Proceedings of the First Australian International Conference on Industrial Engineering and Operations Management, Sydney, Australia, December 20-21, 2022

The Potential of Floating House as A Solution for the Utilization of Water Area in Indonesia

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Abstract

Indonesia is a large country that has a large water surface and land area. Various areas are almost found on the surface of the area. The natural potential has not been touched as a whole in the transportation sector. Water transportation management is still limited to certain areas. In detail, Indonesia's land area is 1,919,440 km². While the ocean area is about 3,273,810 km².The potential for water transportation can still be developed widely, including tourism potential. The use of floating homes as a means of transportation will develop well if there is innovation and management of water transportation in the territory of Indonesia. Variations Structures and designs that adapt to the natural conditions of certain areas will further enhance other potentials and must be carried out from now on. In addition, it is also necessary to increase reliable human resources for the development of floating ship transportation and the availability of good port infrastructure adjustments

Keywords
Indonesia, water transportation, floating homes , potential.

1. Introduction
Indonesia is a archipelago country that has more than 70% of its terotary is covered with water. Yet, as a developing country, the majority activities are still land oriented. The data shows that less than 2% of Indonesian who work in maritime sector (Lipi 2022) For more than 100 years of period, Indonesia has been developed based on argiculture and other sectrors that exploit land based areas.

On the other hand, with the population of more than 250 million people, Indonesia as a developing country has face many problems. The development programs that have been done by the government, soon will be challenged by the limitation of options. The paradigm of land oriented development must be shifted to the optimalitation of water surfaced areas policy.

The existence of floating houses in Indonesia has existed since the Dutch colonial era. The floating house is spread in several provinces in Indonesia, such as in Sulawesi, Kalimantan and Palembang (finance.detik.com, 2022)

The concern of optimalizing water surfaced areas will provide many opportunities for research. Regarding this study, the problem within the provision of housing wiil be discussed. The development of housing facility was focused on horisontal housing in which required more land acquisition. Yet, because of the incrase of land price and limitation of available space, the vertical housing has becomed common, especially in the cities and other congested areas. This situation creates a potential opportunity for the development of housing on the water area.

In the term of water area, there are many option can be considered as the potential area for developing housing facility. Moreover, it can be a fixed structure housing or a floating housing, depends on the location and other considerations. However, this reseach will focus on the provision of the floating stucture housing.

From many form of floating structure, ship is known as the most stable and realible. Moreover, The development of ship technology in Indonesia is can be classified as advanced. The Indonesian has been build ship for decades. Yet, it serves mainly for transportation purpose, carrying people from one place to another place.

Therefore, this research looks for the potential floating housing facility that can be developed as a future solution in provission of housing problem in Indonesia.

2. Literature Review

Indonesian Ministry of Public Work and Housing offers technology which introduce the use of floating houses. According to Dimas Hastama (Kemenpareraf 2022) the idea was inspired by the fact that increase in population within big cities is higher that the provision of land which can be used as housing.

Therefore, the idea to use water surface area as housing area has been proposed. As Figure1 is the example of floating houses that have been implement in Tambah Lorok region. The floating houses have 13,8 m in length and 9,6 m in wide (132,48 m^2 in total square area). The floating house structure is divided in two section which are pontoon (base are of the house/lower structure) and upper structure or housing section. This housing model is designed can withstand maximum of 40 ton of load (combination of dead and life weight). The construction cost for this floating house is estimated Rp. 178.000.000,- (one hundred and seventy eight million rupiah). This model houses is designed for public office (Wikipedia, 2022).

The advantage of living in the water is the flexibility to change positions and locations, for example with a houseboat in the Netherlands, or a house shaped like a boat that can move around. In addition, many houses use a flat base (not in the shape of a boat) which can rotate to change the direction of the house's position and when it moves, it can be pulled by boat.

In many countries, many floating structures/facilities are implemented such as the Ijburg Ijmeer in Amsterdam, Floating Island Onimichi Hiroshima, and the floating restaurant in Yokohama Japan. The technology for these floating houses is called VLFS (Very Large Floating Structure). VLFS technology is divided into two: pontoon and semi-submersible. This VLFS can be applied in floating bridges, floating rides, floating breakwaters, float plants. This floating vehicle is environmentally friendly, independent in energy needs, and does not pollute the environment.

Figure1. Floating Houses in Tambak Lorok Region

On the other hand, AQUATEC produces floating houses for various needs for activities on the water (as Figure2). Built on the AQUATEC Floating Pier, with a housing frame and roof mount from Marine Aluminum, the walls of the house from WPC (Wood Polyethylene Compound), roof from UPVC, and doors from Polyethylene (PE), the AQUATEC Floating House has a very strong and resistant structural strength against waves. The wooden atmosphere makes the floating house comfortable to live in, and can be used as a floating market, floating resort, floating cafe, floating restaurant, tourism facility, boat station and marine highway (suarasurabaya.net/kelanakota, 2022),

Figure 2. AQUATEC Production Housing

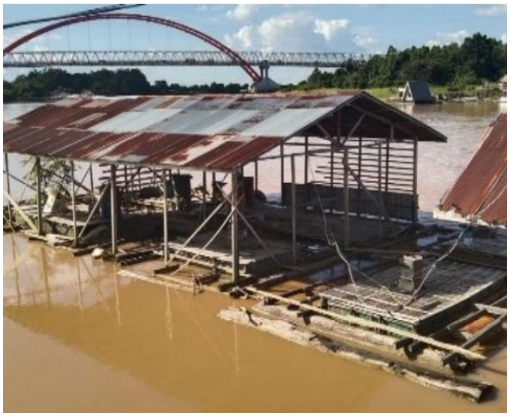

Figure 3 Lanting house people use floating houses to raise fish (farmer caramba)

Figure 4 Floating house community (lanting) who live on the banks of the Kahayan Rive

The provision of sea transportation facilities for the unitary territory of the Republic of Indonesia is absolutely necessary with various types and sizes. Furthermore, the implementation of fiberglass technology within floating structure is notably developed. The fiber ship market opportunity is quite promising, this is proven by the increase in production at PPNS-ITS with orders from the public (regional.kontan.co.id 2022)

Floating buildings use aquatic areas such as lakes, seas, beaches, rivers, and their parts and are not on land or land with floating type and amphibian structures (aquatecindonesia.blogspot.com, 2022)

The researcher team has experienced in designing ship (floating structure) using fiberglass technology. Figure 3 shows the design process until fabrication stages of fiberglass ship that been done by the researcher team. Moreover, in term of ship design, safety is the main concern. The safety means that the ship has to be able providing safety to the passengers during the operational and also there are adequate measurements in case of accidents. One of the way to avoid accidents is by calculating and identifying possible dangers that might occur (arifkoes.wordpress.com 2016).

Figure 5. Design and fabrication stages that been done by the researcher team

One of the most important aspect in floating structure design is stability. The stability is calculate during loading and unloading of the cargo or passengers, transfer of cargo and during the voyage. It can be calculated by knowing the initial stability conditions of the ship in advance. In general, the initial stability of the ship is limited to transverse stability. This means that the transverse stability line of the empty weight of the ship must be known in advance by

carrying out a slope experiment. The transverse stability line of the ship includes the KM line, KB line, BM line, GZ line, GM line and KG line. The value of the KM line and KB line can be obtained from the hydrostatic curve of the ship, while the value of the BM line, GZ line, GM line and KG line can be obtained from the slope experiment. Conventionally, the slope experiment is carried out using a pendulum on the CL line. This study discusses the identification of the transverse stability line of the ship through a slope experiment using the Arduino microcontroller-based Delphi programming which functions as an inclinometer. The level of accuracy of the inclinometer is calculated by comparing it with a pendulum and a protractor which functions as a reference angle measuring tool (regional.kompas.com, 2022).

3. Methodology

The method used in this study was carried out in the PPNS laboratory and the Research Partners laboratory.
The parameters used to design the floating house are:

- Floating house dimensions and geometrical hull forms. This parameter determines the capacity of the floating structure to carry total load. Also this parameter affects hydrostatics, stability, sea keeping, etc. The final design results determine the floating house dimensions and hull forms.
- General arrangements. This parameter is important as it determines the space for living area, servicing and floating structure operations.
- Stability. Floating house stability, especially transverse stability (intact and damaged stability for various loading conditions) is important for the safety of the floating structure, and passengers being transported.
- Resistance and power. This parameter is influenced by the hydrodynamic aspects of the floating structure, especially regarding the dimensions and shape of the hull. These parameters are determined during the floating house design process to determine the amount of thrust of the main motor installed to meet the desired speed target.
- Structures. The structural elements of the floating house must be determined properly so that the floating structure can accept external and internal loads acting on it. The detailed size of the floating house structure is determined so that the floating structure is safe against the maximum loads acting on it.
- Weights and centers. These floating structure parameters are very important in relation to stability, hydrostatics, strength, sea keeping, etc.
- Propulsion Plant, Auxiliary Machinery, Electrical Plant and Housing Equipment. This parameter is important in relation to the floating house's machinery, electricity and equipment needed to support the floating house's overall operation.
- Costs. This parameter is very important related to the cost of making a floating house.
- Other floating structure parameters such as hydrostatics, freeboard, sea keeping, etc. are important and determined in the floating structure design process.

4. Result

The main result of this research is a proposed design in which could accommodate all requirement needed (Figure 6).

4.1. Construction Systems and Materials

The use of materials in the construction of this floating house design uses environmentally friendly materials. Lighting energy that uses solar energy. The upper part uses lightweight parts such as walls made of lightweight concrete, wooden planks, plywood, and glass. The top, roof truss of wood, mild steel and for the cover of concrete, and Zincalum.(Sudarso,2012, Firmansyah et al, 2018, Rachman et al 2014). The floor is made of wood, steel and concrete composite beams. At the bottom, use materials that float easily, such as Styrofoam, Plastic Drum, PVC Pipe and Bamboo

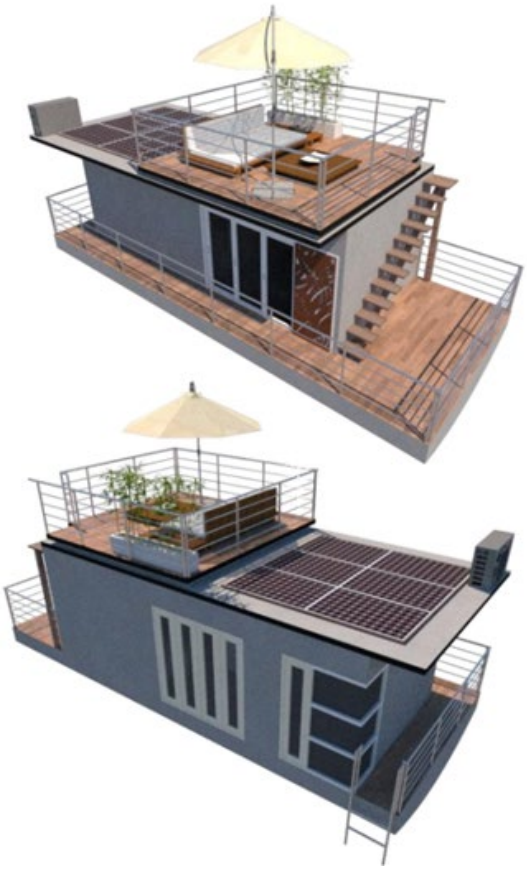

Figure 6. the proposed model for the floating house

5. Conclussion

The conclusion obtained is that the use of floating houses can be carried out in Indonesian waters. This is because there are already several water areas in Indonesia that have done and live in floating houses. The world's natural conditions are changing day by day, causing high water levels in land areas. The need for the construction of floating houses must begin to be carried out to prevent disasters if one day the surface of the land is submerged in water. The use of technology and the right structure is the main thing that must be considered in designing a floating building. Floating house planning is the use of components in the form of floating buildings to be symmetrical and using construction with light weight, floating shapes and plate materials that do not damage the environment, mooring systems must pay attention to changes in water on the site, and inter-circulation buildings to make it easier for users.

Acknowledgements

Thanks to KEMENDIKBUD, with the Independent Campus Learning Program (MBKM) we were able to carry out joint writing activities as well as carry out Key Performance Indicators between Universities.

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Biographies

Arie Indartono is a Senior Lecturer / Supervisor, at Surabaya Institute of Polytechnic Surabaya (PPNS). completed his undergraduate studies in the Marine Engineering of the Faculty of Marine Technology ITS. completed his Masters in Business management from ITS. The monumental work that has been made is the lifeboat, which is the result of a research grant program from the Ministry of Research, Technology and Higher Education. Expertise in the field of sea transportation is proven from several research results related to the shipbuilding process. involvement in the manufacture of ambulance boats, fishing boats prove their expertise in the field of ship design. Current research is directed at the concept of floating housing that is relatively cheap, safe, comfortable and strong

Sri Wiwoho Mudjanarko is currently Deputy Chancellor III concurrently Head of LPPM Narotama University Surabaya Indonesia. Previously served as Chancellor in the 2000-2023 period. Obtained Diploma 3 from Petra Christian University, Bachelor of Civil Engineering from Narotama University, Master of Civil Engineering at the Sepuluh Nopember Institute of Technology (ITS), Doctor of Civil Engineering at Brawijaya University (UB) and a Professional Degree in Engineering from UGM. For 33 years as a practitioner with the business currently held, especially in the field of construction-material services. Member of the Indonesian Railroad Society (MASKA) Indonesia., FSTPT, Concrete Society of Malaysia (CSM), Secretary of LPTNU Sidoarjo, DPD Intakindo East Java, Chair of DPD ADRI East Java, Chair of the Journal of Service Consortium and Manager-Editor-Reviewer of Sinta Accreditation Journal. Various written works in the form of articles, books, copyrights-patents have been produced and winners of National Research-Service grants have been obtained.

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