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The Ecological Architecture Approach Analysis at Kusuma Agrotourism Resort & Convention Hotel

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ABSTRACT
Resort areas are popular recreational destinations for urban populations, but rapid urban development often leads to significant environmental degradation in these areas. This degradation is evidenced by the decline in water, air, and soil quality, the extinction of local flora and fauna, and the destruction of natural ecosystems. As a response, the application of ecological architecture has become essential in designing and constructing city facilities, including resorts, to mitigate environmental damage. This study aims to examine the implementation of various principles of ecological architecture in resort areas and identify sustainable materials suitable for such applications. A qualitative descriptive method is employed, combining literature reviews and field observations to analyze the integration of ecological architectural principles in the resort area. The findings reveal that key principles such as the use of local materials, energy-efficient systems, and environmental management strategies have been applied. However, the study also highlights areas where improvements can be made to better preserve the ecosystem and minimize the negative impacts of architectural design.

Introduction

The many needs and desires of humans today impact human awareness of the state of the environment, and the quality of the environment that has been damaged can directly threaten the sustainability of the ecosystem (Adla et al., 2022; Ahmad et al., 2022; Mondal & Palit, 2022). Environmental damage also causes natural disasters, characterized by a decrease in the quality of water, soil, and even air, as well as the extinction of wild plants and animals and the destruction of natural ecosystems. Conditions where the human population is increasing, accompanied by technological advances, indirectly lead to exploiting natural resources, which can hurt nature and the surrounding environment.

Architecture is a field of science considered influential for environmental damage today. Architectural ecology is one of the concepts that have developed and become a reference in architecture (Chen, 2021; Sommese et al., 2022). The concept teaches about the interdependent relationship between living things and their environment (Frick & Bambang, 2007). According to

(Ryn & Cowan, 2007) An area can be said to be ecological or not after going through a series of assessments or analysis based on the principles of ecological design applied to the building (Adi, 2017; Utami et al., 2017).

This research takes the case study object of Resort buildings and hotels to analyze the application of the principles of ecological architecture concepts in their design. It is hoped that the research of the resort area with an ecological architecture approach can overcome and reduce the adverse effects that impact the environment due to improper architectural design.

Ecological architecture aims to design buildings that conserve natural resources and reduce the impact of global warming by understanding the behaviour of nature. The main goal is to create an ecological design. Ecological architecture is the concept of environmental management that utilizes and maintains the potential or natural resources and utilizes technology based on environmentally friendly management Sidik and Daniel, (2017).

"Ecological architecture" is creating ecological buildings by using natural energy sources and minimizing the negative effects caused by building construction (Mahardika & Widji, 2013). According to Heinz Frick in Muslim et al., (2019) ecological architecture is the harmony between buildings and their natural environment or often referred to as environmentally friendly architecture.

On a broader scope, Cowan and Ryn in Adi, (2018) suggest the principles of ecological architectural design are as follows; 1) SolutionqGrows fromqPlace, namely the solution of design problems that must come from the environment where the architecture is built. The principle utilizes the potential and resources of the environment to overcome every design problem. 2) Ecological Accounting Informs Design is an ecological accounting that seeks to minimize environmental impacts. 3) Design with Nature is architecture that is part of nature. Every architectural design must be able to maintain the ecosystem of its environment so as not to have an impact on the destruction of the surrounding environment. 4) Everyone is a Designer, which involves every party involved in the design process. No one acts as producer or participant only or designer/architect only. Everyone is a participant designer. 5) Make Nature Visible is a cyclical process of natural processes. Architecture should also be able to perform these processes so as to minimize the waste produced.

According to Hui in (Titisari E, Joko T, & Noviani, 2012), complementing the principles mentioned above by proposing the principle of understanding people which seeks to understand the context of culture, religion, race, behavior, and customs of the community that will be accommodated by architecture. Hui's other principles are Understanding Place, Connecting with Nature, understanding natural Processes, understanding environmental impact, and embracing co-creativeaDesignaProcesses.

Based on the opinions of experts Frick, Widig and Metalinaou in Utami et al. (2018) about the Ecological Architecture, which consists of; 1) Conservation of natural resources, which is Conservation of natural resources, which is achieved by the criteria of providing a lot of open space to maintain the presence of trees. 2) The use of energy-efficient building systems, the use of which in this case aims to maximize the use of natural resources, especially sunlight and wind. 3) Using local materials, i.e. the use of materials that are available and safe and healthy in various parts of the area, and demonstrating the use of local materials in various parts of the building. 4) Minimizing negative effects on nature, aiming to reduce air, water and soil pollution. 5) Increase the absorption of exhaust gases, i.e. exhaust gases can be absorbed by the presence of natural components, namely trees. Not only absorbing, the presence of trees can also produce oxygen to produce better air quality. 6) Using

technology with consideration of ecological values that aims to minimize negative impacts on nature and to save energy. This principle seeks to use technology in waste treatment.

The components of Ecological Architecture are; 1) The configuration of the building form is the point of contact between building masses and spaces. Shape is an inclusive term that has several meanings. It can refer to an external take that can be recognized (Ching, 2008). 2) Building orientation. According to Wijaya in (Tyas, Fairuz, Annisa, & Suci, 2015). Sunlight will provide heat to all areas of the building that face towards it. Solar radiation can affect the building. The sun causes heat and glare effects that can be disturbing. 3) Facades and Openings. A good building facade is facing north and south because to get good lighting, the openings found on the facade also face north or south so that they are not exposed to too much sunlight. 4) Energy Sources are everything that produces energy around us. Energy consumed is the energy we use and utilize in everyday life. 5) Environmental Control is a condition of how we manage and maintain the environment from damage caused by human existence. It can be seen from the presence of air, water and air pollution. 6) Material Source, with the use of local materials it will be more efficient to bring in the material 7) The site is a piece of land of a certain size whose shape is very influential in designing buildings so as not to have an impact on the environment around the site. This application aims to study and produce designs that can preserve natural resources and can minimize adverse impacts on nature and the surrounding environment.

This study focuses on implementing ecological architecture in resort developments, specifically at Kusuma Agrotourism Resort & Convention Hotel. Although the principles of ecological architecture are generally understood, their practical application in resort areas, which are often characterized by large building footprints and significant tourist activities, presents unique challenges. While previous research has explored the general benefits of ecological architecture, focusing specifically on its application in resort areas where environmental impacts are often magnified due to high human activity is necessary. The primary issue this research addresses is how effectively ecological architectural principles are implemented in the design of resort facilities to mitigate environmental damage and ensure long-term sustainability. Furthermore, detailed studies on which specific materials and technologies are best suited for ecological architecture in resort areas are lacking. This research aims to evaluate the application of ecological architecture principles at Kusuma Agrotourism Resort, identify the specific materials and designs that support sustainable practices, and assess the effectiveness of these measures in preserving the local ecosystem.

Materials and Methods

This research uses a qualitative descriptive approach. Qualitative descriptive research describes or produces a situation according to the facts and what it is (Nawawi & Martini, 1996). The method used is a case study. The object of research was observed through literature studies and field studies. The literature study is intended to learn about the ecological architecture components implemented at Kusuma Agrotourism Resort & Convention Hotel. In contrast, the field study aims to obtain data and documentation on the object directly. This research process will be carried out in several stages, namely: data retrieval stage, data collection stage, data analysis stage, and conclusion drawing stage.

Results and Discussions

Ecological architecture can be defined as the integration of local ecological conditions, macro and microclimate, site conditions, building schemes, climate-responsive systems, low energy consumption, provision of vegetation and natural ventilation (Yeang, 2006). There are three levels of integration, namely: the first level is physical integration, which includes soil conditions, topography, vegetation, climate, etc.; the second level is system integration with natural processes, including water use, waste treatment, exhaust systems and heat dissipation from buildings; third level: sustainable utilization of natural resources. The architectural concept used in the design of the Kusuma Agro-tourism Resort & Convention Hotel building is in accordance with the principles of ecological architecture.

The six principles of ecological architecture in the design process can be implemented by conserving natural resources, using energy-efficient building systems, using local materials, minimizing the harmful effects of nature, increasing the absorption of waste gases and using environmentally friendly technology. From the various principles viz;

1. Environmental Conservation

Environmental conservation is an effort to provide protection to nature in order to maintain the balance of its ecosystem. The principle of environmental conservation is applied by increasing water catchment areas and green open spaces.

Figure 1 Resort Building Mass

Source: Personal Documentation

From the existing case study, it can be concluded that the site's mass placement consists of several buildings that are not integrated between masses, which creates more green space for surrounding plants. Expanding the water catchment area with buildings with tropical building configurations can maximize natural resources such as airflow and light entering the room.

2. Air, Water and Soil Management

The management of air, water, and soil in the Kusuma Agrowisata Resort & Convention Hotel area is done by creating several large green open spaces so that trees can grow better and produce an abundant supply of clean air.

Figure 2 Vegetation Between Roads

Source: Personal Documentation

To maximize tree growth along the road, it is better to use pavement that can absorb some water into the soil, such as a material with paving blocks arranged with a small gap so that water can still enter the soil. To maintain the soil, trash cans and cigarette bins should be placed every few meters so that the soil is not contaminated with scattered garbage, which can lead to decreased soil fertility.

Figure 3 Ground Contour

Source: Personal Documentation

From the research, it can be concluded that this is what happens in the management of air, water, and soil, namely by managing the area properly. As with land management in development, by following the contour of land so that there is no filling and dumping of land on the site, always maintaining soil quality by not polluting the soil with garbage, in water management providing free

space without hardening so that water can still flow into the ground, in air management there is open space so that trees and plants grow more fertile so that they can produce fresh air.

3. Using Energy Efficient Building Systems

Energy-efficient design is one of the principles of ecological architecture. Energy-efficient systems aim to utilize renewable natural resources to reduce energy use as much as possible. Kusuma Agrowisata Resort & Convention Hotel area applies the concept of energy-efficient buildings, which can be seen from the application of facades and openings that are very wide so that sunlight can enter and illuminate the entire room in the building.

Figure 4 Hotel Facade

Source: Personal Documentation

From the existing case study, it can be concluded that the facade application is very much considered with the tropical climate in Indonesia, where the climate sometimes provides quite hot weather and rain accompanied by quite heavy winds. Hence, it is necessary to apply a facade design that applies teritisan and openings to resolve problems in the tropical climate effectively.

4. Using Local Materials

The essential element in a building is the use of materials. Building materials closely relate to ecological architecture, emphasizing environmental friendliness and energy savings. Before building materials can be used in ecological architecture, criteria must be met. The materials used in this resort have been selected based on the principles of ecological architecture.

The primary material used in this building mass is ironwood taken directly from Kalimantan. This material's selection is considered vital in facing various weather conditions in the Kusuma Agrowisata Resort & Convention Hotel area, and it also indirectly reduces carbon pollution compared to concrete materials.

Figure 5 Resort Building Facade

Source: Personal Documentation

From the existing case studies, it can be concluded that the materials used significantly influence the environment. These materials are environmentally friendly and highly durable. Therefore, selecting the above materials is expected to reduce the impact of environmental damage and be in harmony with the surrounding natural conditions.

5. Minimizing adverse impacts on nature

Waste treatment is carried out effectively to reduce the negative impact on the Kusuma Agrotourism Resort & Convention Hotel area. In waste management, waste is divided into 2 types, namely organic and inorganic waste. Organic waste management in the case study is used as compost, which is helpful in agro-tourism. Meanwhile, inorganic waste is managed with the local government to be directed to a landfill near the area. In addition, waste that can be recycled into crafts can be directed to the surrounding community to reduce environmental pollution.

6. Use of Environmentally Friendly Technology

The use of technology in the Kusuma Agrowisata Resort & Convention Hotel area is to use eco-standard room coolers, which can save much electrical energy so that energy consumption can be reduced and indirectly can also reduce the exhaust gas produced by the generator.

Figure 6 Hotel Interior

Source: Personal Documentation

The placement of space is arranged effectively and adjusted to its function so that the space obtained is more effective and efficient and can optimize the area and function of the building to the maximum. From the case study on kusuma agro-tourism, it can be concluded that the use of technology that considers ecological values can reduce the negative impact on nature. The use of LED lights is considered more efficient than ordinary lights due to the use of LED lights that are more power efficient with the same brightness. In addition, using eco-standard air conditioners is also a consideration because it reduces damage to the ozone layer in the atmosphere due to freon pollution in air conditioners. Therefore, the selection of the right technology is very influential on the implementation of the concept of ecological architecture.

Conclusion

The conclusion is based on the research that has been done. Namely, the right mass arrangement can create effective green open space, which is one of the applications of the principle of maintaining natural resources at the resort. Furthermore, in the management of water, air, and soil, it is important to carry out management in this resort area properly. Minimizing the energy used is emphasized in the shape of the facade and openings; the shape of the facade is adapted to the climate. In addition to using local materials that play an important role in reducing emissions from buildings, waste management is also very influential in ecological architecture, as it separates organic and inorganic waste. In the absorption of exhaust gases in the case study, various kinds of trees are planted around the building mass so that the incoming air can be well filtered. In using electronic technology, the case study applies eco-standard technology to reduce carbon emissions that are harmful to the environment.

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