Bedroom Module Design on Offshore Hotel as a Support for Maritime Based Tourism Accommodation
(Study Case in Sendang Biru, Malang, Jawa Timur, Indonesia)

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Abstract. Aquaculture in Indonesia has only been used as a place for aquatic biota cultivation. At the same time, the structure of the building above the grove has not been used to the fullest. Therefore, with the development of the existing floating net design, support facilities for the offshore tourism sector are being developed, one of which is the Hotel. Hotel on aquaculture is an interesting development concept because it utilizes space on offshore sea buildings with facilities that educate about aquaculture and maritime potential in Indonesia for tourists staying at hotels. In designing the hotel on top of the aquaculture building, it is necessary to analyze the space requirements for hotel users to be comfortable on top of the building in the middle of the sea. Apart from that, the hotel design aesthetic is also needed, in order to attract the attention of tourists. Based on the design by considering the macro and micro concepts, as well as the arrangement of the hotel space, a design with a natural minimalist concept is obtained but still can meet the needs of the user space.

Keywords: Aquaculture, Hotel, Maritime, Tourism

1. Introduction

The marine and tourism sector is the strategy sector which is expected to realize Indonesia's development mission. Some of Indonesia's missions in maritime-based development are: maintaining regional sovereignty, maintaining economic independence by securing marine resources, and reflecting Indonesia's personality as an island nation, realizing high quality, advanced and prosperous Indonesian human life, realizing a competitive country, realizing Indonesia become an independent, developed, strong, and maritime nation based on national interests and realize a society that has a personality in culture.

According to RPJMN 2015-2019 in the field of maritime affairs and fisheries, to prepare Indonesia to be a maritime nation, there are several things that need to be prepared to encourage, strengthen and develop various development potentials in the maritime sector, one of which is marine buildings and marine tourism. One of the points of the development mission in the marine tourism sector is to develop competitive industries, sustainable goals and use responsible marketing (responsible marketing).

The marine tourism sector has the aim of developing tourism which is able to make a significant contribution to the national economy and the welfare of the people which are described as the following targets, increased expenditure and length of stay of tourists, the realization of the management of tourism destinations, increasing the number of foreign tourist arrivals to Indonesia and the movement of domestic tourists, supports increasing the contribution of tourism to the national economy on GDP, employment and investment (Peraturan Menteri Pariwisata dan Ekonomi Kreatif Republik Indonesia Nomor 1 Tahun 2014 Penyelenggaraan Sertifikasi Usaha Pariwisata, 2014).
Tourism makes a significant contribution to Indonesia's finances. Creation of GDP in the tourism sector through domestic tourists, the tourism budget, foreign tourists and investment in businesses. The tourism sector has a strategic role in creating added value for the nation and creating high foreign exchange-earners. In 2015 the tourism sector generated US $ 11.9 billion or equivalent to Rp 163 trillion (up 113% compared to 2014, which reached the foreign exchange rate of US $ 11.17 billion). One that contributed to the increase in Tourism GDP in 2016 was accommodation from Rp18,832 billion up to Rp 61,118.26 billion (Lembaga Penyelidikan Ekonomi dan Masyarakat Fakultas Ekonomi dan Bisnis - Universitas Indonesia, 2018).

There are many ways to exploit the maritime potential in Indonesia, such as Aquaculture. Aquaculture is a fish farming technology that is environmentally friendly and sustainable. Indonesia has a variety of aquaculture building models developed, one of which is a floating net. So far, aquaculture buildings in Indonesia have only been used as a place for aquatic biota cultivation. At the same time, the structure of the building above the aquaculture building has not been used optimally. With the development of the existing aquaculture building design, the concept of supporting facilities for the needs of the offshore tourism sector was made, which is a Hotel by utilizing a structure chart for aquaculture buildings. Hotel on aquaculture is an interesting development concept because it utilizes empty space in offshore sea buildings with facilities that can educate about aquaculture and the potential of the sea in Indonesia for tourists staying at hotels. Therefore, this research will discuss the study of hotel interiors used for offshore aquaculture tourism consisting of: 1) Study of standard furniture & interior materials; 2) Study of standard acoustic materials in the interior of offshore buildings; 3) Hotel Review of Activities and User Needs; 4) Determination of the bedroom module concept.

2. Method
In general, this research develops the design of offshore aquaculture structures that are easy to move and operate, for this reason, the following steps are required:

2.1 Literature Study
The data collected is used as a reference for the interior design to be made. Several aspects are used as a reference in making designs, such as: wall materials, floor materials, furniture, and so forth.

2.2 Analysis of Room Users Room Space Needs Analysis
In terms of building use, data that need to be used as a reference are Ergonomics and Anthropometry and minimum building area. Ergonomics represents all the calculations / aspects of humans that are needed to determine the size of construction or pleasure that will be used in marine buildings in order to create a sense of comfort. Anthropometry is a contribution of the human body.

2.3 Determination of the Room Module Design Concept
Results and data collector used as a basis for creating interior design concepts for offshore hotel bedrooms. The concept used is expected to improve the quality of safety, comfort, and meet offshore building standards. Some things to consider are function, material, design, and cost (Pile, 1994). In the process of determining the macro concept of interior design of offshore hotel rooms, the grouping process is obtained from the main variables discussed in the initial chapter and the results of data analysis. Where this interest consists of three variables including:
   a. Problems from the company side, namely the main problem of the design object in terms of the identity of the aquaculture building image
   b. The problem of applicable offshore building standards, namely the problem of design objects related to the material aspects that are available specifically for buildings on the sea / ship.
   c. The problem of the object side which is a hotel, while the hotel is identical to the place used for vacation, temporary rest, and for relaxation.

Next is to determine the micro concept, which is to determine the concept for each material that builds the sleep module for the offshore hotel building module.
3. Results and Discussion
At this stage, it will discuss the bedroom needs and the development of bedroom design concepts based on identified micro and macro concepts.

3.1 Analysis of User Needs
In the analysis phase of hotel room user needs in an aquaculture building, the assessment method used is ergonomics. Ergonomics is a method that involves people, tools, and work systems. In interior design, ergonomic aspects of applied safety, health, security, and work safety aspects are reviewed both the safety and psychological aspects. The following are the results of the analysis for needs.

| No. | Aspect                              | in   | cm    |
|-----|-------------------------------------|------|-------|
| 1   | Standard Widths of Bed             | 36   | 91.4  |
| 2   | Standard Lengths of Bed            | 78   | 198.1 |
| 3   | Standard Widths of Mattress        | 39   | 99.1  |
| 4   | Standard Lengths of Mattress       | 84   | 213.4 |
| 5   | Dimension Varies with Furniture Plan | 60  | 152.4 |
| 6   | Varies                             | 16-17| 40.6-43.2 |

Figure 2 shows the space requirements for the use of a standard bedroom with a single bed. Taking into account the condition of hotel rooms in aquaculture buildings that have extensive limitations, the minimum distance required by the user agrees in Figure 2.

3.2 Macro Concept
Based on the main variables, translated into a number of points about the interior design concept of a floating grove space building, then the following are problems and solutions which can then be used to get the design concept.

The design concept developed for hotel rooms over the sea leads to the Natural Minimalist style. The description of the Natural Minimalist style relates to the sub-themes obtained by the processing of each variable's solution, namely the identity's sub-theme as a representative of the problem of the corporate side; Natural and Relaxation sub themes as representatives of Resort problem variables used for vacation and Minimalist sub themes as representatives of applicable offshore building standard problem variables. Natural Minimalism is the style / style / main style that underlies this design. Characteristics and application of Minimalist Natural elements in the turbidity of the space will be combined with the preparation of each sub-theme.
This style is basically a combination of minimalist style Natural style. Form follow function is one solution for the utilization of a fairly limited space with the use of an appropriate design, especially on the side of formation. The simplicity of the formation of a minimalist style and prioritizing the function will later be combined with natural elements that tend to impress “earthy” through form, original texture of the material by combining the various fabrication material choices available by considering aspects of safety and security standards for Buildings on water that apply according to the Journal Byun.LS (Byun, 2006). Therefore the design will be made functional but can also offset the preferences of visitors’ tastes through the texture or appearance of the material

3.3 Micro Concept
Development of micro concepts based on macro concepts aimed at the Minimalist Natural style, by that, for the application of Natural Minimalist design concepts, important aspects that need to be considered such as furniture details are used. Furniture that is used specifically is made on request. Furniture must use materials that are lightweight, waterproof, fireproof, and easy to install. In addition, furniture must have a space saving feature considering the area of the room in the building over the sea. The following materials must be considered in the design

3.3.1 Ceiling
The ceiling concept in the building above uses standard materials which have aesthetic element requirements. The use of continuous ceilings is the standard of use for buildings above with dimensions, Width: 100, 200, 300 mm and Length: 600-5000 mm with a ceiling buffer frame Suspension Line Replacement Aluminum: square pipe, (20 × 20 or 20 × 40 mm). Here is one example of ceiling installation using these materials:
This type of continuous ceiling is also a non-flammable material because it has insulation from mineral wool, so that safety protection for users can be obtained.

### 3.3.2 Wall

For aquaculture buildings, the wall material used must have sufficient strength and have good soundproofing capabilities, requiring the required structure consisting of three parts namely: mineral wool (soft core), vermiculite (hardcore panel), and aluminum (metal sandwich panel).

Soft-core panels are materials that have good resistance and are non-flammable (non-flammable materials are substances that will not burn, burn, support combustion, or release flammable vapor when exposed to fire or heat, in the form where it used and under anticipated conditions), but does not have its own panel structure. Upper and lower structural profiles on soft-core panel panels must be added vinyl sheets which are useful for holding air and scratch resistance. In general, the thickness of a soft-core panel structure is around 25mm or 50mm, depending on the criteria of the fire resistance structure.

For the Hardcore Panel structure, the material used is Vermiculite. Vermiculite is a non-flammable material and has a weak resistance to air. The hardcore panel is connected with aluminum profiles and steel connections. Aluminum can be applied to wall panels, panel boards and boards for furniture. Meanwhile, metal sandwich panels are manufactured using a patented production process by printing 2 pieces of metal which are added using adhesives on both sides.

![Figure 4. Hotel room wall structure](image)

The metal used is aluminum, because it has the characteristics of a lightweight material. Metal sandwiches have the advantages of lighter material, good acoustics and very dynamic. Many industries use these materials and methods for building walls above the sea.

### 3.3.3 Floor

Floor finishing can use ceramic tiles, vinyl, carpet, wood, artificial stone, and cats. In addition to meeting the criteria determined by SOLAS Convention and IMO, only material with specific criteria can be used. The carpet can be used with specifications: 70-80% wool, 20-30% nylon with a pole weight of 1600 h / m2, and a mast height of 7mm to minimize gas released during a fire.

### 3.3.4 Furniture

The use of furniture is divided into 2 criteria, custom-made and ready-made. Custom-made furniture that has collections must be installed permanently which cannot be moved. Ready-made furniture is furniture that can be moved. And must follow the criteria of the SOLAS Convention on furniture (2000).

- Furniture such as tables, cabinets, dressers, credenza, cabinets must use non-flammable construction materials of not less than 2mm;
- Free standing furniture such as chairs, sofas and small tables must use a non-flammable frame;
- Upholstered furniture must have materials that are resistant to fire.

In addition, the furniture used must be multifunctional. Multifunctional furniture is used as an alternative solution for minimal space. Furthermore, the shape and finishing must be neutral and simple so that the impression of the resort to recover can be conveyed properly. With PVC foam board material, also known as Chevron boards or Andy boards are widely used for indoor and outdoor applications.
PVC foam board made from a chemical composition, Poly Vinyl Chloride, which is used in the furniture, building and advertising industries. PVC is lightweight and foamy, withstands moisture, chemicals and corrosion. The thickness of the material will increase from 6 mm to 45 mm. Can be used to carve, emboss, paint, laminate and grind board surfaces as needed.

3.3.5 Lighting
The lighting concept for bedrooms uses artificial lighting used for cottages (warm white lights). Warm white lights can give the impression of warmth and relaxation. For general lighting use lamps that depend on the exposed ceiling and down lighting on the upper and lower ceilings.

3.3.6 Aesthetic Element
One application of the concept of Natural to aesthetic elements is interior pot accessories, pillows, cushions, and others. This can be applied to public areas or private areas, but must still use and visual appearance in order to characterize the minimalist look.

Figure 5. Application of Aesthetic Element

3.4 Development of Aquaculture Hotel Room Design
The development of hotel room design for aquaculture buildings based on macro and micro concepts will use the Tree Concept method with an aquaculture building concept that emphasizes the physical and technical structure of the building, as well as the 'Natural Minimalist' concept which has a philosophy of closeness to the environment and is easily created through designs that provide opportunities for humans to live and work in healthy places, at least stress levels, and provide a prosperous life by integrating design with nature.

In the macro concept and application, a decent percentage will be applied, taking into account the minimum space requirements with the many activities that will occur in the room. The function tree method of the aquaculture sub-theme will be more dominant in terms of function and aesthetics that will be applied to the design. Then the second is a Minimalist sub-theme which is represented by the blue color, which includes the use of Furniture and Materials, which will largely determine the use of the 35% design. And the rest use colors and accent shapes that will be applied to the design amounting to 15%.

Figure 6. Result Design Concept of Bedroom
Figure 8 shows the design for a hotel room with a minimalist natural concept. The bedroom concept consists of bed facilities consisting of a bunk-bed with a capacity of 2 people, a seating facility that is compatible for beds and bags, then also provided space for reading tables and chairs. The use of colors for walls and furniture that uses space uses monochrome colors synonymous with minimalist styles, such as gray and navy blue. Both colors can give the impression of clean, peaceful, light, which can affect the psychological aspects of users who want to declare themselves from the bustle of the city.

3.5 Alternative Layout Design
Bedroom is used as a resting place for guests who will visit Aquaculture. This is the one alternative layout designs as follows:

3.5.1 Alternative 1
Alternative 1 has a bathroom design in the center / center position, as illustrated in Figure 9

![Figure 7. Layout Bedroom (Alternative 1)](image)

**Weakness**
- Let the bed slightly uncomfortable due to being partially covered by the bathroom wall. Laying the bed is also in place also adjust the placement of furniture so that there is enough area for the crew's room.
- The kitchen is less ergonomic in terms of the cooking sequence (area and shape of the kitchen space that is less comfortable)

**Advantages**
- Laying a sofa bench in front of a window can give an exclusive and comfortable impression
- There is enough area for hot air circulation from the refrigerator.

3.5.2 Alternative 2
The second alternative layout still uses the concept of a bathroom in the middle but is different and the bathroom is equipped with the facilities provided in Figure 10

**Weakness**
- Lay the sofa bench and study the table area that is directly opposite the entrance that causes discomfort and as if the room is closed.

**Advantages**
- The privacy of the bathroom consists of a shower and toilet which is not visible directly from the entrance
- Circulation that does not lead to the bathroom.
- Service area for guest servants is very important, so area alley and the bed crew get guests that are not too big. In this design both of these rooms feel spacious with different arrangements with alternative 1.
3.5.3 Alternative 3
From the previous alternatives, this layout design focuses more on the needs of the space and furniture chosen.

![Figure 8. Layout Bedroom (Alternative 2)](image)

**Weakness**
- There are still areas that are not used, for example in front of the bunkbed which is a dead corner

**Advantages**
- Is the most relevant alternative in terms of space requirements and available facilities. Configure the bed and study table in line to determine the type of activity for the space through the laying of furniture.
- Storage is placed on a horizontal line which will be done as a weighting point on the structure.

3.5.4 Alternative 4
In this alternative concentrated on the distribution of the burden on the arrangement of laying furniture in Figs.

**Weakness**
- Storage space which becomes one side that causes poor loading makes the load point behind the floating net sinks.
Advantages
- Good configuration in laying furniture causes a fairly spacious room in the middle area, causing a comfortable effect.
- Centralized piping arrangements make bathroom facilities such as showers and washrooms comfortable.

Figure 10. Layout Bedroom (Alternative 4)

3.5.5 Alternative 5
This design is almost similar to the 4th alternative, but there are differences in the laying of the bunkbed

Weakness
- As in alternative 4, storage space depends on one side of the back of the floating net sinks, so it can change the point of load (unbalanced).

Advantages
- Laying a horizontal bunkbed has a roomy effect and doesn’t take up too much space.
- Bathroom facilities consist of showers and washrooms which are quite comfortable due to centralized piping.

Figure 11. Layout Bedroom (Alternative 1)

Based on the five alternatives, analysis of layout selection using a weighted method based on the process of designing the layout, suitability of the facilities to the needs of users is the most important thing in designing the hotel. It is followed by the area of space for the activities and transportation paths that are
important to be transferred, and the last is the suitability of alternative layouts with resort design and branding concepts inspired by the octagonal shape. Then the following alternative designs 3 are selected.

| Aspect                                      | Weight | Alternative |   |   |   |
|---------------------------------------------|--------|-------------|---|---|---|
| Flow of Circulation                         | 0.14   | 45          | 45| 49| 51|
| Suitability of Space to Activities          | 0.29   | 47          | 44| 50| 50|
| Suitability of Facilities Against User Requirement | 0.36   | 49          | 48| 50| 39|37|
| Alternative Layout Suitability with the design concept | 0.21   | 22          | 21| 26| 25|25|
| Total                                       | 40.72  | 39.28       | 43.72| 42.64| 41.92|

Based on the calculation of the weighting method for the five alternative layouts, the third layout design was chosen because it has the highest score. For suitability of facilities against user requirement, the third alternative has the highest score, where this aspect is the main aspect in choosing an alternative design for the aquaculture building layout.

![Selected Design Layout](image)

So, based on the design of macro and micro concepts, as well as the selection of alternative designs for the layout of aquaculture buildings, the layout designs are as follows. The following designs describe a natural, minimalist room atmosphere and match the user's needs.

4. Conclusions

The results of data analysis and discussion, resulting in the conclusion of the concept that will be raised as the interior design concept of Aquaculture is Natural Minimalism. Characteristics and application of Minimalist Natural style elements in the space to be applied and integrated into each sub-theme. To adjust the macro concept, then choose components to fill the hotel building with floating jarring (micro concept) towards a minimalist natural concept, such as the example of choosing the floor concept using Bamboo Plastic Composites. This concept will give a natural impression on space because it has a structure like bamboo.

The alternative layout used in the design of aquaculture building is the third alternative layout, the selection is based on the weighting method of four influential aspects to meet user comfort, namely circulation, the suitability of space for activities, the suitability of facilities to user requirements, as well as the suitability of layout alternatives with the design concept.
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6. Reference
[1] Byun, L. S. (2006). Peculiarity of Interior Design Materials for accommodation areas of cruise ships: A state-of-the-art review. Ships and Offshore Finish Aquaculture, 1:3, 171-183.
[2] Lembaga Penelitian Ekonomi dan Masyarakat Fakultas Ekonomi dan Bisnis - Universitas Indonesia. (2018). Laporan Akhir: Kajian Dampak Sektor Pariwisata Terhadap Perekonomian Indonesia. Indonesia.
[3] Panero, J., & Zelnik, M. (1979). Human Dimension and Interior Space: A Source Book of Design Reference Standards. New York: Whitney Library of Design.
[4] (2014). Peraturan Menteri Pariwisata dan Ekonomi Kreatif Republik Indonesia Nomor 1 Tahun 2014 Penyelenggaraan Sertifikasi Usaha Pariwisata. Jakarta: Kementerian Pariwisata dan Ekonomi Kreatif Republik Indonesia.
[5] Pile, J. F. (1994). Interior design second edition. Harry N. Abrams, inc.
[6] SOLAS. (2000). International Convention for the Safety of Life at Sea 1999/2000 Amendments. International Convention for the Safety of Life at Sea, Consolidated Edition, (pp. pp. Chapter II-2, Part B, C, D). London, UK.