Understanding The Principles of Vernacular Architecture in Designing Environmentally Friendly Architecture

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Abstract. Vernacular architecture is understood as architecture that responds to the natural environment through a local wisdom approach. Response to the natural environment as a form of environmentally friendly principles. The residential architecture of Balinese ethnic vernacular residences is an embodiment of a housing that prioritizes integration with its natural environment through the configuration of the building mass and the presence of green open space in the residential yard. This integration can be found in tall buildings that seek to present green elements on the facade of the building. This study examines the principles of vernacular architecture in traditional and modern facilities that show an environmentally friendly context. The achieve this goal, this study uses a qualitative rationalistic method using the great concept of vernacular architecture. The dependent variable is traditional buildings and modern buildings; the independent variable is spatial planning and building layout principles. The results showed that green elements (vegetation) exist in standard building units and modern facilities to sustain the ecosystem where other living things live.

Keywords: Building Layout, Environmentally Friendly, Spatial Planning, Vernacular Architecture

1 Introduction

Understanding vernacular architecture can be traced to the following keywords: self-build, sustainable sources, the pragmatics of encountering environmental hydrants, and anonymity. Self-building has an original meaning (indigenous, native), sustainable sources understand being focused on local materials, pragmatic of experiencing environmental hydrants is focused on the local environment. At the same time, anonymity is local knowledge as a combination of indigenous, regional material and local environment [1], [2].

The keywords of the above statement are sustainability and local wisdom. Sustainability in question is that vernacular architecture pays attention to environmental aspects in creating the built environment. Build residential dwellings by utilizing the natural potential of the surrounding environment. The embodiment of architecture responds to the surrounding climate, such as airing, lighting, integrated with residential dwellings. This contextual can also be translated into different contexts, utilization and protection, depending on the environment. This

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adaptation is a form of the wise attitude of the vernacular community in interpreting the built environment as part of the natural environment. Utilization of local materials in constructing buildings through a sustainable approach to natural resources by taking into account their existence in the future.

Vernacular architecture is not born from a plot of land or vacant land but from dialogue between humans and the environment, responses to environmental factors, socio-cultural relations, material aspects and local technology [3]. Implies that vernacular architecture is born based on user needs and responds to contextual conditions. The same statement was also conveyed by Oliver (2007) regarding vernacular, namely: (1) vernacular architecture was built by the owner or the community; (2) adapting to contextual (physical, social, and cultural conditions); (3) in its development it utilizes local physical, social, cultural, religious, technological and material resources; (4) the initial typology of the form of the building is a residential building; (5) development aims to meet local needs; and (6) contextual aspects affect the function, meaning and appearance of the building.

Related to the statement above, vernacular is a theory that studies structures built by empirical buildings without intervention from the hands of professional architects. Vernacular architecture is also referred to as primitive architecture, original architecture, ancestral or traditional architecture, folk architecture, rural architecture, ethnic architecture, informal architecture or anonymous architecture or without an architect [5]. Based on the above statement that vernacular architecture is derived from the local climatic conditions, material, social, cultural and economic [4].

Vernacular architecture is not a building without regard to its environmental aspects; it does not consist of only physical structures but also green open spaces in one yard of a residential house. Balinese ethnic houses are composed of simple building mass configurations and available layouts. The concept of building layout responds to the surrounding environment and adapts to the functions it contains. In general, traditional Balinese architecture is located in mountainous areas with cold climatic conditions. The climatic conditions were responded to by buildings using thick clay wall materials, roofs using reeds with steep slopes and high building foundations—the form and use of building materials as an environmental response to a cold climate.

In addition to the building layout, an open space layout functions as a space for traditional and social activities that form a large and spacious common space. The open space is used as a green space to support the need for oxygen for its residents. Sustainability can be seen from the relationship between residential dwellings and their physical environment [6]–[8]. In contrast to buildings in urban areas, which only pay attention to the aspect of the building being built, the comfort of the occupants uses an artificial concept that requires a lot of energy in its operation.

This study aims to understand the principles of vernacular architecture in the context of spatial planning and building design in both traditional and modern architecture. Vernacular architecture is understood as environmentally friendly architecture; this is by the concept of sustainable vernacular. Environmentally friendly in question is integration and contextual with its natural environment. To a minimum, use non-renewable energy and utilize renewable energy in its construction and operations. The method used in this study is qualitative rationalism through grand vernacular concepts as a tool to understand the architecture of the case study.

2 Research Methods

This study uses a qualitative rationalistic method [9]–[11]. This method departs from a theory or concept that is elaborated in the dependent and independent variables. The grand concept used is the concept of vernacular architecture, the dependent variable in selected case studies, namely traditional buildings and modern buildings. The independent variable is the principles of vernacular architecture in the context of spatial planning and building layout. Analysis on Paradi g ma emphasizes the sensual empirical aspects, logic, and ethics. Hot practical comes from observations or observations in case studies, logical empiricism understands the phenomena found based on the concepts that have been built. Ethical empiricism is based on research results that are relevant to this research study.

This research has the following research steps:

Formulating a grand concept as a tool to see, understand and study environmentally friendly aspects as part of the principles of vernacular architecture

Setting the dependent and independent variables as the limits of this research study

Analyzing aspects that have been limited, namely the layout and layout of the building

Dialogue with findings from relevant studies

Draw a concept of synthesis from the analysis that has been done through the limitations on the research objectives.

3 Results and Discussion

Site Management Principles (Green Open Space and Built Space)

Vernacular architecture is an architectural work that grows from folk architecture through a local tradition and can adapt to the local contextual environment by utilizing local potentials such as materials, local technology and local knowledge. It can be said that the vernacular architecture in its implementation uses the basis of local knowledge and local materials [1], [12]. Concerning environmentally friendly architecture, according to Rapoport (1969) one aspect of vernacular architecture that is considered is climatic factors and land factors. The climate factor in question is a vernacular architecture using design principles that are friendly to the environment, integrated with the local climate and utilizing the local environment. Responding and being combined with the local environment can be translated into vernacular architectural principles in site planning (green open space and built-up).

The balance between built and green spaces is an essential aspect of creating environmentally friendly buildings. The beginning of a building site is a plot of land in biotic and abiotic ecosystems. The construction of a building on the ground causes the balance of the ecosystem to be disturbed and even lost. Things that can be done in maintaining this balance are building a built environment and creating a microclimate or incorporating natural elements in the building so that the disturbed ecosystem is recreated in proportion [13].

Balinese vernacular architecture, both in the lowlands and highlands, has site management by paying attention to these aspects. The presence of open space, both green and empty space, is an aspect that is considered in a dwelling [14]–[16]. These green open spaces become a source of oxygen needed for natural ventilation in the dwelling. Various types of plants, except plants that have large roots, are planted in the yard area. The vernacular buildings will utilize the excellent air produced by the yard vegetation through the ventilation gaps. The need for indoor artificial surveillance can be reduced by using a microclimate creation system. In addition, the response to the form of vernacular buildings in low-lying areas consisting of many building

masses is usually open, so there is no difficulty in the ventilation system. It is coupled with the concept of green outdoor space in a residential yard.

The houses in a mountainous area covered in anticipation of a cold climate, the conditions for creating cross ventilation in buildings circumvented by using a lattice on the walls of buildings. The principle of site layout in creating an environmentally friendly structure is that the Balinese vernacular building form has small dimensions and tends to be square. The shape of the building will facilitate the consumption of natural air. With the condition of a small space, the need for biological monitoring is not much compared to the shape of a large building mass and area.

Of course, the demand will increase. Included in this is the sunlight that enters the room, not sure t to reach all the rooms for a small building area. The presence of green open space in which vegetation-vegetation will reduce the consumption of peng h awaan indoor artificial and mitigate the effects of glare from sunlight, which means the sun's warming effect does not optimally cause occupant discomfort. Building patterns that have a lot of mass and are separated will make it easier for sunlight to illuminate the room; artificial lighting can be suppressed. Thus, it can be said that the principles of vernacular architecture in site layout can reduce the consumption of artificial energy as ventilation and lighting [17], [18].

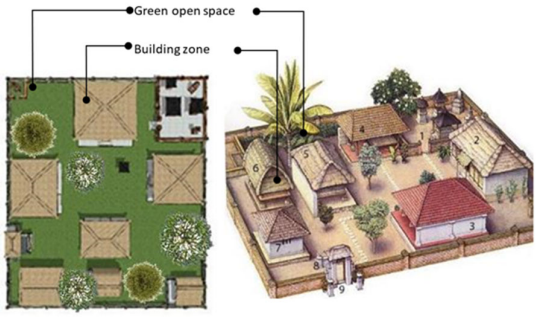

Fig 1. Site layout on the pattern of building mass in lowland areas. Configuration of building mass and green open space

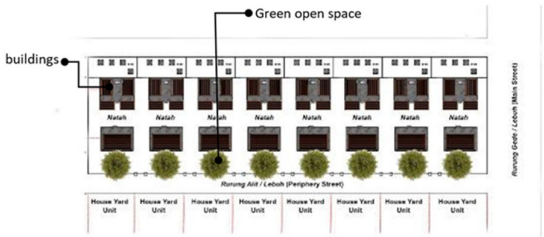

Fig 2. Site layout on the pattern of building masses in the highlands. Configuration of building mass and green open space

These principles have been applied and developed in the design of high-rise buildings. Suppose vernacular architecture applies the concept of balance and environmental friendliness through the site by including green aspects in the yard. It is different from the architectural design of high-rise buildings incorporating green elements in the building (building facade). It

can be seen in the works of Ken Yeang in Mesiniaga Tower are utilized balconies le bar at specific points on the face of the building. Large balconies are equipped with vegetation to create peng h await naturally used indoors. Another example of application is in the architecture of Wisma Dermala, which applies the principles of ventilation that our ancestors have passed down regarding the knowledge of environmentally friendly buildings.

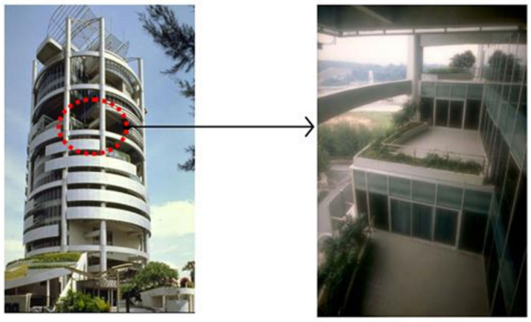

Fig 3. Mesiniaga Tower: A large balcony and elements of vegetation to create air circulation and create a microclimate.

Fig 4. Wisma Dermala: A large balcony and elements of vegetation to create air circulation and create a microclimate

Principles of Tejakan as Green Open Space

Telajakan is a piece or part of a highway or village road in front or next to the house's yard, including the road itself, sewers, and other sideways [19]. In vernacular architectural residences in the countryside, there are still many telajakan spaces used as green open spaces. However, the current development of this space is increasingly being eroded by actions that demand optimization of the built area. In regulation Building permit in Denpasar, every residential design is required to Benghazi r kan element in the licensing of the space. As a green open space, telajakan consists of vegetation or plants that are aesthetic and produce oxygen or clean air for ventilation in community dwellings.

Telajakan also acts as a barrier or filter for air pollutants that interfere with health and reduce noise. Telajakan - telajakan in rural areas very important role is the same as a green open space in a residential yard [20], [21]. Oversight of existence can create incredible, clean and fresh is needed by the human body or occupants; with a probe that can produce O2 and capture CO2,

the energy required for monitoring can be reduced by using it. The energy question is a non-renewable energy artificial ventilation. The following is a description of the telajakan as a green open space in a residential yard.

Fig.5. Telajakan: green space capable of producing oxygen and as a filter for pollution from outdoor spaces

Principles of Building

The vernacular architectural building design principle in supporting environmentally friendly energy management can be seen from the architecture, materials used, and building features [22], [23]. In the case of vernacular architecture in Bali, usually, the shape of the building is straightforward and is a basic form, with small dimensions. The body of this building mass is a response to the lighting system that enters the building. Vernacular architecture building generally has a 3 x 4 M ether that allows sunlight to reach the entire room. That is, space is not needed artificial lighting during the day.

The building floor is relatively high, about knee-deep in adults using local materials, namely polpolan soil. The aims to reduce heat from the ground into the room to become comfortable when used during the day. Such material with a high floor building can store heat and will be family at night to warm the room. The picture above shows that the mass form of the vernacular building can reduce and reduce the use of artificial energy for air and lighting.

Another form of building as a response to the local climate is a stilt-shaped building. The stilt building is a response to cold and hot climatic conditions. Under the bottom of the building, the existence serves to facilitate the flow of cold and hot air into the building. The pit provides a distance from the ground to reduce the evaporation of hot air entering the room—generally, this building form in Kalimantan and coastal areas.

The materials used in vernacular architecture are generally bamboo, wood and clay (polpolan soil). The use of wood materials is generally in highland settlements with high rainfall intensity. Bamboo and wood materials can warm the room compared to using ordinary walls of brick and stucco. For architecture in low-lying areas, the building walls use polpolan soil material combined with brick material. These walls reduce heat from the sun and store heat for use on cold nights.

Fig 6. The high floor of the building and the walls of woven bamboo in anticipation of the heat of the soil and create airflow and sunlight. This reduces the use of excessive energy during the day.

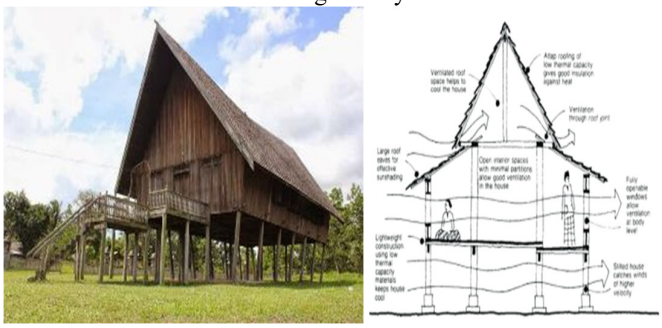

Fig 7. House on stilts as a solution to the local climate

The vernacular building features that can create natural ventilation and lighting are the lattice holes in the walls and at the meeting point between the ring beams and the beam beams. These lattices are generally found in buildings that use woven bamboo walls. The air will move between the holes of the woven bamboo. Solar light also illuminates the room through the cracks of woven bamboo. The stilt building is also equipped with a lattice for air circulation from below into the room. This lattice concept is also applied to Ken Yeang's construction in the form of an atrium equipped with layers of building floors. The air will be lifted by the atrium and continue to the layers to be spread into the room.

Fig 8. Atrium in modern buildings as the adoption of vernacular architectural features in anticipating the local climate in increasing comfort.

4 Conclusion

Environmentally friendly is understood in the embodiment of architecture in spatial planning through the presence of green open spaces as an ecosystem for other living things and has a positive impact on residents. The embodiment in building planning can be built through the use of transitional space as a space that captures free air that is used as natural ventilation and utilizes balconies as green open spaces where other ecosystems live. Vernacular architecture cannot be fully applied to the modern era, only the formation of principles developed to be contemporary to answer modern architecture that is environmentally friendly.

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