Research paper

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Utilization of Local Materials in Nuwo Sesat: A Strategy for the Sustainability of Traditional Lampung Architecture

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Abstract

This study examines the utilization of local building materials in Nuwo Sesat, the traditional house of Lampung, within the context of sustainability and resilience to climatic conditions and natural hazards. Employing a qualitative approach combined with architectural ethnography, data were collected through field observations and in-depth interviews. The findings indicate that locally sourced materials, such as merbau and ulin timber, demonstrate strong performance against extreme weather conditions and exhibit adaptability to the geographical context of Lampung. Furthermore, the study formulates a set of principles for the development of sustainable architecture grounded in local wisdom, emphasizing the integration of traditional knowledge with contemporary environmental considerations.

Keywords: Lampung, local materials, Nuwo Sesat, sustainability, vernacular architecture

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Introduction

Indonesia, as an archipelagic nation with diverse geographical and cultural landscapes, possesses a rich legacy of traditional architecture that reflects the close relationship between humans, nature, and local culture. Each region preserves vernacular buildings that are not only distinctive in form and function but also in the selection and use of construction materials sourced directly from their surrounding environments. This traditional architecture has evolved through a long process of trial and error, transmitted across generations, and demonstrates an inherent capacity to adapt optimally to local environmental and climatic conditions (Rapoport 1969; Oliver 2007).

One significant example of Indonesian traditional architecture is Nuwo Sesat, a traditional house of Lampung that functions as a customary meeting hall and a symbol of community identity. This structure is constructed using locally sourced materials such as merbau wood, ulin wood, bamboo, rattan, and roofing made from ijuk or alang-alang fibers. The use of these materials is not only based on their local availability but also on their resilience to humid tropical climates and natural hazards such as flooding and earthquakes (Sinaga 2016; Wahyudi 2014).

However, contemporary architectural development in Indonesia has shown a significant shift toward the use of industrial materials such as concrete and glass, which are not always compatible with local environmental conditions. This mismatch often results in reduced thermal comfort, increased energy consumption, and the gradual loss of local identity (Widodo 2012; Prianto 2007). Amid the challenges posed by global climate change, the existence and values embodied in vernacular architecture particularly its use of local materials have become increasingly relevant as a model for sustainable and adaptive development.

This study aims to further examine the characteristics and sustainability potential of local materials used in Nuwo Sesat, the traditional house of Lampung. The research focuses on their resilience to tropical weather conditions and natural hazards, their relationship with local geographical and cultural contexts, and the underlying principles that can be adapted for the development of environmentally responsive contemporary architecture grounded in local wisdom.

Adopting a qualitative approach, this study was conducted through observations of a Nuwo Sesat replica at the Lampung Museum, interviews with cultural experts and traditional craftsmen, and a comprehensive literature review. The findings are expected to enrich the discourse on locally grounded sustainable architecture and to provide concrete recommendations for contemporary architectural practices that are aligned with environmental conditions and cultural values.

Methods

This study employs a descriptive qualitative approach combined with an architectural ethnography method to explore the utilization of local building materials in Nuwo Sesat, the traditional house of Lampung. The primary objective of this approach is to understand Nuwo Sesat not merely as a physical structure, but as a cultural artifact that embodies local wisdom, traditional values, and the ecological adaptations of the Lampung community.

Research location

The research was conducted at the Lampung Museum in Bandar Lampung, which features a replica of Nuwo Sesat constructed in accordance with traditional architectural principles and utilizing authentic local materials. The selection of this site was based on considerations of the replica's authenticity, the availability of adequate secondary data, and access to key informants, including curators and traditional craftsmen.

Data collection techniques

Data were collected through three primary techniques: participant observation, in-depth interviews, and documentation study. Participant observation was conducted through direct examination of building elements, including the types of local materials used (such as merbau wood, ulin wood, bamboo, and ijuk), traditional jointing systems, and architectural forms that adapt to the climatic and geographical conditions of Lampung. Visual documentation, including photographs, field notes, and sketches, was also employed to support and enrich the data collection process. In-depth interviews were conducted with key informants possessing direct and extensive knowledge of Nuwo Sesat, including museum curators and staff, craftsmen involved in the construction of the replica, and local traditional leaders. The interview topics covered the historical background, architectural philosophy, material selection and processing, as well as traditional construction techniques. In addition, documentation studies were carried out by reviewing museum archives, building reconstruction reports, scientific publications, and other relevant literature to complement and validate the primary data.

Data analysis technique

The collected data were analyzed using thematic and interpretative approaches. The analysis process involved several stages, including data reduction to filter and select information relevant to sustainability, resilience, and local contextual relationships; data categorization based on the functions and characteristics of materials; and qualitative interpretation that connects field findings with the theoretical framework of vernacular architecture and sustainable design principles. This analytical process provides a comprehensive understanding of how Nuwo Sesat utilizes local resources in a prudent and context-responsive manner, as well as its relevance to the development of contemporary architecture that is adaptive to climate change and grounded in local wisdom.

Results and discussion

Advantages of local materials in the construction of Nuwo Sesat

The findings indicate that the local materials used in the construction of Nuwo Sesat exhibit high technical and ecological performance. Merbau and ulin wood, which serve as the primary structural elements, demonstrate exceptional resistance to high humidity, insect attacks, and exposure to tropical weather conditions. Thermal analysis reveals that these materials possess low thermal conductivity and strong moisture-buffering capacity, making them highly suitable for the climatic conditions of Lampung. In addition, roofing materials such as ijuk provide effective thermal insulation and water resistance, further enhancing the building's environmental performance and durability.

From a structural perspective, the use of traditional jointing techniques such as wooden pegs and rattan bindings enables the building to maintain flexibility, thereby enhancing its resilience to seismic activity. The stilt-house design, elevated approximately 2–3 meters above ground level, effectively mitigates flood risk while maximizing natural ventilation. The Nuwo Sesat replica observed at the Lampung Museum for more than a decade exhibits minimal material degradation, requiring only limited maintenance while consistently preserving its structural performance.

Table 1
Physical and mechanical characteristics of local materials
Source: Compiled from various literature (Jasni, 2010; Utami, 2015; Widodo, 2012)

Material	Specific gravity (kg/m³)	Compressive strength (MPa)	Weather resistance	Insect resistance
Merbau Wood	800-900	65-80	Very good	Very good
Ironwood	900-1000	70-90	Very good	Very good
Meranti Wood	350-450	35-45	Good	Currently
Betung Bamboo	600-700	40-50	Good	Needs Treatment
Fiber	150-200	-	Very good	Good

Sustainability dimensions of local materials

The environmental sustainability of the materials used in Nuwo Sesat is reflected in their low embodied energy and reduced carbon footprint. The relatively short sourcing radius (less than 100 km), high biodegradability, and the carbon sequestration potential associated with timber utilization position Nuwo Sesat as a tangible example of low-emission architecture.

From an economic perspective, the cost of local materials is approximately 30–60% lower than that of modern industrial materials. Although periodic maintenance is required, the total life-cycle cost of buildings utilizing local materials remains more economical. Furthermore, this study highlights that the involvement of traditional craftsmen generates significant local economic impacts, including job creation and the enhancement of added value within the local wood-processing industry.

The socio-cultural dimension constitutes a crucial aspect that reinforces sustainability. The philosophy of Piil Pesenggiri encourages community involvement in the selection of materials and construction techniques, while also positioning the building process as an integral part of cultural rituals. Certain materials, particularly specific types of timber, are selected not solely based on their technical performance but also for their symbolic and spiritual significance.

Material	Embodied Energy (MJ/kg)	CO_2 Emission (kg CO_2/kg)	Transport Distance (km)
Merbau Wood	2,5	0,18	45
Ironwood	2,8	0,21	65
Bamboo	1,2	0,08	25
Concrete (comparator)	5,8	0,95	150
Steel (comparator)	35,2	2,75	850

Table 2
Carbon footprint of construction materials

Material	Thermal Conductivity (W/mK)	Lag Time (hours)	Decrement Factor
Merbau Wood	0,12-0,15	8,5	0,35
Ironwood	0,14-0,18	9,2	0,32
Bamboo	0,08-0,12	6,8	0,42
Fiber	0,06-0,08	12,5	0,28

Table 3
Local material thermal conductivity

Resilience to weather and natural hazards

Nuwo Sesat demonstrates strong resilience to various extreme environmental conditions. In the context of a tropical climate characterized by high rainfall and humidity, the building incorporates natural drainage systems, steep roof designs, and water-resistant materials that maintain indoor comfort. Merbau and ulin timber have been shown to resist decay and insect attacks even under high humidity conditions, as evidenced by both field observations and the reviewed literature.

In the context of natural hazards, the stilt-house design and the use of flexible jointing systems provide essential structural elasticity, enhancing resilience to earthquakes. The study indicates that timber structures with non-rigid connections, such as joinery without nails, are more capable of absorbing seismic energy compared to rigid construction systems. Additionally, the elevated structure above ground level offers effective protection against seasonal flooding, further strengthening the building's adaptive performance in hazard-prone environments.

Material	Water Absorption (%)	Saturation Time (hours)	Recovery Time (jam)
Merbau Wood	12-15	16	48
Ironwood	8-12	20	36
Bamboo	18-25	8	72
Rattan	15-20	12	56

Table 4
Material water absorption rate

The relationship between architecture and the geographical conditions of Lampung

The architecture of Nuwo Sesat demonstrates a high degree of contextual responsiveness to the geographical and climatic conditions of the Lampung region. Building materials are selected from locally available natural resources that grow within the surrounding environment. The characteristics of latosol soil and the predominantly lowland topography influence the design of the stilt foundation system, as well as the selection of moisture-resistant timber species, ensuring both structural stability and environmental adaptability.

The humid tropical climate of Lampung, characterized by average temperatures of 26–32°C and high humidity levels (80–90%), necessitates the implementation of passive ventilation systems and protection against solar radiation. Nuwo Sesat effectively integrates these requirements through wide roof overhangs, the use of materials with low heat absorption capacity, and building orientation that responds to prevailing wind patterns. A material suitability matrix indicates that the primary materials such as merbau wood, ulin wood, and ijuk exhibit a high level of compatibility with these geographical and climatic conditions.

Table 5
Material-environment suitability matrix

Environmental Conditions	Merbau Wood	Ironwood	Bamboo	Rattan	Fiber
High Humidity	Very suitable	Very suitable	In accordance	In accordance	Very suitable
High Rainfall	In accordance	Very suitable	Suitable enough	In accordance	Very suitable
High Temperature	Very suitable	Very suitable	Very suitable	In accordance	In accordance
Soft Soil	In accordance	Very suitable		N/A	N/A
Earthquake Risk	Very suitable	Very suitable	Very suitable	Very suitable	In accordance
Flood Risk	In accordance	Very suitable	Suitable enough	Suitable enough	In accordance

Adaptive principles for sustainable architecture

Based on the findings of this study, several key principles can be formulated as follows:

- Material Selection that considers climatic context and sourcing distance, ensuring environmental compatibility and reduced carbon footprint.
- Adaptive Design Strategies based on passive ventilation and the mitigation of excessive heat gain to enhance thermal comfort.
- Sustainable Construction Methods utilizing joinery systems that allow for disassembly and reassembly, supporting material reuse and longevity.
- Cultural Preservation through the active involvement of local communities in the selection and application of building materials, thereby sustaining traditional knowledge and practices.

Nuwo Sesat offers an important insight that architecture is not merely about physical form, but also about the integration of humans, nature, and the cultural values that accompany it.

Conclusion

This study reveals that Nuwo Sesat, as a representation of traditional Lampung architecture, constitutes a form of vernacular architecture that not only reflects the cultural and spiritual values of the Lampung community but also embodies strong principles of sustainability and environmental resilience. The use of local materials such as merbau wood, ulin wood, bamboo, and ijuk has been proven to provide thermal comfort, durability against tropical weather conditions, and resistance to natural hazards such as earthquakes and flooding.

From an environmental perspective, local materials exhibit a low carbon footprint, high biodegradability, and contribute to the overall energy efficiency of the building.

From an economic perspective, these materials are more affordable and generate positive impacts for local communities, particularly in preserving the skills of traditional craftsmen. The socio-cultural dimension is also highly significant, as community involvement in the construction process and the preservation of values such as Piil Pesenggiri further strengthen the collective identity of the Lampung people.

Furthermore, the analysis indicates that the design and construction principles of Nuwo Sesat can be adapted into contemporary architecture that is more responsive to climate change and the evolving needs of modern society. Principles such as context-based material selection, the application of passive strategies for thermal comfort, and community involvement in the construction process offer valuable lessons for the advancement of sustainable architecture in Indonesia.

Thus, Nuwo Sesat is not merely a cultural heritage artifact, but also represents a model of ecological and resilient architecture that remains highly relevant for both the present and the future.

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