Mixed-use building concept with energy conservation approach

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Abstract. Humans have a variety of necessities of life contained in space and buildings. The mixed-use building design is an effort to unite several functions together in one building. The mixed-use building design considers the needs of the area to be designed, the surrounding environment, and the building user. The application of the concept of energy conservation in mixed-use building design aims to meet human needs and provide comfort for its users. The method used is mixed methods with observation and comparative studies with buildings that apply the concept of energy conservation. The mixed-use building concept will utilize solar panels as a passive design in the recreation zone, which can be a source of electricity in the recreation area at night. The mixed-use building models that are designed can be used to meet the principles of energy conservation that can be used in urban areas.

1. Introduction

Medan City is the Capital of North Sumatra Province which is astronomically located in 3°30' - 3°43' North Latitude and 98°35' - 98°44' East Longitude. With this position, Medan has a tropical climate with two seasons, the dry season and the rainy season. Medan City is currently experiencing rapid development, as evidenced by the number of investments that have emerged recently. This rapid development of infrastructure has resulted in many migrants coming from out of town and inside the city to carry out economic and service activities in the region. In this regard, the development of land price investment in the Medan City Region has continued to increase rapidly in the last five years. It has caused many investors to look to Medan City, even though the price is quite high, but has a very promising potential for regional development. One investment that is rife lately is the construction of mixed-use buildings.

According to Savitri (2007) [1], a mixed-use building is a multi-functional building consisting of one or several building masses that are integrated and directly related to different uses, so a mixed-use building combines residential facilities (apartments), business facilities (offices), recreational facilities (shopping centers), and usually owned by one developer.

Mixed-use Building is the approach to design that seeks to unify the various activities and functions in various parts of the city (the area is limited, the price of land is expensive, strategic location, high economic value) so that there is a complex structure in which all the usability and functionality related to each other.

According to Naufal (2017) [2], the design of the mixed-use building itself aims to provide space that can meet human needs to create comfort for its users. A mixed-use building is a combination of several functions that will be accommodated in one building. For example, Apartment and Mall functions, Mall and Hotel functions, Hotel, and Office function built on one site. The mixed-use buildings can be the best choice to reduce population density, and also mixed-use buildings can reduce heat radiation by applying the Green Architecture concept.

The name that is used in this design project is "Maimun Eco Space", which means:

- Maimun is one of the 21 sub-districts in the City of Medan, where is a downtown area that contains historic buildings in the city of Medan, namely the Istana Maimun. Maimun is one of the city centers with a large portion of the office, trade, and multi-functional service areas.
• Eco (ecology), according to Suharso, et al., (2003) [3]. Ecology is a reciprocal relationship between humans/living things and natural surroundings. The concept of ecology applies the symbol of the balance of the relationship between humans and nature.

• Space means space (both inside and outside). Space is something that has a field that can accommodate objects, humans, and the environment. The inner space can be in the form of buildings, while the outer space covers all aspects of nature, such as green open spaces, forests, house expansion, parks, and others.

So Maimun Eco Space (MES) is a building that applies the concept of reciprocity or the relationship to the environment.

2. Method
This study uses a combined research method (mixed methods) between quantitative and qualitative. The use of mixed methods research is carried out together to complement the results of the phenomenon being studied and strengthen the research analysis.

The quantitative method is carried out by measuring and analyzing aspects to measure the green architecture index. Benchmarks in determining the green architecture index of multipurpose buildings that adopt the GREENSHIP rating system measurement from GBCI are modified based on needs related to research aspects.

The data collection techniques used in this study are divided into two ways, namely observation, and documentation. In this case, the researchers used qualitative research methods. This research approach uses a descriptive approach, which describes the actual phenomena found at the time of data collection and analyzing it. After that, it evaluates the findings in the field. In line with that, the researcher will examine the implementation of the concept of green architecture, which is in line with the mixed-use buildings in the area of Brigjend Katamso street and Letjend Suprapto street, which are also roads leading to the city center.

3. Result and Discussion

3.1 Green Building Provisions
In recent years, the term Green Architecture is discussed. Many architects are interested in this concept. Along with many cases of environmental damage caused by global warming, the development does not care about the environment, even though the environment is one of the critical things for human survival. Harmony between humans and nature is needed to support the balance of the earth.

Green architecture is not just planting grass and also trees. Still, it is broader, for example, treating rainwater, utilizing sunlight to produce energy, a collaboration between buildings and outside space to create beneficial relationships between the environment, people, and buildings. Geographical conditions, climate, site, rainfall, and even natural aesthetics are considered in the concept of green architecture. Green architecture is needed to overcome environmental damage that is getting worse and in the long term or sustainable. So from the above explanation, the green architecture is very influential in human life both in the present and future.

Green Architecture is a concept that applies the principle of environmentally friendly to reduce environmental damage so that it can create a healthier environment by streamlining and optimizing existing resources. Green architecture is also called sustainable architecture. In other words, green architecture includes all matters related to the environment, people, and buildings that promote sustainable architecture to create a better environment.

The approach in green architecture is an awareness of the importance of managing existing resources to create a better environment. According to Vale and Brenda (1991) [4], the understanding of green architecture is:

• General understanding
  Green architecture is a pattern in architecture that makes the four natural bases in an interconnected environment for mutual benefit in nature. These natural elements are; air, water, fire, and earth.

• Special understanding
  Green architecture is a mindset that takes into account all the elements of nature that are on-site without damaging the environment/ecosystem.

The green architecture uses the principle of optimizing and available resources and does not adversely affect the environment, either cutting down trees and polluting water due to development. It would be better if the existence of the building can produce new energy. Green Architecture also has a sustainable nature (sustainable), which means it can survive and be able to function for period of time, because the concept is integrated with life, environmentally friendly, responding to site conditions, and others. Because green architecture is an architectural concept that will reduce all impacts on the environment, it is necessary to consider the following:
- Efficient use of energy, water, electricity, and other resources. Designed by processing existing resources and also at a lower cost.
- Protect the health and comfort of building occupants. In this design, the building occupants are employees, shop visitors, and the public.
- Reduce the use of plastic so that less waste is generated so that it can be recycled.
- Natural buildings, usually using more local building materials to support the economy of the surrounding community.
- They are reducing the environmental effects because green architecture aims to reduce the effects of ecological damage.

For that, the concept of green architecture is suitable to be applied to the Maimun Eco Space building. Because this building will be placed in the central area of Medan City; therefore, the concept of green architecture can play a role in overcoming problems that arise in urban areas.

Medan Maimun Sub-district is located in the City Center of Medan City. Therefore there are certain regulations governing the problem of buildings so that not just any structure in the area. The mixed-use building consists of recreation, office, and shopping functions. There are rules related to regional development following their tasks in the city of Medan, which on City Regulation No. 1 of 2015 concerning Buildings (2015) in Table 1 [1].

| Zone              | KDB Max | KLB Max | KDH Max | Building Height Max | Information                                                      |
|-------------------|---------|---------|---------|---------------------|-----------------------------------------------------------------|
| Trade             | 80%     | 8       | 20%     | 13 Floors / 51m     | Especially for trading types of shops and series, buildings are limited to a height of 5 floors. |
| Office            | 60%     | 6       | 20%     | 13 Floors / 51m     | For the city center and SPK in RT/RW, the KLB applies, and the height of the building can exceed the provisions as long as the building requirements are appropriate. |
| Commercial Services | 70%     | 10      | 20%     | 15 Floors / 60m     | accordance with the eligibility of building requirements for the city center and SPK in RT / RW, a maximum of 21 KLB applies as long as the building requirements are feasible. |

3.2 Application of 2 Functions in Mixed-use Building

According to “Encyclopedia of American Architecture” by William (1980) [6]. Mixed-Use Center is a complex located in the city center where there are various functions of activities including hotels, convention centers, apartments and housing, offices, shopping centers, and other cultural centers. These activities are complementary and closely related and interact with each other. Their development must have a clear and accurate role that is lifted from each function of the movement. The mixed-use building in this project is a combination of office, shopping and recreation functions.

According to Marlina (2008) [7]. An office is a place to carry out the business activities of the company. There are four types of offices, according to Manasseh & Cunliffe (1962) [8], namely:

- Commercial Office: types of offices included in this group are offices (for rent), companies (trading companies), insurance, and transportation.
- Industrial Office: the type of office that is closely related to the factory.
- Personal Office: this type of office is not built permanently, because it has not been used for a long time. Personal office is also an office built in small capital.
- Government Office: this office is an ordinary business in the form of an Institution. They usually use this office
for a long time.
A Shop is a place used for buying and selling/trading. This place is also called a commercial building because there are shops that sell various necessities.
Based on the physical form, there are seven types of shopping centers according to Nadine, Beddington (1982) [9], namely:
- Shopping Street: buying and selling areas that line the road.
- Shopping Center: shopping complex consisting of Yoko's booth that is rented or sold.
- Percent Shopping: Shopping complex, which is at the front of the stand (buying and selling area) facing an open space that is free of all kinds of vehicles.
- Department Store: is a considerable buying and selling area, usually consisting of several floors that sell a variety of items, including clothing.
- Supermarket: is a trading area that sells daily necessities with a self-service system, and the food sales area does not exceed 15% of the entire sales area.
Recreational facilities are significant in mixed-use buildings. The function of recreational facilities is as a place to rest or refresh the mind. Based on the nature of its activities, there are four types, namely:
- Entertainment/preferences: restaurants, cafeterias, snack bars.
- Amusement/fun: cinema, night club, art gallery, ballroom, concert.
- Recreation/playing: bowling, billiards, wildlife parks, games.
- Relaxation: city parks, swimming pools, yacht clubs, cottage beaches.
### 3.2.1 Rental Office

Types of activities carried out in the rental office as well as the space requirements are shown in Table 2.

| User                        | Activity                                                                 | Space Needs                                                                 |
|-----------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------|
| General Manager             | Come, work, administration, receive guests, meet, eat and drink, worship, metabolism. | Parking manager, entrance hall, GM room, living room, meeting room, cafe, restaurant, food court, pantry, mosque, lavatory. |
| GM's Secretary              | Come, work, administration, receive guests, meet, eat and drink, worship, metabolism. | Parking manager, entrance hall, sec room, living room, meeting room, cafe, restaurant, food court, pantry, mosque, lavatory. |
| Marketing Manager           | Come, work, administration, receive guests, meet, eat and drink, worship, metabolism. | Parking manager, entrance hall, MM room, living room, meeting room, cafe, restaurant, food court, pantry, mosque, lavatory. |
| Marketing Staff             | Come, work, administration, receive guests, meet, eat and drink, worship, metabolism. | Parking manager, entrance hall, marketing staff room, living room, meeting room, cafe, restaurant, food court, pantry, mosque, lavatory. |
| Accounting Manager          | Come, work, administration, receive guests, meet, eat and drink, worship, metabolism. | Parking manager, entrance hall, Accounting staff room, living room, meeting room, cafe, restaurant, food court, pantry, mosque, lavatory. |
| Chief Engineering (Utilities, MEE) | Come, work, administration, receive guests, meet, eat and drink, worship, metabolism. | Parking manager, entrance hall, staff room, living room, meeting room, cafe, restaurant, food court, pantry, mosque, lavatory. |
| Security                    | Come, work, administration, receive guests, meet, eat and drink, worship, metabolism. | Parking manager, entrance hall, security room, living room, meeting room, cafe, restaurant, food court, pantry, mosque, lavatory. |
| Security Staff              | Come in, change work clothes, store personal belongings, eat and drink, rest, worship, metabolism. | Parking manager, entrance hall, locker room, warehouse, canteen, cafe, food court, pantry, break room, prayer room |
3.2.2 Mall / Shops

There are several types of activities carried out at the Mall as well as the space requirement, in Table 3.

| User                  | Activity                                      | Space Needs                                      |
|-----------------------|-----------------------------------------------|--------------------------------------------------|
| Tenants/traders       | Come drop off merchandise, trade, packing/shipping, save bank transactions, eat and drink, worship, metabolism, rest. | Merchant parking, entrance, loading dock, retail/kiosk, shipping service, ATM, canteen, food court, mosque, lavatory. |
| Visitors              | Come looking for information, buy goods, send goods, take money, eat and drink, worship, metabolism, relax. | Parking, entrance, kiosk/retail, waiting room, ATM, canteen, food court, mosque, lavatory. |
| Employees/officers    | Coming, changing clothes, working, storing equipment, eating and drinking, worshipping, storing cleaning equipment, metabolism | Parking, changing rooms, workspace, security room, security room, warehouse, canteen, pantry, prayer room, janitor, lavatory. |

| User                  | Activity                                      | Space Needs                                      |
|-----------------------|-----------------------------------------------|--------------------------------------------------|
| Visitors              |                                               |                                                  |
| Employees/officers    |                                               |                                                  |

3.3 Analysis and Application of Themes

Green architecture is often associated with sustainable architecture. It is an applied concept that supports the preservation of the environment and existing resources. So that it lasts longer in the human environment, such as agriculture, industry, and also architecture.

Architectural indications are said to be "Green" when using renewable resources, using plant techniques as roofing materials, using plants as rainfed, using water as additional energy, using the sun as natural lighting, and using natural air systems.

There are regulations that are the benchmarks for green building in Indonesia. According to GBC, Indonesia issued a rating system called GREENS. GREENS are prepared and compiled by the Green Building Council Indonesia by considering the conditions, natural character, regulations, and standards that apply in Indonesia. According to GBC Indonesia (2016) [10], Currently has issued five types of GREENSHIP, namely:

a. Efficient Land Use

Medan City is the center of the city used as a business district, specifically the Brigjend Katamso street and Letjend Suprapto street. For that many buildings that have just were built without regard to green open spaces, there are parking lots and others. The Maimun Eco Space Development Project to be able problems related to the site, to use existing land effectively and efficiently. Maimun Eco Space will leave 10% of the total land area used as green open space. Green public spaces that open not only contain landscapes but more complicated things like green roofs. There are many benefits of using this green roof, namely that it can absorb heat during the day, because sunlight is not absorbed by the concrete, and has a high aesthetic. The development of the Maimun Eco Space with mixed functions is not built parallel. Even so, this construction was built in the same building, namely the podium as a mall area and the tower as an office area. This aims to make the existing sites circulate, given the limited land area. Some of the above actions are a form of effective and efficient land use. Also, Maimun Eco space development also considers the urban spatial regulations that apply in the area.

b. Energy Efficiency

Light becomes one of the crucial things in human life, with the light we can see objects around us. The Source of light is two, namely natural and artificial. Naturally sourced from the sun while made from lamps. In constructing buildings, there are aspects that need attention, one of which is energy-saving. Also, no one wants to pay electricity at high prices. For that, we need a variety of ways to cope with the need for sizeable electrical energy.

- Solar cell is additional energy on the side of the building where it is more exposed to sunlight.

According to Tamiami Fachrudin, H (2020) [11], Energy efficiency is one of the green building principles. Energy conservation can be made by utilizing natural resources such as wind and sunlight using solar panels.
c. Material Efficiency

Using green building material is one of the sustainable design construction and operation strategies. Therefore the use of elements in the Maimun Eco space project will increase the use of environmentally friendly materials, so as not to damage the environment. The materials used are like choosing approved wood, fabrication materials, and local materials. By the concept of using green architecture, for that, the materials used are environmentally friendly such as glass in the facade of the building. This is needed for energy savings in the building during the day. Using this red brick material needs maintenance and is not painted anymore.

d. Water Treatment Efficiency

To overcome the rampant water pollution occurring in the city of Medan is to do the management of liquid waste before being discharged into the environment can improve the quality of liquid waste that exceeds the quality standards set by the Decree of the Minister of Environment No. 58 of (1995) [13, 14]. The management of liquid waste aims to reduce the content of materials polluting liquid waste to obtain effluents that can be accepted by water bodies. This water pollutant content will be reduced if the management of liquid waste is following existing
regulations.

e. The Efficiency of Accessibility and Circulation

According to Pynkawati (2014) [15, 16], to construct a building, the main concern is access to the building. Try not to make inbound access on roads that have the potential for congestion but instead make access to the driveway. This aims to save time and make it easier for visitors to reach them. Make entry access with three types, namely the entrance of private vehicles, the entrance of public vehicles, and the pedestrian entrance.

4. Conclusion

Constructing a building must be following all existing conditions, including climate problems such as high rainfall, excessive heat, pollution problems such as vehicle fumes, social issues such as population density and stress levels, traffic problems such as traffic jams and with the presence of Maimun Eco-space, which applies the theme of green architecture answers all of the issues that exist in that location with a well-prepared design that follows the existing requirements.

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