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BEACH CLUB LIKUPANG
Biomimicry Architecture

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Abstract

Likupang, located in North Sulawesi, is one of Indonesia's super-priority tourism destinations, offering rich natural resources such as white sandy beaches, coral reefs, and abundant marine biodiversity. This is further evidenced by the increasing number of tourists visiting North Sulawesi each year. However, as a tourist destination, the existing attractions and facilities in Likupang are insufficient to fully leverage its tourism potential. To address this issue, the Likupang Beach Club is proposed as a new attraction and facility to support Likupang as a premier tourism destination. By integrating buildings with nature, the biomimicry approach serves as an appropriate theme to apply natural principles in architectural design.
The design of the Likupang Beach Club, based on a biomimicry architectural approach, aims to create a structure that seamlessly integrates with the natural beauty of Likupang and fosters harmony between the building and its surroundings by mimicking natural principles.

Through stages of determination, data collection, and implementation, the design process combines the variety development and reduction methods with cycles of imagination, presentation, and testing. This process incorporates typological, site, environmental, and thematic approaches to achieve a unique design that positively impacts the surrounding environment and nature.

The application of biomimicry in architecture, which integrates buildings with nature, offers an innovative and visually appealing solution for sustainable tourism development. The design of the Likupang Beach Club demonstrates that working with nature does not mean harming it. Instead, it showcases how a design can collaborate with its environment, resulting in a sustainable and harmonious development.

Keywords: ***Likupang, Toursim, Beach Club, Biomimicry. Architecture***

INTRODUCTION
Background

The Likupang area, with its extraordinary natural beauty, is one of the tourism destinations with immense potential for development. The uniqueness of this region lies in its panoramic white sandy beaches, majestic coral reefs, and abundant marine biodiversity. Data from the Central Statistics Agency (BPS) indicate that the number of tourists visiting North Sulawesi has steadily increased over recent years, reaching a record high in the most recent year. However, this potential has not been fully optimized. Therefore, sustainable tourism development efforts are becoming increasingly relevant to enhance the competitiveness of this area as a premier tourism destination. As part of the effort to develop the tourism potential of this region, a facility designed to serve as a center for tourist and recreational activities—currently an emerging trend yet unavailable in Likupang—is the Beach Club.

In the context of natural tourism, where the aim is to provide facilities for visitors to enjoy the natural beauty, one proposed approach is the design of a beach club using a biomimicry architectural concept. This concept not only functions as a recreational center but also as an innovative architectural work that harmonizes with nature. Moreover, a beach club with a biomimicry concept can serve as an educational attraction for visitors, raising awareness about the importance of environmental sustainability. By providing a positive tourism experience, this project will not only act as a recreational destination but also as a center for environmental awareness that aligns with the principles of sustainable development.

Problem Formulation

Based on the background provided, the authors formulate the following problems in the design of the Likupang Beach Club with a biomimicry architectural theme:

- How can biomimicry architectural concepts be effectively integrated into the design of the Likupang Beach Club to create harmony between the building, the environment, people, and the surrounding

nature?
- How can the spatial needs and circulation of a comfortable beach club be accommodated within the building?
- How can the presence of the facility align with the functional area and increase the utility value of the region?
- How can a design be developed that provides a unique experience for visitors in line with the biomimicry theme?

DESIGN METHODOLOGY

Design Approach

The design approach is divided into three main aspects:

- Typological Approach
  Understanding and identifying the types of objects to be built based on function, form, and style. In this case, the typology of recreational buildings focuses on a beach club as the object.
- Locational Approach
  Analyzing the site in Likupang, North Minahasa Regency, North Sulawesi, to understand its compatibility with the environment and human activities.
- Thematic Approach
  Utilizing a thematic study of "Biomimicry Architecture" with the aim of creating a design that integrates seamlessly with nature.

Design Process

The design process involves three stages and integrates two design methodologies: Horst Rittel's variety development and reduction method and John Zeisel's imagination-presentation-test cycle.

- Determination Stage
  In this stage, ideas, design flow, and initial project concepts are established.
- Data Collection Stage
  At this stage, all data and information relevant to the defined concepts are gathered and analyzed to determine an appropriate design concept. The variety development and reduction method by Horst Rittel is applied to identify and select the best alternatives for the design.
- Implementation Stage
  In this stage, the reviewed design concepts are implemented into the project. The imagination, presentation, and testing cycle from John Zeisel is employed to refine the alternatives into a maximized final design.

The application of these two methodologies is adjusted to fit the biomimicry theme. Mimicking natural principles requires careful adaptation in the design process.

OBJECT DESIGN ANALYSIS

- **Prospects**
  The presence of a beach club in Likupang offers positive contributions to the development of tourism and the local economy. The supporting potentials for designing a beach club in Likupang include:
  1) Tourism Potential: Beautiful natural surroundings and recreational activities.
  2) Economic Development: Creation of job opportunities and support for local businesses.
  3) Destination Promotion: Enhancing the area’s appeal as a tourism destination.
  4) Socio-Cultural Impact: Positive influences on the local community.
  5) Regional Revenue Growth: Increased income for the region.

  By leveraging these factors, the Beach Club design in Likupang is poised to enhance the local economy, boost tourism, and positively impact the community.

- **Accessibility**
  The proposed Beach Club in Likupang has high feasibility, supported by the following factors:
  1) Tourism Growth: Increasing numbers of tourists.
  2) Unique Location: Distinctive attractions as a tourism priority area.
  3) Infrastructure Support: Availability of roads, airports, and transportation.
  4) Government Policies: Existing plans for developing Likupang’s tourism and potential revenue generation.

By considering these factors, the Beach Club design is deemed highly feasible, especially when combined with effective management, sustainability measures, and innovative ways to attract tourists.

Design Object

- **Literature Study**

  Based on the meaning of the term, "Beach Club" is derived from two words: "Beach," which translates to "pantai" in Indonesian, meaning "coast" or "shore," and "Club," which refers to an "association" or "gathering." When combined, "Beach Club" refers to a "gathering place located by the beach."

  In various definitions proposed by the literature, a beach club is described as a collection of buildings and outdoor facilities, such as cabanas and daybeds, situated by the beach. These spaces typically blend traditional and modern architectural elements enriched with contemporary features, including restaurants, lounges, bars, swimming pools, and spas (Suarka, 2020). Furthermore, a beach club is defined as a term for a design concept that functions as a recreational and entertainment area located on the beach (Martha, 2022).

  From the above definitions, a beach club can be understood as a collection of buildings, facilities, and activities aimed at recreation and entertainment purposes.

- **Function Typology**

  The Beach Club described in this design is a structure that accommodates and facilitates various recreational and entertainment activities that can take place on the beach. These activities include relaxing, dining, drinking, photography, music concerts, and other forms of recreation and entertainment.

  Given its purpose and the scale of use, the Beach Club must cater to a large number of users while prioritizing user comfort. Recreational and entertainment activities typically attract significant numbers of participants who come to relax and enjoy leisure. These activities form the core function of the Beach Club, aligning with its primary purpose. To complement its recreational and entertainment functions, the Beach Club also incorporates commercial features such as restaurants and retail spaces, which contribute to the growth of the tourism industry and the local economy.

- **Geometry Typology**

  Architecturally, the design of the Beach Club focuses on open structures to maximize the natural beauty of the surrounding environment or outdoor spaces (landscape architecture). Through a landscape design approach, the geometry of the Beach Club will adhere to the principles of landscape design.

- **Supporting Object Studies**

  1) Basic Principles of Landscape Design
     Unity, Harmony, Visual Appeal, Simplicity, Accentuations, Balance, Scale and Proportion, Repetition and Transitions
  2) Sequence and Serial Vision
     Possession, Occupied Territory, Possession in movement, advantage, viscosity, enclaves, enclosure, focal point, precincts, indoor landscape and outdoor room, the outdoor room and enclosure, Multiple enclosure, block house, insubstantial space, defining space, looking out of enclosure, there ness, here and there, looking into enclosure, pin pointing, truncation, change of level, netting, silhouette, grandiose vista, division of space, screened vista, handsome gesture, closed vista, deflection, projection and recession, incident, punctuation, narrows, fluctuation, undulation, closure, recession, anticipation, infinity, mystery, the maw, linking and joining the floor, pedestrian ways, continuity, and hazards.

Site and Location

The site was chosen based on specific selection criteria. The designated site is an open area located in Kalinaun, East Likupang, North Minahasa Regency, North Sulawesi, with a total area of 48,000 m².

Figure 1. Selected Site
Source: Google Earth, 2024

Based on Government Regulation No. 84 of 2019, Likupang has been designated as a Kawasan Ekonomi Khusus (KEK) with tourism as its primary industry. According to the North Sulawesi Provincial Spatial Plan (RTRW) for 2014–2034, Section Two on Spatial Planning Policies, Article 3, Point (c), the enhancement of potential, resources, production marketing accessibility, and the quality of human resources in the fields of marine, fisheries, tourism, and agriculture is one of the objectives of spatial planning. Furthermore, Article 55, Paragraph 3, Letter (b), Point 1, establishes Likupang as a key area for tourism development in North Sulawesi.

Regulatory Compliance:
- Maximum Building Coverage Ratio (KDB): 30%
- Minimum Green Open Space (KDH): 40%
- Floor Area Ratio (KLB): Not regulated
  Based on these parameters, the calculations are as follows:
- KDB = 48,000 m² × 30% = 14,400 m²
- KDH = 48,000 m² × 40% = 19,200 m²

Functional program

The design object is divided into three primary functions: recreation, entertainment, and commercial, which are further categorized into three zones: visitor areas, user areas, and service areas.

Following the typology of the object, which emphasizes outdoor spaces, the rooms are categorized based on their zones:

Table 1. Indoor and Outdoor Spaces

Indoor Spaces	
Manager's Room	Private
Marketing Management Room	Private
Event Management Room	Private
Operational Management Room	Private
Facilities and Maintenance Management Room	Private
Meeting Room	Private
Guest Room	Semi-Public
Reception	Public
Information Center	Public
Staff and Employee Room	Private
Rest room	Semi-Public
Pantry	Semi-Public
Restaurant	Semi-Public
Bar	Semi-Public
Lounge	Semi-Public

NightClub	Semi-Public
Fitness Center	Semi-Public
Spa	Semi-Public
Bathhouse	Semi-Public
Souvenir Shop	Public
Storage Room	Private
Changing Room	Private
Security Post	Service
Generator Room	Service
Pump Room	Service
MEP Room	Service
CCTV Room	Service
Restroom	Service
Warehouse	Service
Janitor room	Service
Outdoor spaces	
Enterance	Public
Parking Lot	Public
Drop-off	Public
Pedestrian Walkways	Public
Sunbathing Area	Semi-Public
Swimming Pool	Semi-Public
Music Stage	Semi-Public
Plaza	Semi-Public
Open Area	Semi-Public
Water Sports Area	Semi-Public
Children's Play Area	Semi-Public

Source: Author's Analysis, 2024

Based on the estimated spatial dimensions, the summarized space allocations for the design object are as follows:

Table 2. Spatial Allocation Summary

SPACE TYPE	TOTAL AREA
Indoor Room	13.083.4 m^2
Non-Green Open Space	11.816,5 m^2
Green Open Space (40%)	19.200 m^2
Total Non-Green Open Spcae and Green open space	31,016.5m^2
KDB	14.400 m^2
Beach Area	3814 m^2
Total	47,913.9 m^2

Source; Author's Analysis, 2024

Design Theme and Principles

Biomimicry architecture is a design approach that draws inspiration from nature in form, systems, and mechanics. Derived from the Greek words *bios* (life) and *mimesis* (imitation), biomimicry examines how organisms adapt to challenges and applies these solutions efficiently to human technology.
As described in *Biomimicry: Innovation Inspired by Nature* by Janine Benyus, biomimicry involves innovation inspired by nature, adopting patterns and designs from the natural world to solve human problems.

Biomimicry is structured around three core principles:
1) Nature as a Model: Mimicking natural designs, such as solar cells inspired by leaves.
2) Nature as a Measure: Using ecological standards to guide innovations.
3) Nature as a Mentor: Learning from nature to develop new solutions.

Biomimicry Approaches in Design

1) Bio-Inspiration: Applying natural principles to architectural designs.
2) Biomorphic: Incorporating natural forms into building structures.
3) Biomimetic: Adapting natural strategies and functions into design.
4) Bio-Passive: Utilizing natural elements, such as sunlight and vegetation, to enhance energy efficiency and thermal comfort.

DESIGN CONCEPTS

Tematic Implementation Concept

The application of biomimicry principles in the Beach Club design includes:

Table 3. Implementation of the design theme

Principle	Site Development	Building Configuration	Indoor Spaces	Outdoor Spaces	Envelope	Structure & Utilities
Bio-Inspiration	√	√		√		
Biomorphic	√	√	√	√	√	√
Biomimetic		√		√	√	√
Bio-Passive	√	√	√	√	√	√

Source; Author's Analysis, 2024

Site Development Concept

The site is divided into two primary zones, the building Area and the Recreational Outdoor Area Additional portions of the site will be utilized as green open spaces and parking facilities.

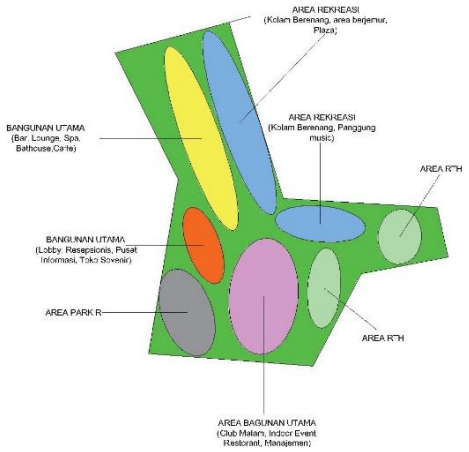

Figure 2. Site use zoning

Source; Author's Analysis, 2024

Mass Placement on the Site

The building mass placement considers circulation patterns, site contours, and optimal viewing angles. This ensures that each building aligns with natural movement flows and integrates harmoniously with the surrounding environment.

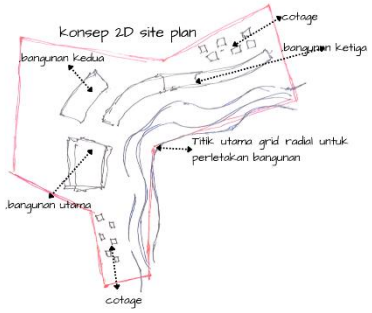

Figure 3. 2D Sketch of Building mass placement
Source: Author's Analysis, 2024

Mass Form Concept

The building mass follows natural forms, which were derived from observing the site's contoured terrain. By cutting and shaping the site, it is envisioned to resemble the waves of the ocean.

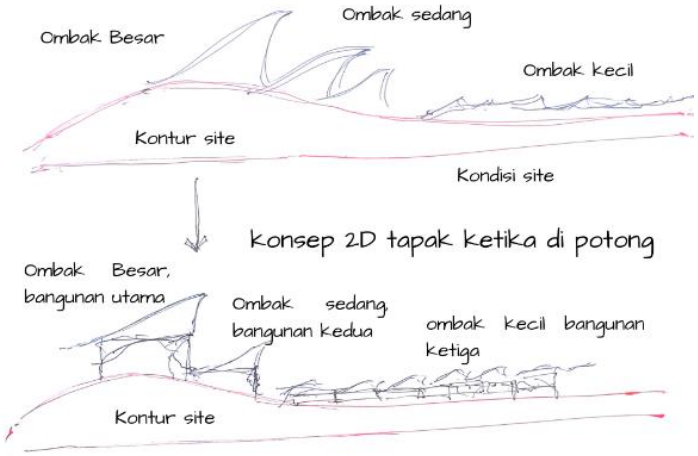

Figure 4. 2D Concept Sketch of Biomimicry in Building Mass
Source: Author's Analysis, 2024

With the initial idea of wave formation, the entire building mass on the site, when viewed from the front, will appear as a cohesive wave pattern transitioning from larger waves to smaller ones. To achieve this unified wave pattern, the three main building masses will be designed to reflect the shapes inspired by waves. This approach creates a visually captivating design, where the Beach Club appears as a wave in opposition to the natural waves of the ocean.

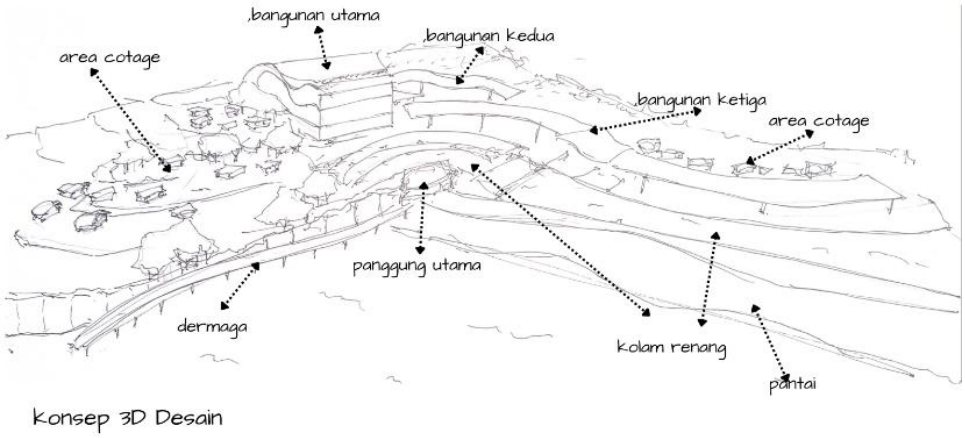

Figure 5. 3D Concept Sketch of Mass Configuration and Placement
Source: Author's Analysis, 2024

DESIGN RESULT

Site plan and Lay out

The layout of the building mass on the site is a single structure, designed based on the site's topographical contours and the planned utilization of site zoning..

Figure 6. Site Plan
Source: Author's Analysis, 2024

Figure 7. Lay Out
Source: Author's Analysis, 2024

Figure 8. Site Elevation View and Site Section View
Source: Author's Analysis, 2024

Architectural Form Composition

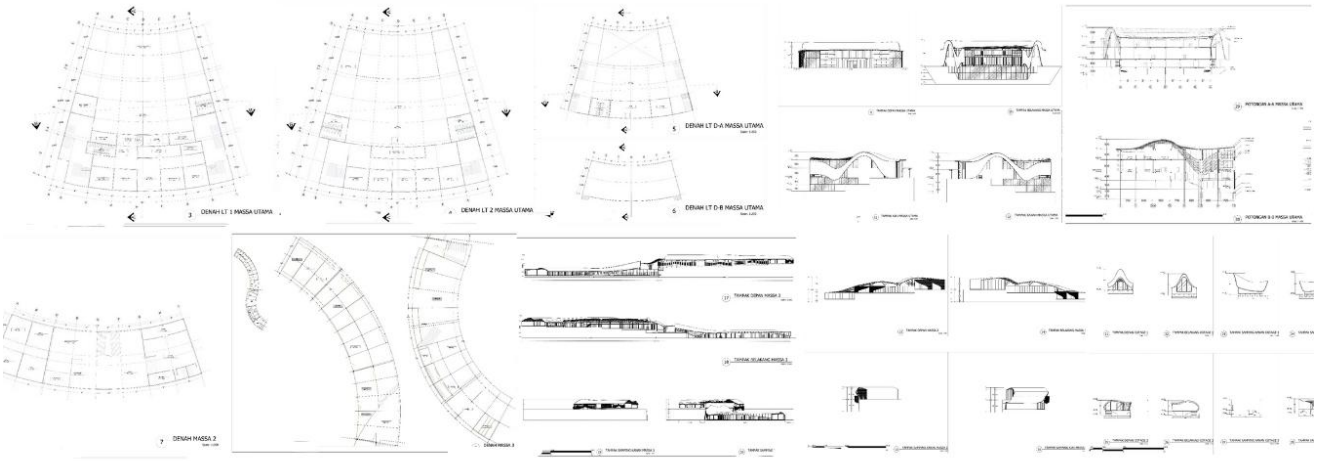

Figure 9. Building plans, Elevations, and Sections
Source: Author's Analysis, 2024

Figure 10. Site and building perspective
Source: Author's Analysis, 2024

Achitectural Space Composition

- **Outdoor Space**

Figure 11. Outdoor space spot
Source: Author's Analysis, 2024

- **Indoor Space**

Gambar 12. Indoor space spot
Source: Author's Analysis, 2024

CONCLUSION

The design of the Likupang Beach Club, based on biomimicry architecture, introduces unique ideas that harmonize the building with its natural environment. The design not only contributes to tourism development but also promotes sustainability by aligning building functionality with the site's potential and the chosen theme.

As Janine Benyus emphasizes in *Biomimicry: Innovation Inspired by Nature*, "We are surrounded by

genius. The designs we see in nature are solutions to the same challenges we face as designers, engineers, and innovators."

Through this project, the Likupang Beach Club aspires to serve as a model for sustainable tourism development, emphasizing the synergy between natural beauty and architectural design. It demonstrates that designing within a natural area can coexist with preserving and enhancing the environment.

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