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Implementation of the Biophilic Design Concept to Co-working Space in Bandar Lampung

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Abstract
The current industrial revolution 4.0 has a major impact on the Indonesian economy, one of which is the emergence of startup business models. The current millennial generation is required to be able to innovate, collaborate and create new discoveries. The need for co-working space is important because it can accommodate these activities with its flexible and collaborative nature. Working indoors continuously for long periods of time can cause nature deficit disorders or reduce human well-being and can cause stress due to lack of interaction with nature. Biophilic design is a solution to reduce stress levels in workers because it has a positive impact on health. The basic concept of biophilic is to connect humans and nature in architecture. This study used descriptive qualitative method. Data collection and data analysis techniques include observation, documentation and literature study through scientific references. The design of the co-working space in Bandar Lampung aims to provide a new space for the young generation to be creative, collaborate and create new discoveries supported by a biophilic approach to reduce user stress levels and support the creative process of innovation. The basic concept of biophilic is applied well in buildings by implementing 14 biophilic design patterns.

Keywords: Startup; Work stress; Co-working Space; Biophilic Design.

1. Introduction

This creative economy era is the term for the current Indonesian economy. The creative economy era or often called the industrial revolution in Indonesia continues to experience development until it is currently entering its fourth era. One impact is that the number of workers increases every year, dominated by the millennial generation [1]. Along with industrial development in Indonesia, many local startups are involved in creative industries such as visual communication design (DKV), game application development, interior design, advertising, animated films and videos, and etc. The creative industry is a form of utilizing individual creativity, skills and talents by producing and utilizing individual creativity and inventiveness [2]. Surveys show that 70% of young people in Indonesia have a great interest in developing entrepreneurship based on creative products and technological innovation [3].

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The creative industry in Bandar Lampung has great potential to be developed optimally. According to the Central Statistics Agency (2016), there are 36.113 companies in Bandar Lampung City that fall into the creative industry category or classification. The three highest sectors are culinary, crafts and fashion [4]. There are not many subsectors related to digital and startups, but this subsector has the potential to be developed because of support from the Provincial Government to facilitate startups in Bandar Lampung [5]. The growth of digital startups in Bandar Lampung is increasingly rapid due to the enthusiasm of the startup activists themselves. A total of 123 startups registered for the Startup Pitching Competition organized by the Lampung Millennial Digital Festival 2022 and have been selected as 12 startup finalists [6]. This startup operates in the fields of education, agriculture, services, social, big data, trade and the environment.

A startup is an initial company or start-up that is formed to create products that are innovative, creative and have never been created before [7]. Examples of successful startups in Indonesia include Traveloka, Tokopedia, Bukalapak, and many more. One way to achieve this success is by continuing to develop innovation. Individual and corporate creativity is very necessary in efforts to create new discoveries. The current generation is required to be able to innovate, be creative and collaborate to make this happen. One source of inspiration is through internet media. By connecting to the internet, people can complete work without having to meet each other, so work becomes more flexible and can be done online (remote), anywhere and at any time.

With activities carried out online, the current generation accesses information more often through social media. As a result, they become passive in socializing directly with their environment. This generation has three characteristics, they believe in user-generated content rather than unidirectional information, the digital world responds well to the millennial generation who are always online all the time, and the millennial generation tends to work more effectively. Using the devices they own and an internet connection, they always carry out activities indoors for quite a long time. To support these activities, a comfortable room and complete facilities are needed. An uncomfortable room will make you feel bored, fed up and in a bad mood. Boredom that is left for too long will cause a person to become emotionally and mentally disturbed.

A comfortable and conducive room atmosphere can help someone develop the user's creativity [8]. An uncomfortable atmosphere will affect a person's performance at work so that they are unable to do their work optimally. It is felt that having a co-working space can help overcome these problems. Co-working space is a shared work space concept where all users can use the space to work and interact to create joint collaboration [9]. Apart from being a shared work place, co-working space will also be a center for the development of creative industries.

Co-working spaces are designed to create a productive, effective and efficient work atmosphere, and are expected to become a place for self-development that is of interest to many people. There are many benefits offered by co-working spaces. Digital coworkers will find it easier to expand their personal and professional networks. Coworking spaces offer a flexible, open and innovative work culture. Because the system is flexible, coworkers can arrange their work time according to their needs [10]. In this way, coworkers become more productive, efficient and motivated in carrying out creative activities because the coworking atmosphere is comfortable and avoids stress. The facilities offered by co-working spaces vary, from private rooms, seminar rooms, to other supporting facilities such as wifi, canteen, etc.

There are not many co-working spaces in Bandar Lampung. The need for co-working space in Bandar Lampung is very important because the development of startups in Bandar Lampung is increasingly rapid. Most co-working spaces in Bandar Lampung are still close to other cafe functions. The function of co-working space in Bandar Lampung can be optimized by facilitating user needs. With the existence of a co-working space in Bandar Lampung, it is hoped that it can accommodate and facilitate creative industry players and startup activists who are still starting their businesses.

Working in a co-working space alone is not enough to innovate, be creative and collaborate to create new discoveries. Working continuously indoors can result in a decrease in a person's well-being. Boredom and even stress cannot be avoided at work. Anxiety and stress can arise while working.

Work stress is a situation where individuals experience physical and psychological disorders

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when workers face problems at work and are unable to solve them [11]. According to Trisnasari and Wicaksono (2021), work stress in Indonesia is a serious problem because it causes a rate of mental emotional disorders of 9.8% and work-related stress of 35% [12]. Based on the results of the latest MMB or Mercer Marsh Benefits survey (2021), involving more than 1,000 workers in Indonesia, 2 out of 5 workers in Indonesia experience stress due to work. This shows that Indonesian workers are vulnerable to psychological problems and emotional disorders.

Work stress factors can include workloads that are too heavy, an environment that is not conducive, and salaries that are considered too low [13]. Apart from that, work stress can also arise from working in one room for too long, resulting in reduced human interaction with nature. This condition is called nature deficit disorder which results in a decline in a person's general well-being [14]. Based on Indonesian BPS data, the average duration of working hours in Indonesia in 2015-2018 reached 43 hours/week, and in 2019 it fell to 42 hours/week. This value exceeds the specified time limit as regulated in Law Number 11 of 2020 concerning Work Copyright. In article 77 paragraph 2 (a) and (b) it is stated that the working time of 6 (six) and 5 (five) working days in 1 (one) week is 40 (forty) hours. Working hours that exceed the specified standard limits indicate heavy work demands that cannot be completed within normal working hours.

Efforts to respond to the phenomenon of work stress in Indonesia can be done by creating a good relationship between humans and the natural environment. One way is to design a room with a biophilic design approach. There are many health benefits that can be obtained if you apply this concept to a building. Biophilic design can reduce stress, improve cognitive function and creativity, improve well-being, and can speed healing [15]. Involving the natural environment in human activities will help increase a person's productivity and creativity.

Based on the background description, by using a biophilic architectural approach, it is hoped that the space formed in the co-working space will have strong characteristics, high flexibility, blend with the environment, and be dynamic in terms of geometry and building design concept, thus providing an illustration of how biophilic can be approach to design problems related to shared work spaces or co-working spaces.

2. Materials and Methods

Research methods are a scientific way to obtain data with specific purposes and uses [16]. The research method used in writing this report is a qualitative descriptive research method. In general, qualitative research is research that is descriptive and tends to use analysis. This research aims to intensively study the background of the current situation and environmental interactions of social units, individuals, groups, institutions and society. The application of qualitative research in this paper is to describe the application of biophilic design patterns in co-working spaces. The steps for systematic data collection in this research are:

2.1 Research ideas

The study stages used in the Co-Working Space design concept with a biophilic architectural approach are as follows:

- Looking for ideas or concepts about co-working space,
- strengthening co-working space design ideas that apply biophilic design patterns through architectural and non-architectural information and data from various sources and media as comparison material.

2.2 Analysis research

In the analysis process it is necessary to use certain approaches that support the design process. The analysis carried out is related to the approach used, namely biophilic design. These processes include:

- Site analysis

Analysis carried out at selected site locations aims to find out everything that is on the site.

- Functional analysis

This analysis aims to determine the need for co-working space by considering the users, activities and uses.

- Spatial analysis

Aims to obtain space requirements and dimensions by considering the function and layout of the space.

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2.3 Research concept

The study of design concepts are as follows:

- The basic design concept contains the concepts underlying the construction of a co-working space in Bandar Lampung with a biophilic design approach,
- Site design concept, including circulation and accessibility, orientation and zoning,
- The building design concept includes the concepts of building mass composition, interior layout and exterior layout,
- The concept of structural system design, containing the lower structural system, middle structure and upper structure of the building,
- Utility system design concept, containing dry utility systems and wet utilities in buildings.

3. Result and Discussions

3.1 Site Location

Figure 1. Site Location

The site location is on Jl. ZA. Pagar Alam, Labuhan Ratu, Kedaton District, Bandar Lampung City, Lampung. The existing location conditions are as follows:

- Land area: 6.710 sqm,
- Land use: regional scale services trade and government centers,
- Landscape: softscape,
- Topography: low slope with a difference of approximately 4 meters from flat ground.

The site boundaries are as follows:

- North: residental areas and modern library in Lampung Province
- South: Jl. ZA. Pagar Alam
- East: Darmajaya Institute of Informatics and Business
- West: SPBU Labuhan Ratu

Based on Regional Regulation No.4 of 2021 concerning the Bandar Lampung RTRW for 2021-2041 and Regional Regulation No.10 of 2011 concerning the Bandar Lampung RTRW for 2011-2030, the provisions for building construction at this location are as follows:

- KDB (basic building coefficient) maximal 60% from land areas

60% x 6.710 sqm = 4.026 sqm (maximal)

- KLB (building floor coefficient) worth 2,4

2,4 x 7.710 sqm = 16.104 sqm (maximal)

- KDH (green basic coefficient) minimal 20% from land areas

20% x 6.710 sqm = 1.342 sqm (minimal)

- GSB (building boundary lines) 15 meters from the edge of the road because it is a secondary arterial road..

3.2 Mass Composition Concept

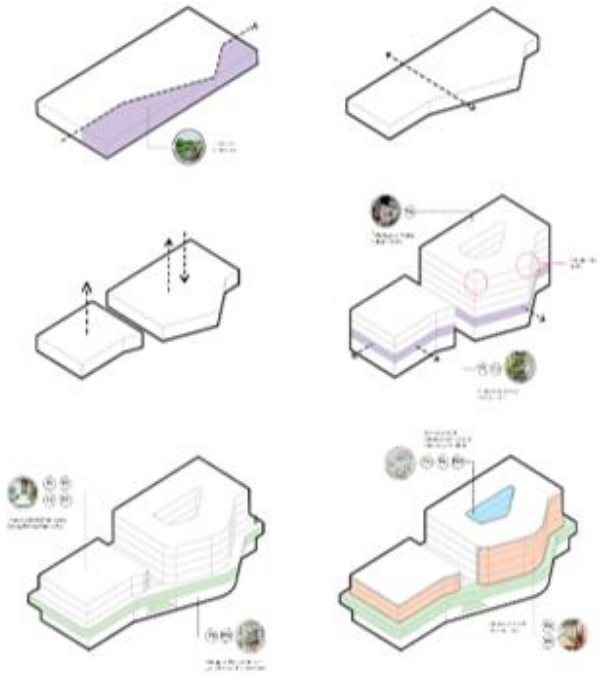

Figure 2. Mass Composition Concept

The composition concept comes from a simple basic geometric shape, namely a rectangle, which is then reduced as a circulation space. The form of transformation in the form of addition and subtraction adapts to the needs therein.

DOI: DOI:10.31629/jit.v6i1.7389

3.3 Zoning Concept

Based on its nature, the mass is divided into 5 zones marked with different colors. The green color is a public zone with a supporting function. Red is a private zone with office management functions. Blue is a semi-public zone with a coworking function. Gray is a semi-private zone with startup office functions. Yellow is a service zone with service and utility functions.

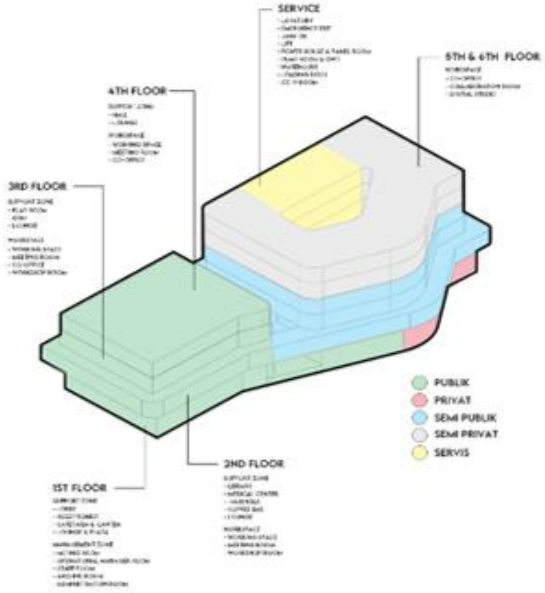

Figure 3. Zoning Concept

3.3 Biophilic Implementation in Co-working space

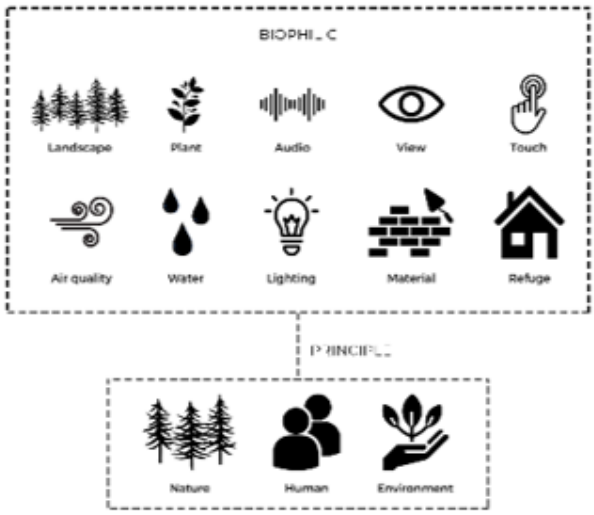

Figure 4 Biophilic Concept

The basic concept of designing a co-working space office in Bandar Lampung is to use a biophilic approach. The biophilic approach focuses on design that connects interactions between humans and nature in architecture. The biophilic approach aims to increase a person's productivity, creativity and well-being. The biophilic approach is also a solution to reduce the stress experienced by workers due to fatigue due to working long hours. The following is the concept of biophilic architecture.

Biophilic design is divided into 3 principles, nature in the space which consists of 7 patterns (visual connection with nature, non-visual connection with nature, non-rhytmic sensory stimuli, thermal and airflow variability, presence of water, dynamic and diffuce light, and connection with natural system), natural analogues which consists of 3 patterns (biomorphic form and pattern, material connection with nature, and complexity and order), and nature of the space which consists of 4 patterns (prospect, refuge, mystery, and risk or peril). The application of biophilic patterns in co-working spaces in Bandar Lampung is as follows:

P1. Visual Connection with Nature

The P1 pattern is applied by presenting green plant elements, both natural and artificial vegetation. The P1 pattern is applied to the building entrance which is a transition space to the atrium lobby, with a vertical garden along the side walls. There is an atrium in the middle of the building which is an indoor garden. The work space also applies the P1 Pattern by presenting artificial plants in the form of hanging plants and vertical gardens.

Figure 5. Application of the P1 Pattern in the Transition Zone

DOI: DOI:10.31629/jit.v6i1.7389

P2. Non-visual Connection with Nature

Figure 6. Application of the P2 Pattern at Cafetaria

The application of the P2 pattern can be applied through the senses of touch, hearing and smell. The sense of touch can be applied through the use of natural textured materials such as wood and stone in the outdoor atrium plaza and exposed brick walls in the cafeteria. The sense of hearing can be felt through the sound of gurgling water coming from waterfalls, outdoor and indoor atrium pools. The sense of smell can be felt through the use of vegetation that has certain characteristics or aromas.

P3. Non-rhytmic Sensory Stimuli

The application of the P3 Pattern can be felt through a subtle connection with nature. This can be seen through the use of skylight roofs. With skylights, you can create a subtle connection with nature, you can feel the clouds moving over the building. There are two skylights in the transition space to the lobby and the main co-working space office building.

P4. Thermal and Airflow Variability

The P4 pattern is applied through openings in the building. There is a large void in the atrium as a space for indoor air circulation, use of windows that can be operated, and an open space concept. The workspace and co-office parts of the startup also use active windows that can be opened and closed as needed for air circulation.

Figure 7. Application of the P4 Pattern at lobby atrium.

P5. Presence of Water

The P5 pattern experience can be felt by seeing, hearing and touching the water with the pool and waterfall in the indoor atrium. This waterfall uses glass media so that water does not splash and wet the surrounding area. In addition, there is a koi pond at the entrance to the square. This pool is able to reduce the heat of the sun, giving the building a cool impression.

Figure 5. The Application of the P5 Pattern is Using Waterfall.

P6. Dynamic and Diffuce Light

The P6 pattern is implemented by using a large skylight roof. The building and the rooms inside will receive sufficient sunlight because of the many cavities in the building. Apart from that, the use of glass material and large openings can maximize the application of the P6 pattern. Apart from natural lighting, the rooms in the building use artificial lighting from the afternoon to the evening. In coworking offices, hanging lamps, standing lamps and downlights are used.

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Figure 9. The Application of the P6 Pattern Uses a Skylight Roof and Large Voids.

P7. Connection with Natural System

Connections with natural systems are found at the building entrance, main building atrium, and 2nd floor corridor. At the entrance to the building there is a natural system that presents a biophilic space in the form of a long corridor as a transition space planted with various types of vegetation and a vertical garden. On the 2nd floor there is a corridor with sun shading as a secondary skin. Natural systems are vegetation that is planted from seedlings until they grow to flower.

Users can see and follow the growth and development of the vegetation. The vegetation planted is chrysanthemums with yellow and pink colors. Chrysanthemum flowers can reduce stress so they can maximize biophilic function. On the building's atrium stairs there is also a connection system to nature, there is a mini garden complete with a waterfall. The atrium stairs are designed to include tables and chairs so that users can work in the atrium while connecting to the natural system.

Figure 10. Application of the P7 Pattern to the 2nd Floor Corridor.

P8. Biomorphic Form and Pattern

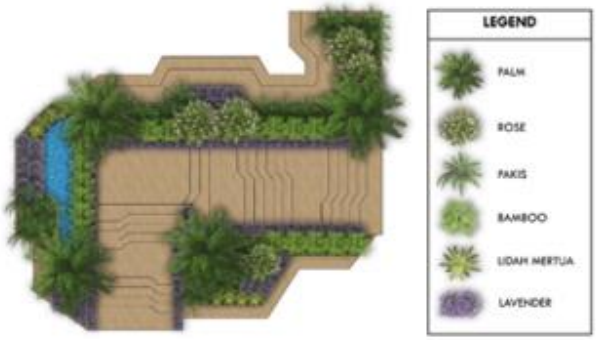

Figure 11. Application of the P8 Pattern on the Atrium Stairs

On the atrium stairs of the main building, a biomorphic pattern is applied as a symbol of life. Users can work or carry out activities in this space as if they were in the middle of a garden. The atrium stairs are designed to have chairs and tables, making it easier for users to place their devices. Other biomorphic patterns can be seen from the use of natural materials.

P9. Material Connection with Nature

The P9 pattern is implemented using local furniture and materials such as wood and stone. Apart from being a furniture material, wood is also used for aesthetics and decoration. The outdoor area uses natural stone materials.

Figure 12. Application of the P10 Pattern Using Natural Material Furniture

P10. Complexity and Order

The P10 pattern is applied by arranging various workspace layouts, namely there is a dedicated desk, group workspace, private workspace, quiet room, meeting room, co-office, hall, and conf room. The various rooms have different interior designs so they give a fresh impression because there are many rooms that don't make you bored. Of course this will max its biophilic function.

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P11. Prospect

Figure 13. Prospects in an Open Space Concept

The prospect in this case is a wide and clear view, meaning that users can clearly distinguish one room from another. The prospects could be a biophilic corridor on the 2nd floor, a transition space on the ground floor, and an open space concept in the building. The open space concept can be in the form of using large voids that allow users to see wide views in a vertical direction. The use of glass materials is also included in the prospects.

P12. Refuge

Refuge can be a place or space that protects its users, so that users can feel safe when carrying out activities in it. The protection applied is in the form of higher ceilings, closed spaces in work spaces (dedicated desks, quiet rooms, meeting rooms, coworking offices). Protection in 2 dimensions can be in the form of a protected building, namely the roof. The roofs used are curved roofs, gable roofs, skylights and cast concrete roofs.

P13. Mystery

Figure 14. Application of the P13 Biophilic Corridor Pattern

The advantage of the co-working space design concept in Bandar Lampung is the emphasis on the P13 pattern. The application is by having biophilic corridors on the ground floor and second floor. The experience of biophilic space is felt when entering the building. Visitors are forced to walk inside a large cave filled with vegetation along the walls. On the second floor there is a biophilic corridor that surrounds the work area. Users can walk in this space to help reduce stress and boredom. The atrium on the ground floor is made in such a way that it can be explored further because it can arouse someone's feelings.

P14. Risk or Peril

Applying the P14 pattern to the outdoor atrium plaza, there is a koi fish pond whose height is lower than the atrium stairs and the road leading to the building, so visitors can see the koi pond from the top of the atrium and the road which seems dangerous if you look down. This can stimulate dopamine in the brain, thereby awakening a person's feelings. In the indoor atrium there are stairs that do not have railings so they seem a little dangerous but the railings have been replaced with taller plant pots, so that it still provides protection to users even when they are still.

4. Conclusions

The design of the co-working space building concept in Bandar Lampung aims to provide a space that can accommodate startup activists and communities so that the millennial generation can be creative, create and collaborate in creating new discoveries, especially in the startup sector, by paying attention to aspects of physical and non-physical needs in co-working space. The biophilic design approach in the co-working space design concept in Bandar Lampung is a solution to the work stress problems experienced by workers by integrating biophilic design in buildings. The application of biophilic will help increase user creativity and productivity because it has a positive impact on health. The biophilic design approach is applied to co-working space buildings through 14 biophilic design patterns through site design concepts, building mass composition, interior layout, exterior layout, structural systems and utility systems.

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