Design of a Co-Working Space Building with a Biomimicry Architecture Concept in Bandar Lampung

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Abstract

The economic development in Bandar Lampung is becoming increasingly competitive, leading to higher demand and marketing of office spaces as business actors will need new spaces. Therefore, co-working spaces become a beneficial solution in overcoming these challenges, serving as workspaces and venues for collaboration. However, working continuously indoors can cause feelings of boredom and stress. Several workplace studies show that contact with nature experienced at work or in the office can improve health. One approach is to bring the concept of nature into the building through Biomimicry Architecture by adopting the principles of nature's mechanisms. By adopting these principles, Biomimicry Architecture can also help minimize stress levels for workers in the co-working space; thereby, creating a more comfortable working environment and reducing stress. Based on the analysis and design concepts for the co-working space with the biomimicry architecture concept, biomimicry can address issues related to air pollution by adapting nature's mechanisms. The biomimicry concept in the co-working space applies three principles mass composition, interior layout, exterior layout, skin facade, and utility systems in the building.

Keywords: Biomimicry Architecture, Co-Working Space, Rain Tree, Stress, Nature.

I. INTRODUCTION

Business development in Indonesia has become increasingly competitive, with rapid changes and uncertainties [1]. This condition has resulted in intense competition among companies, driven by the increasing number of competitors, growing product volumes, and rapid technological advancements. The business development in Indonesia is also accompanied by changes in the Indonesian economy, including the economy in Bandar Lampung. The economic development in Bandar Lampung will also impact the increasing demand and marketing of office spaces, as business actors will need new spaces for new businesses or larger spaces for business expansion. Along with the rapid development of the creative industry in Bandar Lampung, more and more creative industry players such as SMEs, startups, remote workers, and freelancers need places to work and collaborate effectively.

Based on data from the Central Statistics Agency (BPS) and the Creative Economy Agency (Bekraf), Bandar Lampung is the city with the highest number of business units and creative economy actors in Lampung Province, with 36,113 companies in Bandar Lampung falling into the creative industry category or classification, with the top three sectors being culinary, craft, and fashion [2]. In the subsectors related to digital and startups, the number is still relatively small, but with the support from the Provincial Government to facilitate startups in Bandar Lampung, this subsector has great potential for development [3]. With the potential for growth in this subsector, there is a need for a place to conduct their business. However, in their journey, they often face common obstacles, such as limited budgets for renting their own office space.

Especially for those who are just starting their business, the available capital may not be sufficient to buy or rent a private office. Therefore, the presence of co-working spaces becomes a beneficial solution to overcoming these challenges.

Co-working spaces provide a comfortable and flexible working environment at a more affordable cost compared to conventional company offices [4]. Creative industry players can take advantage of the facilities provided, such as workspaces equipped with modern equipment, meeting rooms, high-speed internet access, administrative facilities, and collaborative areas. By working in an inspiring and productive environment, users can improve their performance and meet professionals from various backgrounds, share ideas, and establish collaborations. Additionally, the flexibility in choosing work hours and rental durations also provides convenience for those with varying schedules or diverse projects. In this context, where the creative industry is growing rapidly, the presence of co-working spaces significantly contributes to promoting the growth of the creative economy in the area. Co-working spaces become places that allow creative industry players to interact and support each other. Thus, co-working spaces not only provide practical solutions to budget issues but also strengthen the creative industry community and encourage the creation of sustainable collaboration and innovation. However, continuously working indoors can lead to feelings of boredom and stress.

Stress is a disorder of the body and mind caused by changes and demands of life (Vincent Cornelli, in Jenita DT Donsu, 2017). According to Trisnasari and Wicaksono (2021) in (Suhendarlan et al., 2022), work-related stress in Indonesia is a serious problem, with 9.8% experiencing mental and emotional disorders and 35% experiencing stress due to work [5]. A recent survey by MMB (Mercer Marsh Benefit) in 2021, involving more than 1,000 workers in Indonesia, showed that 2 out of 5 workers experience work-related stress. To address this issue, efforts are needed to minimize stress levels, one of which is by incorporating nature into building designs. Several workplace studies have shown that contact with nature at the workplace or office can improve health. For example, taking a short break outside during work, having plants in the office, and having office windows with views of the outdoors are associated with reduced stress (Erin Largo Wight, 2011). To present nature in building designs, one approach is through the concept of Biomimicry Architecture by adopting the principles of how nature works. Biomimicry architecture can also be used for aesthetic purposes to attract users. Good aesthetics can create a pleasant and inspiring atmosphere for co-working space users. Visually appealing designs can also help enhance mood, creativity, and productivity.

Biomimicry Architecture can be defined as the science or art of designing buildings by imitating aspects of organisms or living creatures. The term biomimicry first appeared in scientific literature in the early 1960s [6]. Biomimicry has various meanings according to scientists and researchers. Biomimicry is a theory that interprets nature as a model, mentor, and measure in terms of design references or drawing knowledge from nature [7]. By adopting the principles of how nature works, Biomimicry Architecture can also help minimize stress levels for workers in co-working spaces. The Biomimicry Architecture approach in design is inspired by how nature works and utilizes principles found in natural ecosystems to create more sustainable and comfortable environments for humans. By applying these principles in the design of co-working spaces, it can create a more comfortable working environment for workers and help minimize stress levels.

II. MATERIALS AND METHODS

In this study, the author applied a descriptive qualitative research method with a case study approach. This approach aimed to provide a systematic and accurate description of facts related to the design patterns of Biomimicry Architecture in co-working spaces. By applying qualitative research in this paper, the goal was to describe in detail how the design patterns of Biomimicry Architecture are applied to co-working spaces.

1. Research Ideas
   The following are the research ideas that the author aims to realize through the design of a co-working space building with the concept of Biomimicry Architecture:
   - To discover ideas or concepts regarding co-working spaces that can accommodate the needs of industry players in Lampung and its surroundings, considering the psychological aspects of users to increase work efficiency, creativity, and productivity.
   - To strengthen the idea of co-working spaces that align with the concept of Biomimicry Architecture, capable of producing designs that minimize air pollution by drawing inspiration from nature.
2. Research Analysis
   The analysis process includes several aspects, such as site analysis, function analysis, user activity analysis, space analysis, and other analyses relevant

to the research to be conducted.

3. Research Concept
   The research concept includes several aspects, such as design approach concept, site response concept, mass or form concept, space concept, and structural concept.

III. RESULTS AND DISCUSSIONS

A. Site Analysis

Fig 1. Site
Sumber: Google Maps

The site is located on Raden Intan Street, Enggal, Tanjung Karang District, Bandar Lampung City, Lampung, in the Tanjung Karang City Service Center (PPK) area with a service area covering the entire city, functioning as a trade and service center, health center, and land transportation hub, with a land area of 11,100 m². The site boundaries are as follows:

a. North: Grand Mercure Lampung
b. East: Jalan Raden Intan and commercial area
c. South: Commercial area and Adipura Monument
d. West: Residential area

Based on the site analysis, here are some responses of site analysis that can be applied:

a. Sun, utilize secondary skin on the western side where the afternoon sun directly hits the building facade and utilize vegetation in sun-exposed areas to block direct sunlight
b. Vegetation, flatten vegetation on the site to support construction
c. Wind, use vegetation in areas with the strongest wind gusts and employ overhangs with secondary skin on the eastern side to prevent rainwater from directly reaching the facade.
d. Circulation, implement a Drop-off system to minimize traffic congestion and create parallel or Raden Intan Road-following entrances and exits.
e. Accessibility, separate pedestrian and vehicular areas and provide canopies in certain pedestrian areas to minimize direct sunlight exposure.
f. Air Pollution and Noise, utilize vegetation in areas most exposed to noise and air pollution, and position buildings slightly further back to reduce noise pollution or disturbance.
g. View, maximize visualization towards the east, where the view from that direction is the most frequented by pedestrians and motorists, and orient buildings towards the east or Raden Intan Street.
h. Utilities, coordinate with relevant parties to tidy up cable networks and relocate electric poles that disrupt aesthetics.

B. Functional Analysis

The functions of co-working spaces are divided into three categories:

a. Primary Function, the primary function of a co-working space is to provide workspaces outside of conventional offices, with an atmosphere conducive to collaboration and idea exchange.
b. Secondary Function, co-working spaces also serve as open places for various groups, such as students and the general public, to engage in activities according to their needs and interests.
c. Supporting Function, the supporting function of a co-working space is to support both primary and additional activities that take place within it.

Table 1. Space Requirements

Area Classification	Rooms
Rental Office Area	Open Working Space
	Close Working Space
	Close Working Space
	Rental Office
	Meeting Room
	Print and copy area
	Event Room
	Workshop Room
	Press Conference Room
Supporting Area	Restaurant/Cafeteria
	Smoking Room
	Gaming Room
	Product Display
	Sports Facilities
	Relaxation Area
	Coffee Shop
	Mini Library
	ATM Center
	Director's Room
	Restaurant/Cafeteria
	Manager's Room
	Secretary's Room
	Marketing Room
	Administration and Finance Room
	MEP Division Room
	Management Staff Room
	Staff Changing Room
	Management Meeting Room
	Guest & Lobby
	Pantry
	Warehouse
	Reception
	Male Staff Toilet
	Female Staff Toilet

Area Classification	Rooms
Service Area	Male Staff Toilet
	Female Staff Toilet
	Equipment Warehouse
	Prayer Room and Ablution Place
	Janitorial Room
	Emergency Stairs
	Lift
	Electrical Panel Room
	Pump Room
	Genset Room
	Security Room
	Transformer Room
	Lift Machine Room
	AC Machine Room
Parking Area	Visitor Parking
	Management Parking
	Drop-off Zone

C. Building Mass

The building mass prioritizes function, where the form follows the space requirements as follows:

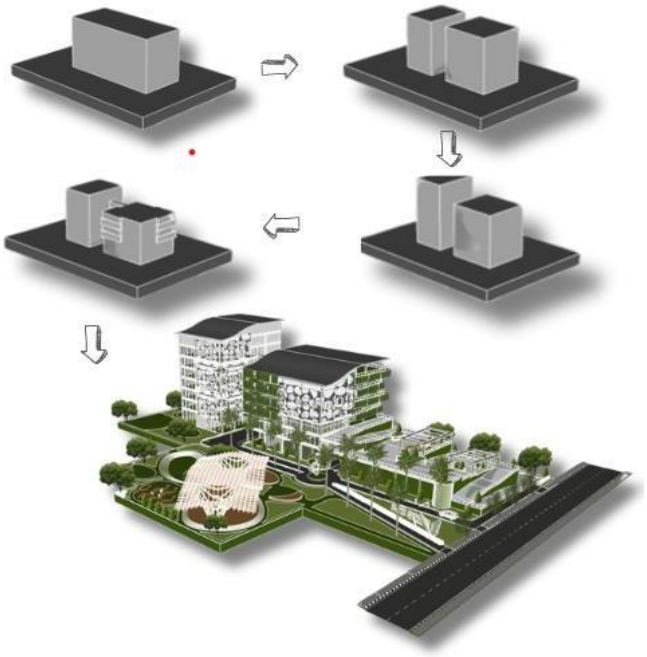

Fig 2. Building Mass

D. Bubble Diagram

The following is a macro bubble diagram for the design of a co-working space with the concept of Biomimicry Architecture:

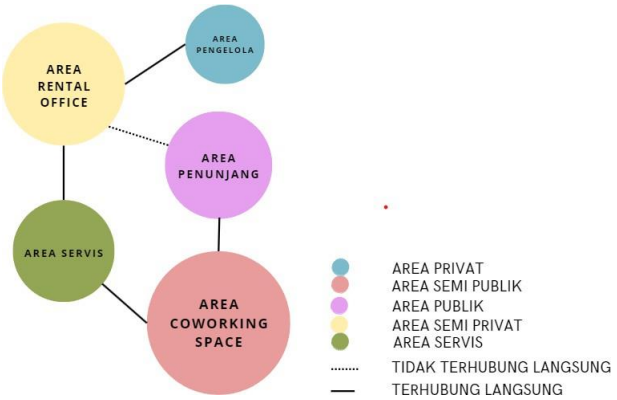

Fig 3. Bubble Diagram

E. Application of Biomimicry Architecture in Co-Working Space

The co-working space design incorporates the functioning of the rain tree into the concept of Biomimicry Architecture. Here are some characteristics of the rain tree applied to the building:

a. Photosynthesis Process

Plants can undergo the process of photosynthesis, wherein they absorb carbon dioxide, water, and sunlight to produce oxygen and glucose. This characteristic can be applied to buildings through the usage of vegetation on the building structure.

Fig 4. Vegetasi

b. Curved and Branched Canopy of Trees

1. Sunshading

The shape of the sunshading is inspired by the curved and branched canopy of the rain tree, which forms a unique pattern when viewed from below.

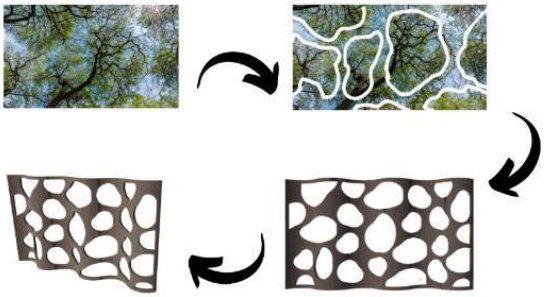

Fig 5. Sunshading

Sunshading is used to minimize the entry of solar heat into the building.

Fig 6. Sunshading

2. Landscape

The pattern of the rain tree canopy is not only applied to the building facade but also integrated into the building's landscape to form pathways and grass boundaries.

Gambar 7. Landscape

3. Interior

The pattern of the rain tree canopy is also applied to the interior spaces of the building, particularly in the co-working space area known as the "Treehouse Room." Occupants in this room will experience sensations similar to being in a treehouse, complete with artificial vegetation.

Fig 8. Treehouse Room

c. Storing Rainwater Reserves in Roots

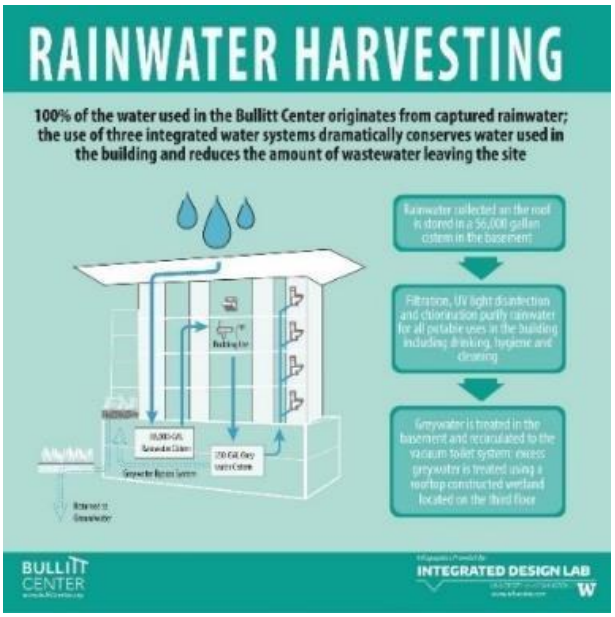

Fig *9.* Rain Water Harvesting
Sumber: bullittcenter.org

The co-working space building that adopts the functioning of the rain tree, namely its roots' ability to store groundwater, will be integrated into the building as a Rainwater Harvesting system. This system allows the building to produce its own water by storing rainwater, which can then be distributed throughout the building.

Fig 10. Rain Water Harvesting

IV. CONCLUSIONS

Based on the analysis results of the co-working space building design with the concept of Biomimicry Architecture in Bandar Lampung, several aspects have been successfully applied. Here are some aspects of Biomimicry Architecture inspired by the rain tree that has been successfully implemented into the co-working space building: Form Aspect, The shape of the sunshading is inspired by the canopy of the rain tree, forming a unique pattern when viewed from below. The pattern of the rain tree canopy is not only applied to the building facade but also integrated into the building's landscape to form pathways and grass boundaries. The pattern of the rain tree canopy is also applied to the interior spaces of the building, particularly in the co-working space area known as the "Treehouse Room." Occupants in this room will experience sensations similar to being in a treehouse, complete with artificial vegetation

Some materials used are made from natural materials such as wood applied in the interior of the co-working space. The co-working space building that adopts the functioning of the rain tree, where its roots can store groundwater, is integrated into the building as a Rainwater Harvesting system. This system allows the building to produce its own water by storing rainwater, which can then be distributed throughout the building.

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