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Architectural Analysis of Rumah Kancingan in Merauke

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Abstract. Rumah kancingan is a distinctive house used by residents of Merauke, Papua. The house is unique because it combines walls made of both orthotropic and isotropic materials, which is a combination of brick walls and wooden frames, built from isotropic and orthotropic materials, respectively. As a result, this study aimed to provide a better understanding of Rumah kancingan in Merauke and explore new information about its architectural design. A typology method was used through an interpretive method to analyze 100 samples. The objective was to describe and categorize them based on architectural aspects, encircling house type (floor plan), and visual features such as roof shape, entrance, ornaments, and building materials. Despite wood being the main structural and framing material, the results showed that the varied size of the houses did not necessarily limit the spaciousness of the rooms, considering the dimensional constraints of wood. The roof shape was an indicator of the construction era and the terrace served as additional space for adding aesthetic value to the house. Additionally, the presence of a terrace allowed for more diverse roof designs, contributing to a modern appearance. Ornaments were not commonly found in the place. It should be acknowledged that older houses tended to emphasize their kancingan construction, while newer ones concealed the structure for a more modern and sturdy look. Finally, the type of wood and its dimensions used in construction could help identify the era of Rumah kancingan development.

Keywords: Merauke; Papua; Rumah kancingan; Timber frame

1. Introduction

House serves as a comfortable home, a foundation for building a family, and a representation of the dignity of its residents, which is also an asset for its owners (President Republic Indonesia, 2011). On the other hand, a home is a physical structure providing shelter for individuals, families, or social environments. It holds the second level of importance for security and satisfies the needs of individuals and the family, distinguishing one family from another.

House is where humans reside and is typically constructed using concrete materials, which include sand, cement, and gravel. However, in Merauke, the main challenge lies in the availability of quality sand and limited gravel. This scarcity leads the community to explore alternative construction materials, with wood being the primary choice.

Wood has gotten recent attention among various building materials due to its contribution to green design and lower energy consumption. Engineering efforts have been

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invested in enhancing the performance of wood as an alternative building material. For years, wood has been used for construction due to its availability, strength, and sustainability. Additionally, it can be used in various parts of a building, including foundations, floor frames, walls, and roofs. Wood is also classified as an orthotropic material with three axes namely longitudinal, tangential, and radial (Tjondro, 2014). An application of using timber as a building material includes using it as the primary structure in house construction. This construction also known as timber frame masonry building, has been a traditional construction style for hundreds of years, evolving across continents such as Europe, America, Asia, and Africa.

The structural design of a timber frame house with a masonry infill wall offers several advantages over a house with concrete as its primary structure. This building system is recognized for effectively resisting lateral and seismic loads, particularly in earthquake-prone areas including the Himis house in Bursa, Turkey (Bağbanci and Bağbanci, 2018). Extensive study has been conducted on the construction of timber frames with infill masonry walls (Hejazi, Hoseyni and Çiftçi, 2022; Dutu *et al.*, 2022; ; Qu *et al.*, 2020; Xie *et al.*, 2019; Vasconcelos *et al.*, 2013; Kouris and Kappos, 2012).

Timber frame masonry buildings remain in high demand in certain developing countries due to both economic considerations and seismic resilience, surpassing the performance of local reinforced concrete buildings (Tu *et al.*, 2021; Cui *et al.*, 2020) These buildings show variations in timber frames and infill materials across different countries, known as Chuandou in China, The Hımis in Turkey, The Pombalino in Portugal, and The Berykiou building in Lefkas City. In Merauke, Indonesia, it is referred to as Rumah Kancingan.

Similar to timber frame masonry buildings worldwide, the house uses timber as its primary structural material. Simultaneously, the wall fillings use brick, as seen in Figure 1. The term "kancingan" originates from the construction process, where the timber structure is assembled before installing the brick wall infill, locally known as "dikancing." Additionally, the term "kancingan" reflects the use of two distinct materials, timber and masonry brick, integrated in a manner resembling "dikancing".

Rumah Kancingan, a prevalent house construction method in Merauke, warrants thorough study due to its cost-effectiveness and environmentally friendly nature. This construction style uses wood as a substitute for concrete, which is deemed relatively expensive in Merauke, given the challenges of obtaining good-quality sand and gravel from outside sources, namely Palu, Makassar, and Surabaya. Although previous study has explored the visual elements (Topan *et al.*, 2018) and structural performance of Rumah Kancingan (Octavia *et al.*, 2018). There is a lack of studies addressing the development of this construction style since it was first introduced in Merauke.

Originally established by the Dutch government in the 1950s as official housing, Rumah Kancingan has experienced changes influenced by material availability, lifestyle shifts, cultural influences from immigrants, and modern housing trends. Investigating the evolution of housing can address challenges, ensure sustainability, promote innovation, enhance adaptability, and ideally lead to the widespread adoption of this construction method as an affordable housing option in Merauke. Affordable housing schemes have proven effective in addressing housing issues in various countries, such as Malaysia (Kamaruzzaman *et al.*, 2018).

Figure 1 Rumah Kancingan before (on left) and after the construction process(right)

2. Study Purposes

This study aims to deepen the understanding of Rumah Kancingan in Merauke and provide new insights into its construction. The focus extends to architectural aspects, including house plans, building forms, roof shapes, entrances, and materials. Particularly in regions where high-quality gravel and sand are scarce, this construction method arises as a cost-effective alternative with a quicker building process compared to permanent structures using concrete frames.

3. Methods

This study used the typology method to categorize samples based on architectural aspects, using an interpretive method that emphasized understanding the context, experiences, and perceptions of the observed phenomena (London and Ostwald, 2004). The study surveyed 100 Rumah Kancingan in Merauke district, spanning 11 sub-districts. The sampling method included purposive sampling, considering the owner's willingness to permit their house for study. Due to a large and dispersed population, purposive sampling was deemed more effective in collecting data and determining suitable characteristics for this study. The focus was on self-owned houses built by the owners, making the data a valuable resource for information. Samples were drawn from 11 sub-districts which were 10, 17, 14, 10, 6, 10, 8, 10, 6, 7, and 2 in Samkai, Rimba Jaya, Muli, Mandala, Kamundu, Bambu Pemali, Kelapa Lima, Karang Indah, Seringgu, Maro, and Kamahedoga, respectively. These samples were later analyzed to identify common elements or distinctive features and grouped based on similarities and differences. Field data collection included measurements, documentation, and interviews with homeowners to gather comprehensive insights into the characteristics of the house.

4. Results and Discussion

4.1. Type of plans of Rumah Kancingan

In Merauke, the models and plans for rumah kancingan were generally consistent with common house types. Although there were no explicit size restrictions, wood, given its comparatively limited physical properties in contrast to concrete, served as the primary material. This choice was guided by the understanding that materials, construction methods, and technology were not decisive factors in shaping a building rather, they served as modifying elements. A survey of 100 houses showed diverse building sizes, ranging from 36 m^2 to 135 m^2. A total of 20 out of the measured samples featured building sizes between 70 and 75 m^2, as shown in Figure 2. These houses consisted of 3 bedrooms, a living room, a family room, a kitchen, and a bathroom/toilet.

The plans for rumah kancingan were linked to the spatial and volumetric considerations shaped by the activities defining each room's function. Each room was closely in line with the grid of the timber frame and the surface area of the brick wall. This integration of structure into architecture has been a fundamental aspect of housing design throughout human history, from primitive dwellings to contemporary technology-driven homes (Frampton, 1999). Structure was indispensable for architecture and its absence negated the essence of architecture. To meet the needs of residents, the spatial organization in the house remained deliberately simple, and interior spaces typically varied from 4 m^2 to 24 m^2.

4.2. Visual Appearance of The Houses

The primary purpose of house was to be sturdy and meet owners' needs, yet the visual appearance was equally significant. In Rumah kancingan, every element, including the roof, entrance, and ornaments, contributed to the total visual appeal.

4.2.1. Roof shape

The roof of Rumah kancingan typically took the form of a gable or a simple hip roof. Only a small proportion of the house incorporated modified roof shapes. A survey of 100 houses in Merauke district showed that those constructed around the 80s and earlier predominantly featured unmodified gable or hip roofs. In addition, houses built from the 90s onwards adopted modified roof shapes.

Figure 2 The Roof Shape of Rumah Kancingan around 1950s on the left and 1980s on the right

Figure 2 showed a house built in 1980 with a Single-Gable Roof Shape. In Rumah Kancingan, the most prevalent roof type was the box gable roof, although some opted for the open gable variety. The construction of brick walls varied between houses with open gable roofs. For those using the open gable roof type, the walls were built with ¼ stone brick, leading to a wall thickness of approximately 8 cm. Conversely, the construction of open gable roofs included the use of ½ stone brick, yielding a thickness of about 15 cm, as shown in Figure 5.

Figure 3 The Roof Shape of Rumah Kancingan built in 2000s.

Recently, the development of roof designs in Rumah Kancingan in Merauke has evolved. The desire for aesthetics was in line with the need for more space in houses has prompted modifications in roof shapes. While single-pitched roofs were prevalent in the past, many Rumah Kancingan now feature modified roofs that blend gable and hip shapes. Additionally, roofs with varying heights have become popular, imparting a more modern impression, as shown in Figure 3. Meanwhile, Figure 5 showed that houses constructed in the 1950s and 1960s typically used a gable roof with a Dutch gable type.

Figure 4 Brick masonry construction on the open gable roof shape of Kancingan houses

Figure 5 Roof model of houses built during the Dutch colonial era in Merauke. Both using gable dutch type

4.2.2. Entrance

A terrace served as an open space that connected a house with its surroundings, shaping the whole appearance of the dwelling. Homeowners often bestowed special attention on the terrace, considering it an integral part of the house. In the context of Rumah Kancingan, the terrace served as a means to express the house's aesthetics. However, not all Rumah Kancingan in Merauke district included a terrace.

Regarding those without a terrace, the house's entrance was typically shown by a height difference between the yard and the entrance, often featuring a concrete floor. In Rumah Kancingan, known for its affordability and simple designs that prioritize residents' needs, the decision not to include a terrace was often driven by a desire to manage construction costs.

Figure 6 Rumah Kancingan with a terrace and without a terrace. House on the left was Rumah Kancingan without a terrace and the right was with a terrace.

Some Rumah Kancingan lacked a terrace, but for those that had one, it was seen as an integral and essential part of the house, enhancing its aesthetic appeal. The terrace served as an important space that distinguished the living room from the yard and played a significant role in maintaining privacy for homeowners while also providing a space for socializing with neighbors or guests. This was in line with Hall (1969), exploration of the connection between personal spaces' interpretation and the significance of privacy in meeting human needs, achieved through environmental and behavioral mechanisms.

According to Figure 6, adding a terrace to Rumah Kancingan contributed significant aesthetic value to the total appearance of the house. The inclusion of terrace space introduced variety to the originally simple roof design, creating a more modern impression.

The terrace acted as a crucial boundary between the indoor and outdoor spaces, enhancing the house's aesthetic appeal. Therefore, some homes lacked a terrace, the distinction between indoor and outdoor areas was observed from elevation changes and stepped floors. A front terrace added to the total aesthetic, creating a varied roof design and contributing to the house's visual appeal.

4.2.3. Ornaments

Ornaments played a crucial role in defining the character of a house, reflecting the taste and personality of homeowners. In Rumah Kancingan, ornamentation was often limited to wooden carvings on the house's canopy. The brick construction was showcased as a decorative feature, and the construction framework was decorated by exposing the timber frame. This served to emphasize the play of lines in the house facade, as shown in Figure 7.

In some Rumah Kancingan, an effort to convey a more modern and robust impression included wrapping wooden columns with brick pairs. This created larger columns with dimensions greater than the timber structure, which served as the main framework. Some houses even combined reinforced concrete construction with kancingan methods to eliminate the aesthetic in their dwellings. The terrace, an integral part of the house intended for lasting use, was built with concrete columns. This added to the overall sense of permanence and durability in the building. While the walls of the house continued to use kancingan construction, the terrace columns were made of concrete.

Figure 7 Various ornaments on Rumah Kancingan, based on the year of construction. On top of figure was built in 1950s and the bottom was built 2000s

4.3. Materials

In Merauke, the absence of naturally occurring high-quality gravel and sand necessitated their importation from external sources. The preceding study explored the quality of concrete using local sand from Merauke, showing lower compressive and tensile strength compared to concrete using non-local aggregates. This difference might have been due to the local aggregates having a higher capacity to absorb water. This caused an uneven distribution of water and cement in the mold, with the cement paste being absorbed into the aggregate granules, which led to uneven concrete strength (Betaubun and Hairulla, 2018). Rumah Kancingan was a building that combined two types of materials with different physical properties. Wood was an orthotropic material, while brick had isotropic mechanical properties.

This local material usage was consistent with the principles of regenerative housing, contributing to sustainable design practices in architecture (Baper, Khayat, and Hasan, 2020). Among various construction materials, wood garnered attention for its recent contributions to green design and lower energy consumption. Recognized as a sustainable construction material with environmentally friendly attributes, wood proved efficient in construction technology. The global demand for housing and the growing awareness of the built environment's impact on climate change underscored the increasing importance of using sustainable construction materials (Connolly *et al.*, 2018). Owing to its use of local materials, Rumah Kancingan was known for its expedited and cost-effective construction process, presenting an environmentally friendly method.

Various types of timber are found in common use in Rumah kancingan, including besi, meranti, rahai, red bus, and white bus wood. A survey of 100 Rumah Kancingan in Merauke district showed that those built before the 1980s predominantly used besi or rahai wood. In contrast, houses constructed after the 1990s predominantly used bus wood, which was abundantly available in Merauke during that period.

Beyond the use of bricks for walls, some Rumah Kancingan from the 1950s incorporated bamboo as reinforcement. Bamboo served as a structural support for the bricks, subsequently covered with a sand and cement mixture. Bamboo, recognized

globally as a sustainable construction resource, was widely embraced in developing countries as a wood alternative due to its eco-friendly characteristics, sustainable nature, economic viability, and social acceptance (Ameh, Soyingbe and Oyediran, 2019). Using local materials such as wood and bamboo, Rumah Kancingan was distinguished for its cost-effective and environmentally friendly consstruction process. Drawing from the analysis of Rumah Kancingan, a periodization was established based on roof shape, ornaments, and the materials used.

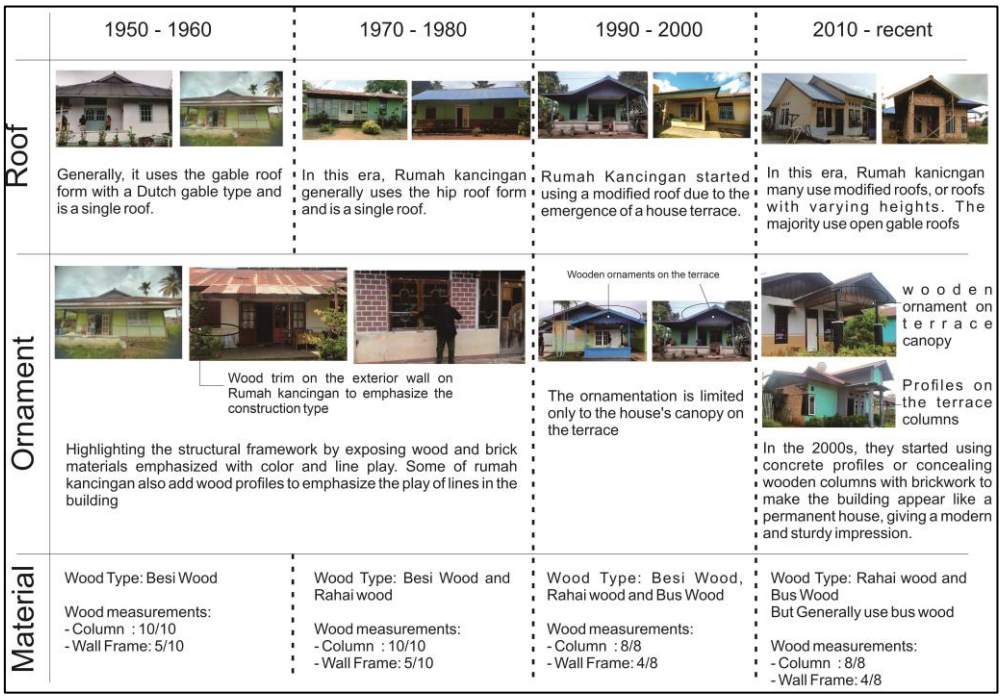

Figure 8 Periodization of Rumah Kancingan based on roof shape, ornament, and material.

As shown in Figure 8, there was a distinguished absence of visible elements reflecting the local Marind culture, the indigenous tribe in Merauke. The limitations on access and exploration hindered the incorporation of traditional architectural values in residential structures and in government offices, which ideally should have represented the region's identity. As opposed to typical vernacular architecture, which incorporated local cultural elements, Rumah Kancingan uniquely described the cultural aspects of the homeowner's place of origin. This was predominantly expressed through wooden ornaments on the houses' canopies. The influx of immigrants and the restricted access to indigenous communities contributed to a cultural shift, leading to the gradual loss of regional characteristics. Traditional architecture, including Rumah Kancingan, was not immune to this transformative process.

Vernacular architecture covered residences and other constructions tailored to specific environments and resources. Typically constructed by the owners or the community using traditional methods, it was designed to meet specific needs and to be consistent with the values, economy, and lifestyles of a particular culture (Oliver, 2006). In shaping vernacular architecture, cultural identity played a crucial role. However, the attempt to integrate primitive art into contemporary architectural designs was still in its early stages, as observed in Papua New Guinea (Kaitilla, 1997).

The people in Merauke became more aware that the house was a construction product that functions as a place to live, thereby serving an aesthetic purpose for the esteem and actualization needs of the homeowner. This was evident in the appearance of the facades of houses built in the 90s.

5. Conclusions

In conclusion, Rumah Kancingan was the preferred housing option for middle-class and lower-middle-class residents in Merauke who pursued an affordable yet aesthetically pleasing alternative to permanent houses. The houses came in various sizes, ranging from 36 m^2 to 100 m^2. Despite using wood as the primary material for walls and framework, the spaciousness of the rooms was not compromised. The average bedroom size was 9 m^2, prioritizing efficiency and necessity over structural or material choices. The visual simplicity was evident in its predominant single-roof design. However, modern variations surfaced, providing a more expressive and contemporary impression. The style of the roof could also serve as a marker of the construction era when the Rumah Kancingan was built. Houses from the 1950s-1960s typically used a single Dutch gable roof, while those constructed in the 1970s-1980s employed a single hip roof. Houses built and modified in the 1990s onwards adapted roof designs influenced by terraces and aesthetic considerations.

In Rumah Kancingan, the terrace served as a socializing space, improving homeowners' privacy and adding aesthetic value to the house. The presence of a terrace led to diverse roof shapes, but homes without it relied on elevation changes and stepped floors to define the indoor-outdoor boundary.

Ornaments were not prevalent in the houses, but a few homes adorned their canopies with various wooden decorations. Some older houses, in particular, showcased their kancingan construction as a decorative feature. However, the trend shifted towards hiding the kancingan construction in houses over time. Homeowners preferred their houses to appear as permanent structures with a modern and sturdy look. This change reflected the influence of lifestyle on the appearance of Rumah Kancingan. Initially, it was just a product of the need for an affordable house.

Rumah Kancingan, constructed using local materials, remained an affordable housing option. Besi wood was common in houses constructed before the 1980s, while newer buildings preferred bus wood due to the scarcity and protected status of besi wood in Merauke. Rumah Kancingan, having been an eco-friendly construction option, minimized the use of cement, an impactful source of carbon dioxide emissions contributing to climate change by substituting it with natural wood.

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