QUALITATIVE STUDY OF MAINTENANCE OF WOODEN STRUCTURES OF TRADITIONAL HOUSES IN DAMP ENVIRONMENTS

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Abstract

The maintenance of wooden structures in traditional houses located in humid environments poses significant challenges due to the high risk of damage caused by moisture, fungal growth, and termite infestation. This study employs a qualitative approach to explore community maintenance practices, the challenges encountered, and the role of local wisdom in sustaining wooden traditional houses. Data were collected through in-depth interviews, participatory observation, and documentation at several traditional house sites in humid climate regions. The findings reveal that traditional maintenance methods, such as the use of natural preservatives, replacement of damaged components, and ventilation management, are effective in extending the lifespan of wooden structures. However, limited knowledge and resources remain major obstacles to preservation efforts. The integration of traditional techniques with modern technologies is expected to enhance maintenance effectiveness. This research provides strategic recommendations for the sustainable preservation of traditional houses and serves as a reference for the development of cultural heritage conservation policies in humid regions.

Keywords: Wooden Maintenance, Traditional Houses, Humid Environment, Local Wisdom, Structural Conservation

INTRODUCTION

Traditional houses are one of the cultural heritages that represent the historical, architectural, and social values of a community. In Indonesia, many traditional houses are built using wood due to its ease of shaping, good mechanical strength, and ability to provide thermal comfort (Wijayanti & Pramudito, 2020). However, the use of wood as the primary structural material requires special attention, particularly in terms of maintenance to ensure durability and strength. This is especially important in humid environments, where the risk of damage from biological factors such as fungi, termites, and decay increases significantly (Putra & Wahyudi, 2019).

Humid environments, typically characterized by high air humidity and heavy rainfall, create ideal conditions for the growth of wood-damaging organisms. Moisture content above 20% in wood fibers can trigger attacks from decay fungi (Fitrah & Suryana, 2021). In addition, extreme fluctuations in temperature and humidity can accelerate the physical degradation of wood, including cracking, weathering, and deformation (Rahman et al., 2022). Therefore, regular maintenance and proper protection methods are key factors in preserving the quality of wooden structures in traditional houses located in humid areas.

Over time, many traditional houses have lost their original function and have been transformed into cultural tourism objects or museums. This functional transformation poses new challenges, as high visitor numbers can accelerate material wear and require more systematic maintenance strategies (Ardiansyah & Lestari, 2020). Preservation efforts require not only technical knowledge regarding the physical repair of wood but also an understanding of the cultural values embedded in it (Sari, 2021). Thus, the approach used must holistically integrate technical, social, and cultural aspects.

Maintenance of wooden structures in humid environments cannot rely solely on conventional methods but requires the application of appropriate technologies capable of reducing moisture and preventing attacks from destructive organisms. Several studies have shown that the use of natural preservatives such as plant extracts, vegetable oils, and borax salt solutions can significantly extend the service life of wood (Iskandar & Mahendra, 2018). However, the effectiveness of these methods greatly depends on environmental conditions, wood species, and the intensity of maintenance performed.

In addition to technical aspects, the socio-cultural factors of local communities play an important role in ensuring the sustainability of traditional houses. Local wisdom regarding construction techniques, material selection, and maintenance methods—passed down through generations—has proven effective in preserving traditional houses for decades or even centuries (Wulandari & Nugroho, 2019). Unfortunately, modernization and shifting cultural values often lead to the neglect of such practices, making it necessary to document and revitalize this knowledge.

A qualitative study approach is relevant for examining the maintenance of wooden structures in traditional houses within humid environments, as it allows researchers to explore community experiences, perceptions, and practices in depth. This method enables a simultaneous understanding of social, cultural, and technical contexts, making the results applicable as a reference for developing sustainable preservation strategies (Creswell, 2018). By involving various stakeholders—such as traditional house owners, traditional carpenters, and local government—this research is expected to provide applicable and context-specific solutions.

Based on the above description, this study aims to explore the maintenance practices of wooden structures in traditional houses in humid environments through a qualitative approach. The focus of the research includes identifying the problems encountered, the maintenance strategies employed, and the cultural values underlying the process. The findings are expected to contribute to the preservation of wooden traditional houses and serve as a reference for developing cultural heritage conservation policies in Indonesia.

LITERATURE REVIEW

Wooden traditional houses are a form of vernacular architecture widely found in various regions of Indonesia. Wood is chosen as the primary material due to its abundant availability, ease of processing, and excellent thermal comfort properties (Wijayanti & Pramudito, 2020). However, the natural susceptibility of wood to moisture requires appropriate maintenance strategies, particularly in high-humidity environments. According to Sumarni (2019), traditional houses hold both architectural and cultural value that must be preserved, making material maintenance an integral part of safeguarding cultural heritage.

Environmental humidity is one of the main factors that accelerates wood deterioration. Conditions with air humidity above 70% and warm temperatures create an ideal environment for the growth of fungi, moss, and wood-destroying insects such as termites (Fitrah & Suryana, 2021). Wood with a moisture content exceeding 20% is vulnerable to decay caused by white rot or brown rot fungi, which ultimately reduces its mechanical strength (Rahman et al., 2022). Therefore, maintenance in humid areas should not only focus on physical repairs but also on biological prevention through moisture control and the application of wood preservatives.

Wood preservatives fall into two main categories: synthetic and natural. Synthetic preservatives such as borax–boric acid are highly effective in preventing insect and fungal attacks (Iskandar & Mahendra, 2018). Meanwhile, natural preservatives—such as neem oil, coconut oil, and certain plant extracts—are considered more environmentally friendly and safe for human health (Puspitasari et al., 2020). The choice of preservative type is often influenced by material availability, the community's technical knowledge, and the costs associated with its application.

Local wisdom plays an important role in ensuring the sustainability of wooden structures in traditional houses. Traditional construction techniques, such as using wooden peg joints without metal nails or selecting termite-resistant wood species, have been proven to extend building lifespan (Wulandari & Nugroho, 2019). According to Dewi (2020), such practices are usually passed down orally from generation to generation, and modernization coupled with declining interest among younger generations poses a challenge to preserving this knowledge.

Research on the maintenance of wooden traditional houses in humid environments has been conducted by several scholars using various approaches. Ardiansyah & Lestari (2020) revealed that routine maintenance, such as repainting, replacing damaged components, and cleaning the surrounding area, can slow deterioration. Meanwhile, a study by Yuliani (2021) emphasized the importance of integrating traditional methods with modern technology, for example, using moisture sensors to monitor wood conditions in real-time. This integrative approach is seen as capable of addressing environmental challenges while preserving the historical value of the building.

A qualitative approach in traditional architectural studies enables researchers to gain an in-depth understanding of social, cultural, and technical dynamics. According to Creswell (2018), this method is effective for exploring community experiences, perceptions of traditional house maintenance, and the factors influencing maintenance decisions. By actively involving homeowners, local carpenters, and policymakers, qualitative research can produce practical and contextually relevant recommendations.

In the context of preserving traditional houses in humid environments, this literature review indicates that successful maintenance depends on the synergy between technical knowledge, local wisdom, and government policy support. A combination of traditional methods adapted to the environment and modern technological innovations can serve as an effective strategy to sustain the function and value of wooden traditional houses over the long term.

RESEARCH METHODOLOGY

This study employed a qualitative approach with a case study design to explore in depth the maintenance practices of wooden structures in traditional houses located in humid environments. This approach was chosen because it allows the researcher to gain a holistic understanding of the phenomenon through direct observation, in-depth interviews, and analysis of socio-cultural contexts (Creswell, 2018). The case study design was deemed relevant as the research focus lies on a specific unit of analysis, namely wooden traditional houses situated in high-humidity areas.

The research location was determined purposively in areas with a concentration of wooden traditional houses situated in high-humidity environments, such as coastal regions and mountainous areas with high rainfall. The selection of the location was based on criteria such as the presence of inhabited or actively used traditional houses, the level of environmental humidity, and accessibility for the researcher. Determining the right location is essential to ensure that the data collected are relevant and representative of the research objectives.

Figure 1. One of the Traditional Wooden Houses

The research subjects consisted of traditional house owners, traditional carpenters, cultural leaders, and local government officials who play a role in the preservation of historical buildings. Informants were selected using purposive sampling based on their knowledge, experience, and involvement in the maintenance of wooden traditional houses. According to Sugiyono (2019), purposive sampling is effective in qualitative research to obtain rich and in-depth information from relevant sources.

Data collection techniques in this study included in-depth interviews, participatory observation, and documentation. The in-depth interviews were conducted face-to-face using a semi-structured interview guide to provide flexibility in exploring more detailed information. The interview questions covered the history of the traditional house, the maintenance methods used, the types of damage that frequently occur, and the informants' perspectives on preservation challenges in humid environments.

Figure 2. Conducting an Interview

Participatory observation was conducted by directly observing the physical condition of the wooden structure, maintenance techniques, and community activities related to the preservation of traditional houses. This observation included photographic documentation of key elements such as pillars, walls, floors, and roofs to assess the level of damage and the effectiveness of the maintenance measures undertaken. Field observation was also useful for identifying environmental factors, such as surrounding vegetation, lighting levels, and air circulation, which influence wood moisture levels.

Documentation involved collecting archives, technical records, and historical photographs of traditional houses obtained from homeowners, customary institutions, or government agencies. Documentary data were used to strengthen the information gathered from interviews and observations, as well as to help analyze changes in the condition of traditional houses over time. The use of documentation was also important for comparing the physical condition of the building before and after the application of certain maintenance methods.

Data analysis was carried out using the Miles & Huberman (1994) model, which consists of three stages: data reduction, data display, and conclusion drawing. Data reduction was performed by selecting relevant information and grouping it according to themes, such as maintenance methods, damage factors, and community roles. Data display was conducted in the form of matrices, descriptive narratives, and field photographs to facilitate interpretation. Conclusion drawing was carried out inductively, formulating findings based on patterns emerging from the data.

To enhance data validity, this study employed source triangulation and method triangulation techniques. Source triangulation was done by comparing information from various informants, while method triangulation was achieved by combining the results of interviews, observations, and documentation. In this way, the accuracy and reliability of the research findings could be ensured (Patton, 2015).

Research ethics were maintained by obtaining informed consent from all informants before conducting interviews or observations. Informants were given explanations about the research objectives, the expected benefits, and their right to withdraw at any time. Informants' identities were kept confidential by using codes or pseudonyms in the publication of the research results.

The limitation of this research is that it focuses on wooden traditional houses in humid environments with a limited number of informants. Therefore, the findings of this study are not intended to be generalized but are instead aimed at providing an in-depth understanding of the phenomenon under study. The research findings may serve as an initial reference for similar studies in other regions with different environmental and cultural characteristics.

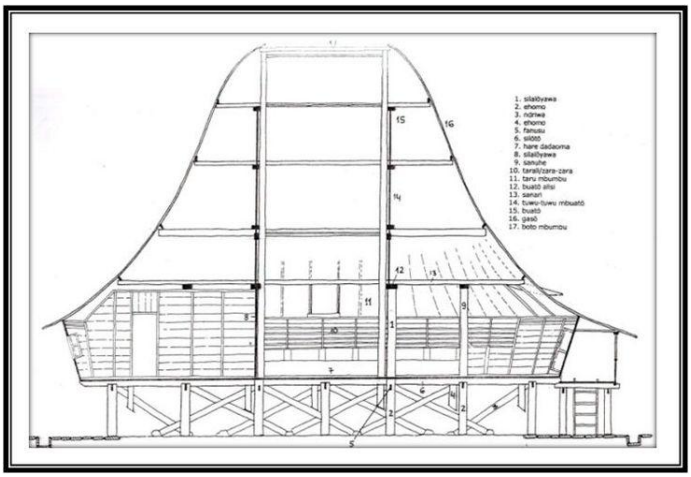

Figure 3. Analysis of Traditional House Structure

RESULTS AND DISCUSSION

Characteristics of Traditional Houses and Environmental Conditions

Based on the results of observations and interviews, the traditional houses that served as the research objects have main structural materials made from local woods such as meranti, ulin, and teak. These types of wood were selected because they are known for their resistance to humid environmental conditions and hold significant historical value. The surrounding environment tends to have a humid climate, with an average annual rainfall exceeding 2,000 mm and air humidity levels reaching 80–90%.

This environmental humidity has a tangible impact on the physical condition of the wood, particularly on the lower parts of pillars and walls that are in direct contact with the ground or surface runoff. Table 1 presents the general types of damage found in the wooden structures of traditional houses.

Table 1. Condition of Damage to Wooden Structures of Traditional Houses in Humid Environments

No	Wooden Structural Part	Type of Damage	Frequency (%)	Impact of Damage
1	Support Pillars	Decay, termite attack	75	Reduces structural strength
2	Wooden Walls	Fungal growth, weathering	65	Cracking and loss of aesthetics
3	Wooden Floors	Weathering, deformation	50	Risk of accidents, deformation
4	Wooden Roof (frame)	Cracking and peeling	30	Leakage and further damage

Maintenance Methods Used

Maintenance methods used by communities and traditional carpenters are divided into several techniques, both preventative and repair. In-depth interviews revealed that:

- Natural Preservative Treatment: Coconut oil and local plant extracts are used as natural preservatives to prevent termites and mold.
- Replacement of Damaged Sections: Severely decayed pillars or walls are replaced with new, preserved wood.
- Routine Cleaning: Regularly clean the underside of the wood and vents to reduce moisture.
- Air Circulation: Create additional ventilation in the structure to increase airflow and reduce humidity levels.

Table 2. Wood Structure Maintenance Methods and Their Effectiveness

Maintenance Method	Brief Description	Effectiveness Level (Scale 1–5)
Natural preservative (coconut oil)	Coating the wood with natural oil	4
Replacement of damaged wood	Cutting and replacing decayed wood parts	5
Routine cleaning	Removing dust and dirt from the wood	3
Additional ventilation	Creating new ventilation openings	4
Repainting with wood paint	Protecting wood from moisture and insects	3

Causes of Deterioration and Maintenance Challenges

Informants revealed that, aside from the humid environment, several major factors contribute to the deterioration of wooden elements in traditional houses, including:

- Infestation by Wood-Destroying Organisms: Termites and fungi are the primary and most persistent threats, often difficult to control permanently.
- Lack of Technical Knowledge: Some homeowners are unfamiliar with proper and effective wood maintenance techniques.
- Limited Resources: The cost and availability of high-quality preservatives frequently pose challenges.
- Impact of Modernization: Shifts in culture and lifestyle have led to the gradual abandonment of certain traditional maintenance practices.

These challenges highlight the need for collaboration among local communities, conservation experts, and government authorities to develop practical, cost-effective, and culturally appropriate maintenance methods.

Role of Local Wisdom in Maintenance

This qualitative study found that local wisdom plays a significant role in the maintenance of traditional houses. Traditional techniques—such as selecting fully matured timber, using wooden peg joints without metal nails, and designing natural ventilation patterns—have proven effective in protecting structures from damage. However, there is concern that this knowledge is gradually fading due to modernization.

Several informants suggested the importance of documenting and reintroducing these techniques to younger generations through training programs. Additionally, integrating traditional methods with modern technologies, such as humidity sensors, is considered a promising solution to enhance maintenance effectiveness.

Implications for the Preservation of Traditional Houses

The findings indicate that maintaining wooden structures in traditional houses located in humid environments requires a multidimensional approach. Relying solely on traditional methods is insufficient; technological applications and supportive policies are also necessary for long-term preservation.

Key recommendations emerging from the study include:

- Providing community training and outreach on effective wood maintenance techniques.
- Supplying environmentally friendly and easily accessible natural preservatives.
- Developing regular monitoring programs for assessing the condition of traditional houses.
- Encouraging collaboration among stakeholders to safeguard cultural heritage.

CONCLUSION

This study successfully identified key aspects of wooden structure maintenance in traditional houses located in humid environments. High moisture levels have a significant impact on wood deterioration, particularly in the form of decay, termite infestation, and weathering of major structural components such as pillars, walls, and floors. If left untreated, such damage poses a threat to the stability and continued function of traditional houses as cultural heritage assets.

Maintenance methods practiced by local communities include the use of natural preservatives, replacement of damaged wooden components, regular cleaning, and ventilation control. Although these techniques are relatively simple, they are effective in extending the lifespan of wooden structures. However, limited technical knowledge and resource constraints remain major challenges to ensuring consistent and optimal maintenance.

Local wisdom plays a crucial role in sustaining traditional wooden houses. Practices such as selecting moisture-resistant timber species and employing wooden peg joints without nails have proven effective in preventing structural damage. Unfortunately, this knowledge is gradually eroding due to modernization and cultural shifts, highlighting the need for preservation efforts through documentation and intergenerational training.

The study also revealed that wood deterioration is not solely caused by environmental factors but is also influenced by insufficient policy support and a lack of public awareness regarding heritage preservation. Therefore, collaboration among communities, government bodies, and conservation experts is essential to develop more structured and sustainable maintenance strategies.

Integrating traditional methods with modern technologies offers a promising approach for maintaining traditional houses in humid regions. The application of humidity sensors, eco-friendly preservatives, and periodic monitoring techniques can aid in early detection and mitigation of damage, thereby preventing more severe deterioration.

Overall, this research provides valuable insights into the holistic maintenance of traditional wooden houses in humid climates. The findings serve as a basis for developing preservation policies that are responsive to local conditions and community needs, as well as a reference for similar studies in regions with comparable environmental and cultural characteristics.

For future efforts, it is recommended to strengthen community outreach and education on effective wood maintenance techniques and to empower local communities as primary actors in heritage preservation. By doing so, the continuity of traditional houses as cultural heritage and symbols of community identity can be safeguarded for generations to come.

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