Climate Adaptation Strategies in Traditional Housing of Central Vietnam and Lessons for Sustainable Interior Design

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Abstract

Traditional houses in Central Vietnam, particularly the ancient garden houses of Hue known as Nha Ruong and shophouses of Hoi-An, demonstrate climate-adaptive strategies developed over centuries of vernacular knowledge. These dwellings have evolved to respond effectively to the region's tropical monsoon climate marked by high humidity, intense rainfall and seasonal typhoons. Undeniably, they offer valuable lessons for contemporary sustainable interior design. In this context, this study investigates how vernacular housing integrates environmental adaptability with cultural identity in order to inform contemporary practice. It fills a gap in understanding how vernacular adaptations can inform interior design at the scale of interior spatial experiences and user comfort.

This research employs a qualitative methodology with a number of case studies of traditional houses in Hue and Hoi-An. It thus identifies adaptive layers in environmental, cultural, and material dimensions. Using the Iceberg Model, Design Thinking, and SWOT Analysis, the study synthesizes how deep cultural cognition and surface-level design expressions interact to sustain comfort and identity.

Findings reveal that adaptive practices such as elevated flooring, ventilated walls, and multi-functional interior zones not only mitigate heat and humidity but also promote social resilience. Lessons derived from these systems inform modern interior design principles emphasizing human well-being, local material empathy, and climatic attunement. The study contributes to expanding sustainable design discourse from form-based imitations toward cognitive adaptations grounded in vernacular intelligence. Indeed, it offers insights for future design education and practice.

Keywords: Vernacular housing, Climate adaptation, Sustainable interior design, Iceberg Model, Design Thinking, SWOT Analysis

Introduction

Central Vietnam, characterized by a tropical monsoon climate, represents one of the most climatically challenging regions in Southeast Asia. Locations such as Hue and Hoi-An experience extremely high annual rainfall, humidity, and strong monsoon winds, which significantly influence building performance and human comfort. Despite these harsh conditions, the region's traditional housing has evolved and adapted over centuries, embodying

a delicate harmony between the natural environment and cultural identity. These dwellings-particularly Nha Ruong in Hue and traditional shophouses in Hoi-An reflect a profound integration of climatic responsiveness, cultural symbolism, and refined craftsmanship, demonstrating that sustainability is not a modern invention but rather an indigenous wisdom accumulated through generations. This alignment between ecological ethics and aesthetic sensibility echoes the argument of Carlson (2018), which suggests that environmental aesthetics forms a moral bridge linking perception, culture, and sustainable behavior.

However, amid rapid urbanization and the dominance of reinforced concrete architecture, the passive design intelligence once embedded in vernacular dwellings has gradually faded. As a result, many contemporary living spaces have become thermally uncomfortable, energy-intensive, and detached from local identity (Tran & Le, 2021). Within this shift, the interior environment, the very layer that mediates between human behavior-material experience, and climatic response - has been largely overlooked. Yet, it is precisely at this scale that adaptations become tangible and lived. Despite growing interest in sustainable architecture, studies exploring how vernacular adaptation strategies can inform interior design are limited, especially related to Central Vietnam, where climate and culture are deeply intertwined.

In response, this study examines how the climatic adaptation strategies embedded in the Nha Ruong of Hue and the ancient houses of Hoi-An can provide conceptual and practical lessons for sustainable interior design in Vietnam. The paper specifically raises the following questions.

1. Environmental Adaptation: How do spatial configurations and materials in Central Vietnam respond to climatic challenges?
2. Cultural Cognition: How do these strategies embody intangible values, rituals, and social relationships?
3. Design Translation: How can these vernacular logics inform contemporary interior design processes?

Its aim is to contribute to a broader understanding of ‘cognitive sustainability;’ a paradigm that redefines sustainable design not as the imitation of traditional forms but as the continuation of adaptive intelligence that balances culture, climate, and comfort.

Its objectives are to:

1. Identify sustainable principles and practices of traditional buildings in Vietnam.
2. Ascertain climate adaptation strategies present in the ancient houses of Vietnam.
3. Devise ways of adapting such techniques in contemporary developments.

Theoretical Framework

This study is based on an integrated theoretical framework that combines the Iceberg Model, Design Thinking, and SWOT Analysis. In order to create the theoretical framework, it ascertains the core concepts of indigenous knowledge, environmental adaptation, and sustainability, to provide a multi-dimensional lens to interpret how vernacular architecture in Central Vietnam embodies cultural intelligence and ecological balance, and how such traditional wisdom can be transformed into strategies for sustainable interior design. These theoretical constructs therefore need closer scrutiny.

Vernacular Knowledge, Tradition, and Environmental Responsiveness

In other words, it is essential to clarify three foundational concepts to understand the climate adaptation strategies embedded in the vernacular architecture of Central Vietnam: indigenous knowledge, environmental adaptation, and sustainability. Among them indigenous knowledge refers to the cumulative system of wisdom, skills, and experiences developed through generations of interactions with the natural environment. In architecture, this knowledge is reflected in the orientation of buildings, spatial organization, and the use of

natural materials such as wood, bamboo, and tiles, which promote ventilation, insulation, and ecological harmony. This tacit knowledge is primarily transmitted through practices and rituals, rather than through written documentation; yet it embodies a profound environmental logic.

Environmental adaptation denotes the capacity to modify architectural forms in response to extreme climatic conditions such as typhoons, floods, heat, and humidity. Traditional solutions such as sloped tile roofs, deep verandas, cross-ventilated openings, inner courtyards, and surrounding vegetation illustrate a refined adaptive mindset.

Sustainability is the ability to meet the needs of the present without compromising the ability of the future generations to meet their own needs. It involves balancing economic, environmental, and social systems—often called the 'three pillars'—to ensure long-term viability, resource conservation, and ecological balance (sustainability@ucla.edu).

They are expressed through material circularity, repairability, and strong community cohesion. When applied to contemporary contexts, these principles form the foundation for sustainable interior design, emphasizing eco-friendly materials, indoor microclimate optimization, and regional identity preservation.

The Integrated Theoretical Framework: Iceberg Model, Design Thinking, and SWOT Analysis.

This study is grounded in an integrated theoretical framework that combines three well established complementary models: the Iceberg Model, Design Thinking Model, and SWOT Analysis.

First, the Iceberg Model (Senge, 1990) helps explore the multi-layered structure of indigenous knowledge. According to this theory, the surface level events involve visible architectural features such as roof slopes or ventilation openings; the pattern level reflects recurring cultural practices like courtyard organization, while the deepest structural and mental levels represent communal values of harmony and ecological balance. Decoding these layers unveils the philosophical foundation of sustainability inherent in traditional forms.

Brown (2009) argus that design thinking transforms traditional knowledge into creative and human-centered sustainable strategies. The stage of empathy examines how local communities live and adapt; define and reframes the design questions:

How can modern interiors remain cool, airy, and culturally rooted?

Ideate translates vernacular principles into new models such as 'interior micro-climate design'. Simultaneously, prototype and reflective synthesis evaluate materials, spatial, and environmental performances through user feedback and microclimate measurement.

Finally, SWOT Analysis provides a strategic overview of the Strengths, Weaknesses, Opportunities, and Threats in preserving and applying vernacular wisdom. Strengths include rich indigenous knowledge, local materials and flexible structures; weaknesses involve limited quantitative data and urban applicability; opportunities arise from green design trends and heritage tourism whereas threats stem from climate change and loss of culture.

Integrating the three models yields a three-tier interdisciplinary framework:

- Insights: uncovering the deep cultural and ecological logic (Iceberg Model);
- Assessment: identifying potentials and constraints (SWOT Analysis);
- Innovation: translating traditional intelligence into sustainable interior design (Design Thinking).

This research is based on the premise that this integration not only illuminates adaptive intelligence of vernacular architecture of Central Vietnam but also provides a practical roadmap for sustainable design innovations grounded on local culture and environmental harmony. This can be presented graphically as follows.

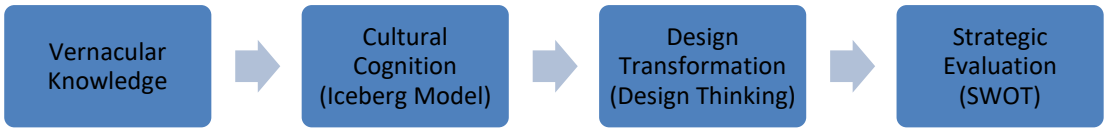


Fig. 1 A holistic framework constructs\ed by Integrating these models and concepts
Source: Author, 2025.

Review of Literature

A growing body of literature has explored the relationship between vernacular architecture and environmental adaptation in Southeast Asia. In fact, Rapoport (1969) was one of the first who emphasized the cultural logic embedded in traditional dwellings, arguing that forms and functions are products of socio-environmental negotiations. Oliver (1987) adds to these when he writes about the traditions of the past. Indeed, many studies exist internationally. For example, Rudofsky (1964) presents 'architecture without architects' while Asquith and Vellinga (2024) compare them with the architecture in the 21st century. Extending these, In fact. Dayaratne (1999;2006;2012), examines the transformations of vernacular housing in Sri Lanka and Bahrain. He (2018) further looks at the transformation of vernacular architecture in Sri Lanka while (2010) also examines the ways in which traditional technologies are re-invented for sustainability. Through these, Dayaratnr offers lessons from the vernacular settlements of Sri Lanka towards promoting sustainable developments.

Similarly, Kaja (2012) examines the issue of reinventing traditional technologies for the sustainability of built environment in tropical areas of India. Added to this is Kumara et al. (2026) who reveal that traditional systems effectively reduce energy consumption, resource depletion, and waste generation while preserving cultural continuity. They point out that comparative assessments highlight the potential of indigenous techniques to inform sustainable design and product innovation. Pointing to these developments, Silva and Fernando (2023) articulate the legacy of Amos Rapoport in theorizing built-form and culture while Shankar (2024) discusses the potency of the vernacular settlements.

In Vietnam, studies by Pham (2017) and Tran & Le (2021) have documented how traditional houses in Hue employ wooden lattices, verandas, and raised floors to mitigate flooding and promote ventilation. Similarly, Nugroho, Triyadi & Wonorahardjo (2022) show that in Hoi-An, shophouses exhibit adaptive facades and longitudinal plans that enable airflow while maintaining privacy. Similarly, Phuong (2026) shows that the ancient houses of Binh Duong in Vietnam demonstrate 'embedded sustainability' where ecological performance is integral to spatial and cultural logic. Indeed, they offer enduring lessons for environmentally responsive and culturally grounded architectural practices, learning lessons from the vernacular.

In specific terms, Ihunwo & Ezinwo (2025) point out that passive design strategies have long been employed in traditional buildings as effective architectural responses to achieve thermal comfort, particularly in regions with challenging climatic conditions. They show that these strategies, deeply rooted in indigenous knowledge and adapted to local environments, successfully mitigate the effects of high temperatures, humidity, and solar radiation. They demonstrate that a proper thermal comfort framework can inform the retrofitting of existing buildings and guide the design of contemporary structures in similar climatic contexts.

In fact, many previous studies have highlighted the environmental performance of vernacular forms- natural ventilation, thermal comfort, and flood resilience (Heath, 2009; Pham & Tran, 2019). However, relatively few have examined the cognitive and cultural mechanisms that shape such adaptive behaviors. More critically, few studies examine how vernacular adaptation strategies can inform sustainable interior design, which involves human-scale experiences, furniture layouts, materials, and sensory comfort.

Interestingly, recent scholarship advocates a holistic approach that integrates cultural cognition, environmental science, and design methodology (Salama & Wiedmann, 2013; Heath, 2021). Within this discourse, the integrated Iceberg–Design Thinking–SWOT

framework proposed in this study offers a new way to understand, evaluate, and transform indigenous knowledge into sustainable interior design strategies. It situates Vietnamese vernacular housing not merely as heritage to be preserved, but as an active knowledge system capable of informing resilient, human-centered, and ecologically grounded design futures.

Research Methodology

Research Design

To analyze these dimensions, this study employs a qualitative case study approach that uses the Iceberg Model, Design Thinking, and SWOT Analysis. This integrated lens allows for decoding the deep cultural cognition underlying visible design expressions while positioning interior design as a mediator between heritage and sustainability.

The research design focuses on two representative vernacular housing typologies in Central Vietnam: Nha Ruong in Hue and ancient houses in Hoi-An. The aim is to explore how each expresses distinct yet interconnected strategies of climate adaptation and to extract lessons for sustainable interior design. Qualitative design was selected because the research emphasizes interpretive understanding, decoding cultural cognition and spatial experience, rather than quantitative measurements. The study integrates field observations, spatial mapping, semi-structured interviews, and content analysis of architectural documentation.

Case Study Selection

The selection of Hue and Hoi-An was based on three criteria:

1. Climatic representativeness – both regions face tropical monsoon conditions, with high humidity, heat, and seasonal floods.
2. Architectural continuity – both retain traditional housing types still inhabited.
3. Cultural diversity – Hue represents royal and Confucian domestic traditions; Hoi An reflects urban-commercial adaptation and multicultural influence. Within each location, three representative houses were selected for close analysis through direct observation and visual documentation between 2022 and 2024. These include:

- Hue: Nha Ruong at Kim Long (No. 2/3 Phu Mong Street), Phu Hiep (No. 31 Nguyen Chi Thanh Street), and Huong Long (No. 58 Nguyen Phuc Nguyen Street).
- Hoi An: Ancient houses located at No. 33 Nguyen Thai Hoc Street, No. 62 Bach Dang Street, and No. 77 Tran Phu Street.

Fig. 2: Representative vernacular dwellings selected for the case studies in Central Vietnam: (2a–2c) *Nha Ruong* in Hue – Kim Long, Phu Hiep, and Huong; (2d–2f) Ancient houses in Hoi An – No. 33 Nguyen Thai Hoc Street, No. 62 Bach Dang Street, and No. 77 Tran Phu Street.
Source: Author, 2024.

Data Collection Methods

Data collection involved three main techniques:

(1) Field Observation & Spatial Mapping:
- Systematic observations of spatial organization, materials, openings, and ventilation systems.
- Use of measured drawings, photographs, and climate diagrams to record passive cooling strategies and material details.

(2) Semi-structured Interviews:
- Conducted with homeowners (n=6), craftsmen (n=4), heritage officers (n=2).
- Focused on perception of comfort, maintenance practices, and spatial flexibility during climatic stress (e.g., floods, humidity).

(3) Documentary and Archival Review:
- Analysis of heritage documentation, local design guidelines, and previous restoration reports from the Hue Monuments Conservation Center and Hoi-An World Heritage Office.

All the data were triangulated to ensure validity and cross-verified with existing literature.

Process of Data Analysis

Data analysis proceeded in three iterative stages, aligned with the theoretical framework:

(1) Cultural Decoding (Iceberg Model)
- Identified visible elements (forms, materials and spatial sequence) and invisible layers (beliefs, rituals and environmental reasoning).
- Compared how each house type expresses environmental adaptation as cultural cognition.

(2) Design Process Mapping (Design Thinking)
- Reconstructed vernacular design logic through the five stages of empathy, definition, ideation, prototyping, and testing.
- Mapped adaptive design decisions from user narratives and historical evolution.

(3) Strategic Evaluation (SWOT Analysis)
- Synthesized findings into four categories: Strengths, Weaknesses, Opportunities, and Threats.
- Used as a tool to extract applicable interior design principles that align with modern sustainability goals.

Ethical Considerations and Limitations

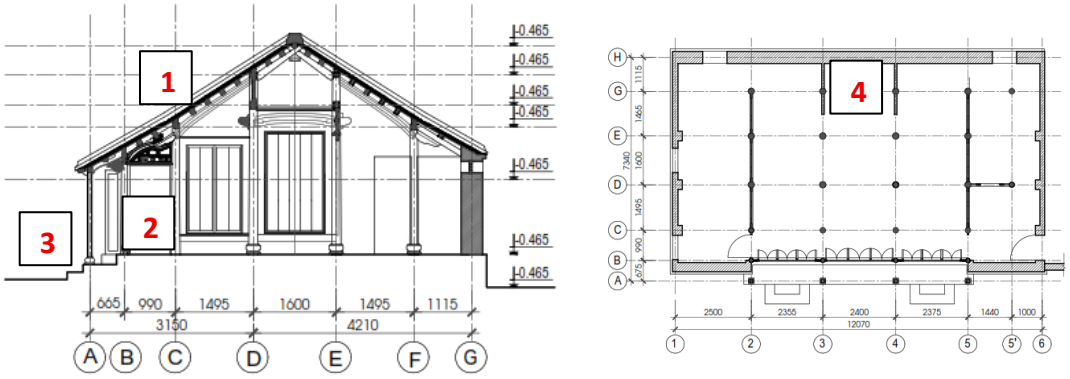
The research adheres to ethical protocols by obtaining consent from the participants and ensuring respect for cultural and property rights. However, the study acknowledges several limitations: Small sample size due to heritage restrictions; dependence on qualitative interpretations rather than empirical measurements and seasonal variations in climate that may influence spatial perceptions. Despite these constraints, triangulation of methods and theoretical integrations enhance reliability and contributes to a contextually grounded understanding of sustainable interior strategies.

Findings and Discussion

The findings reveal that the traditional houses of Central Vietnam embody a multi-layered system of environmental and cultural intelligence, where climate adaptation is not only a technical response but a reflection of worldview and community life. Through the application of the Iceberg Model, Design Thinking, and SWOT Analysis, this section discusses how vernacular adaptation can inform sustainable interior design in terms of both the conceptual and practical dimensions.

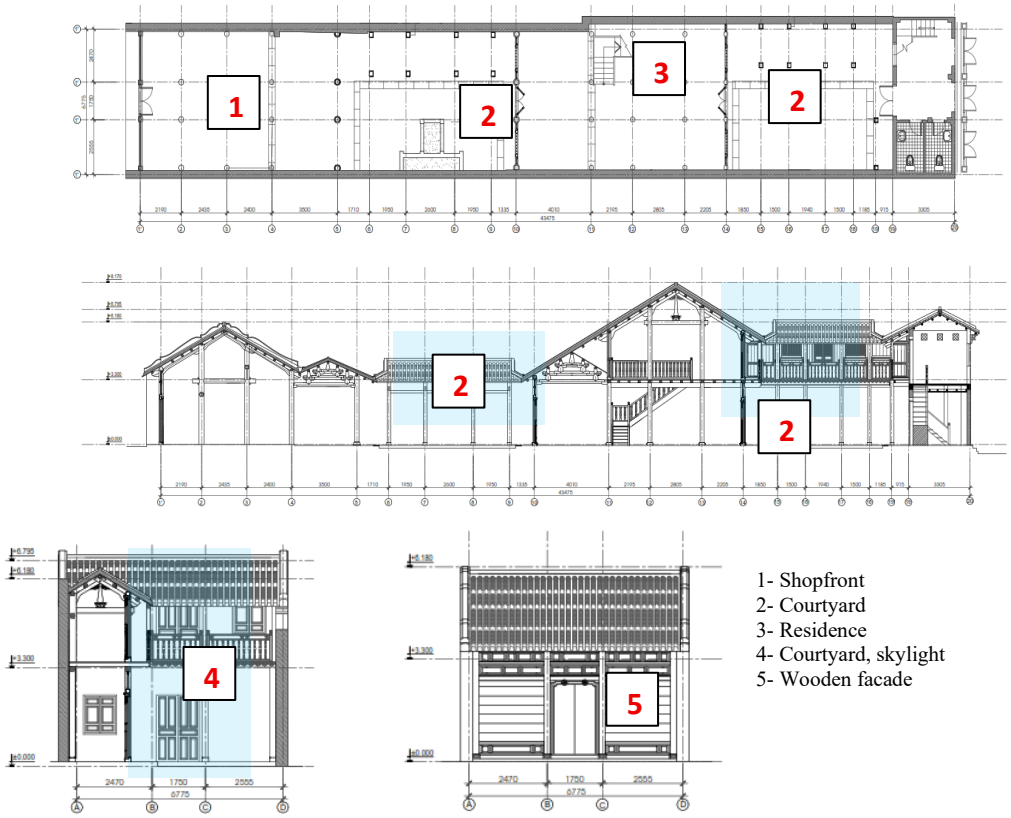
Identifying Environmental Adaptation through Iceberg Model

Analysis through the Iceberg Model of Culture reveals that climatic adaptations in the vernacular architecture of Central Vietnam is not merely a physical reaction to environmental conditions, but also an expression of cultural cognition, social order, and philosophical worldviews accumulated across generations. Beneath the tangible architectural forms lie deeper cognitive layers in which environmental adaptation functions as a systemic mode of thinking, integrating technology, ethics, and cosmology.



1- Sloped clay-tile roof
2- Deep veranda
3- Elevated wooden floor.
4- "Three-bay, two-wing" layout with the Central altar

Fig. 3: Architectural structure of Hue's traditional Nha Ruong house
Source: Author, 2025.



1- Shopfront
2- Courtyard
3- Residence
4- Courtyard, skylight
5- Wooden facade

Fig. 4: Architectural structure of Hoi An's traditional shophouse
Source: Author, 2025.

Table 1: The Iceberg Layers of Vernacular Climate Adaptation in Central Vietnam
Source: Author

No	Iceberg Layer	Description	Nha Ruong of Hue	Shophouses of Hoi-An	Cultural–Climatic Interpretation
1	Event	Tangible expression of climatic adaptation	Sloped clay-tile roofs, deep verandas, elevated wooden floors, timber shutters.	Courtyards, skylights, wooden façades and lime–brick walls.	Physical adaptations to heat, humidity, solar radiation, and flooding.
2	Pattern	Recurrent spatial solution	"Three-bay, two-wing" layout, surrounding the veranda.	Linear sequence: shopfront–courtyard–residence.	Flexible spatial logic balancing airflow and light.
3	Structure	Cultural and social order shaping architectural forms	Central altar axis, gender-based space hierarchy.	Layered commercial–residential organization, communal connection.	Spatial order governed by moral hierarchy and livelihood.
4	Mental Model	Underlying beliefs and worldviews	Thuan thien – living in harmony with Nature.	Heaven–Human–Earth unity – balance and reciprocity	Sustainability as cultural morality, not merely a technique.

(1) Layer 1 – Event: Physical Manifestations of Climatic Adaptation

At the surface level, the ancient shophouses of both Hue *Nha Ruong* and Hoi-An display specific adaptive strategies responding to the tropical monsoon climate. In *Nha Ruong*, the East–West orientation minimizes solar radiation and captures breezes from the Perfume River to promote natural ventilation. Deep verandas and sloped clay-tile roofs create shades and reduce the radiant heat, while raised wooden floors (60–90 cm) prevent ground moisture and facilitate air circulation. Meanwhile, shophouses in Hoi-An respond to compact urban settings and flood-prone conditions. Narrow façades and deep floor plans reflect the morphology of ancient trading streets while the inner courtyards and skylights serve as 'climatic lungs,' regulating light and vertical airflow. During the floods, upper floors function as temporary shelters. At this layer, materials such as wood, tiles, lime, and bamboo are not merely structural components but act as microclimatic instruments that maintain natural comfort in temperature, humidity, and light.

(2) Layer 2 – Pattern: Recurrent Spatial Structures of Adaptation

A common spatial pattern in *Nha Ruong* is the "three-bay, two-wing" configuration, in which the central bay is dedicated to ancestor worship while the side bays serve daily living functions. This layout simultaneously embodies moral order and enhances natural ventilation. Surrounding verandas form transitional climatic zones that buffer heat and humidity. In contrast, shophouses in Hoi-An follow a linear spatial sequence - front shop, inner courtyard, and rear dwelling. This arrangement enables continuous airflow and daylight, ensuring adaptations within the dense urban contexts. The courtyards act as both a climatic node and social space, exemplifying an *empathetic spatial mindset* where human-needs guide architectural forms. These spatial patterns, repeated across generations, constitute a cultural DNA - a tangible expression of communal and climatic knowledge.

(3) Layer 3 – Structure: Cultural and Social Values Organizing Form

Vernacular architecture in Central Vietnam reflects a clear ethical and social order. In *Nha Ruong*, the central altar and the main hall align along a ceremonial axis derived from Confucian spatial hierarchy, expressing family lineage, moral discipline, and communal cohesion. In the shophouses in Hoi-An, the influence of trade creates flexible configurations balancing commercial and domestic functions, yet spatial organizations still adheres to principles of 'front–back' and 'upper–lower,' symbolizing order and social relations. Thus, the

physical structure of the house also serves as a moral structure - a spatial codification of etiquette, gender roles, rituals, and livelihood.

(4) Layer 4 – Mental Model: The Philosophy of Heaven–Human–Earth Harmony:

At the deepest level, the architectural mindset of Central Vietnam is shaped by the philosophy of *thuan thien*- living in harmony with Nature as a moral and aesthetic foundation. The dwelling is not seen as separate from Nature but as an extension of the ecosystem. Every design decision - from building orientation and roof proportion to material selection- embodies the belief that sustainability arises from the balance among the environment, humanity, and the cosmos. This worldview represents an indigenous ecological consciousness, where climate, materials, and culture interweave within a self-regulating system. This analysis demonstrates that sustainability in vernacular architecture of Central Vietnam does not lie in materials or form alone but in a multi-layered cognitive system where climate, culture, society, and philosophy intertwine to create an integrated ecology of thought. Nha Ruong of Hue and shophouses of Hoi-An represent two expressions of the same iceberg principle: the visible form reflects physical adaptations, while the submerged layers reveal cultural intelligence, moral order, and the subtle relationship between people and Nature.

Translating Vernacular Wisdom into Interior Design Innovations

Building upon the Iceberg analysis, the Design Thinking framework was employed to reinterpret vernacular wisdom as a creative and human-centered process for sustainable interior design. This method views design not as a replication of traditional forms but as a translation from cultural cognition into adaptive interior strategies, ensuring that sustainability remains experiential, flexible, and locally grounded.

Through the five stages: Empathize, Define, Ideate, Prototype, and Reflective Synthesis, the research identifies five key outcomes for interior design in tropical contexts, focusing on how climate-responsive logic can inform spatial and material innovations.

Table 2. Application of Design Thinking to Vernacular Knowledge
Source: Author

No	Stage	Action	Interior Design Implications
1	Empathize	Spatial Behavior and Thermal Comfort	Focus on thermal comfort, light, and material tactility
2	Define	Identifying the challenges of modern interiors	Reframe goals toward comfort, ventilation, and locality
3	Ideate	Translating vernacular forms into creative ideas	Reinvent the spatial porosity of verandas and courtyards
4	Prototype	Experimenting with layouts and materials	Develop modular partitions, bamboo–wood composites, natural lighting strategies
5	Reflective Synthesis	Evaluating environmental and cultural coherence through analytical reflection.	Translated vernacular observations into applicable interior design principles

(1) Empathize – Spatial Behavior and Thermal Comfort

Field observations revealed that residents of the shophouses of Hue - *Nha Ruong* and Hoi-An naturally adjust interior functions to daily climatic rhythms. Sleeping, cooking, and gathering areas shift seasonally, and windows or partitions are opened or closed according to humidity and temperature. This behavior underlines the need for adaptive zoning in interior layouts, emphasizing cross-ventilation, movable partitions, and semi-open circulation corridors.

(2) Define – Reframing the Interior Challenge

The study identifies that modern interiors in tropical cities often depend excessively on-air conditioning and sealed envelopes, which weaken sensory connections with Nature. By

redefining the problem as 'how to design *breathable interiors*,' the focus shifts from mechanical comfort to microclimate design, integrating natural airflow, light modulation, and material tactility.

(3) **Ideate – Reinterpreting Vernacular Spatial Logics:**

Traditional elements such as verandas and courtyards were reimagined as transitional interior zones - climatic buffers that can exist inside contemporary buildings. These include light wells, shaded atria, and double-skin partitions that regulate humidity and enhance social flexibility. The ideation process translated vernacular principles into new spatial metaphors: 'breathing wall,' 'porous threshold,' and 'climatic furniture.'

(4) Prototype – Material and Construction Experimentation:

Conceptual prototypes explored the potential of hybrid materials combining bamboo, reclaimed timber, and lime plaster to achieve breathable yet durable interior envelopes. Surface treatments such as perforated panels, woven screens, and reflective lime coatings were proposed to improve natural ventilation and diffuse daylight, maintaining both ecological and aesthetic continuity.

(5) Reflective Synthesis – Integrating Vernacular Lessons into Interior Principles:

Rather than physical testing, this final stage involved analytical reflection - evaluating findings from Hue and Hoi-An to derive applicable design principles. The reflection revealed that the essence of sustainability lies in interior relationships: between open and enclosed spaces, between material density and airflow, and between comfort and cultural meanings. From this synthesis, three interior principles emerged as follows.

(a) Gradient Zoning: spatial layering that mediates between exterior heat and interior coolness;
(b) Material Breathability: selection of hygroscopic materials that regulate humidity naturally;
(c) Cultural Resonance: incorporation of symbolic details and rhythms that evoke local identity without imitation.

5a 5b 5c 5d

5e 5f 5g 5h

Fig. 5: Sequential illustration of the design research process integrating vernacular adaptation: (5a–5d) *Nha Ruong* interiors in Hue and (5e–5h) Hoi An shophouse interiors
Source: Author, 2025.

Through this iterative process, Design Thinking transforms vernacular adaptation into a living design framework; one that enables interior spaces to breathe, sense, and respond to climate as organically as the traditional dwellings of Central Vietnam once did.

Potentials and Challenges in Applying Vernacular Principles to Interior Design

Finally, the SWOT Analysis synthesizes findings into a strategic framework, identifying the Strengths, Weaknesses, Opportunities, and Threats associated with applying vernacular principles to sustainable interior design.

Table 3: SWOT Analysis of Vernacular Climate Adaptation for Interior Design Practice
Source: Author

No	Category	Key Findings	Implications for Design
1	**Strengths**	Passive cooling, porous envelopes, responsive zoning.	Basis for *microclimate interior design* using cross-ventilation, shaded layering, and open spatial logic.
2	**Weaknesses**	Material fragility, irregular maintenance, limited measurement data.	Need for standardized testing, modular hybrid materials, and modern fabrication techniques.
3	**Opportunities**	Growing demand for eco-interiors and heritage identity.	Encourage design studios to integrate vernacular prototypes and community workshops.
4	**Threats**	Urban densification, cultural erosion, climate instability.	Require adaptive policy, heritage protection, and cultural material research.

The SWOT results indicate that vernacular systems offer not only technical efficiency but cognitive coherence: a philosophy of living with climate that modern design can operationalize at the interior scale. The major challenge is translating qualitative wisdom into quantifiable and scalable interior strategies for urban housing.

Conclusions

This research demonstrates that vernacular housing in Central Vietnam embodies a sophisticated system of climate-responsive design, integrating material intelligence, spatial adaptation, and cultural symbolism. Through empirical observations and analytical interpretations, the study establishes that these dwellings are not mere aesthetic relics but active models of sustainability.

By synthesizing Design Thinking, Iceberg Model, and SWOT Analysis, the paper articulates a multi-dimensional framework for sustainable interior design rooted in vernacular wisdom. The findings emphasize that adaptation is both a technical and cultural process, where design is understood as a negotiation between human comfort, environmental constraints, and social values. In this context, for contemporary interior design education and practice, this study recommends three directions:

1. Pedagogical Integration: Incorporate vernacular adaptation strategies into curricula for sustainable design studios.
2. Material Innovation: Revive local materials through hybrid technologies (e.g., engineered bamboo, reclaimed wood).
3. Cultural Continuity: Preserve craft techniques and spatial patterns as living knowledge systems adaptable to new contexts.

Finally, the lessons from Hue and Hoi-An exemplify that sustainability for contemporary settlements must not be imported but rediscovered from the historical vernacular. This research concludes that the historical vernacular settlements and houses – as demonstrated through these case studies in Vietnam - stand as both a reminder and a blueprint for future design: one that breathes, learns, and evolves with its climate and culture. It is anticipated that the modern communities will learn the lessons and contribute to making the world a sustainable and wholesome habitat. With the dissemination of the knowledge and insights developed in this research, Vietnam will certainly do so.

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Statement of Conflict of Interest: The authors decare that there is no conflict of interest in carrying out this research.

Ethical Practice: This research followed accepted ethical practices. It did not involve any personal data, nor did it coerce any participants to take part in this research under pressure. No person has been identified.

Availability of Data: Data presented in this research is selected from a larger data set and they are available for scrutiny by any legitimate organization.

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