costs respectively – resulting in the substantial reduction of construction costs, contributing to economical sustainability. Whereas the use of local materials reduces the environmental impact of transporting materials over long distances.

Hiring local labour for construction promotes economic and social sustainability by creating local jobs, strengthening local economy, and promoting social wellbeing. Moreover, the use of local materials and skills enhances the distinct visual character and image of the settlement, strengthening the identity and sense of belonging within the community.

Fig. 1:

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Traditional houses of Kanalkadu built using local materials such as mud and stone.

Principle 2: Multifunctionality

Case studies revealed that the vernacular architecture of Kanalkadu typically employs multifunctionality as a key space-saving strategy used in the design of traditional houses – thereby contributing to both economic and environmental sustainability. Incidentally, it was noticed that owing to it's the very multifunctionality of these spaces gave it a strong socio-cultural significance, thus contributing to social sustainability in architecture.

The commonly found multifunctional space-types in the traditional houses of Kanalkadu are presented below:

Koodam – The *koodam* is typically an enclosed space in the heart of the house that is intended to be a multipurpose space. In Kanalkadu, the *koodams* were found to serve the following functions – cooking, sleeping, eating, storage, praying, studying, celebrating family functions, etc.

Thinnai – *Thinnai* is a raised platform that acts as a 'semi-enclosed' seating area that doubles as a transition space between the house and the street. In Kanalkadu, *thinnais* serving as a place for resting, chatting, taking an afternoon siesta, playing, studying, drying coffee and pepper seeds, food preparation, storing firewood, etc.

Open spaces – Most houses in Kanalkadu had an open space attached to the house – either in the form of a space between houses, a courtyard, or a backyard. In Kanalkadu, these open spaces catered to various needs ranging from cooking, bathing, drying coffee, and pepper seeds, relaxing, storing firewood, boiling water, rearing of livestock etc. (as highlighted in the figures a, b, and c)

Paran – The *paran* or attic space is the space between the sloped roof and the ceiling, which is used for multiple purposes depending on the nature of space that is available. In Kanalkadu, the *paran* was found to be used for activities such as, drying and storage of coffee seeds, family prayers, sleeping, etc.

The number of activities that each space catered to, or the nature of activities would change depending on factors such as time of the day, week, or year, number of people in the house and their various needs, nature and design of the space and the context in which it was situated, availability (or absence thereof) of other spaces in the house, etc.

Fig. 2

Multifunctional use of spaces in Kanalkadu

Principle 3: Contextual approach

The study revealed that the traditional houses of Kanalkadu were predominantly context-driven from social as well as environmental aspects, as has been highlighted below:

In response to the climatic context, traditional houses have thick walls, low ceilings, few, small window openings, in order to retain warmth in the building. Walls and plinths are protected by overhangs and stones to keep the rainwater away.

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Materials are locally sourced and assembled using local skills

The houses are designed in levels to suit the natural contours of the site, minimizing the need for cut-and-fill, levelling etc.

The spaces are designed to suit the socio-cultural needs of the community. For e.g., attic spaces are provided for storing coffee seeds, the *thinnai* serves as a social space, bathrooms are traditionally not provided as part of the house in deference to traditional values.

As illustrated by the examples above, contextual architecture contributes to environmental sustainability by a) reducing the energy spent in transportation of materials, minimizing cut and fill at site, and through c) the application of passive design strategies. Whereas (i) the use of local materials and skills, (ii) minimizing earthwork at site, and (iii) the adoption of passive strategies also contributes to economical sustainability. By contextualizing the architecture to the socio-cultural context, vernacular architecture enhances the identity and sense of belonging within the community thereby contributing to social sustainability.

Principle 4: Incremental design

As opposed to building one large house – which needs requires more capital and alterations to the site, we found the concept of incremental design was commonly practiced in Kanalkadu.

The family initially builds a basic unit made of a simple, rectangular, multipurpose space *(koodam)* with or without an attic space *(paran)*. Based on their means, the family may add other enclosed spaces or semi-enclosed spaces *(thinnai)* to the unit in response to their changing needs and aspirations. Depending on the nature of requirement, more units may be added to the site forming a cluster. Each additional unit is carefully positioned giving due respect to the natural features (e.g., climate, terrain, vegetation, waterbody etc.) and existing man-made structures on the site.

They ensure that positive spaces are created between the buildings to ensure that it can serve as a courtyard, besides ensuring sufficient light and ventilation in all the units on site. A *thinnai* may be added to visually tie the building, while serving as a semi-enclosed transition space with multiple other uses.

Later modifications and additions to traditional houses and housing clusters have been found to use newer forms (e.g., flat roofs), materials (e.g., brick, hollow blocks, cement), and methods of construction (e.g., reinforced cement concrete framed structures).

Principle 5: Minimalism

Minimalism in architecture is popularly understood as an aesthetic comprised of simple, evocative forms using clean lines, pleasing proportions, and a limited colour palette. However, in this paper, the term minimalism is applied to the principle of minimizing material usage, energy, waste, which helps to minimize both building costs and environmental impact.

In general, rural communities are known to practice a simple, low-impact, zero-waste approach to life, which may be attributed to their closer connection to nature, and limited access to resources when compared to their urbanized counterparts. In Kanalkadu – which is located in the hilly region surrounded by forests and plantations, goods are not readily available here, or require a lot of time, energy, money, and efforts to procure. This influences the community to practice simpler ways of living and building.

The following examples of minimalist strategies were observed in the traditional vernacular houses of

Kanalkadu:

Use of simple shapes and forms: Simple, rectangular shapes are the most commonly used footprint in Kanalkadu. They are easier or the eye, simple to construct, easy to expand (as previously explained), easy to maintain, and are most efficient to use in terms of space. They are covered by the humble, pitched roofs.

Frugal use of materials: The material palette is limited to basic materials that were used in their as-found condition or were roughly dressed. Surfaces of walls and woodwork were often left rustic and un-plastered. This minimized the use of materials and kept it low maintenance.

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Simple methods of construction or assembly: Houses were often self-built, using simple methods. The design and workmanship were common-sensical and utilitarian. They were easy to build, maintain, repair, or replace. Houses are sited on the terrain with minimum interventions or alterations to the site.

Use of built-in features: The houses typically had simple, built-in features designed as part of the house to serve various practical functions. These features offered physical comfort without physical or visual clutter. They also eliminated the need for moveable furniture. Examples found in Kanalkadu include built-in seating, cooking platforms with wood-burning stove, storage units, grinding stones, etc.

Passive design: Passive design strategies were adopted to ensure thermal comfort eliminating the need for energy-consuming mechanical devices.

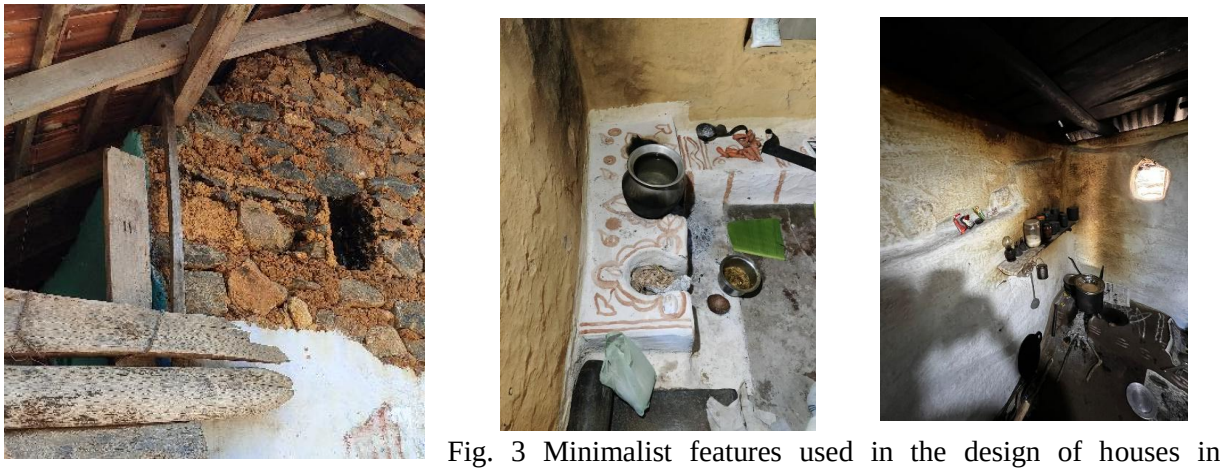

Fig. 3 Minimalist features used in the design of houses in Kanalkadu

Conclusion:

The study aimed at understanding the principles of sustainability embedded in the vernacular architecture of Kanalkadu – a hill-side settlement in Tamil Nadu. It brought out the traditional building practices that allowed locally found materials to be transformed into socio-culturally relevant, climate-responsive architecture with help of minimum inputs or environmental impacts. The lessons learnt from the study have been framed as the five principles of sustainability architecture as understood in relation to the three pillars of sustainability – environmental, social, and economic.

The study adds to the existing knowledge on vernacular architecture and sustainability studies in general, and more specifically provides insights into the traditional building practices in the hilly regions of Tamil Nadu. The lessons in sustainability that have been gained from the study can be particularly useful for the practice of sustainable architecture.

References:

C. Helena, Bioclimatism in vernacular architecture; Renewable and Sustainable Energy Reviews, 2 (1-2) (1998), pp. 67-87

N. Engin, N. Vural, S. Vural, M.R. Sumerkan; Climatic effect in the formation of vernacular houses in the Eastern Black Sea region; Building and Environment, 42 (2) (2007), pp. 960-969

A. Sayigh, H. Marafia, Vernacular and contemporary buildings in Qatar Renewable and Sustainable Energy Review, 2 (1-2) (1998), pp. 25-37

Oliver. P, Built to Meet Needs: Cultural Issues in Vernacular Architecture; Routledge: London, UK, 2006

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Philokyprou, M.; Michael, A.; Malaktou, E. A typological, environmental and socio-cultural study of semi-open spaces in the Eastern Mediterranean vernacular architecture: The case of Cyprus. Front. Archit. Res. 2021, 10, 483–501
WCED (World Comission of Environment and Development). 1987. Report of the World Commission on Environment and Development: Our Common Future.
Rapoport, A. House Form and Culture; Prentice-Hall: Englewood Cliffs, NJ, USA, 1969