Vernacular Architectural Characteristics of Floating Houses in the Lake Tempe Tourism area, South Sulawesi, Indonesia

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Abstract

Floating houses are a form of vernacular housing for people living in coastal waters, lakes, and rivers in various parts of Indonesia. Living on the water and carrying out daily activities is the identity of a fishing community that is integrated with its environment. People living on the water create house structures to prevent climate change. Some districts in Indonesia use a bamboo raft house system, such as the floating vernacular dwelling in the Tempe Lake area in South Sulawesi. The Tempe Lake floating house functions as a place to live as well as a place to conduct economic activities. The mobile settlement with the floating house system in Tempe Lake has several specific characteristics as the hallmark of the building that can be compared with other floating houses.

This study examines the visual and spatial characteristics of floating house buildings that still exist today. The research is qualitative and uses a naturalistic research method. It examines 11 floating houses in Tempe Lake.

The findings reveal that the visual characteristics of floating houses consist of raft foundations, columns, roofs, doors, windows, floors, walls, roofs, and latrines. Spatial characteristics include space function, organization, circulation, orientation, and hierarchy. It concludes that there are three categories according to the visual characteristics and spatial characteristics.

Keywords: vernacular dwelling, floating house, visual characteristics, spatial characteristics, Tempe Lake.

Introduction

Tempe Lake is a natural lake located on the island of Sulawesi. Tempe Lake has an area of about 14,406 hectares, making it the second-largest lake on Sulawesi Island and the eighth-largest in Indonesia (Agustin Purwanti *et al.*, 2022). Tempe Lake is rich in natural resources, especially fisheries, with various uses such as agriculture, fisheries, tourism, and water transportation services. The utilization of lake resources by the local community has been going on for a long time and has been passed down from generation to generation (Zamzani *et al.*, 2022). Communities around the lake have long and traditionally used the pattern of utilizing the potential of lake resources as a source of livelihood to meet daily life and family needs (Priyatna and Sumartono, 2011). The activities of fishermen and farmers vary according to the season. The

activities of fishermen and farmers vary according to the season. In the rainy season, they become lake fishermen; in the dry season, they become farmers or farm laborers (Hamka and Naping, 2019).

Lake Tempe covers three administrative areas: Wajo Regency, Sidrap Regency, and Soppeng Regency. With the division of the lake area, the largest is in Wajo Regency, at 54.6%; Soppeng Regency, at 34.6%; and Sidenreng Regency, at 10.8% (Nawawi, 2018), as shown in the Figure 1.

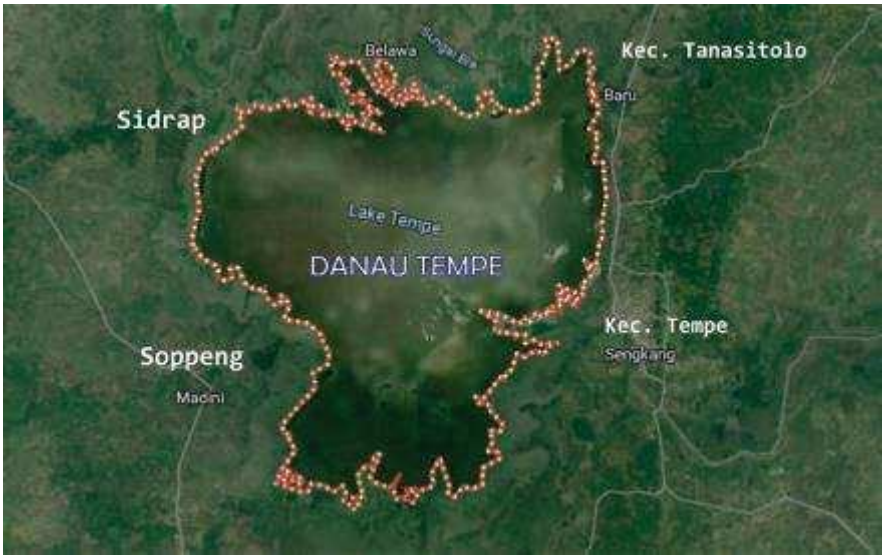


Fig. 1: Tempe Lake location
Source: Processed from Google Earth, 2023

The area of Tempe Lake is surrounded by seven sub-districts spread across three districts, including Tempe District, Belawa District, Tanasitolo District and Sabbangparu District in Wajo District, Donri-Donri and Marioriawa Districts in Soppeng District, and Pancalautang District in Sidenreng Rappang District, and covers 21 villages in total (Naing, 2019).

A house is a settlement process which involves patterns of activities. A residential environment can be adequately expressed if it is associated with the people who occupy it. Rapoport (1969) emphasizes that a house is the ability of people to adapt themselves to the environment. According to Ronald (2008), it is related to the conditions of the physical environment and the ability to shape it in response to the emergence of variations in the concept and material changes in the place.

A house on stilts is a dwelling with a floor level on a stage structure. The dwelling is supported by several poles that keep the building and pass the load to the ground. Houses on stilts can stand on water with part of the space underneath filled with water. In many parts of the world, houses on stilts over water can be found in coastal communities. Stilt houses can also stand on the ground with the space underneath empty. Houses on stilts on land are a typical characteristic of vernacular architecture in Southeast Asia to South China (Gao, 1998).

Floating houses in Tempe Lake are above the water and exist in the form of floating houses on stilts; They are floating and are not fixed (Suprijanto, 2000). They can move around following the tides and water currents. The concept of floating structures, is used as a substitute for land in the construction of a building in addition to being an alternative pre-arrangement of the area besides reclamation because the structure can float on the water (Putra and Pribadi, 2016). The culture of life of the residents who build floating houses is local wisdom that has been passed down from generation to generation, and the Tempe Lake area is a place for people's livelihoods such as gardening, mining, and fishing, which are the livelihoods of the people who live in the Tempe Lake area.

A house is one of the basic needs of people and is a means of support or access that makes it easier to reach their work, such as people in the water area building floating houses on the water as a place to live. The fishing community of Tempe Lake and the surrounding community usually call the house on this raft bola mawang (bola = house and mawang = float or float). Floating houses then and now do not differ much, both in model, form, and function. Only some modern materials have been used as a form of security from climatic influences and ease of maintenance (Naing, 2019).

Fig. 2: Floating House on Tempe Lake
Source: Author documentation, 2023

The shapes of houses, especially houses on stilts, is generally based on functions adapted to natural conditions. The harmonious relationship between people and the surrounding environment becomes the controlling pattern of the relationship between people and people and people and Nature, which is interpreted in traditional houses.

One form of this relationship can be seen in the Bugis house in Tempe Lake, Wajo Regency. Interestingly, the floating settlement in Tempe Lake is one of the most popular destinations many local and foreign tourists visit. It is indeed one of the tourist attractions in the form of a lake area and tributaries that are inhabited by many local people who depend on their daily lives in this area.

Floating settlements in the Tempe Lake, as shown in the Figure 2, are some of the main destinations that many local and foreign tourists visit. Their floating houses are unique, as rows of floating houses owned by fishermen in the middle of the lake decorated with colorful flags. The uniqueness of the patterns and shapes of the floating houses in Tempe Lake depict the culture of the traditional fishing community. They employ traditional techniques to build. In addition, they also haev cultural values that are still upheld by the community. One of them is tradition and local wisdom in resource management, which is still maintained today (Irianti, Yusuf and Sartika, 2017).

Initial observations show that there 13 housing units as floating houses in the Wajo Regency. Previously, there have been 15 units. One housing unit has been sold and 1 unit has been damaged. However, only 11 units could be visited; two other houses were inaccessible. Floating houses are endangered because people tend to have more houses on land; over time, the culture of floating houses along Tempe Lake will decline. This is due to the changes in activities and lifestyles on the mainland, where it is easier to get facilities and infrastructure for the settlements. There is also a decline in the economy of people living in Tempe Lake. Identification of existing houses must be done to document the cultural heritage of the people of

Wajo Regency and its surrounding vernacular architecture. Their visual and spatial characteristics are under threat due to the increasing number of local and foreign tourists visiting. This research describes the visual characteristics and spatial characteristics of floating stilt houses in the Tempe Lake area.

The Theoretical Basis

Vernacular means local and people made; in architecture, this term refers to forms that apply elements of culture, and environment, including regional climate, expressed in the physical architectural form (Sumalyo, 1993). In the context of the development of science, the topic of vernacular architecture has been thoroughly studied (Rapoport, 1969; Oliver, 1989). The characteristics of vernacular distinguish them from the others.

Character or characteristic is an object's specific aspect that can differentiate it from other things. Every architectural object or work has characteristics that distinguish it from others. Building characteristics can be found through the visual and spatial aspects of a building, which are considered necessary to maintain the authenticity of the building.

Some characteristics differentiate an individual from other individuals or groups (Adenan, Budi and Wibowo, 2012). The visual character of a building can be discerned from the floors, roofs, exterior walls, doors, windows and building columns (Ridwan, Antariksa and Suryasari, 2015). Indicators that can be used to look for special characteristics include shapes, materials, texture, colour, ornamentation, and changes that occur (Fajarwati and Suryasari, 2011). According to Berry (1980), the overall visual character can be seen from the physical elements in the building itself. These include the following.

1. Basic shape of the building
2. Formation of openings (doors and windows)
3. Roofs with slope angles
4. Building materials
5. Markers on buildings
6. Colors in buildings
7. Vertical elements such as columns in buildings
8. Horizontal elements, such as beams seen in buildings

The spatial characteristics of buildings include building orientation, spatial patterns, circulation flows and spatial orientation (Ceria, Antariksa and Suryasari, 2015). They can be seen also from the composition formed by spatial organization and building orientation, with the principles of symmetrical design and rhythm (Fajarwati and Suryasari, 2011). Length as sangkan-paran is defined as origin and destination. Sangka means direction of coming and Paran means the direction of going. In other words, the world is a space of travel, not just staying (Josef, 2009).

Space characteristics include space orientation, size, shape, barriers, components, and conditions (Hermanto,2008). In this connection, Rapoport (1986) says that space can be formed from three things, namely:

1. By non-permanent elements, namely space created by an activity carried out by someone and is more abstract.
2. By semi-fixed elements (for example, internal garden patterns and dividing walls), even furniture in a room
3. By fixed elements (e.g. walls, floors, ceilings) which include spatial organization, orientation, size, location and hierarchy.

Thus, floating buildings differentiate themselves because of the characteristics acquired by floating, which can be delineated from forms, spaces and elements.

Review of Literature

A number of studies related to floating houses have been conducted focusing on architecture. Characteristics is a concept that many researchers have explored in the past. However, each study has a different scope, subject, and methodology. Following are various studies on floating houses, each featuring discussions from different authors.

Daryanto (2004) examines floating houses on water and review the building typologies using qualitative methods. Findings show th e differences between lanting houses in Martapura River Banjarmasin and in Danau Panggang District, based on building functions, building materials and roof shapes. In terms of building typologies, it reviews forms and styles. On the contrary, Sudiyatama and Pramitasari (2019) examine horizontal spaces of Bugis House in Floating House at Tempe Lake. They use descriptive qualitative methods and point out that Bugis houses and floating houses on Tempe Lake have similarities in the division of horizontal space using the lontang system. However, the function of each lontang in floating houses is different. Its placement is due to the location, which is not on land. Thus, it must adapt to watery places or lakes. They also show that the primary user prioritizes the spatial arrangement that suits the house's owner without heeding the Bugis house method as the origin of the tribe settled in Tempe Lake. However, this research only explains the horizontal and vertical spaces of the building, and the analysis includes examining the spatial characteristics of floating houses. It does not present other spatial systems, such as space orientation, organization, and circulation.

Similarly, Naing (2018) examines Bugis tribe floating house. She uses a qualitative method that explains a shifting settlement in Tempe Lake with a floating house system with several specific characteristics. According to her, this settlement has a location arrangement that stays at a particular time, then moves at other times according to water level conditions, climate change and settlement security. When the Tempe Lake overflows due to flooding and the water level reaches the mainland, these settlements tend to occupy the location above the water by approaching the houses around the continent or the edge of the lake. However, after the water level of Tempe Lake falls to at least a height of 1 meter, this floating house settlement moved somewhat to the middle of the lake, where the water depth still allowed the house to flow on it. This research covers the meso scope but needs to explain in detail the micro size of the characteristics in all floating house units. It is desirable if the analysis is carried out that describes and identifies all the floating house units that remain today because of differences found during the research.

This study of previous research discusses floating houses in various scopes of discussion, ranging from building typology, the concept of horizontal and vertical space of the building and the exact location. Although previous studies have contributed to the discussion of Tempe Lake floating houses, this research study has advantages in terms of being a micro-study of the spatial and visual characteristics of 11 homes in Salotengnga Village, Tempe Lake, Wajo Regency.

Research Methods

This research employs a qualitative approach. Its intention is to analyze and determine the characteristics of vernacular floating houses in the Lake Tempe Tourism Area. It also aims to contribute to maintain and preserve the cultural and historical values that exist in the Tempe Lake Area.

This is naturalistic research meaning that it is "natural", without being manipulated, or regulated by experiments or tests (Nasution, 2003). In otherwords, research is conducted in a "natural setting." The naturalistic study is one of the scientific methods that seek to reveal the actual circumstances that may be closed and hidden, which is caused by the existence of oral and written stories made by previous people about real events in less tangible ways (Sukardi, 2006).

Research Location

This research is located in a settlement on the water in Tempe Lake, South Sulawesi. Tempe Lake is located in three South Sulawesi Province districts: Wajo District, Sidrap District, and Soppeng District. The lake's most significant part (70%) is in the Wajo Regency. Getting to the floating vernacular dwelling can be through two directions: Pallimae Village in the Sabbangparu sub-district and Padduppa Village in the Tempe sub-district. This research was conducted over three months, from May 2023 to July 2023.

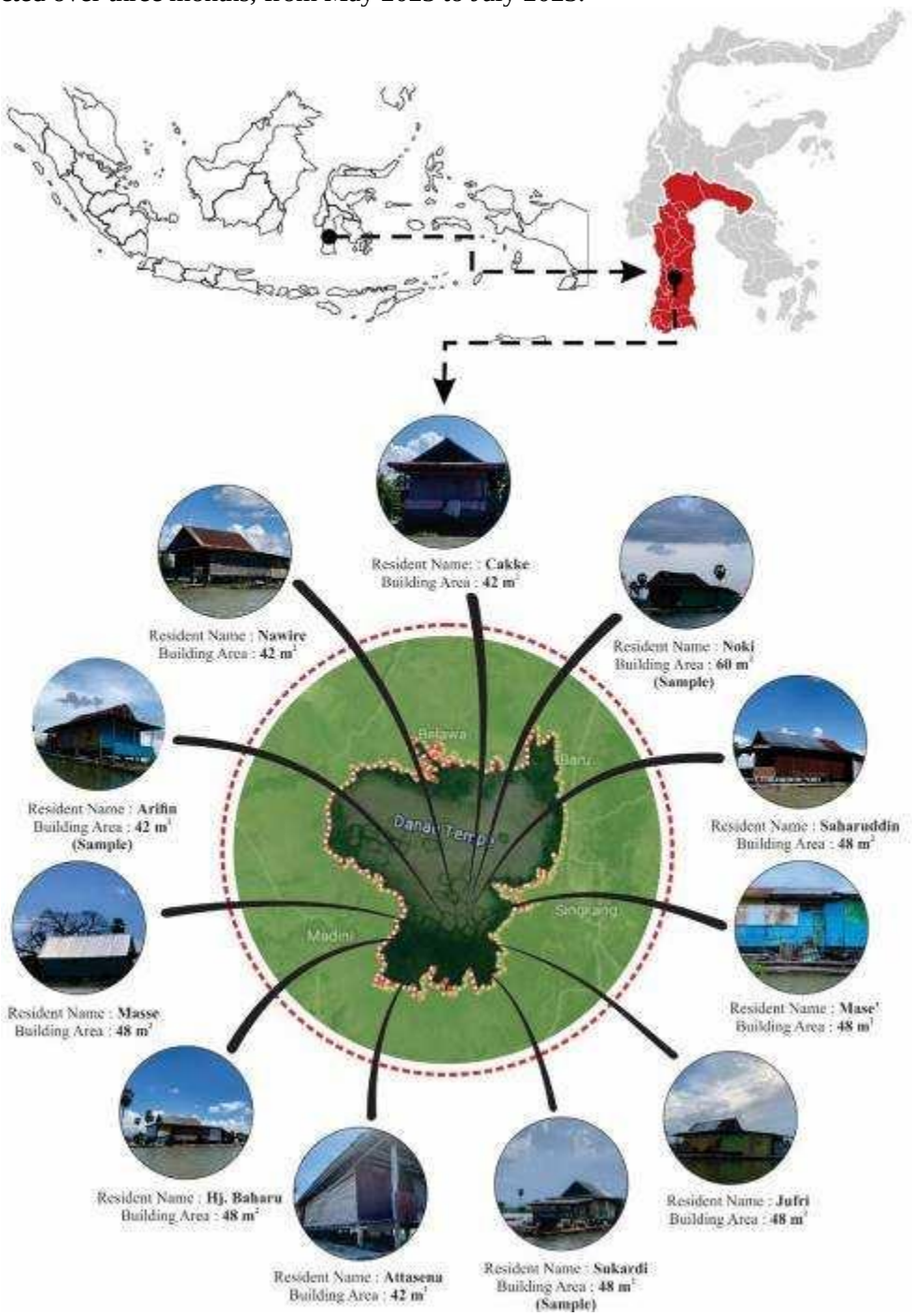


Fig. 3: Tempe Lake Area
Source: Author's analysis based on survey results in May-July 2023

Object of the Research

The research object consists of the analysis unit and focus of observation, as follows. The unit of analysis is a specific unit that is taken into account as a research subject. In another sense, the unit of analysis is defined as something related to the focus/component under study. Thus, the unit of analysis in this study is 11 units of floating houses in Tempe Lake.

At the time of observation in the field, three houses were in the middle of the lake, and eight houses were on the shore of the lake. However, this condition can change depending on weather. The focus of observation is the visual and spatial characteristics of the building contained in the Floating House building. To analyze the visual and spatial characteristics of the building in terms of three aspects: the characteristics obtained in the field and the visual characteristics, the indicators include raft foundations, floors, walls, poles, doors, windows, roofs and latrines; and for the spatial characteristics, it includes space functions, space organization, circulation, orientation and hierarchy.

Sources and Types of Data

This research uses primary data and secondary data. Primary data sources are data obtained directly by researchers from direct observation in the field. Preliminary data is obtained through observations, interviews, field notes, and documents. Secondary data is obtained from literature, internet sites related to the research conducted, related agencies, and past documentation obtained from the source archives in the form of object data and data from affiliated agencies.

Data Collection Techniques

Four techniques were used as follows.

1. **Direct observation:** by physically observing and monitoring ongoing events. The observation guideline is in the form of questions with free and structured answers that informants will answer as data sources related to the research.
2. **Record/literature analysis**: commonly referred to as literature study, this involves collecting theoretical literature data relevant to the research discussion and tracing literature containing theories from published or unpublished scientific works in hard or soft copies in books (e-books), papers, and online journals.
3. **Documentation technique:** by collecting data through written relics, especially in the form of archives including books regarding opinions and arguments related to the problem of investigation. The documentation technique is carried out to obtain data in the field by recording everything found.
4. **Interviews**: These are in the form of direct communication between researchers and sources. Direct contact in the form of questions and answers in face-to-face relationships were held so that the gestures of the interviewees are media patterns that complement verbal words. The interview technique for information sources uses purposive sampling, namely the purposive withdrawal of informants or sources carried out to determine specific informant criteria by researchers; the requirements The specific informants are the people of Wajo Regency, people who live in Tempe Lake and people who live around the Tempe Lake. The informants were 13 people, consisting of 11 heads of families or residents who live in Tempe Lake and two who live close to the Tempe Lake or have visited Tempe Lake, namely the Head of the RT and boat taxi drivers at the Tempe Lake.

Findings and the Discussion

Tempe Lake is located in South Sulawesi Province at the coordinates 119°53' - 120°04' East and 4°03' - 4°09' LS. It is located in a lowland, which is a place to accommodate the water of the Bila River, Walennae River, and small rivers around it, with the Cenranae River as the only river that flows out of the lake. It has an area of 13,750 hectares and is located in three administrative regions, namely Wajo, Soppeng and Sidrap regencies. The area of Tempe Lake is 286.43 km2, which consists of 7 sub-districts, namely four sub-districts in Wajo District, one

sub-district in Sidrap District, and two sub-districts in Soppeng District, and covers 21 villages in total.

Floating houses located in Tempe Lake are the residences of fishermen who do not settle in one place (nomadic). These floating houses always move from place to place following the tides of the lake. During the dry season, some of Tempe Lake's waters dry up, so the floating settlements move to the center of the lake where there is still standing water. However, when the lake water level rises, this group of floating houses moves closer to the land to the lake's edge. But for the fishing community in Tempe Lake, almost 80 percent of their time is spent living in floating houses, and only 20 percent of their time is spent living on land. Therefore, the fishermen build houses to accommodate all their activities to live on the water. In addition, the houses are also made to deal with the unpredictable climate and weather conditions on the lake. These things happen throughout the seasons. Some fishing communities prefer to live on the water for several reasons, including:

1. It is a tradition passed down from parents.
2. Close to where they work and do their activities.
3. I still need a place/land to live on the mainland.

The shape of the Tempe Lake floating house follows the form of a Bugis stilt house on land. The main difference between floating houses and houses on the ground is the foundation of the building; houses on land use an umpak as the foundation, while Tempe Lake floating houses use a series of bamboo arranged like a raft as the basis. Another difference between houses on land and floating houses is the use of lower house poles compared to houses on stilts on the ground. Floating houses only have stakes as high as 40-50 cm connected to the raft as the foundation. The utilization of traditional technology in the construction of floating houses through a process of learning and experience for decades causes this floating settlement to survive in the environment of Tempe Lake. This year, the total number of floating houses is 13 units; 11 units are located in the Salotengnga Village area, while the other two units cannot be accessed.

Table 1: Number of dwellings at Tempe Lake in Salo Tengnga Village each year
Source: Wajo Regency Tourism Office, 2023

No.	Year	Number of Occupancy
1	2017	27
2	2018	25
3	2019	22
4	2020	20
5	2021	18
6	2022	19
7	2023	13

The decrease in the number of residential units in Tempe Lake from the previous year was caused by the number of people who moved to the mainland, so the house owner sold the house, and other houses were damaged. From the identification data of floating houses in Table 2, 11 units of floating houses in Tempe Lake have almost similar visuals. The differences/variations found in 11 units of floating houses are in terms of materials, such as on walls that adjust the homeowners want to use any material; the types of materials used vary, such as zinc, bamboo (Salima), woven bamboo and boards, while the other difference is from the building area or size of the house in the Lake Tempe settlement because there are three variations in size obtained in the field, namely a small size house with a building area of 42m2, medium size with a building area of 48m2 and large size with a building area of 60m2. Based on the identification data, the size of floating houses is divided into three categories that represent 1 sample, so there are three samples that will be described completely, and each house represents a small, medium, and large size.

1. Small floating house (Pak Arifin)

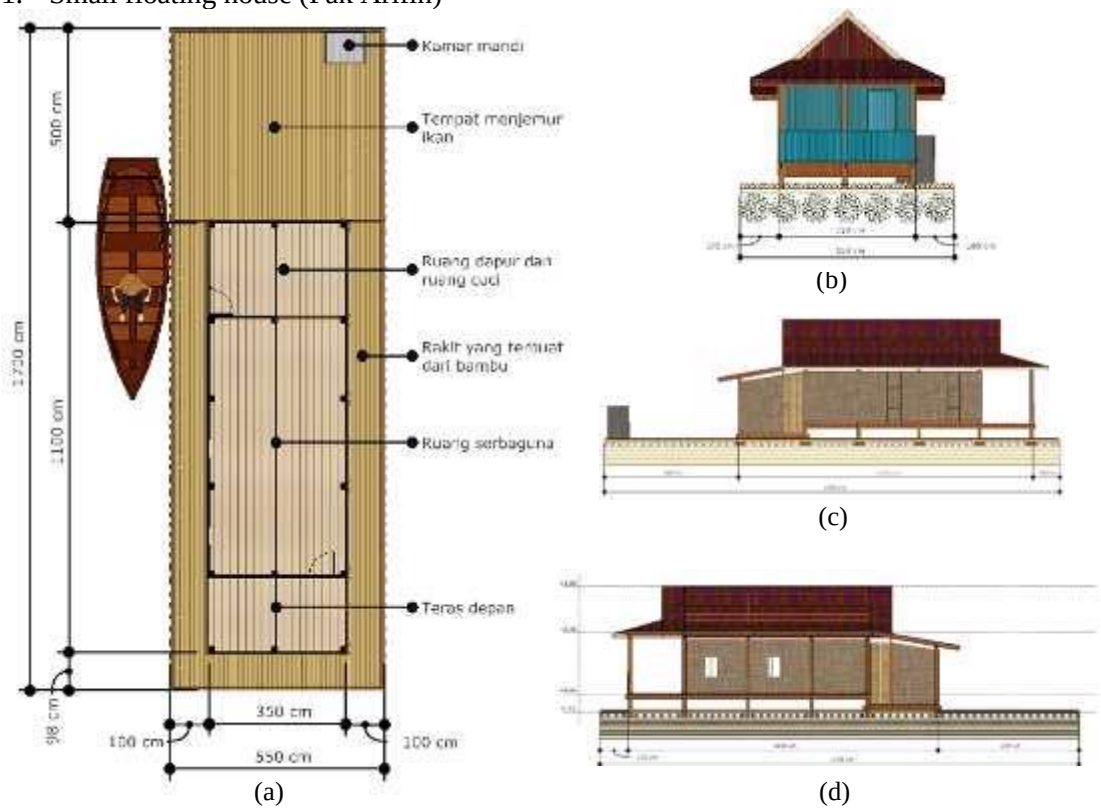


Fig. 4: (a) Floating house plan, (b) Front view, (c) Side view, (d) Section
Source: Sari, 2023

2. Medium sized floating house (Pak Sukardi)

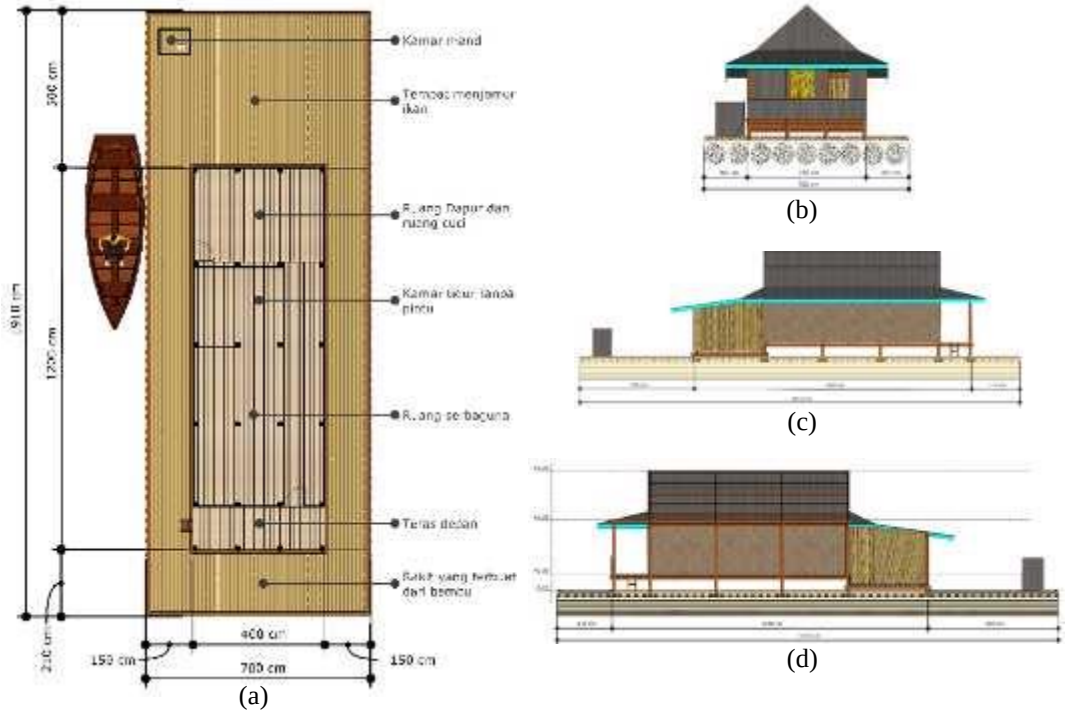


Fig. 5: (a) Floating house plan, (b) Front view, (c) Side view, (d) Section
Source: Sari, 2023

3. Large Floating House (Pak Noki)

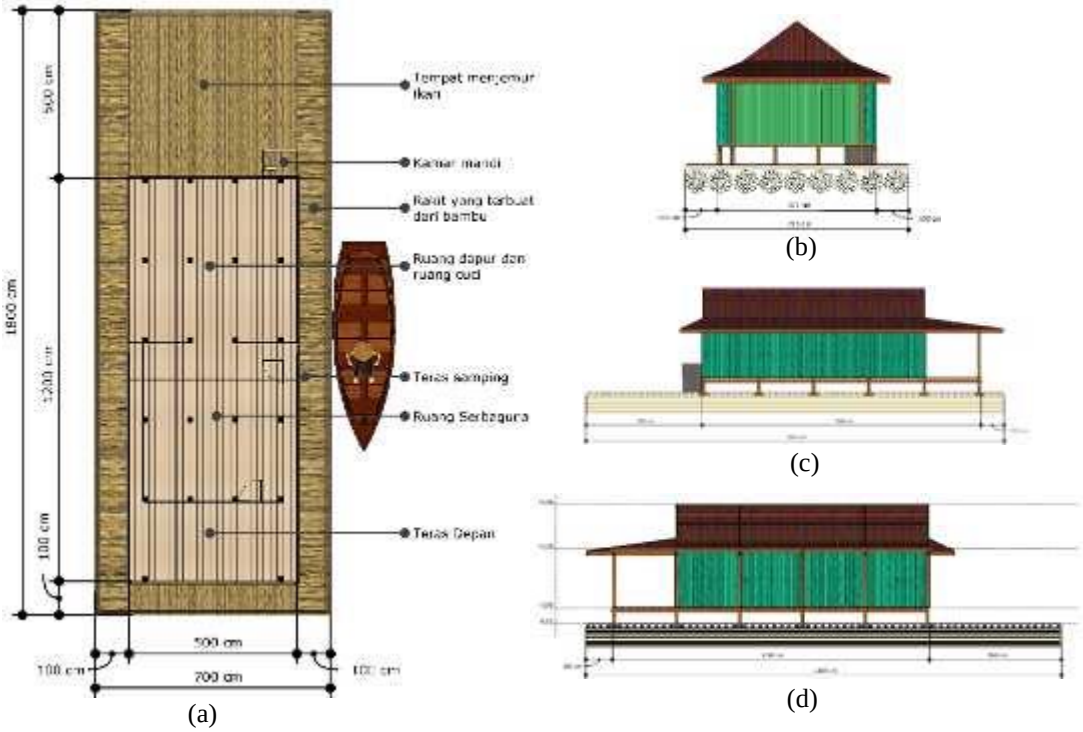


Fig. 6: (a) Floating house plan, (b) Front view, (c) Side view, (d) Section
Source: Sari, 2023

The figure above shows that the houses in the Lake Tempe settlement in Salo Tengnga Village have several variations to identify their visual and spatial characteristics. The visual characteristics identified are raft foundations, floors, walls, pillars, doors, windows, roofs, and latrines, while the spatial characteristics are space function, space organization, circulation, orientation, and hierarchy. Below, we will explain the visual and spatial characteristics of the Lake Tempe floating house.

Visual Characteristics of Lake Tempe Floating House Vernacular Architecture

From the three samples used, the analysis of the visual characteristics of buildings in the Tempe Lake area, Wajo Regency obtained the following results:

1. Raft Foundation

In the Tempe Lake floating house, the material that forms the floating raft comes from bamboo, which is arranged based on the bamboo knowledge system and the tradition of house construction by the community. Bamboo is also related to the availability of natural bamboo resources around the settlement to reduce construction costs and facilitate transportation. The bamboo is cut around the lake and floated or pulled by boat because it can save materials and transportation costs and continue using local natural resources. Each raft comprises 6-8 bundles, each containing 20-30 bamboo sticks. The amount of bamboo used to float the floating house depends on the size of the house being built. The bamboo binding material is made of plastic rope or old tire rubber. Bamboo sticks, split bamboo (salima), and wooden planks are usually used for the raft cover material. The size of the raft foundation is uncertain because it is adjusted to the size of each fisherman's/house occupant's house.

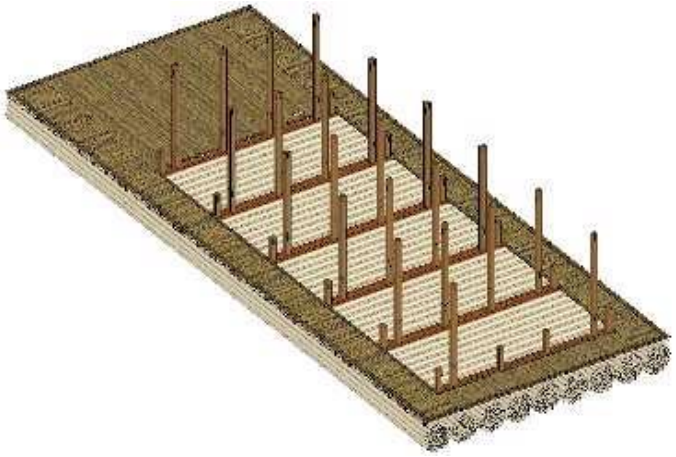


Fig. 7: Illustration of a floating house raft foundation
Source: Sari, 2023

2. Building columns

Columns are generally made of rectangular wood with a 12 x 12 cm side size. In houses on stilts, the columns are placed on pedestals. Usually, the pole support is called pellagra alibi. However, in floating houses, the column structure system (allure) is supported by wooden beams or boards installed parallel to the row of poles. The purpose of the support beam is to prevent the column from coming into direct contact with the raft foundation so that the load is evenly distributed and the house poles that extend to the roof function to carry the roof load.

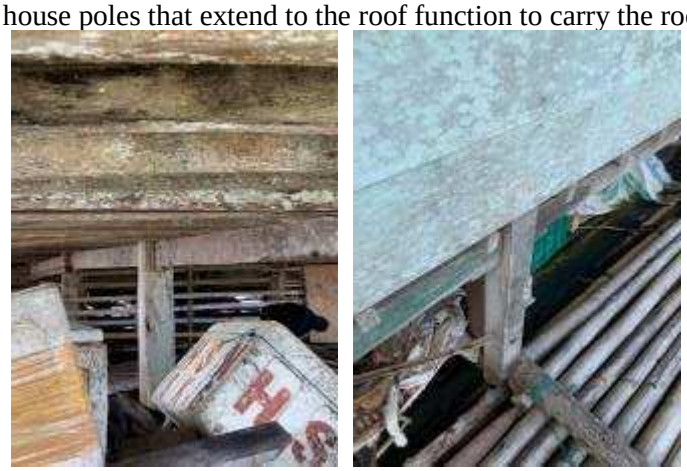


Fig. 8: Columns on a floating house
Source: Author documentation, 2023

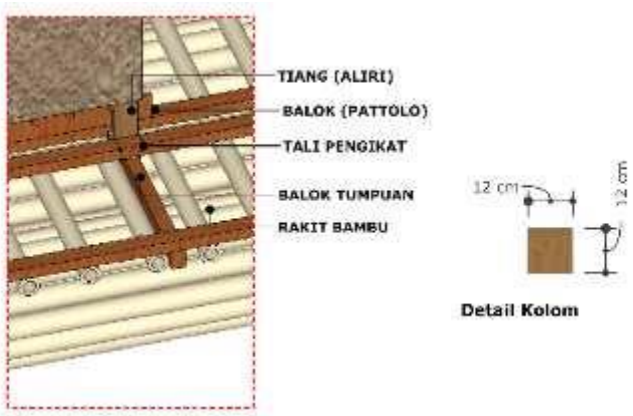
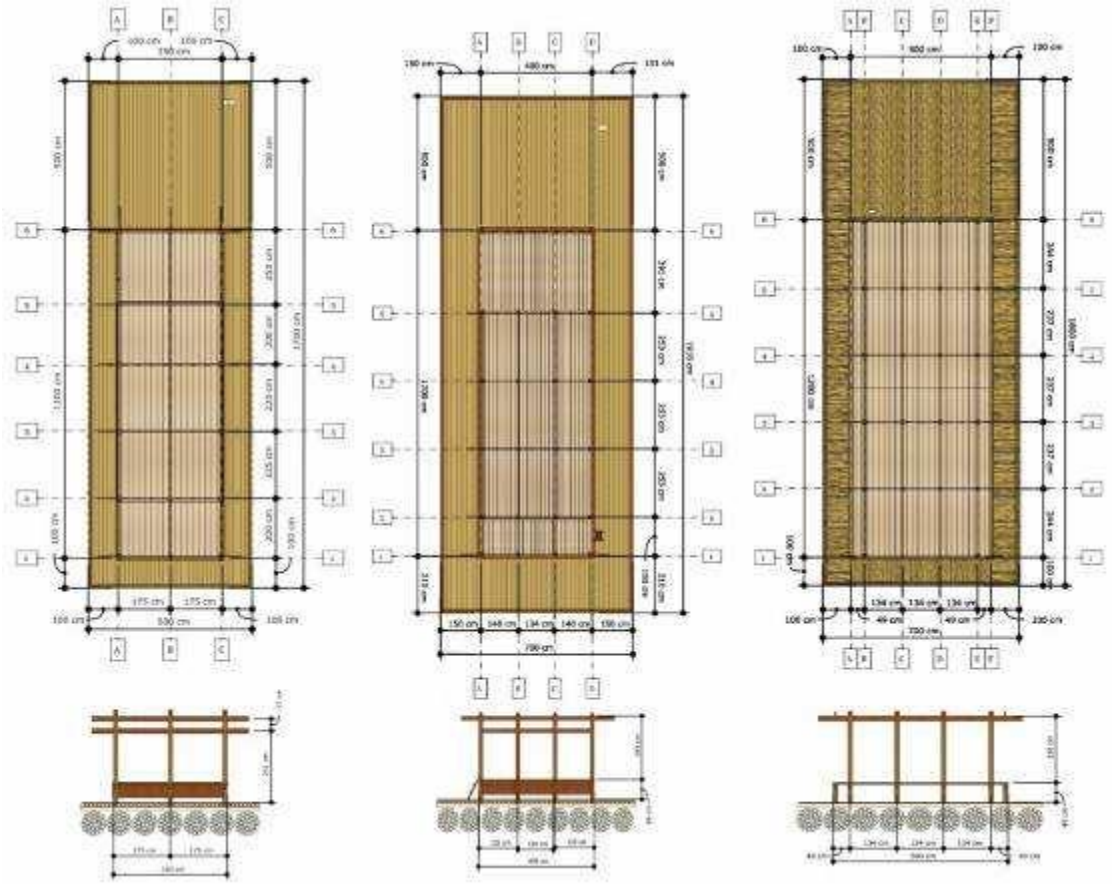


Fig. 9: Pole shape and size (alliri)
Source: Sari, 2023

In the samples used, there are variations in the poles of floating houses based on the number of bars of the whole house and the height of the poles of each sample, as shown in the figure below. The overall number of poles for tiny houses is 18 poles, while medium-sized houses have 24 bars, and large houses have 30 sticks with a pole size of 12 x 12cm from wood material.



(a) (b) (c)

Fig. 10: Floating house columns/poles, (a) small house, (b) medium house, (c) large house
Source: Sari, 2023

3. Doors

The spatial arrangement of floating houses is based on the activities of residents and is organized based on easy access to boats and economic activities. The floating house on Tempe Lake has two doors: one directly connecting the front porch (lego-lego) with the multipurpose room and one side door as the main entrance connecting the side porch with the kitchen; the side door is the main door on the floating house. In contrast, the front door is an additional door used to receive guests. The main entrance (side) has easy access to the kitchen, the place to dry fish, and the place to lean the boat. The place where the ship rests is located on the side of the raft near the main door because, in addition to making it easier for residents of the house to access the boat, it also facilitates the rotation of the house against the wind/current, so it is not against the wind. The doors on floating houses in Tempe Lake mostly use bamboo or zinc material and generally measure 200 x 70cm.

Fig. 11: Location of the door to a small floating house
Source: Sari, 2023

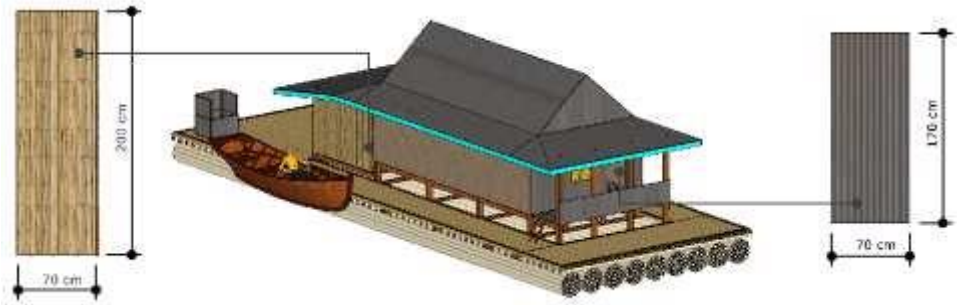


Fig. 12: Location of the door to a medium sized floating house
Source: Sari, 2023

Fig. 13: The location of the large floating house door
Source: Sari, 2023

The placement of the main door on the side of the floating house is a process of adjusting the shape of the house with the accessibility of economic activities and the water climate, thus creating a unique house shape with the main door on the side of the house. The door material mainly depends on the material found on the wall; for example, if the fence is wooden, then the door is also made of the same material.

4. Floor

The floor of a floating house consists of floor beams of floor covering material using wooden planks or bamboo (salima). However, the current condition of the remaining dwellings only uses wooden planks. This board material is used because it is easy to find. The wood material reduces cold air from below (water surface) in the gathering and resting area because wood can neutralize room temperature. The floor height in the kitchen or lontang rilaleng is different because it is lower than lontang risaliweng, lontang ritengnga. The placement of kitchen space is placed at the back of the floating house because it can be a source of odor that will affect the activities of the residents of the house, and this affects the spatial arrangement in the place, which makes the floor height lower than the floors of other rooms in the house, as seen in Figure 14.

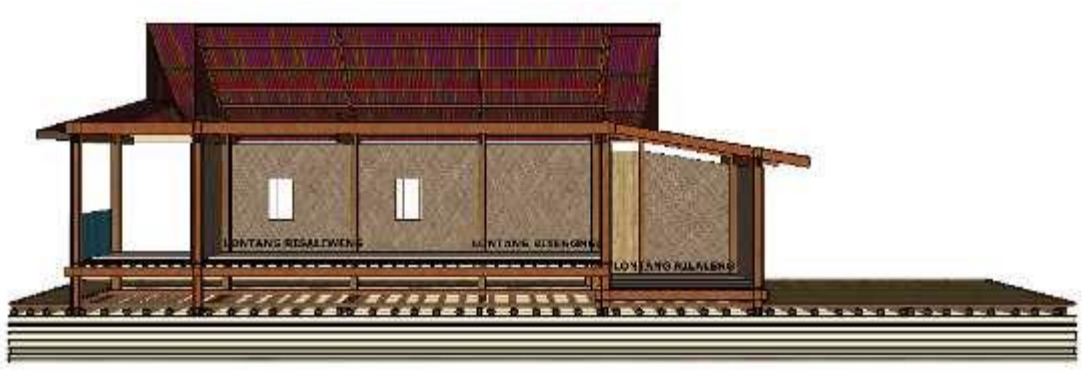


Fig. 14: Illustration of the floor height of a floating house
Source: Sari, 2023

5. Window (Tellongeng)

The use of windows in floating houses is different from dwellings on stilts in general because the use of windows in Tempe Lake floating houses is usually avoided. After all, the wind movement in the water area is quite strong, so most houses do not have windows. Of 11 housing units identified, only two houses have windows, one seen in Figure 15.

Fig. 15: Floating house with windows
Source: Author documentation, 2023

Fig. 16: A floating house that has no windows
Source: Author documentation, 2023

Windows in floating houses only function as they should, only for air circulation. Floating houses not equipped with windows are replaced with walls with vents on the sidelines made with specific spacing arrangements. From Figure 13, floating houses with a size of 45 x 80 cm are only aesthetic elements and get air and natural lighting because the windows of floating houses are not used as a symbol of the social status of their inhabitants.

Fig. 17: Illustration of a floating house with windows
Source: Sari, 2023

6. Roof

The roofs of Tempe Lake floating houses have the same roof model with the same slope. Generally, the roof slope in Tempe Lake settlements is ≥ 45º. The shape of the roof affects the final form of the building, and ultimately, the condition also affects the facade and body of the building. This is due to the community's lack of knowledge of the traditions and rules of building Bugis traditional houses. It is called the Bugis roof model because its shape is the same as the roof pattern of traditional Bugis houses and the Sao Raja of the Bugis Kingdom, which is an equilateral triangle. Based on field observations, the roof model used is a gable roof. Most floating houses in Tempe Lake settlements do not use ornamental varieties at the end of the top. The roof covering material (Pabbingeng) generally uses zinc and nipa materials because it is considered adequate protection during the rainy season, is durable, and serves to protect the building from climate and weather influences.

Fig. 18: The shape of the floating roof of the house
Source: Author documentation, 2023

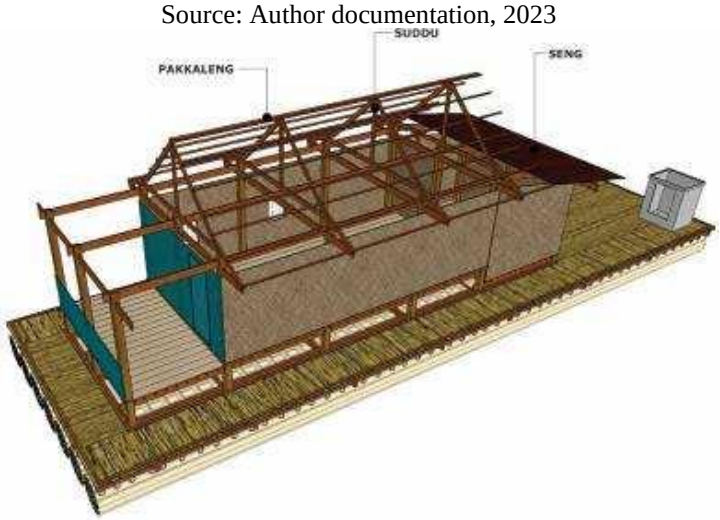


Fig. 19: Illustration of a roof construction system
Source: Sari, 2023

7. Wall (Renring)

The walls in a floating house can be classified as non-structural, meaning that the walls only function as weather protection and space dividers that do not receive building loads. The wall frame is installed between the house's columns with a simple nail/bond connection. The walls of the floating house function as a barrier and protect the occupants from hot and cold weather and strong winds.

(a) (b) (c)

Fig. 20: (a) Walls made of split bamboo (salima), (b) Walls made of zinc, (c) Walls made of woven bamboo
Source: Author documentation, 2023

Wall materials in Tempe Lake floating houses have several materials, usually Bamboo; there are two types depending on how it is made. Bamboo that is split and then clamped with other bamboo splits is usually called awo tetta or salima, while bamboo that is broken, sliced thinly and then woven is called gamacca or tabba. Several houses use wooden planks installed in a row using a gapit system.

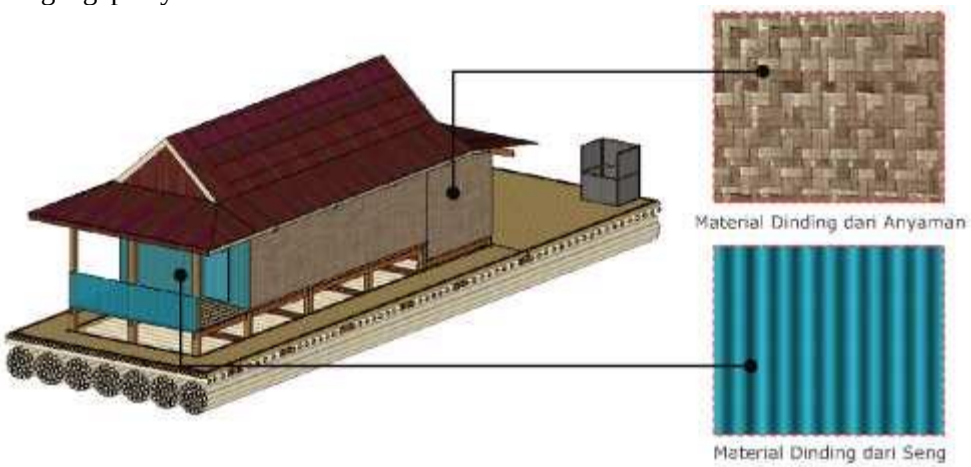


Fig. 21: Material illustration on the wall of a small house
Source: Sari, 2023

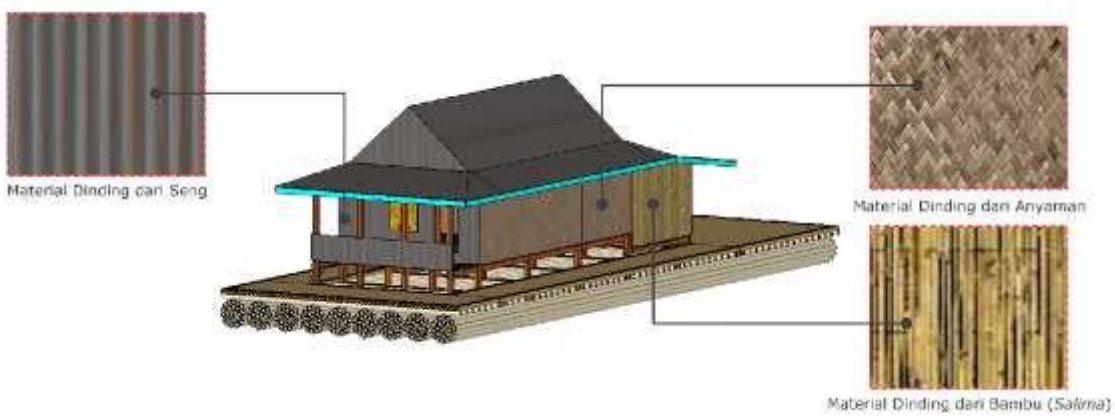


Fig. 22: Material illustration on the wall of a medium sized house
Source: Sari, 2023

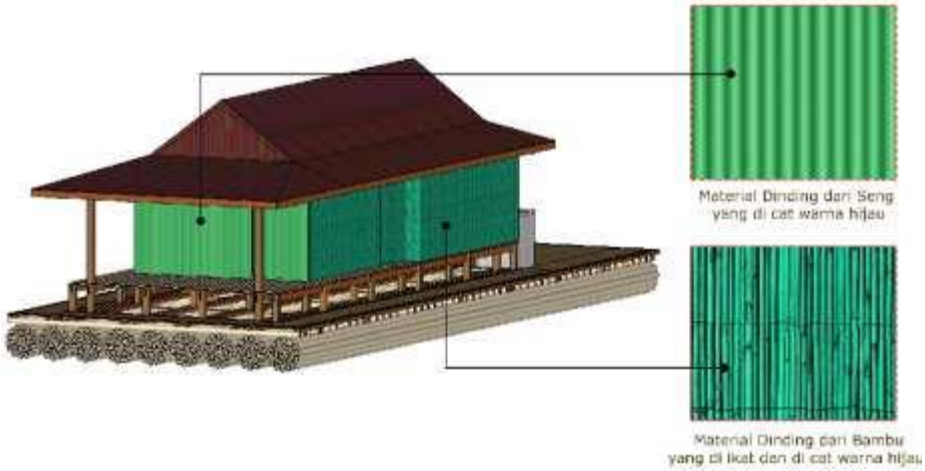


Fig. 23: Material illustration on a large house wall
Source: Sari, 2023

8. Toilet (Latrine)

Pit latrines/toilets in floating house settlements are square and roofless, with walls made of zinc, split bamboo, or just a piece of cloth. According to the local community, this sanitation system is an effective model for approximating the conditions of a mobile settlement. The natural sewage system is a biological treatment process based on accelerating the natural breakdown cycle so that bacterial activity in the water can stabilize the organic matter in the sewage. Using pipes and holding ponds for biological processes is impossible in the floating settlement area. Because the settlement system is constantly moving without a certain pattern, it isn't easy to design flexible piping that can proceed with the tides of the lake. Based on the results of research in the field, restrooms in floating houses have the same shape, but the only difference is the location of the toilet at the back of the floating house; some make the latrine in the left corner of the back side of the building and the right side of the building, besides that, there are floating houses that make the location of the restroom right at the back of the building which is tight to the kitchen wall.

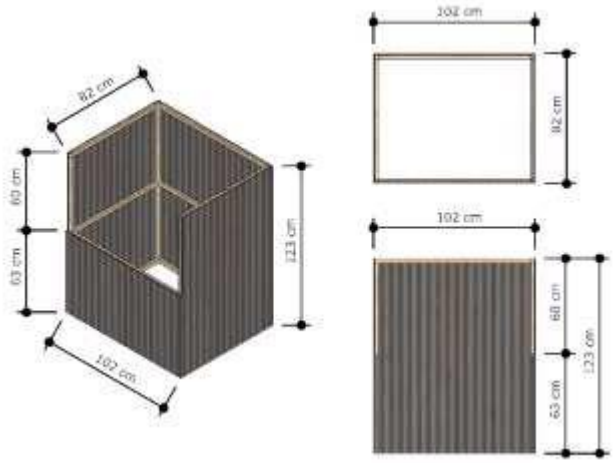


Fig. 24: Illustration of the shape and size of a floating house latrine
Source: Sari, 2023

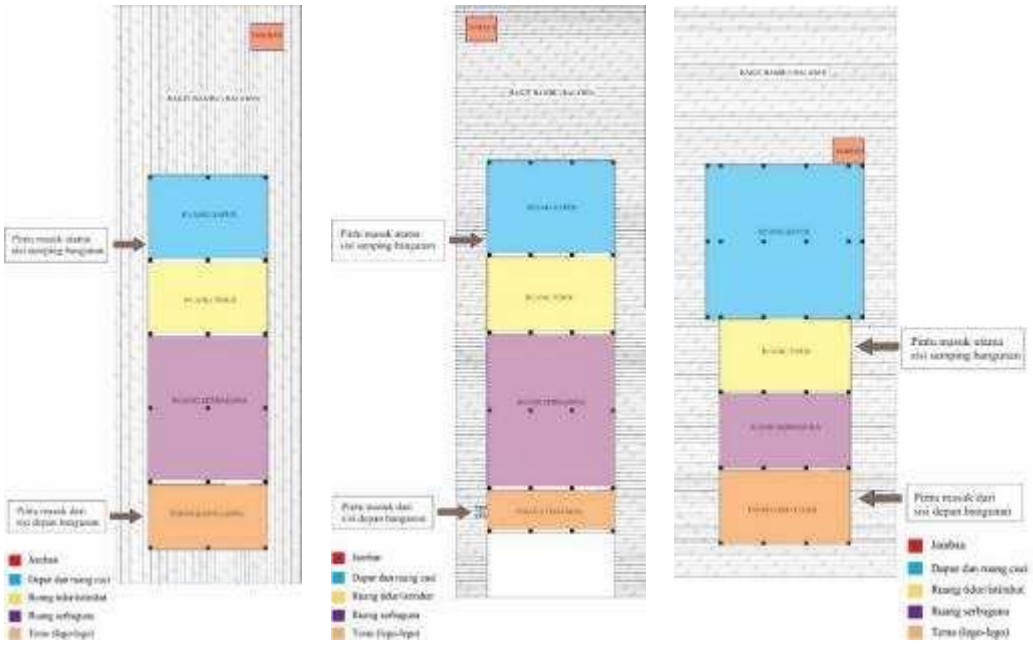
Based on the results of research in the field, the latrines on floating houses have the same shape, but the only difference is that the location of latrines is located on the back side of the floating house; some make latrines in the left corner of the back side of the building and the right side of the building, apart from that there are floating houses that make the latrine location right behind the building close to the kitchen wall.

Spatial characteristics of Lake Tempe Floating House Vernacular Architecture

In addition to visual characteristics, there are also spatial characteristics obtained where the layout of settlements is not fixed or changing, created based on adjustments to environmental conditions.

1. Space Function

In general, the floating house space functions as a place for activities. The formation of space in a floating house can be based on the family structure, which affects the layout and size of the house. For those with many family members, the house is usually large, and the spatial solution is suitable for the activities of many family members. Meanwhile, houses with few family members or, like most couples, only have a smaller house size and an interior layout intended for small family activities. The goal is maintaining economic cooperation relationships, such as fishermen and the residents' family relationships. The floating house building is a residential house for fishermen who work and do activities on Tempe Lake. Still, it is open to the public because Tempe Lake is a place for tourists to enjoy nature and relaxation or the view. Floating houses with bamboo rafts as the base still have ±70 cm of space between the raft and the floor of the house, which some floating residents can use as a place for fishing equipment for fishing, drying fish, chicken storage, boat storage, and daily necessities such as kitchen utensils, firewood, and others. The rafting area must be larger than the area of the floating house, which is intended as an activity area on the terrace/raft area to the left and right of the building and behind the floating house. The inner space of the floating house consists of a Lego-lego terrace, multipurpose room, bedroom, kitchen, and toilet located outside the building, precisely at the back of the building.

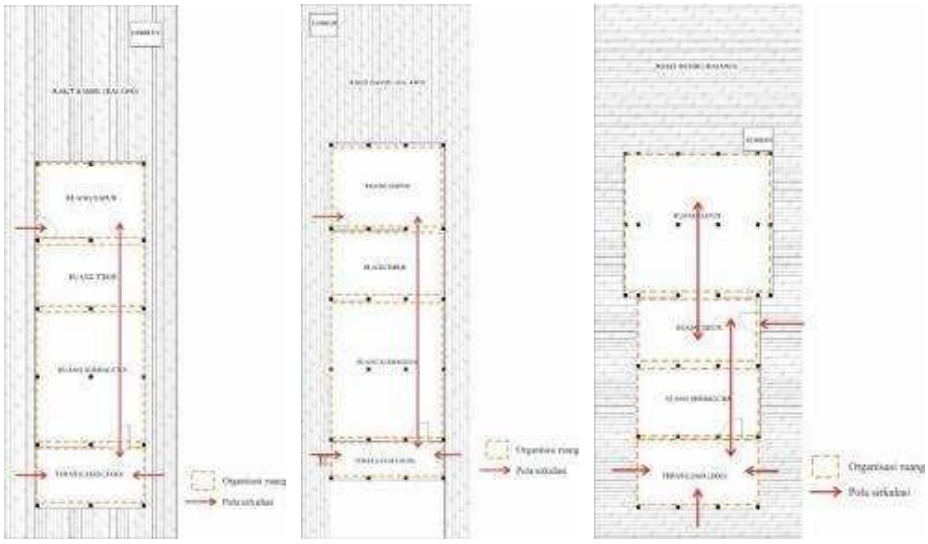


(a) (b) (c)

Fig. 25: Space Function (a) small house, (b) medium house, (c) large house
Source: Sari, 2023

2. Space Organization

The organization of space is formed from the activities of the actors (residents of the house) who are influenced by their culture and character. In addition, the organization of space is also formed according to the needs of the function of space and buildings. The organization of space is related to the circulation patterns in a building. Tempe Lake floating house has a linear spatial organization pattern because of its elongated nature (Figure 23). A linear organization consists of a series of spaces. Spaces that can be directly related to each other or connected through a separate and distant linear area (Ching, 2008). A sequence in a line and repeating spaces. Linear means a straight line that organizes spaces in a row following the direction of the line. In linear spatial organization, space or time always refers to the linear sequence that becomes the benchmark. The organization of linear space, usually an example, is the road dividing and organizing the area.



(a) (b) (c)

Fig. 26: Space organization and circulation patterns (a) small house, (b) medium house, (c) large house
Source: Sari, 2023

3. Circulation

Circulation in the floating house building there are two doors to the space inside the floating house; the main door is on the side of the building connecting the side terrace (raft area) with the kitchen, which facilitates activities inside the house or outside the house and access to the boat. And the front door connecting the terrace (lego-lego) to the multipurpose room.

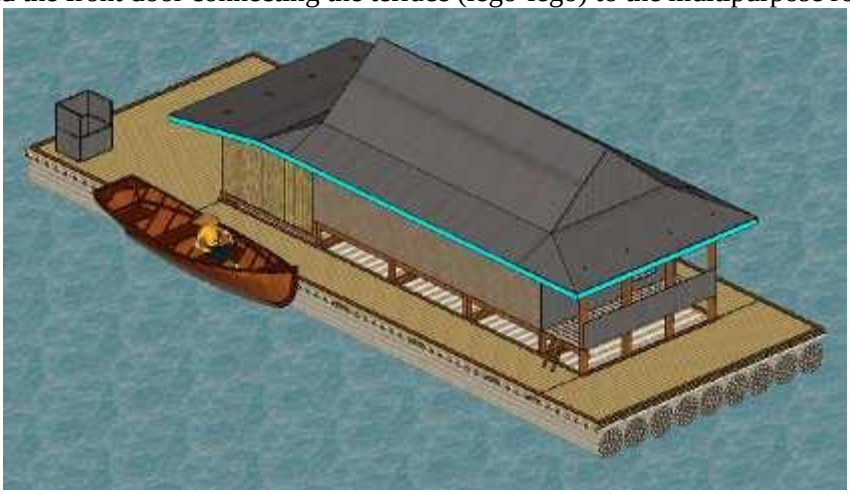


Fig. 27: Illustration of a boat mooring next to the main door area
Source: Sari, 2023

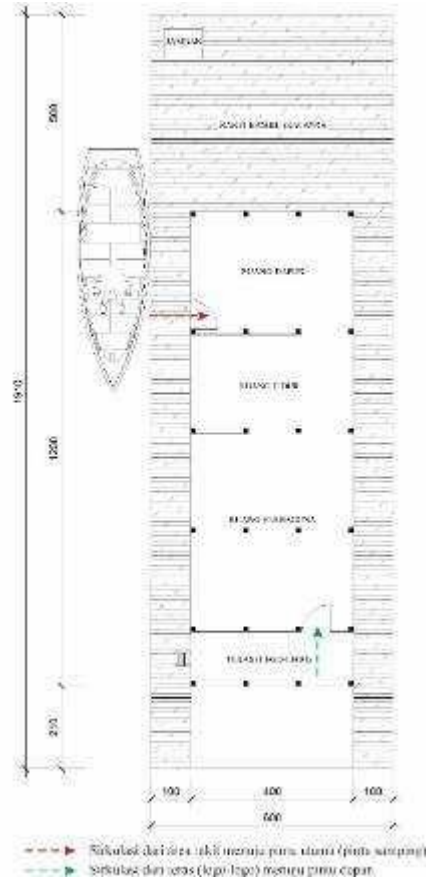
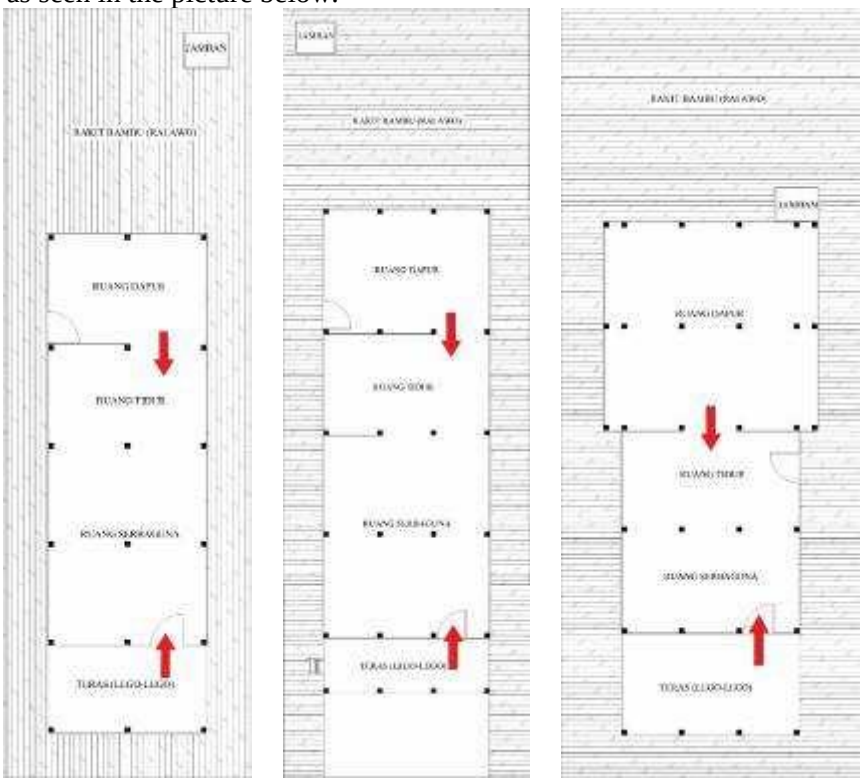


Fig. 28: Circulation in floating houses
Source: Sari, 2023

In Figures 27 and 28, the boats of the fishermen or homeowners are located next to the raft area close to the main door on the side of the building because it facilitates circulation to the building if they want to enter the fish catch and others.

4. Orientation

The orientation of the floating house is always opposite to the wind direction. If the wind comes from the East, the house faces west. Similarly, the house faces east if the wind comes from the west. Seasonal changes affect the orientation of the house in general. The choice of location where the water level allows the house to remain floating is a minimum water level of 1 meter; the aim is to facilitate the sticking of one pole to the bottom of the lake as a point of tying the house because the Tempe Lake floating house is connected to one bar in front of the floating house or commonly called *Patto kalampang* so that the house can move when the wind hits and make the structure of the house more resistant and durable. A 5- to 10-meter-long rope is tied to a 5 (five meter) high pole so that the houses do not touch each other when the house turns to follow the wind direction. Due to the influence of currents and waves and wind deflection, the movement of the house changes irregularly over time. The position of the house with neighboring houses is still being determined; sometimes, the neighbor's place is in front, on the side, or behind. While the orientation of space in the residential space of floating houses on Lake Tempe can be explained that there are certain spaces, especially spaces in floating houses, arranged linearly or oriented to an area, the sleeping room is always parallel to the multipurpose room and kitchen because the space orientation system is found in various activities of the inhabitants, as seen in the picture below.



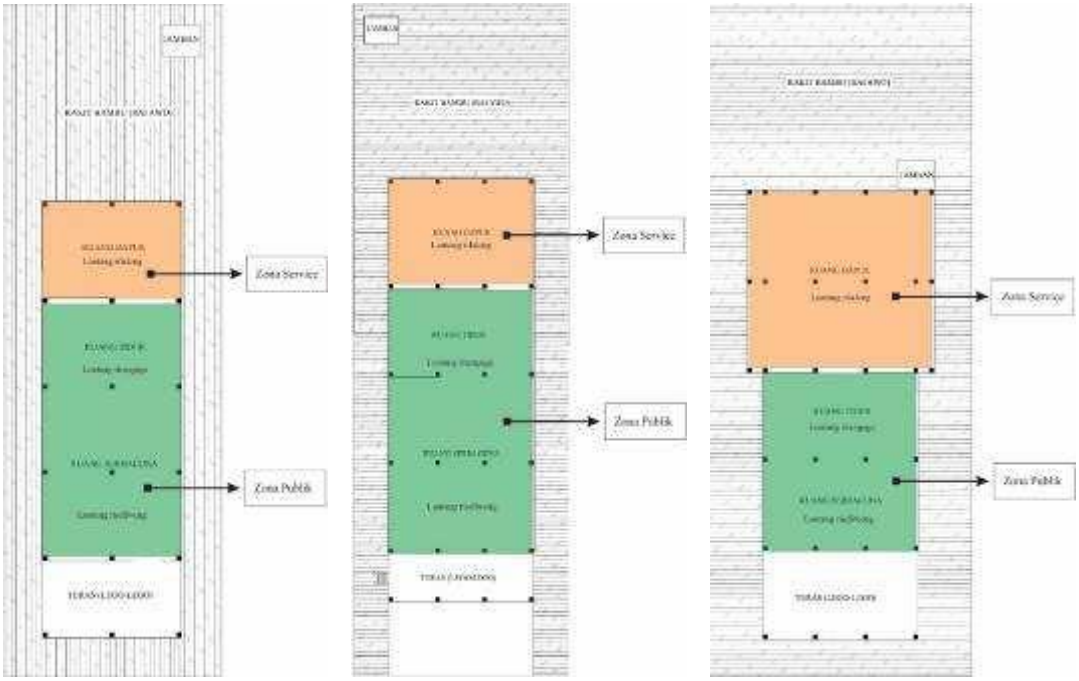
(a) (b) (c)

Fig. 29: The spatial orientation of the floating house (a) small house, (b) medium house, (c) large house
Source: Sari, 2023

5. Space hierarchy

A spatial hierarchy can be seen from space's layout, magnitude, and spatial form. The layout hierarchy can be divided into horizontal spatial and vertical spatial hierarchies. Vertically, the house's lower part (bottom) consists of a raft under the house. Usually, the front of the house (under the front porch) is used to raise chickens. The body of the house (ale bola) is used for

living and economic activities. At the same time, the upper part (rakkeang) is only used as a place to put fishing equipment. The hierarchy intended here is a hierarchy that discusses the zone where the zone is divided into two, only public and service zones because it adopts an open concept (open building). The general/public zone includes the living, gathering, resting, and production rooms. At the same time, the service zone is the kitchen and laundry room. The public/multipurpose room is located at the front and can function as a living room, resting/sleeping room, dining room, and space for production activities. The main activity in the house is the production process (economic activity). This can be done in the service zone, and the final approach can be done on a raft outside the floating house.



(a) (b) (c)

Fig. 30: Hierarchy of floating houses on Lake Tempe (a) small house, (b) medium house, (c) large house
Source: Sari, 2023

Conclusion

Based on the identification carried out regarding the visual and spatial characteristics of Lake Tempe floating houses, there are characteristics and some differences or variations found, so the 11 housing units are different but have differences in terms of visual and spatial characteristics. The visual characteristics of floating houses in Tempe Lake are composed of building elements: raft foundations, building columns, exterior walls, doors, windows, floors, roofs, and toilets/lavatories. These building elements are the shapers of the visual characteristics of the Tempe Lake floating houses and characterize the floating houses. Meanwhile, the spatial characteristics of the floating house are obtained from the function of space, space organization, circulation, orientation, and hierarchy in the building. The open concept applied to the floating house makes the utilization of each space more flexible and optimal. There are no functional restrictions for each room because each room can be used according to the use time.

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