**THE DEVELOPMENT OF ECO-ARCHITECTURE CONCEPT
FOR ENVIRONMENTALLY RESPONSIVE IN TROPICAL CLIMATE**

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ABSTRACT

Global warming is the impact of environmental degradation is the increasing average temperature of the earth's surface, including the atmosphere and the ocean. Architecture is the study of the reflection of human settlements with its surroundings so that it has a tendency to adapt to the environment through a variety of approaches in architectural design method is oriented to the environmentally friendly development. Architectural Ecology concept is the concept of building that takes into account the environmental balance of natural and man-made with the main elements, the building and the environment. Academically, awareness of architecture students need to be directed to the development process-based ecological both quality and quantity. A discussion of the concept of eco-architecture useful for studying the ecology-based architectural design methods, identify potential and constraints of the tropical climate in the design development strategies that can be systematised as a learning method in the design of sustainable development. Method of discussion by comparing the theoretical analysis method browse through relevant precedent studies to determine the potential and environmental constraints as well as perceptions of the application of the concept of eco Architecture. The results were obtained from the study of theory Architectural Ecology of Heinz Frick and study precedent through the works of Kenneth Yeang and compared with traditional architecture. Summary of the second groove will be used as the draft approaches design strategies in the process of planning and designing environmentally friendly and can be recommended and implemented as a design methodology in learning to achieve sustainable development with an emphasis on quality local development in harmony with nature.

Keywords: *Eco architecture, Sustainable environment.*

1. INTRODUCTION

1.1. Back ground

At the first architecture is a part of nature, that the architecture grew out of the material and the natural environment with the small intervention of science of architecture. With the increasing number of humans and the depletion of certain natural ingredients through science and technology development for human needs, are running low natural resources, becomes damaged. Architectural remains a part of nature as far as an architectural real still on earth and become part of a place (site) a particular environment above ground level issues of society, culture and the environment as well as how to achieve or produce works of contemporary architecture that pressure is no

longer just the technology and exploitation of nature, the concepts was born from the fusion of knowledge that can be used for the consideration of the design concept is different from the issue of the 20th century are still being developed by most architects.

A. Problem statement

1. How to anticipate the environmental damage caused by development
2. How to introduce and developing of eco-architecture concept in learning

B. Purpose of study

1. The students can be understand of the natural architecture with as the Eco Architecture concept
2. understanding about building materials environmentally friendly

II. THEORY

II.1. Architectural environment

Environment is everything that is around us, an infinite space in which we live and where various sources of the environment itself. Broadly can also be interpreted as all the things we feel and see or hear around us, and have a relationship with the human psyche. While the architecture is all kinds of development that was originally done to change the physical environment and adapt them to the schemes and the particular procedure with a greater emphasis on socio-cultural elements (Amos rapoport). Culture is influenced by beliefs, religious, and social. As a result of man's work is influenced by the circumstances for arsitektur ,geography, geology and climate will also determine the physical form of a building.

Based on the environmental occurrence can be divided into :

1. Natural Environment

- biotic (biological): Elements such biological environment consisting of all living things that are on earth. Like humans, animals, plants, and microorganisms. Plants obtain nutrients from microorganisms, plants eaten by animals and humans, animals and people die and are broken down by microorganisms into nutrients.
- A biotic, Non Biological: Physical components, chemical (soil, water, air, sunlight, climate), as medium For life Each element has the power and dynamic, which forms the

natural environment surrounding environment kita. Elemen the process of life and interconnected.

2. Artificial Environment (Built Environment)

- Facility Services Industry –

Public Facilities (social facilities)

- Environment Facility (physical / infrastructure)

- Facility dwelling

Components in the artificial environment continues to change, because of human activities that are dynamic. Human activities changing of nature if not designed properly will give a negative impact on human and nature. Design to be need understand of environment that has a different character, but mutually influence that natural and artificial environment can not be separated (Golany, 1995)

II.2. Ecology.

thousands of years for ecological processes to mature, for example, for all the successional stages of Ecology is the scientific study of the relation of living organisms with each other and their surroundings. Earth has many kinds of living things, from plants and animals that are very complex to simple organisms such as fungi, amoebae and bacteria. Nevertheless all living beings without exception, can not live alone. Each depends on the other living beings or inanimate objects around him. Ecology is a sub-discipline of biology, the study of life. The word "ecology" ("oekologie") was coined in 1866 by the German scientist Ernst Haeckel (1834–1919). Haeckel was a zoologist, artist, writer, and later in life a professor of comparative anatomy. Ecology is as Biodiversity in the full-scale of life and its processes, including genes, species and ecosystems forming lineages that integrate into a complex and regenerative spatial arrangement of types, forms, and interactions.

Ecosystems are confronted with natural environmental variations both over time and by differences between locations. The variations occur over vastly different ranges in terms of magnitudes as well as distances and time periods. It can take a forest. The area of an ecosystem can vary greatly from tiny to vast. A single tree is of little consequence to the classification of a forest ecosystem, but critically relevant to the smaller organisms living in and on it. Several generations of an aphid population can exist over the lifespan of a single leaf. Each of those aphids, in turn, support diverse bacterial communities. Fine scale structure of aphid populations can be constrained by influences from the

growth of the tree, that is related to site specific variables, such as soil type, moisture content, slope of the land, and forest canopy closure, all phenomena on a much larger scale than the world of the aphid community. Likewise, finer scale dynamics operating in the aphid populations can impart influence on tree growth rates, i.e. influences from the small to the big. The scale of ecological dynamics can operate as a closed island with respect to local site variables, such as aphids migrating on a tree, while at the same time remain open with regard to broader scale influences, such as atmosphere or climate. Hence, ecologists have devised means of hierarchically classifying ecosystems by analyzing data collected from finer scale units, such as vegetation associations, climate, and soil types, and integrate this information to identify larger emergent patterns of uniform organization and processes that operate on regional, local, and chronological scales. By learning the ecology imply help in understanding how abiotic environment affect the biotic. It also can help to estimate or predict the impact of environmental problems such as acid rain or greenhouse effect.

II.2.1. Ecosystems

Ecosystems are defined by a web, community, or network of individuals that arrange into a self-organized and complex hierarchy of pattern and process. Ecosystems are formed of an abiotic community environment such as climate, soil, water, air, nutrients and energy. Rotation of energy is as the flow of energy that form or that have no effect on an ecosystem into six main elements are:

1. Sun
2. Anorganic Materials
3. Manufacturers
4. First Consumers
5. Second Consumers
6. Decomposers.

The sun provides the energy that is almost required all produsen to make food. Produsen consists of green plants such as grasses and trees make food through photosynthesis. Plants also need abiotic materials such as water and phosphorus to grow. Decomposers such as fungi and bacteria, destroy plants and animals that have died into simple nutrients. The nutrients back into the soil and reused by the plant. This level is known as the food chain. In natural ecosystems are not disturbed amount of phosphorus is fixed, but when an ecosystem disrupted mainly by human activities, such

as when humans change the forest into agricultural land for the construction of phosphorus usually leak out. This will reduce the ability of ecosystems to support plant life. In the absence of forest that protects the rainy season phosphorus drift along the ground and swept into a river or lake. Keadaan affects the growth of algae causing pendakalan rivers and lakes resulting in flooding.

II.5.Environmental Friendly Material Utilization

II.5.1. Bambo

Bamboo is one of the oldest building materials and is very versatile with many applications in the field of building construction, especially in developing countries. Bamboo grows abundantly throughout the Indonesian archipelago, and has become part of Indonesian society for centuries. Rapid growth of bamboo to make bamboo as a sustainable resource. Bamboo is a strong, lightweight material and can often be used without processing or finishing. Bamboo construction is easy to construct, resistant to earthquake forces, and easily repaired if damage occurs. Timber resources is reduced by the restrictions imposed on logging in natural forests, especially in the tropics, has focused world attention on the need to identify replacement materials that can Replaces, environmentally friendly and can be used widely.

The existence of an increasingly scarce wood for wood utilization past massive, while the growth of the wood to be used as construction material so long to reach 40 years in comparison with bamboo which is only about 3 to 5 years. With rapid growth, good adaptability to most climatic conditions and soil conditions, bamboo emerged as a very suitable alternative. However, in order to fully utilize the potential of bamboo as a construction material, development efforts should be directed to its preservation. Utilization of lands that are less productive for growing bamboo is an attempt to preserve the bamboo. With the extensive use of bamboo structures in the field, the circulation where bamboo can support the economy of the people and provide a positive impact on the environment

II.5.2.The role of bamboo in environmental restoration

Bamboo stalks can be harvested every year after 3 to 5 years, compared to 30 to 50 years for the trees. With a 10-30% annual increase in biomas compared to 2-5% for trees, bamboo can yield 20 times more timber than trees on the same area. Bamboo can be selectively harvested annually and give birth without replanting. Bamboo produces 30% more oxygen than trees. This helps reduce carbon dioxide gases that cause global

warming. Bamboo clump can absorb carbon dioxide and 12 tons per hectare, which is the bamboo chargers efficient fresh air. Bamboo is a natural water flow barrier, because the wide-spread root system, bamboo greatly reduces rain runoff, prevent soil erosion massive and make twice as much water in watersheds .Bambu help reduce water pollution due to high nitrogen consumption , so it is a solution for excess nutrient uptake of wastewater from agriculture, manufacturing, farming, and sewage treatment.

III. PEMBAHASAN

I.Eko-Arsitektur

There are two currents that affect human life; engineering experience and natural. Techniques arise where there is a shortage due to biological processes that late or take too long. But excessive use of techniques that result in a critical condition in relation to biology, psychology and ecology. This is where the role of ecological architecture with attention to the influence of alternative development, bionics (engineering and construction biologic), climatic and local conditions as well as biological development, so be a link between humans and their environment as a whole.

Architectural study of the reflection of human settlements with the surrounding environment Through the architecture planning architecture has a tendency to adapt to the environment is based on the utilization of nature and the use of materials that exist in the local area or location. As the tropical areas of Architecture and development should also consider and develop new alternatives on utilizing alternative abundant sunshine and anticipating temperatures and high rainfall.

II.Eco- architecture as Naturalism.

According Frick.H (1998), an architecture quality can be judged from the relationship between the real architecture.Architectural works that can improve the quality of human life of the inhabitants, it means that the architecture of quality eco-architecture.

Aspects that determine the quality of eco-architecture (Frick, H1998: 17-29)

- 1.Understand the task of architects and architectural quality
2. Understand humans view of the house (the world and the natural environment) as occupancy.
3. Understand of the building as three human skin.

4. Premise or hypothesis that the system of human life and the environment that determines quality (including the quality of its architecture)

Architects must know how the human view of the harmony of the building users "small world" and the "big world" (macro-cosmos) and rites are held to neutralizes if there is an unbalance between forward. This means that such awareness will only be apparent in traditional societies, where the natural environment is still very closely connected with human. What as human behavior, will result in ugliness on the environment and then also of human. Such a view is also found in humans today,

II. Folk building

Traditional architecture known to be highly responsive to nature. Works of architecture in the past and at present much inspired by Folk architecture. As folk architecture, traditional building is the result of a particular culture and community (civilization). Its construction is based on the knowledge of the techniques and experience and, usually built their own (possibly assisted by the family, relatives, or craftsman in his tribe). Traditional structure is easy to learn and understand. Made of local materials and in line with ecology, which according to the local climate, flora, fauna and life patterns. Thus, traditional buildings have compatibility with the environment and human.

A. climate aspects in traditional Minangkabau

Nature is a source of customs and beliefs as well as the architecture of Minangkabau society is heavily influenced by the climate and environment. Part west Bukit Barisan always influenced by the sea breeze all year round temperate humid with temperatures between 22 ° C and 32 ° C, with rainfall of 2,289 mm per year. Overall these areas including the environment humid tropical climate overall shape of the Tower House can explain his relationship with the climate and local conditions.

B.The form and structure

House Tower shaped stage with a height of about one or two meters above ground level. The room under the floor covered bamboo that serves as an enclosure. Tower House vault or cage is made high so that air can flow to provide the air is fresh, especially in the summer, in addition also make it more secure in the face of the danger of flooding. The outside walls are enlarged to the roof of the Tower House called Silek handy during the rainy season, given the climate in Indonesia has a high rainfall. The walls are shaped like this serves to liberate the building from exposure to rainwater. The roof is a pointed useful to free water deposits on the fibers are layered because that way no matter how heavy rains, the water will slide quickly on its roof. In addition, the Tower House were relatively resistant to the earthquake or high winds caused by foundations that are not planted into the earth.

C.Aspects Material available

Materials are available in the Minangkabau region is a kind of wood that grows tropical forest such as meranti, wood Kalek, fowl, paniang, banio, bapati, incense, rattan, manau, surian, Razak. In addition, there are also bamboo wood and of palm fiber.

Material provided that has an influence on the materials used in the House Tower. In the original House Tower, the floor is not made of wood, but made of bamboo were broken up and leveled called palupuah. So do not use nails in the installation but only using the cane that has been cut to bind so that the floor can not be separated. Poles or columns

made of solid wood. To use a password or foundation stone flat surface. Roof made of palm fiber. While the attic is a space between the floor and roof of the building, usually made of wood or board that is not flat. Limited available materials, will have an impact on construction techniques, as well as the structure and construction.

III.3. Mesiniaga Tower

When the IBM headquarter Mesiniaga Tower , situated in Subang Jaya near Kuala Lumpur, was erected in the summer of 1992 iv , its architect Ken Yeang had the terms energy-saving, climate-consciousness and occupancy comfort realized in built form. IBM approached Ken Yeang's firm, T.R. Hamzah and Yeang, and asked them to design a building which was a showcase for the firm's high-tech corporate image i . Yeang designed the building but added his ideas and principles of a "bioclimatic skyscraper" which gave IBM a progressive and environmentally responsible image that proved so valuable that it actually increased surrounding land value ii .

Subang Jaya Kuala Lumpur Malaysia. Having a tropical climate. All year round temperatures, heat and humidity are almost the same throughout the year. With the temperature difference during the day and the night temperature is relatively little difference

Mesiniaga Tower is built on the concept of a Malaysian traditional building which evolved into modern principles.

III.3.1.. ENVIRONMENTAL DESIGN STRATEGIES:

"The bioclimatic high-rise is a tall building with passive low energy benefits, achieved through design responses to the climate of the place and through optimizing the use of the locality's ambient energies, to enhance the quality of life and comfort for its occupants." The noticeable building features of the IBM tower not only visually define the high-tech style of the company and its conceptual organic disposition, but also define it as bioclimatic high-rise.

First, the building's general form, structural strategy, component cores, glazed surfaces, is oriented for maximum environmental efficiency shading against direct overheating but allowing for natural daylight.

Second, where the main components of the building and its orientation cannot shade the building, ingeniously calculated shading devices are installed on the building face for passive cooling. Finally, the extension of the land that begins at the sloped berm spirals up the height of the building with planted terraces that culminates at the inhabited rooftop. These terraces not only provide for vertical gardens and transitional spaces, but also shades and ventilates the building. These major innovations in form, envelope and regional adaptations to the typical skyscraper indicated that Yeang's work was at the leading edge of the then contemporary architecture at the time ecological design was at its organizational infancy.

II.3.2.The idea and concepts for Mesiniaga Tower

- Extensive gardens serve as countryside
- Landscape vertical spiral can improve the microclimate in the building and can absorb carbon dioxide and monoxide pollution in buildings.
- Window in the East and the West hidden and shady
- The curtain wall of glass in North and South
- Hot Side - East with a single service core toilets, stairs and enter the ventilation of sunlight
- Spiral balcony at an exterior wall with a sliding door to the office interior

The concept of this building is utilizing solar energy as much as possible in some parts of tropical climate have sunlight that illuminates the whole 12 hours, so that utilization can be useful for the building, of course, with use some of the techniques , such as use of sun shading to regulate how much daylight that it applied in the room. landscaping processing, in the form of a spiral wrapped around the park from the bottom to the top of the building. Landscape This vertical functioning as an evaporative cooler in order to obtain thermal comfort (the environment around the building to be not too hot), the application of vegetation on the strategy of this landscape while providing imagery of the areas inside and the inner walls outside, also will minimize the reflection of heat and sunlight. In addition vertical landscaping can improve the microclimate in the building and can absorb carbon dioxide and monoxide pollution in building.if applications of these buildings was applied to the tropics it is expected to be buildings that are responsive to the environment, according to the tropical climate and does not harm the building or the surrounding environment.

A. Building Orientation

building design with attention to a lot of openings to minimize the use of lights during the day with natural light. Set the building orientation to maximize sunlight into the room.

Axonometrics: (Left to Right) Built form, Planting & sky gardens, Solar orientation, Sliding devices

The exposed steel and reinforced concrete structure can be conceived of as an exoskeleton that is suspending the differently shaped office floors with each floor's main girders connecting to the concrete core for shear resistance. Where the general rule of thumb for buildings in colder regions is 'skin outside, structure inside', the tropical climate may have an exposed structure without adverse temperature effects. In fact, the structure that wraps around the curtain wall shields the sun off the building face and act as a heat sink iv . Of course, in a tropical climate where winter temperatures hover in the high twenties to low thirties, it is useful to minimize heat absorption. Therefore, the steel columns are clad with stainless steel to reflect the sun, and the entirely exposed columns and beams are open to cross ventilated cooling.

The majority of the building's double-glazed, operable curtain walls lie flush to the façade only on the north and south side. Being near the equator, the Malaysian afternoon sun shines from high in the sky, a slight overhang is enough to block shallow penetrating rays into the building. For most of the west half of the building, external solar shades are installed. The southwest and northwest are protected by aluminum fins offset approximately 40cm away from the building face iii . These devices are utilized where high-angled rays may hit the curtain walls. But for more far reaching direct light,

deeper, single panel aluminum louvers offset from the building twice as far as the fins is installed. iii

East Side: Banding core shades direct east sunlight and acts as heat sink

North-East: North side is glazed as it receives little sunlight

Shaded outdoor terraces

The overhang of the curvilinear roof shades the south façade from high angled afternoon sun

The major visible architectural elements topping off the office levels include a cantilevering rooftop pool and a gym with a curvilinear roof; these facilities are open to employees. v The pool 'greens' the rooftop by insulating and reflecting the overhead sun. The overhang of the curvilinear roof is enough to shade most of the entire south façade from the high angled afternoon sun. Crowning the building is a tubular steel trellis that shades the top floor amenities and is designed to accommodate solar panels in the future iii that will further increase the building's ecological efficiency.

IV. CONCLUSION

Monopolistic education from primary school to university will only damage the world in general and the world of education. Towards a new future to improve the quality of life is thought, based on the ecology is the study of organisms in relation to the physical environment. How does this result in the achievement of final form and its integration with the human and the natural surroundings. Educational ancient avoiding interdisciplinary education, networked thinking, and cybernetics that restrict the human and the human form that is limited. It has to be higher education in general and in particular architecture, based on the ecology. Linear progress on technical progress exchanged with an ecologic development in balance with the natural surroundings. Education grounded in their own culture can advance / create the impression of national autonomous and headed Indonesian architecture. Less education adapts to local cultures and traditions unfavorable to educate architects and which will build the building that will be unbalanced with the local context. The architecture will be International, monotonous, without fantasy, and create a "mono culture" (Rudolf Doernach).

Architectural education based on the architecture of western education system less appropriate for developing countries, because of the cultural background and biological are different. Architecture easier flourish in Indonesia in accordance with the basic architecture of the country "Unity in Diversity", based on human unity with nature. The development of modern architecture with high-tech applications will damage the foundation of human life and the natural environment. Thinking deeply about the ecological, with alternatives would bring it to life, education and housing are based on local wisdom in balance with nature.

Environmentally responsive on design architecture is to bring together what we are building with the surrounding natural environment in an integrated and sustainable. "(Ken Yeang, Betterbricks Interview).