

ARCHITECTURAL IMPERMANENCE: TECTONIC ECOLOGY OF THE SUMBANESSE TRADITIONAL HOUSE

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Published: 2025-10-31

Submitted: 2025-09-30

Accepted: 2025-10-30

ARSNET, 2025, Vol. 5, No. 2, 86–101

DOI: 10.7454/arsnet/v5i2.171

ISSN 2777-0710 (online)

ISSN 2777-0702 (print)

Abstract

This research proposes tectonic ecology as the framework for understanding the impermanence of architecture, challenging the views of permanence in architecture and positioning impermanence as an ecological building practice. This study explores the idea of impermanence in vernacular architecture as a living spatial practice, acknowledging the growth, decay, and regeneration taking place in such a context. The research focuses on the Sumbanese traditional house in Weelewo Village, Southwest Sumba, as a case study. The Sumbanese house is constructed with natural materials and utilises joinery without using nails. The study collected data on the local construction practice through fieldwork, which included open-ended interviews, model-making demonstrations, observations, and documentations. The study reveals how local building practice understood the concept of impermanence through three interrelated principles that define the traditional house's tectonic ecology: layered, disassembly, and regeneration. The findings demonstrate that disassembly is the mechanism of tectonic ecology, enabling the temporal transformation of materials and sustaining buildings' capacity for regeneration. The exploration of tectonic ecology contributes by offering a framework of materiality and building practices that value impermanence. In doing so, such architectural practices emphasise the rhythm of the environment, as rooted within the wider ecosystem.

Keywords: impermanence, tectonic ecology, materiality, traditional house, Sumba

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Introduction

This research challenges the notion of permanence in architecture and puts forward the architecture that embraces impermanence, rooted in the understanding of how its construction is situated within the surrounding environment. In seeking permanence, architecture often resists time (Leatherbarrow, 2021) by making irreversible construction; using sealed joints, synthetic coating, or fixed assembly. Buildings that are fixed cannot be disassembled, as when they age, they become solid construction waste. Furthermore, buildings that resist decay also ultimately resist renewal, cutting off architecture from the natural cycle of time. This study argues that it is necessary to rethink permanence by rediscovering impermanence, emphasising the ecological rhythm and time as the basis of architectural design.

In this study, the idea of impermanence aims to re-read the relations between architecture and time. Leatherbarrow (2021) stated that architecture endures not by resisting time but by participating in it. Weathering, repair, and maintenance are modes of architectural participation to time, and it is related to its materiality (Leatherbarrow, 2021; Moe & Friedman, 2024). In this sense, architecture needs to be situated within the cycles of growth and decay that define ecological rhythm. This study defines the capacity of a building to decay, disassemble, and reassemble as a way to be able to participate in the rhythm of the natural environment, thus creating an ecological practice of architecture.

This study takes on vernacular architecture as a case study because of the embeddedness of environmental, social, and spiritual factors within its construction practices, showing deep adaptation to the climatic condition and material availability (Ara & Rashid, 2016; Bocco Guarneri & Habert, 2024; Dabaieh et al., 2021; Oliver, 2006). Leatherbarrow and Wesley (2018) stated that houses in older civilisations, such as ancient Greece, do not show division between natural and cultural phenomena. Vernacular houses and their craftsmanship respond to their environments through material availability, production, and construction systems (Oliver, 2006; Yatmo et al., 2019). In this sense, the study suggests that vernacular architecture has the potential to demonstrate the impermanence of architecture in relation to its material availability, construction, and the rhythm of its surrounding natural environment.

This study focuses on the Sumbanese traditional house, one of the vernacular architectures in Indonesia that has a soaring tower-like roof form. Studies on this traditional house's type have shown how its semi-arid savanna landscape and spiritual belief system, known as *Marapu*, have produced a spatial and form architectural logic grounded in ecological respect (Gunawan, 2017). Other studies on Sumbanese traditional architecture demonstrate a unique cultural meaning of the form-structure of the house (Clamagirand, 1997; Gregory, 1998; Mross, 1997; Solihin, 2018). However, the relations between material, construction, and ecology of such traditional houses

have rarely been studied. Thus, this study aims to investigate the relations between tectonic and ecological logic, how the structure's assembly and material life cycles sustain both environmental and cultural systems. In the end, this study seeks to situate vernacular architecture as a critical reference for understanding impermanence in architectural discourse, informing theories and contemporary practice of tectonics.

The tectonic ecology of impermanence architecture

The notion of impermanence challenges the assumption that durability can only be achieved through material resistance. Leatherbarrow (2021) stated that in ecological time, endurance arises not by resisting deterioration, but through participation within the cycles of transformation. Architecture is shaped by weathering, the slow inscription of time, climate, and use upon the surface of the built (Leatherbarrow, 2009, 2021; Schmidt & Austin, 2016). Rather than resisting decay, architecture can express it through materials and techniques that accommodate transformation. Architecture that values impermanence emphasises its capacity to change, repair, and maintain continuously (Dabaieh et al., 2021; Leatherbarrow, 2009, 2021; Schmidt & Austin, 2016).

In the realm of impermanence in architecture, then, tectonic becomes the means for the process of transformation, change, and renewal. Tectonic is defined not just as a relation between form and structure but as a living building/construction practice where structure, material, and environment are viewed as interdependent (Bech-Danielsen et al., 2012; Beim & Hvejsel, 2016; Deplazes, 2005; Fascari, 1996; Frampton, 1995; Schwartz, 2017). Thus, in this study, tectonic ecology is understood not only as the formal expression of structure (Frampton, 1995), but also the making process of assembling, transforming, and regenerating architecture through its material and construction within the ecological rhythm of the natural environment.

This study defines the tectonic capacity of architecture to change and transform continuously in relation to the environment and time through three main aspects. The first aspect is the understanding of layers that define buildings' rate of change (Brand, 1995). The second aspect is the construction joints that enable the assembly, disassembly, and reassembly (Schmidt & Austin, 2016). The joint or connection becomes an important point where structure, material, and craft knowledge translate into form (Deplazes, 2005; Frampton, 1995). The third aspect is understanding the material's growth and decay and their relation to the construction system.

These aspects reflect different ways of architectural project impermanence. Brand (1995) introduces an architecture of layers that change at different rates: structure, skin (enclosure), services, space, and use. Through Brand's (1995) understanding of layers, this study will look into architecture rates of change for different parts of architectural elements. In subsequent studies, this study will look into how the process of construction can be related to the building's capacity to change, focusing on

the assembly, disassembly, and reassembled ability of its joinery. Schmidt and Austin (2016) explained disassembly as one of the capacities of architecture to adapt, further describing that "the essence of adaptability is the investment in the outset in the things you are really going to need, and to leave others the option of adding or subtracting things you are not sure about" (p. 68). Thus, disassembly here is defined as the construction ability of a building to dismantle its structure and skin (e.g., enclosure which includes walls, floors, ceiling, roofing). The construction's ability to be assembled, disassembled, and reassembled is related to how the components are joined, loosened, and replaced.

The last aspect discusses the material resources of the building that undergoes cycles of growth and decay. Sennett (2008) explains how building deteriorates and undergoes the ongoing process of making and repairing. This approach views a building as an evolving system whose parts can be detached, repaired, and reassembled over time according to the material growth and decay process. This study aims to investigate how the layeredness, disassembly capability, and material regeneration construct tectonic ecology, enabling architecture to respond towards impermanence.

This study explores the idea of tectonic ecology as building practices that emphasise architectural capacity for cyclical renewal, where buildings learn to adapt, age, and re-form within ecological time. Thus, the logic of impermanence in architecture calls for a form of architectural tectonic that participates in the life cycles of the environment, in connection to the social, cultural, and material continuity. In addition, this study focuses on exploring tectonic ecology in the context of vernacular architecture. As Oliver (2003, 2006) observes, vernacular architecture emerges from relations between community and the environment, where materials are gathered from the resources that grow, are used, and returned through cycles of regeneration. Vernacular traditions also reflect multiple building practices which involve the constructing and dismantling act of building to adapt to their environments (Oliver, 2006). Vernacular architecture has the potential to understand impermanence as part of a lived practice, informing contemporary design.

Methodology

This study aims to understand the logic of construction as a form of ecological knowledge that can inform contemporary architectural tectonic thinking. This research conducted a qualitative study that examines the living building practices of the Sumbanese traditional house, focusing on the relationship between material, construction, joinery, and the ecological rhythm. Sumba was chosen for the society's active practice of traditional house building until now. The fieldwork is conducted in Weelewo Village, an origin village of the Wewewa Tribe in Southwest Sumba, observing nine traditional houses in the village (Figure 1). It should be noted that there were 20 traditional houses in Weelewo Village, but all had been burned down and only nine had been rebuilt. The other 11 houses were

still waiting to be rebuilt. The rebuilding of a traditional house can take several years to complete because it requires the whole clan, mostly males who are the heads of their nuclear families, to gather and decide together on every step and ritual related to the trees, the size, and the days, including the funds.



Figure 1. The Weelewo Village and its nine traditional houses that have been rebuilt (Photograph by authors)

As can be seen in Figure 2, the Sumbanese traditional house is a distinct house type with tower-like roof forms and multiple floor levels. The house still uses natural materials such as stone for foundations, wood for pillars and beams, bamboo for walls, floors, roof frames, and reeds for thatch roof. The houses are constructed without nails, using rattan, coconut fibre, and tree roots for the joinery. The materials are sourced locally within the surrounding forests. In front of the house, there are usually some stone tombs that originated from their ancestors.



Figure 2. Traditional house with its tower-like roof forms in Weelewo Village (Photograph by authors)

This Sumbanese traditional house type is occupied by a clan with similar ancestors. The house is guarded by a nuclear family caretaker, chosen by the clan to take care of their traditional house. The other nuclear families in the clan lived outside of the village, distributed largely on and off Sumba Island. The head of a traditional house is also usually the father, as the head of the family. The caretaker's family use the house for their daily activities. During specific ritual or gathering events, such as Christmas time, as many Sumbanese are now Catholic and

Christians, burial ceremonies, and so on, the whole clan would get together in the traditional house.

The data about the house's different aspects of impermanence are collected through open-ended interviews and observations. The interviews are organised around the construction process and the ecological origin of each material component. Since there are nine traditional houses in Weelewo Village, the interview was conducted with nine heads of the traditional houses, who are also the heads of a nuclear family, accompanied by their sons. They are also the master builders who will impart their construction skills and knowledge towards the next generations.

The study collects understanding about the construction process through assembling a model, being involved in the gathering process of bamboo and rattan from the forest, and understanding details through observing the assembly process (Figure 3). The study also documents the traditional house as a physical object following Brand's (1995) building layers principles: separating each layer, such as the posts and beams as the structure, walls and floors as the skin, in addition to other parts such as the foundations, roof frames, thatch, and their joinery. Photographs and on-site measurements were collected to document the physical building and the construction process.



Data analysis is conducted in three main stages. The study identifies and maps the building layers in relation to what elements can be replaced and how such replacement can be conducted. Secondly, the study investigates the disassembly capacity of the building through understanding the construction processes and the components. In the subsequent, the study analyses how the construction and material knowledge of the builder is rooted in the local ecology of such context.

Results and discussion

The analysis explores the tectonic system of the Sumbanese traditional house in Weelewo Village and how it informs ecological knowledge in response to impermanence. This section discusses the findings through the tectonic ecology

Figure 3. Demonstrations of the construction process by the community during the field study, including building a maquette (left) and the rattan tying technique (right) (Photographs by authors)

framework that views architecture as a living building practice, where the construction system and the material knowledge are in line with the ecological rhythm of the environment. The discussion is arranged in three sub-sections: the layeredness of Sumbanese houses, the disassembly capacity of its joinery, and the material regeneration of its parts.

The layeredness of the Sumbanese house

The tectonics of the Sumbanese house are constructed from the inner part of the house and expanded layer by layer sequentially outward. The inner part of the house is the centre of the house and is marked by the four main pillars buried roughly one metre into the ground, defining the main structure of the house. These pillars support the tower-like main roof frames like a hat that sits on the central structure. The roof frames are laid on top of the upper beams without any ties and clamped by the ceiling frames, relying on gravity and their weight to achieve stability.

Expanding beyond the four pillars, there are more pillars that construct the layeredness of the whole house. After the core, there are second, third, and even fourth layers of structures, depending on the size of the house (Figure 4). The second layer of pillars (yellow coloured) and the third layer of pillars (green coloured) lay on top of stones and were tied together with the floor beams using the rattan ropes. The stability and strength of the house rely not only on the pillars, but also on the bamboo poles and the levelling arrangement of the floor. The bamboo poles support the internal walls vertically; meanwhile, the different levelling arrangements of the floor stabilise the position of all pillars and poles horizontally. It can be seen how the layeredness provides the structural stability of the whole house.

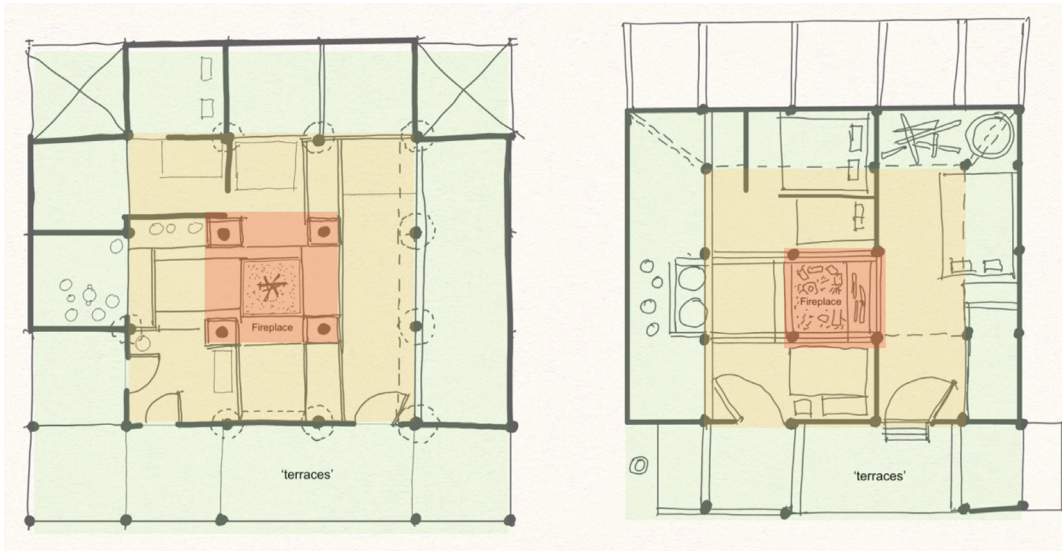


Figure 4. The layeredness of two traditional house examples in Weelewo Village, expanding from the core to the peripheral spaces (Image by authors)

Aside from the structural ideas, the four pillars in the centre become the core as well as the foundation of the house as they represent a nuclear family—the father, the mother, the son, and the daughter-in-law (Figure 4). Symbolically, the four pillars

represent the heart of the house, as in the middle between these pillars lies the hearth, the everlasting fire that sustains daily life and ritual continuity. It is where the food is cooked and the family bonds are formed, anchoring both the earth and social relations to the house.

The layeredness of the house constructs a spatial arrangement between the pillars, which has different uses. The inner layer or the core is more sacred and grounded, dedicated to the central fire. Meanwhile, for the outer layers beyond the core, the space is arranged for performing everyday domestic routines, such as resting, working, storing, and gathering. The space at the outer layers corresponds more to the temporal and replaceable use of space. Each layer of the house generates an intimacy and the communality, the constant and the change, the stability and flexibility in terms of functional and symbolic.

Table 1. The layeredness of the Sumbanese house

Layer	Component	Material	Joinery	Function
Core structure	Four main pillars	Wood	Ground in the soil	Supports the roof structure
	Upper beams	Wood	Rest on top pillars	Support the ceiling frame
	Lower beams	Wood	Tied with rattan to the pillars	Support floors
	Ceiling frame	Bamboo	Tied together on the top upper beams	Clamped the roof main frame, hung the storage box
Second and third layer structure	Outer pillars	Wood	Laid on top of the stones	Support beams
	Upper beams	Wood	Tied with rattan to pillars	Support the roof structure
	Lower beams	Wood	Tied with rattan to pillars	Support floors
Roof frame	The tower-like main frame	Bamboo pole	Tied together with roots	Clamped to the ceiling frame
	Rafters	Bamboo pole	Tied together with roots	Support thatch and stabilised centre structure
Enclosure	Thatch roof	Reeds	Tied to rafters with roots	Shelter
	Floors (raised, different-level platform)	Bamboo pole	Lay on top of beams, at the edge, tied with rattan	Strengthen structure, mediates earth and interior daily life
	Walls (periphery)	Bamboo pole	Tied to pillars with rattan, pegged	Strengthen structure, mediates earth and interior daily life

Table 1 outlines the layeredness of the house constructed from the components, materials, and joinery, in line with Brand's (1995) concept of layers. Each of the house layers—structure, skin, space plan, and use (without services)—can be clearly identified and is composed of material systems that age, change, or transform at different rates. The structural layers of the house can be differentiated into two rates of change and transformation. The core structure shows more permanent characteristics compared to other layers, functionally and symbolically, and is rarely replaced. The secondary and third layers of structure, as well as the roof frame, serve as a middle layer that is durable yet replaceable, making them less permanent. The enclosure layer that is constructed from bamboo and reeds thatch that act as a vertical partition and also roofing material, is more temporary, as it can be easily replaced as it weathers

and decays under the exposure of the sun and rain. Meanwhile, the space plan is always changeable, as no internal partition that divides the space, no big furniture like a wardrobe or bed, and no specific rules or arrangement for activities inside the house.

The layeredness of the house expands from the core inside to the outer structure and skin or enclosures outside. Each layer is organised according to the materials' ecological rhythm of growth and decay. The tectonic layers suggest how they are organised temporally in space, embracing the cycles of transformation and deterioration of materials. The ecological rhythm becomes part of the building structure and construction. Here, layering acts as a technical and temporal strategy as part of ecological understanding.

However, layering alone does not ensure continuity. Without a mechanism to replace or renew these parts, the building would eventually fail to flow with the rhythm of ecological time. Thus, the next section will discuss further the disassembly of material as part of the operative method to explain the tectonic ecology of the Sumbanese traditional house.

The disassembly capacity of its joinery

As mentioned before, the layeredness of the house relies on the material properties and the joinery as part of the cycle of change and transformation. Such an idea urges the layer to be constructed following the logic of assembly-disassembly, allowing the change and transformation to take place as required. Unlike modern construction that employs fixed joints, the Sumbanese house employs the system of tying and weaving using rattan, tree roots, and coconut fibre ropes to connect and join all structural components (Figure 5). Every connection between pillars, beams, floors, and roofs relies on compression and tension, requiring ties and knots as the joinery. Thus, the absence of nails that tend to fix the joint becomes a prerequisite of such construction, signifying a complex vocabulary of knots and loops made from rattan, tree roots, and coconut fibre ropes. It demonstrates a thorough understanding of structural and construction behaviour, and not about technological limitations.



Figure 5. Types of Sumbanese traditional joinery: rattan joinery (left), combination of rattan and pegs joinery (middle), and the combination of coconut fibre and roots joinery (right) (Photographs by authors)

The rope tie and knot can be differentiated into several types, corresponding to specific layers of the house. The pillars and

the beams, the walls, and the floorboards are all bound by rattan ropes. The upper beam, the tower-like main roof frames, and the thatch roof are tied to the roof frame with a kind of roots, while the outer edges of the roof are tied with long, continuous cords of woven coconut fibre. These coconut fibre ropes are woven continuously, creating a long rope without breaking, so they can wrap around the roof edge. For example, the edges of the roof are bound with continuous coconut fibre ropes on the outermost beam layer. In Figure 5, all the joints are exposed visually. Such visibility is to ensure that decay can be anticipated and replacement can be conducted when necessary.

This joinery strategy allows every component to be assembled and disassembled—detached, replaced, and rejoined—without compromising the structural integrity of the whole house. When a section of the bamboo walls or bamboo floors deteriorates, the decayed or damaged parts can be untied and replaced with new materials without disturbing the rest of the structure. Disassembly is therefore a way of keeping the building alive through selective renewal.

Types of Joinery	Material of Joinery	Role of Joinery	Layers
Tie	Rattan	Connect beams to outer pillars	Core structure
		Connect the bamboo pole floors to the lower beams	Enclosure
		Connect bamboo pole walls to pillars	
	(A kind of) roots	Connect the bamboo pole roof frame and rafters	Roof frame
	Coconut fibres	Connect the edge of the thatch roof with rafters and beams	
Peg	Wood/ bamboo	Hold together using bamboo pole walls	Enclosure

Table 2. Joinery in the Sumbanese traditional house

The types of joinery and choices of the material reflect a deep understanding of material behaviour. Rattan shrinks and tightens with tension and age, increasing joint strength, while coconut fibre softens and expands in humidity, providing flexibility at the roof edges where movement and wind load are greatest. Table 2 shows the positioning of joinery in relation to the material capacity that allows the disassembly to occur accordingly.

The disassembly becomes the key to its tectonic ecology as it enables the architecture to take place in cycles of decay and renewal. Every joinery has the capacity to be assembled, disassembled, and reassembled. It reveals how the capacity of disassembly in the Sumbanese traditional house embraces the impermanence in the tectonics, not only as a technical dimension but also the social and cultural ones.

When the traditional house is being repaired, whether the house is rethatched or its bamboo panel is replaced and retied, family members and neighbours gather bringing materials and labour, not only for repairing or rebuilding the house but also as making it as a ritual. The adult males of the house build the

house, while the females cook feasts for the events. Children play and sing. The repair and rebuilding is not an individual task, but a communal event where tradition and transmission are lived and performed. It becomes a collective act that transmits building knowledge across generations.

Furthermore, the processes of weaving, binding, and tying in the making of coconut fibre ropes are performed collectively by the community. It becomes a social and cultural act which requires cooperation from the community. To untie is to participate in the ongoing cycle of renewal of the house in relation to its inhabitants and the environment. The life of the Sumbanese traditional depends on the continuous process with the disassembly capacity of the joinery, highlighting a living dialogue between human, material, and the environment.

The material regeneration of its part

The discussion above shows how the layeredness of the house reflects the temporal logic of its construction and disassembly, enabling its operation. Continuing from such a stance, this study will further reveal how regeneration as part of the tectonic process is experienced, expressed, and nurtured. The traditional house temporality begins at the hearth, the centre of warmth and light. The fire is kept constantly lit when there is an inhabitant in the house for cooking and gathering, sustaining the spirit of the house. As the smoke goes up through the tower-like roof, the dust and soot cover and blacken the bamboo storage hung above the hearth, including the ceiling frame and the bamboo rafters over time. Such a process preserves the material in the core structure, as the dust and soot slowly coat the material, create a protective layer of durability, and participate in their own temporal cycles.



Figure 6. The material regeneration process through weathering of the bamboo surfaces (left) and the blackening of the material above the hearth (right) (Photographs by authors)

In the Sumbanese house, time flows through the building itself. The passage of time shows itself in its surface, the darkened bamboo floors, the changing colours of the thatch due to weather, and the smoke-stained beams are traces of everyday inhabitation. These traces are what Leatherbarrow (2021) calls the inscription of time. The house ages and at the same time renews through its materials, the acts of disassembly,

as well as material regeneration as a response to the cycle of nature and environment.

The layeredness and its disassembly capacity demonstrate a pace of material regeneration, indicating that the house also contains multiple temporal layers. Each materials, such as woods, bamboo, rattan, coconut fibres, and plant roots, are selected from particular vegetation by considering their growth rate and regenerative capacity. Wood is utilised as the structure, as it is more durable, but takes a longer time to regenerate itself. Bamboo used for the enclosure is weathered more rapidly, but it regenerates faster than wood. Each material ages and will be replaced at different intervals, showing a material temporality that is closely related to the understanding of regeneration of the material itself.

In this case, the plants are planted by the traditional builders. They grow, nurture, and regrow the material in their surrounding environment, forming an architectural ecology grounded in the rhythm of nature. They grow their own bamboo plants in their backyards, source particular trees for pillars from the sacred forest; and the rattan, coconut trees, and the roots from the surrounding forest. Such material understanding ensures that the process of rebuilding does not exhaust the environment. In this sense, regeneration becomes ecological by maintaining a balance between the need to build and to nurture nature.

The knowledge of material regeneration of the traditional house is also maintained through the vernacular know-how and transmitted by practice. The community re-enacts the act of making, particularly when the plants are grown, selected, and cut for house-building. This means that material regeneration becomes sustained through the continuity of social practice and cultural knowledge.

This study reveals that the tectonics of the Sumbanese traditional house allow every component to be taken apart and rebuilt as it decays. The visible joinery expresses an understanding of impermanence and renewal in its own natural rhythm, which operates through layered construction that bears of changes. The layeredness of the house distributes the temporality across the structure, while disassembly enables it. Both arrangements allow regeneration, in which materials and practices can always enter and re-enter cycles of material growth, decay, and renewal. In this framework, temporality renders the tectonic ecology through layered organisation, disassembly mechanism, and material regeneration. The Sumbanese architecture becomes the ecological outcome, demonstrating how architecture participates in time.

Conclusion

This study has put forward tectonic ecology as a conceptual framework for understanding architecture's participation in time. Through the case of the Sumbanese traditional house, the research demonstrates that impermanence in architecture is not the direct opposite of permanence. It endures not by resisting decay, but by integrating growth and renewal into its

construction logic. Its components are allowed to age and be replaced in rhythm with the natural material within a natural landscape that weathers and sustains it. Its construction demonstrates how sustainability can be achieved through temporality, by its capacity to be remade across generations.

In Weelewo Village, the house is never finished. It is continually maintained, repaired, and renewed over time, demonstrating how natural time becomes the rhythm of the house. The house embodies an awareness that form is always in process, shaped by weather and used through its capacity to be disassembled and reassembled. To build with time means to accept change and disassembly becomes a form of participation within the environmental cycle as well as of transmission of know-how. Thus, the act of building and rebuilding is not only about technical aspects, but also a social and cultural ongoing practice between human craft and environmental process.

The first is the layered construction system showing how the tectonic plate expands from the centre to the periphery. The second shows disassembly becomes a capacity of the joinery that allows the material of the house to be detached, replaced, and reassembled. The third signifies the material regeneration as an embodiment of temporality, how the assembly and disassembly of architecture becomes aligned with material natural cycles and climate. Such findings reflect on the broader implications for design knowledge, positioning the traditional house as a critical reference for ecological thinking of architectural tectonics.

Such understanding highlights how the Sumbanese traditional house contributes to the discussion of contemporary architectural practice in three interrelated ways. First, it reframes the architecture of impermanence in relation to the capacity of architecture in responding to changes. Second, it introduces disassembly as the operation of tectonic ecology, redefining construction as an ongoing collaboration between human craft and environmental process, as it is rooted within the wider ecosystem. It positions how architecture becomes the intertwining of technical, environmental, and socio-cultural perspectives. Third, the paper demonstrates tectonic ecology as a framework for the impermanence in architecture, suggesting how vernacular architecture is a critical reference for tectonic ecology strategy in architecture. Future research should aim to uncover other possible strategies embedded in the vernacular's tectonic ecology in the world.

Acknowledgements

This research is a collaboration between Parahyangan Catholic University, Indonesia and Construye Identidad, Peru.

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