Exploring Climate-Responsive Wisdom of Traditional Lampung Architecture for Contemporary Sustainable Design

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***Abstract*— Traditional Indonesian architecture holds climate-responsive strategies that are relevant to sustainable design, but these principles have not been systematically translated into contemporary architecture. This study aims to identify and analyze the principles of climate responsiveness in traditional Lampung houses and their potential for today's sustainable design. The study uses qualitative case studies with field observations, architectural documentation, simple thermal condition measurements, and semi-structured interviews with 15 informants consisting of residents, traditional leaders, and architectural practitioners. The data were analyzed thematically and comparatively. The results identified an interconnected climate-responsive configuration in traditional Lampung houses, characterized by site- and wind-responsive orientation, elevated floors approximately 1.2–2.0 m above ground, opposing openings that facilitate cross ventilation, large roof volumes, shading elements, local timber materials, and adaptive spatial organization. Spot measurements showed lower indoor temperatures than simultaneous outdoor temperatures during the observed periods; however, these measurements are interpreted as indicators of passive thermal response rather than direct evidence of thermal comfort. The study contributes a Lampung-specific climate-responsive design framework that translates vernacular principles into measurable criteria for contemporary sustainable architecture.**

Keywords—Climate-Responsive Architecture; Lampung; Local Wisdom; Sustainable Design; Traditional Architecture.

I. INTRODUCTION

Climate change, rising environmental temperatures, and the growth of building energy needs have placed the architecture and construction sectors as one of the strategic areas on the sustainable development agenda. Buildings not only contribute to energy consumption and carbon emissions, but also face increased mechanical cooling needs, especially in hot and humid climates. Ahmed Ali et al. [1] affirm that the building sector is responsible for a significant portion of energy consumption and global greenhouse gas emissions, so reducing energy requirements while maintaining thermal comfort is an important issue in architectural design. In this context, passive design strategies are increasingly relevant because they can take advantage of building orientation, natural ventilation, opening configurations, building envelopes, shading, and microclimate conditions to reduce dependence on active cooling systems. Min J et al. [2] showed that the implementation of a passive strategy that is appropriate to building conditions and climate is able to result in energy savings of around 6.7–66.2%, while a systematic study by Hu et al. [3] found that passive strategies in residential buildings in hot areas can on average reduce the temperature in the room by about 2.2°C, reduce the cooling load by 31%, and result in energy savings of around 29%. The findings show that the development of climate-responsive architecture is no longer just an aesthetic or technical option, but rather a need to strengthen the environmental resilience and energy efficiency of buildings.

In the development of sustainable architectural discourse, traditional or vernacular architecture has an important position because it is formed through a process of long-term adaptation between humans, climatic conditions, local resources, and social and cultural needs. In contrast to buildings that rely on mechanical technology to obtain thermal comfort, many vernacular buildings use a combination of thermal mass, natural ventilation, shading, local materials, spatial configuration, and building form as a mechanism for adaptation to the environment. Ameri [4], through a comparative study of six vernacular dwelling typologies, shows that the combination of natural ventilation, thermal mass, and shading is able to provide effective protection against overheating and results in a better level of user comfort than some modern types of housing. Sargazi and Tahbaz [5] further place climate-responsive strategies and adaptive behavior of residents as two important components in understanding the thermal comfort of vernacular architecture. This perspective is reinforced by Ayoobi et al. [6], who show that vernacular principles are related to a number of key indicators of sustainable design, especially energy, materials and resources, environmental quality in space, site and ecology, and socio-cultural dimensions. Thus, traditional architecture needs to be understood not as a formally replicated artifact of the past, but as a system of design knowledge that can be extracted, evaluated, and critically transformed to answer the needs of contemporary architecture.

The Indonesian context reinforces this urgency because geographical and climatic diversity result in the need for different passive cooling strategies between regions. Putra et al. [7], based on climate data from 106 locations in Indonesia, identified eight integrated climate zones and showed that the potential for comfort ventilation, night ventilation, and evaporative cooling differ according to the characteristics of temperature, humidity, wind speed, and atmospheric conditions of each region. This diversity explains why the principle of climate responsiveness in traditional Indonesian architecture cannot be separated from

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the local context in which the building develops. In Lampung, the relationship between environment and culture can be found in traditional house typologies that use stilt structures, local materials, traditional connection systems, specific space configurations, and strong connections to local geographical conditions. Putri et al. [8] found that traditional Kenali houses in Lampung show spatial adaptation, structure, construction, and connection systems to the environment and local natural potential. Meanwhile, Siregar [9], through field research and semi-structured interviews on traditional-vernacular houses in Kinali, West Lampung, showed that building forms, structural systems, use of materials, connection techniques, building skills, and the use of local resources are part of indigenous knowledge that is relevant to be considered in today's construction practices. This condition makes Lampung a strategic context to examine the relationship between traditional architectural wisdom, responses to humid tropical climates, and contemporary sustainable design needs.

Although attention to the environmental performance of vernacular architecture is increasing, the literature still points to an important gap between the identification of traditional characters and their translation into measurable and applicable contemporary design principles. Angkasa and Kamil [10], through a systematic review of the passive cooling strategies of traditional Indonesian houses, found that studies that explicitly link passive cooling mechanisms to the character of the location are still limited, and many studies have not explored these aspects optimally. At the empirical level, Nugroho [11] shows that elements such as the volume and slope of the roof, low-conductivity walls, east-west orientation, open spatial layout, differences in floor height, openings, vegetation, and shading contribute to the temperature comfort of the Samin vernacular houses. However, such findings are generally still case-specific and focus on evaluating the performance of existing buildings. On the other hand, Ab Rashid N et al. [12] identify broader problems in the process of adapting vernacular architecture to contemporary architecture, including the risk of loss of cultural meaning, conflicts between traditional values and technological developments, superficial formal imitation, incompatibility with the needs of modern life, and institutional and social barriers. Therefore, there is a research gap in the form of a lack of a robust framework that simultaneously identifies climate-responsive wisdom, relates it to environmental performance, and translates these findings into principles that can be adapted to contemporary design, especially in the context of traditional Lampung architecture.

Previous studies on Lampung traditional architecture have mainly documented structural systems, construction techniques, cultural values, local materials, and general environmental adaptation. However, limited empirical attention has been given to how these elements operate together as a climate-responsive system and how their environmental logic can be translated into measurable contemporary design criteria. This concern is consistent with studies showing that roofs, walls, openings, cross ventilation, orientation, shading, and spatial configuration influence passive thermal performance in hot climates and Indonesian vernacular housing [3], [11]. Angkasa and Kamil [10] further emphasize the need to move beyond documenting traditional forms toward understanding location-specific passive cooling strategies and their application in contemporary design. The novelty of the present study therefore does not lie merely in identifying commonly recognized vernacular elements such as stilt construction or natural ventilation. Rather, it lies in identifying their Lampung-specific configuration and interaction: site- and wind-responsive building orientation, elevated floors approximately 1.2–2.0 m above ground, opposing openings that support cross-airflow paths, large roof volumes, shading elements, timber-based envelopes, and spatial arrangements that collectively moderate indoor thermal conditions. The study further translates this integrated configuration into a performance-oriented framework for contemporary sustainable design.

Accordingly, this study aims to: (1) identify the Lampung-specific configuration of climate-responsive architectural mechanisms in traditional houses; (2) examine how these mechanisms are understood and experienced by occupants, traditional leaders, and architectural practitioners; (3) evaluate indoor–outdoor temperature and relative-humidity differences during selected observation periods as indicators of passive thermal response; and (4) translate the identified vernacular mechanisms into measurable design criteria for contemporary sustainable architecture.

Theoretically, this research is expected to expand the discourse of climate-responsive architecture by placing local wisdom not only as a cultural expression, but as a source of environmental knowledge that can be analyzed through the relationship between building shapes, microclimatic conditions, thermal comfort, materials, and occupant adaptation strategies. The approach reinforces the view of Ayoobi et al. [6] that the integration of vernacular principles with sustainability indicators can result in a more holistic design framework as it includes not only energy and environmental aspects, but also social and cultural dimensions. In practical terms, the results of the research can serve as a basis for architects, planners, developers, and policymakers in adapting principles such as natural ventilation, climate-responsive orientation, stage structures, shading, local materials, and spatial arrangements into contemporary buildings in Lampung and other tropical regions of Indonesia. Such adaptations are not directed at the literal copying of traditional forms, as Abd Manaf et al. [12] warn that reproduction without an understanding of values and context can result in superficial imitations. Instead, traditional principles need to be translated according to the needs of functions, technologies, comfort standards, and contemporary environmental challenges. In this perspective, research contributes to the development of designs that are more energy-efficient, contextual, rooted in local identity, as well as being able to link the conservation of traditional knowledge with sustainable architectural innovations [13].

II. Literature Review

A. *Climate-Responsive Architecture and Sustainable Design*

Climate-responsive architecture places local climatic conditions as the basis for determining the orientation, shape, materials, openings, and configuration of building spaces. This approach aims to create thermal comfort with minimal energy requirements. This principle is in line with the concept of passive design which utilizes natural ventilation, shading, building envelope character, orientation, and thermal mass as part of the building's environmental control system. Studies [14] show that the application of a combination of passive strategies can result in energy savings of 6.7–66.2%, depending on the climatic conditions and characteristics of the building. Similar findings are reported in [15], which show that passive strategies are able

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to reduce the room temperature by about 2.2°C while reducing the cooling load and energy consumption. Thus, climate responsiveness is one of the fundamental components in the development of sustainable architecture that is oriented towards energy efficiency and thermal comfort.

B. Vernacular Architecture as Climate-Responsive Knowledge

Vernacular architecture can be understood as a form of environmental knowledge that develops through the process of community adaptation to climatic conditions, material availability, local resources, and local life patterns. The study [16] shows that research on vernacular housing increasingly places climate responsiveness as one of the main themes, especially in examining the relationship between building characteristics and thermal conditions in the space. The study found that the combination of thermal mass, natural ventilation, and shading in vernacular dwellings can reduce the risk of overheating while increasing occupant comfort. Meanwhile, research [17] shows that vernacular dwellings have a higher level of climate resilience than buildings that have undergone material modernization. These findings show that the value of traditional architecture lies not only in its visual character and physical form, but also in the environmental adaptation mechanisms formed through the experience of people across generations.

C. Passive Cooling and Thermal Comfort in Hot-Humid Climate

In hot-humid regions such as Indonesia, thermal comfort is greatly influenced by the ability of buildings to control heat, humidity, solar radiation, and air movement. The study [18] identified that elements such as roofs, walls, windows, opening-to-wall ratios, and cross-ventilation optimization are passive strategies that have a significant influence on thermal comfort in hot climates. In addition to the physical characteristics of buildings, the adaptive behavior of residents also plays a role in determining the success of climate responses in vernacular architecture [19]. In the Indonesian context, the study [20] identified eight climate zones based on data from 106 locations and showed variations in natural ventilation potential and passive cooling techniques between regions. These variations confirm that climate-responsive design strategies need to be studied based on geographical conditions and local climatic characteristics. Therefore, understanding the specific climate context, including the conditions of the Lampung region, is important in identifying appropriate passive cooling strategies.

D. Climate-Responsive Wisdom in Indonesian Traditional Architecture

The diversity of traditional architecture in Indonesia has resulted in various adaptation strategies to the climate which are reflected through the use of stilt houses, roof slopes, building orientation, opening configuration, cross ventilation, shading, spatial arrangement, and the use of local materials. Based on a systematic literature review in [8], Indonesian traditional houses have great potential as a source of knowledge about passive cooling strategies. However, the relationship between these strategies and the geographical characteristics of the buildings is still relatively rarely explicitly analyzed. In the context of Lampung, the study [9] shows that traditional-vernacular houses in Kinali, West Lampung, are formed through local knowledge of structure, construction, materials, connection techniques, environmental conditions, and the use of local resources. This shows that traditional Lampung houses can be understood as an adaptive design system that integrates environmental and cultural aspects, rather than just as traditional architectural artifacts.

E. Local Materials, Building Form, and Environmental Adaptation

Local materials and building shape configuration are two important aspects that determine the ability of vernacular architecture to create adaptive thermal conditions. Research [21] shows that the change in the use of traditional materials to industrial materials in a number of residential types can increase thermal stress as well as dependence on mechanical cooling systems. However, material performance cannot be understood in isolation from other design elements. The study [22] confirms that the thermal performance of materials is closely related to the ventilation system, shading, and building envelope configuration. More recent findings [23] also show that traditional buildings that integrate local materials with passive systems are able to maintain room temperatures about 3–4°C lower than outside temperatures during summer. Based on these findings, the analysis of traditional Lampung houses needs to consider the relationship between stilt houses, local materials, building orientation, shading, cross ventilation, and spatial configuration in shaping the building's thermal response.

F. Translating Vernacular Wisdom into Contemporary Sustainable Design

The use of vernacular architectural knowledge in contemporary design should not be done through the literal reproduction of traditional forms. Instead, a more relevant approach is to identify and extract the performative principles underlying the formation of such architecture. Studies [24] show strong linkages between vernacular architectural principles and various sustainable design indicators, especially in the aspects of energy, materials and resources, environmental quality within the space, footprints and ecology, and socio-cultural dimensions. Nonetheless, the process of translating vernacular principles into contemporary design faces a number of challenges. Research [25] shows that the integration of vernacular architecture in modern design can face risks in the form of loss of cultural meaning, the emergence of formal imitations, conflicts between modern needs and traditional values, and various technological and institutional constraints. Therefore, principles such as cross ventilation, climate-responsive orientation, shading, stilt house concepts, use of local materials, and spatial configuration need to be reinterpreted according to contemporary needs, technology, and comfort standards without eliminating the underlying environmental logic.

G. Synthesis and Research Gap

Based on the literature review, there is a consensus that traditional architecture holds a variety of climate adaptation strategies that have the potential to improve thermal comfort, energy efficiency, and building resilience. However, there are still several research gaps that are important to study further. First, the study [26] shows the need for a more integrated approach in analyzing the relationship between climate strategies, building elements, geographical location, and thermal conditions. Second, the study [10] shows that studies on traditional Indonesian houses that explicitly link passive cooling strategies with geographical location characteristics are still limited. Third, the study [27] identifies a gap between the recognition of the value and

potential of vernacular architecture and its systematic application in contemporary sustainable design.

On this basis, the present study is positioned not merely as another documentation of vernacular architectural elements, but as an effort to identify the integrated environmental mechanisms specific to traditional Lampung houses and translate them into measurable design parameters. The study therefore extends previous Lampung research by linking architectural form, local knowledge, observed indoor–outdoor thermal differences, and contemporary performance criteria within a single analytical framework.

TABLE I. POSITIONING OF THE PRESENT STUDY IN PREVIOUS RESEARCH

Previous Study	Main Focus	Existing Contribution	Remaining Gap	Contribution of This Study
Putri et al. [8]	Kenali Lampung architecture	Structure and local cultural wisdom	Limited environmental-performance linkage	Connects architectural configuration with passive thermal response
Siregar [9]	Kinali traditional houses	Construction, materials, local knowledge	Limited measurable contemporary translation	Identifies climate-responsive mechanisms and design criteria
Angkasa & Kamil [10]	Indonesian traditional dwellings	Passive cooling strategies	Limited location-specific linkage	Provides Lampung-specific integrated configuration
Nugroho [11]	Samin vernacular house	Passive design and thermal performance	Different vernacular and geographic context	Shows Lampung-specific environmental mechanisms
Present study	Traditional Lampung houses	Integrated climate-responsive analysis	—	Links form, local knowledge, thermal observation, and measurable design translation

III. METHODOLOGY

A. Types of Research

This study uses a qualitative approach with case study design to identify the wisdom of climate responsiveness in traditional Lampung architecture as well as its potential for contemporary sustainable design. The analysis is focused on building orientation, stilt houses, space configuration, cross ventilation, openings, shading, local materials, building envelopes, and thermal conditions [28].

B. Case Selection and Inclusion Criteria

Five traditional Lampung houses were selected purposively as information-rich cases rather than as statistically representative samples. The inclusion criteria were: (1) the building retained identifiable characteristics of traditional Lampung architecture; (2) the house was still occupied or actively used; (3) major climate-responsive elements such as elevated floors, openings, roof form, shading, and timber construction remained observable; (4) access for architectural observation and environmental measurement was permitted; and (5) the owner or occupant was willing to participate. Houses that had undergone major alterations that substantially obscured the original spatial, envelope, or ventilation configuration were excluded.

C. Population and Sample

Informants were selected using non-probability sampling with purposive sampling techniques based on the relevance of knowledge and experience to the research object [29]. The study involved 15 informants consisting of traditional house dwellers, traditional leaders, and architectural practitioners to obtain user, cultural, and professional perspectives.

The 15 informants were distributed equally across three stakeholder groups: five traditional-house residents, five traditional leaders, and five architectural practitioners. This composition was intended to capture three complementary perspectives: lived experience, cultural-historical knowledge, and professional interpretation. The sample size was determined based on information richness and the focused case-study design rather than statistical representativeness.

D. Research Instruments

Data were collected using observational guidelines, architectural documentation, simple thermal condition measurements, and semi-structured interviews. Observations included orientation, stilt house shape, space configuration, openings, ventilation, shading, materials, and building envelopes. Interviews were used to explore local knowledge, thermal comfort experiences, and mechanisms of building adaptation to climate [30]. The validity of the data was strengthened through triangulation of sources and methods [17].

Semi-structured interviews were conducted individually and lasted approximately 30–45 minutes. Interviews were conducted in Bahasa Indonesia, depending on participant preference and familiarity with the research context. With participants' permission, interviews were audio-recorded and subsequently transcribed verbatim. Relevant quotations included in the English manuscript were translated from Bahasa Indonesia into English and checked against the original transcripts to preserve the intended meaning.

E. Data Collection Procedure

The research began with a literature review and instrument preparation, followed by field observations, architectural documentation, thermal condition measurements, and interviews with 15 informants. The data were then transcribed, grouped, and compared through triangulation to identify the relationship between architectural character, thermal conditions, and local knowledge.

Data collection followed a sequential field procedure. Each house was first documented in terms of orientation, floor elevation, spatial organization, openings, roof form, shading, and material use. Thermal measurements were then conducted at predetermined indoor and outdoor points. Interviews were carried out after the physical observations so that participants could explain the architectural characteristics and environmental experiences associated with the observed house. Field notes, architectural documentation, interview transcripts, and measurement records were then organized for triangulation.

F. Data Analysis Techniques

Data were analyzed using thematic and comparative analysis through the process of familiarization, coding, category and theme development, and interpretation of inter-

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findings relationships [31]. Comparative analysis was used to compare the results of observations, interviews, documentation, and thermal measurements. Qualitative data processing can be assisted by Nvivo 15, while thermal data is tabulated using spreadsheet software. The reliability of the results is maintained through triangulation, coding consistency, and systematic recording of the analysis process [17].

G. Ethical Considerations

This study involved adult participants through non-invasive semi-structured interviews concerning architectural knowledge, building use, and environmental experience. Participation was voluntary, informed consent was obtained before the interviews, and participants were informed about the purpose of the research and the intended use of their responses for scientific publication. Personal identities were anonymized using participant codes, and participants were free to withdraw at any stage.

IV. Results and Discussion

A. Characteristics of Informants and Research Objects

This study involved 15 informants who were selected using purposive sampling techniques based on the level of involvement, experience, and knowledge of traditional Lampung houses. Informants were grouped into three main categories, namely traditional house dwellers, traditional leaders, and architectural practitioners. The division of informant groups was carried out to gain a comprehensive understanding of the relationship between the physical character of the building, the experience of thermal comfort, local knowledge, and opportunities for the application of traditional architectural principles in contemporary design.

In addition to interviews, the study also observed five units of traditional Lampung houses that are still used by the community. Observations were made on the elements of building orientation, the shape of the stilt house, the configuration of the space, openings, ventilation, shading elements, and building materials.

TABLE II. Characteristics of Research Informants

Code	Informant Group	Quantity	Age Range	Features
P1–P5	Residents of traditional houses	5 people	48–72 years old	Have 25–60 years of experience living in traditional houses
A1–A5	Traditional leaders	5 people	56–70 years old	Understand the cultural, historical, and construction values of traditional houses
AR1–AR5	Architectural practitioners	5 people	38–45 years old	Have experience in tropical design, conservation, and sustainable architecture

Source: Primary data from research through semi-structured interviews, 2026

Most of the resident informants have been occupying traditional houses for more than 25 years. These conditions provide information about residents' long-term experiences of temperature changes, ventilation patterns, spatial comfort, and adaptation strategies carried out in daily life.

B. Identification of Climate-Responsive Architectural Elements in Lampung Traditional Houses

The results of field observations show that Lampung traditional houses have several architectural elements that play a role in responding to humid tropical climate conditions. Based on the observation analysis and documentation process, five main categories of climate-responsive elements were found, namely building structure, orientation, ventilation system, solar radiation protection, and the use of local materials.

TABLE III. Identification of Lampung-Specific Climate-Responsive Mechanisms

Architectural Elements	Field Findings	Environmental Function
Stilt house	The floor of the building is approximately 1.2–2 meters above the ground	Reduces humidity and improves air circulation beneath the building
Building orientation	The building follows the direction of the wind and site conditions	Optimizes natural airflow
Openings	The doors and windows are positioned on opposite sides	Supports cross ventilation
High and sloping roof	The roof space has a large volume	Reduces heat accumulation
Long cut-out	Protective elements are located on the sides of the building	Reduces exposure to solar radiation
Local wood materials	Dominant use of wood in the building structure	Provides thermal characteristics suitable for the tropical environment

Source: Primary data of the study based on field observations and architectural documentation on five traditional houses in Lampung, 2026.

The results of the observations show that the elements do not work in isolation, but form an interconnected system of climate adaptation. The stage structure, for example, not only serves as a traditional architectural identity, but also creates an air space that helps reduce heat transfer from the ground to the living space.

C. Lampung-Specific Climate-Responsive Configuration

A key finding of this study is that climate responsiveness in the observed Lampung houses was not associated with a single architectural element, but with a recurring configuration of mutually supporting mechanisms. Across the studied cases, elevated floors of approximately 1.2–2.0 m created an open buffer beneath the occupied space; openings on opposing façades supported cross-building airflow paths; orientation decisions were related to prevailing wind and site conditions; large roof volumes reduced direct heat accumulation near occupied zones; shading elements moderated direct solar exposure; and timber construction was integrated with these ventilation and spatial strategies. The distinctive contribution of the Lampung cases therefore lies in the configuration and interaction of these mechanisms rather than in any single element considered independently.

D. Thematic Analysis Results of the Interview

Analysis of interview transcripts yielded 5 main themes that illustrate the wisdom of climate responsiveness in traditional Lampung houses. The analysis process is carried out through the initial coding stages, category grouping, and theme formation.

TABLE IV. RESULTS OF THEMATIC CODING OF RESEARCH

Data Excerpt	Initial Code	Category	Main Theme
"*The house still feels comfortable because the wind can come in from the front and back*."	Natural airflow	Space ventilation	Passive cooling system
"*The bottom of the house is left open so that air can move freely*."	Open space beneath the building	Adaptive structure	Stilt houses as a climate strategy
"*The wood used in the past does not feel as hot as stone walls*."	Wood material	Local materials	Material adaptation
"*The house is oriented according to environmental conditions, not merely following the shape*."	Site adaptation	Building orientation	The relationship between buildings and the environment
"*It can be made modern now, but the principle should not be lost*."	Modern adaptation	Design transformation	Translation of local wisdom

Source: Primary data of the research based on the results of the transcription and coding process of informant interviews, 2026.

E. Occupants' Perceptions of Indoor Thermal Conditions

The results of interviews with residents' groups show that the comfort of traditional homes is more perceived through the quality of airflow, room temperature, and the ability of buildings to reduce heat.

Informant P1 explained:

"*During the day, it is hot outside, but when you enter the house, it feels different. The air is still moving because this house has many openings*." (P1, Traditional House Residents, May 12, 2026)

Informant P3 said:

"*This house has not used air conditioning for a long time. Our parents made a house so that the wind could pass through*." (P3, Traditional House Residents, May 13, 2026)

Meanwhile, the P5 informant explained the relationship between the shape of the house and comfort:

"*Tall houses are not only because of custom, but so that the lower part is not damp and the upper part is more comfortable to occupy*." (P5, Traditional House Dwellers, May 14, 2026)

Based on the results of the interviews, residents understand traditional architectural elements through everyday experiences. The knowledge suggests that climate response strategies have become part of space use practices.

F. Perspectives of Traditional Leaders on Local Wisdom of Architecture

Traditional leader groups provide information about the process of forming traditional houses based on people's experiences with the environment.

Informant A1 stated:

"*The ancients built houses based on natural conditions. They looked at the direction of the wind, the position of the sun, and the condition of the soil before determining the shape of the house*." (A1, Traditional leaders, May 15, 2026)

Informant A2 explained:

"*Every part of the house has a reason. The stilt house, roof, and spatial arrangement are not only for beauty but follow the needs of people's lives*." (A2, Traditional leaders, May 15, 2026)

The results of the interviews show that the local knowledge of the community is not only related to the physical shape of the building, but also includes the decision-making process in determining the location, orientation, materials, and configuration of the space.

G. Measurement Results of Thermal Conditions of Traditional Houses

Thermal conditions were measured in five traditional houses using a digital thermo-hygrometer. Measurements were carried out in three time periods, morning (09:00), early afternoon (13:00), and late afternoon (16:00).

TABLE V. TEMPERATURE AND HUMIDITY MEASUREMENT RESULTS

Location	Time	Temperature (°C)	Humidity (%)
Exterior of the building	09.00	29.8	78
Main room	09.00	27.5	72
Lower area of the stilt house	09.00	27.2	74
Exterior of the building	13.00	34.1	68
Main room	13.00	30.2	70
Lower area of the stilt house	13.00	29.5	72
Exterior of the building	16.00	31.6	75
Main room	16.00	28.7	71

Source: Primary data of the study based on thermal condition measurements using digital thermo-hygrometers in five traditional houses in Lampung, 2026.

The spot measurements indicated indoor–outdoor air-temperature differences of approximately 2.3°C at 09:00, 3.9°C at 13:00, and 2.9°C at 16:00 for the reported measurement points. These differences indicate short-term indoor temperature moderation during the observation periods. They should not, however, be interpreted as direct evidence of thermal comfort because air velocity, mean radiant temperature, solar irradiance, clothing insulation, metabolic rate, and adaptive comfort parameters were not measured. The measurement results show that the interior space of a traditional house has a lower temperature than the outside condition of the building, especially during the daytime period.

H. Practitioner's Perspective on Adaptation to Contemporary Design

Interviews with architectural practitioners show that the main value of traditional Lampung houses lies not in the reproduction of their physical form, but in the underlying environmental principles.

Informant AR1 said:

"*What can be applied is not just the shape of the traditional house, but the way of thinking. How the building responds to heat, wind, and environmental conditions*." (AR1, Architectural Practitioner, May 20, 2026)

The AR3 informant added:

"*The concept of passive design actually exists in traditional houses. The challenge is to translate the concept to the needs of modern buildings*." (AR3, Architectural Practitioner, May 21, 2026)

The results of the interviews show that the principles considered most relevant to apply to contemporary design are presented in Table VI.

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TABLE VI. LAMPUNG CLIMATE-RESPONSIVE DESIGN TRANSLATION FRAMEWORK

Vernacular Mechanism	Environmental Logic	Contemporary Translation	Measurable Criterion
Opposing openings	Support cross-airflow path	Operable openings on opposite façades	Air velocity; ACH; effective opening area
Site/wind-responsive orientation	Increase exposure to prevailing wind	Climate-based orientation	Wind incidence angle; pressure differential
Elevated floor 1.2–2.0 m	Create ventilated underfloor buffer	Raised/ventilated ground floor	Underfloor air velocity; floor temperature; RH
Shading elements	Reduce direct solar exposure	Overhang, fins, secondary skin	Solar irradiance; shading coefficient
Large roof volume	Separate heat accumulation from occupied zone	Ventilated roof cavity	Roof cavity temperature; ceiling heat flux
Timber envelope	Lightweight climatic response	Low-energy/lightweight envelope	Thermal conductivity; U-value; embodied energy
Adaptive spatial layout	Maintain airflow continuity	Permeable spatial planning	Airflow path continuity; indoor air speed

Source: Primary data of the study based on the results of interviews with architectural practitioners and comparative analysis of the research, 2026.

I. Synthesis of Research Findings Model

Based on the integration of observation, interviews, documentation, and thermal measurements, the research produced a model of the relationship between local wisdom, architectural strategies, and environmental performance.

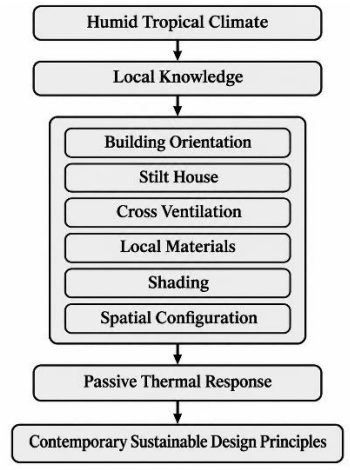


Fig. 1. Lampung Traditional House Climate-Responsive Mechanism and Contemporary Design Translation Model

Overall, the results of the study show that Lampung traditional houses are an adaptive architectural system formed through the interaction between the environment, culture, and community experiences. The findings of the study show that local wisdom is not only in the form of visual character of buildings, but also in the form of performative strategies that can be the basis for sustainable design development.

V. DISCUSSION

The results show that the traditional house of Lampung is a form of adaptive architecture that develops through the relationship between humid tropical climatic conditions, community experience, and the use of local resources. Findings regarding building orientation, stilt house structure, cross ventilation, shading, local materials, and spatial configuration show that the response to climate in traditional houses is not formed through a single element, but through the integration of various passive strategies that work simultaneously to support passive thermal response and indoor temperature moderation. The concept is in line with the principle of climate-responsive architecture which places local climate factors as the basis for determining building shapes, orientations, openings, materials, and spatial organization with the aim of reducing dependence on mechanical cooling systems [32]. In the context of tropical buildings, passive strategies are becoming increasingly important because the increase in ambient temperature and building energy consumption encourage the need for a more adaptive and sustainable design approach.

Previous Indonesian studies have established that stilt construction, openings, shading, and spatial organization can contribute to passive cooling. The present study does not claim these elements as newly discovered architectural features. Rather, its contribution lies in demonstrating how, in the observed Lampung cases, they operate as a coordinated environmental configuration. The 1.2–2.0 m elevated floor, opposing openings, site- and wind-responsive orientation, large roof volume, shading, timber envelope, and spatial organization collectively form a multi-layered passive-response system. This interpretation extends previous Lampung studies that primarily emphasized structure, construction, cultural meaning, and local resources by explicitly linking these characteristics with environmental mechanisms and measurable contemporary design parameters.

The findings of this study reinforce the view that traditional architecture is not only a cultural representation, but also a form of environmental knowledge formed through the process of community adaptation to natural conditions. Lampung traditional houses show that decisions regarding building shapes, spatial positions, material use, and ventilation systems are the result of the accumulation of community experience in dealing with heat, humidity, and local air movement patterns. This is in accordance with the research of Nugroho et al. which shows that Indonesian vernacular houses have a passive cooling strategy through a combination of building shapes, orientation, openings, shading, and spatial configurations that together contribute to increasing thermal comfort [11]. Thus, the results of this study expand the understanding that Lampung's architectural wisdom does not only need to be seen as a physical heritage, but as a design system that has performative principles and can be analyzed scientifically.

One of the important findings of this study is the role of stilt houses and cross ventilation as the main mechanism in controlling the thermal conditions of the space. The structure of the stilt house provides air space between the floor of the building and the ground surface, thus helping to reduce humidity and improve air circulation around the building. In addition, the presence of openings on the opposite side allows the movement of natural air which helps reduce heat accumulation in the room. This finding is in line with the study of natural ventilation strategies in vernacular buildings which explains that the effectiveness of passive cooling is influenced by the relationship between the orientation of the building, the configuration of the openings, the path of air movement, and the character of the surrounding environment [33]. The results of temperature measurements in this study which show that the conditions of the inner

space are lower than the outside environment reinforce that traditional architectural elements have a contribution to natural heat control.

However, the observed indoor–outdoor temperature difference should be interpreted as evidence of short-term thermal moderation rather than direct confirmation of thermal comfort. A comprehensive assessment of thermal comfort would require additional parameters such as air velocity, mean radiant temperature, operative temperature, and occupant-related adaptive variables.

In addition to the physical factors of the building, this study found that the behavior of the occupants has an important role in maintaining the environmental performance of the traditional house. The results of the interviews show that the community has an empirical understanding of how to utilize openings, regulate the relationship between spaces, and maintain the character of the house to remain comfortable without dependence on mechanical cooling. These findings show that thermal comfort in vernacular architecture is the result of the interaction between the building system and the adaptive behavior of the occupants. Research on the thermal comfort of traditional Indonesian houses also shows that the behavioral factors of the occupants are an important component because building users actively adapt their activities and use of space to the available climatic conditions [34]. Therefore, the sustainable design approach is not enough to only consider the physical performance of the building, but also needs to understand the relationship between humans and the built environment.

The use of local materials and spatial configuration is also an important aspect in explaining the ability of traditional Lampung houses to respond to the climate. The wood materials used by the community have thermal characteristics that are suitable for the tropical environment and provide a different experience of space comfort compared to modern materials with higher heat storage capacities. Research on vernacular architecture shows that the selection of local materials is often related to the ability of materials to adapt to local climatic conditions, while reducing dependence on industrial materials with greater embodied energy [35]. In this study, materials do not stand alone as a determinant of comfort, but work together with ventilation systems, building shapes, and spatial configurations to produce more adaptive thermal conditions.

The results of the study also provide important implications for the development of contemporary sustainable design. The main principles found in traditional Lampung houses, such as building orientation, cross ventilation, shading, stilt houses, and the use of local materials, have the potential to be reapplied to modern buildings through a reinterpretation approach of principles, rather than simply imitating traditional forms. This is important because the process of adapting vernacular architecture to contemporary design often faces the risk of losing cultural value if it only takes the visual aspect without understanding the underlying environmental logic. Research on the integration of vernacular strategies in modern design shows that the application of traditional principles needs to consider the needs of function, technology, comfort standards, and social context in order to remain relevant to the development of contemporary architecture [36].

Compared to previous research that generally focused on identifying traditional architectural elements or evaluating thermal performance separately, this research contributes through an integrative approach that connects the physical aspects of buildings, thermal conditions, and community knowledge. The integration between architectural observations, interviews, documentation, and thermal measurements results in an understanding that the climate response in traditional Lampung houses does not only come from the character of the building, but also from the process of social and cultural adaptation that takes place from generation to generation. Thus, this research strengthens the position of vernacular architecture as a source of sustainable design knowledge that can be developed to answer the challenges of climate change and the increase in building energy needs.

However, this study has several limitations that need to be considered. Thermal condition measurements were carried out in a limited observation period so that they did not describe variations in building performance throughout the year with changes in seasons and different weather conditions. In addition, the study used a case study approach on traditional Lampung houses so that the results could not be generalized to all traditional Indonesian architectural typologies. These limitations are a common challenge in vernacular architecture research because building performance is greatly influenced by the character of the location, microclimate, space use patterns, and occupant behavior [37]. Further research needs to conduct long-term measurements with more complete thermal parameters such as operating temperature, air velocity, relative humidity, and thermal comfort index. In addition, the use of building energy simulations and computational fluid dynamics (CFD) methods can be developed to evaluate the extent to which the principles of Lampung traditional houses can be applied to contemporary design quantitatively.

VI. Conclusion

This study shows that Lampung's traditional house is a form of adaptive architecture that has climate-responsive wisdom through the integration of physical elements of the building and local knowledge of the community. The main contribution of this study does not lie in identifying individual vernacular elements as new, but in demonstrating their Lampung-specific configuration, their interaction with local knowledge and occupant practices, and their translation into measurable contemporary design criteria. Strategies such as stilt house structure, building orientation, cross ventilation, shading, use of local materials, and spatial configuration were identified as interrelated passive design mechanisms associated with indoor thermal moderation during the observed periods in humid tropical environments. These findings confirm that traditional architecture not only has cultural value, but also holds sustainable design principles that are relevant to answer energy efficiency and climate change challenges.

This research contributes to the development of sustainable design by showing that the principles of traditional Lampung architecture can be translated into contemporary design through a reinterpretation approach, rather than simply imitating its physical form. The integration of local knowledge, passive strategies, and the needs of modern architecture can be the basis for the development of buildings that are more contextual, energy-efficient, and responsive to tropical environmental conditions. Further research is recommended to conduct long-term thermal performance measurements and energy simulations to evaluate the application of these principles to contemporary buildings.

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