Application of biophilic architecture in apartment design

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Abstract. According to UN Habitat related to Environmentally Sustainable, Healthy and Livable Human Settlements, an artificial environment has an impact on people's well-being, behavior and also on human health. At this time, Apartment design is a public space as a place for residents to socialize already lost, it was caused by the design itself. Even though an open space can be interacting and having ecological functions for the surrounding environment. The application of biophilic design in apartment is felt to be very necessary because it is able to help humans by providing a sense of comfort, calm and healing effect on a dwelling is needed.

Keyword : Livable human settlements, apartment, biophilic

1. Introduction

According to UN Habitat related to Environmentally Sustainable, Healthy and Livable Human Settlements, the design of an artificial environment is recognized to have an impact on people's well-being, behavior and also on human health. Good design in new housing in upgrading and rehabilitation is important to create sustainable living conditions. The high-rise housing design must complement the context of the environment in which it lives. In particular, large-scale development of high-rise housing can bring social and environmental losses. Therefore special attention must be paid to the quality of the design, including scale and height, proper.

Some examples of apartment designs in Jakarta that become public spaces as a place for residents to socialize are missing in the arrangement of blocks and arranged concrete. Public spaces in the form of green open spaces were only found on the ground floor of apartment buildings. This is what triggers the loss of social relations between residents so as to form an individualist individual. Though green open space can be a means of interacting and having ecological functions for the surrounding environment. In the construction of buildings in Jakarta, they often forget their existence. This shift in land use has a major impact on the city of Jakarta, which is the green space in the city of Jakarta, which is getting fewer and fewer, this will cause concern later because the green space itself is depleted by development that does not think about the surrounding environment and only think of buildings. Other problems in the city of Jakarta ranging from population density, traffic jams, flooding, demands in the field of high work resulted in increased levels of stress on the citizens of Jakarta. Not only that, urban communities spend about 90% in space. Unfortunately most of the character and quality of the built environment increases human tendency to be isolated from the natural environment (Kellert, 2005). Basically, green open space can help reduce stress in the capital city. Bringing natural
elements into the building to create a relationship between humans and nature is also able to give psychological and physical impacts on users. The best solution which can help reduce carbon dioxide is quite high from air pollution generated by transportation in Jakarta and also presents the green space itself in the building.

![Figure 1. Urban Farming and Biophilic Design](Source: Yanita Mila Ardiani’s Digitalitation)

The application of biophilic design to buildings is an effective way to make it happen. Biophilic design is a design based on biophilia aspects with the aim of producing a space that can participate in improving the welfare of human life physically and mentally by fostering positive relations between humans and nature in places that have cultural and ecological significance. Biophilic design can create spaces that are restorative for the physical human being, nourish the nervous system, and display the aesthetic vitality of life (Kellert, 2005). The application of biophilic design in apartment buildings is felt to be very necessary given the state of the hustle and bustle of the city of Jakarta and the level of human stress that is high enough so that comfort, calm and healing effect on a dwelling is needed. The benefits of applying biophilic design can not only be felt for apartment dwellers, this concept is also environmentally friendly because it uses principles to harmonize buildings with nature. In urban areas, when urbanization shows no signs of decline, biophilic design is able to provide a sense of happiness for building users and the surrounding community. Although the relationship between humans and nature may continue to decline, with the application of biophilic design to buildings, it can help to reconnect. (journal of Veronika Sudirman, 2018)

Therefore, vertical dwelling planning is needed in the form of an apartment that is able to relate directly to nature where human and nature are inherently inseparable despite being blocked by concrete, glass windows, etc. But the ironic reality is that for the architect profession, the field involved in development and construction, which is supposed to improve the quality of human life, is the biggest contributor to natural damage. Globally, the construction sector consumes 50% of natural resources, 40% of energy, and 16% of water. Besides transportation and construction also contribute the most CO2 emissions, which is 182.5 tons per year and 45% of course the best solution is not to stop development, but to build more wisely, one of them is by applying biophilic architecture, which is expected to minimize natural damage and this can't wait anymore and must be done right now.
2. Methods
The research methods carried out in the planning and design concept are as follows: Exploring the issue of UN Habitat where there are several points in it, Environmentally Sustainable, Healthy and Livable Human Settlements were chosen because they are in accordance with the current problems. Data collection was carried out using qualitative research methods by finding information about apartments and also biophilic design by finding literature studies and precedent studies. This research considers several aspects based on the book Housing written by John Macsai and also the book 14 Patterns of Biophilic Design by Terrapin Bright Green. Refer to 14 Biophilic Design patterns, namely visual connection to nature, nonvisual connection to nature, water, non-rhythmic stimuli, dynamic light, thermal and variation of airflow, biomorphic shape and pattern, connection between natural systems, connection between material and nature, complexity and order, prospect, risk, refuge, and mystery.

3. Result and Discussion
The discussion will start with the basic consideration of Biophilic aspects in Architecture especially in Apartment building, then analyse 2 examples of high rise building (hotel and apartment) by using 5 basic aspects of Biophilic Design

3.1. Basic Aspects of Biophilic Design in Apartment

Based on consideration of the needs of the apartment and the effect of supporting stress reduction, emotions and moods, 5 Biophilic design patterns are taken, namely

1. Visual Connection to Nature
   Basic considerations for creating a strong visual connection with nature include:
   - Prioritize natural nature compared to artificial nature, but it is better to apply artificial nature than there are no natural elements at all.
   - Prioritize biodiversity compared to area quantity
   - Prioritize or present space opportunities to be close to green space

   ![Figure 2 Visual Connection to Nature](Source: Digitalisation of Amir Sholihin)

2. Non-visual connection to Nature
   Basic Considerations for creating strong non-visual connections with nature include:
   - Prioritize natural sounds over urban sounds.
   - Have easy access from one or several locations to get a non-visual connection with nature at least 5-20 minutes per day.
   - Integrate non-visual connections with other aspects in the design program.
3. Water
Considerations for creating Thermal & Airflow Variability include:
- Combining thermal conditions and air flow into the material, lighting, ventilation machinery and arrangement of windows and doors at the height of the building will help the distribution of space and time variability.
- Thermal comfort is an important connecting component between Biophilic Design and sustainable design, especially in dealing with climate and rising energy costs.

4. Thermal and variations in Airflow
Design considerations to optimize the impact of water presence:
- Prioritize the use of water elements that can be felt by various senses to achieve beneficial results
- Provision of shadows on water, use of surfaces that can reflect sunlight, and reduce the area of surface water that is exposed to direct sunlight can minimize the evaporation of water.
5. Prospect
Design a space, where users can feel the feeling when in nature. This principle encompasses the prospect, which is an impression of a free view. Prospects in this case are views of supervision and planning.
- Create a sky bridge as a new space experience in the corridor.
- Creating an outdoor area in the dwelling as a space for interaction with fellow residents.
- A residential unit that is made a balcony as an analysis of the prospect.

![Figure 6 Prospect](Image)

- **Figure 6** Prospect
- Source: Digitalisation of Amir Sholihin

3.2. Analyze the Biophilic in a hotel and Apartment building

1. Chicland Hotel
This project designed by: Architects: VTN Architects, Location: B4, 6 Võ Nguyên Giáp, Mân Thãi, SơnTrà, Đà Nẵng, Vietnam, Principal Architect: Vo Trong Nghia, Takashi Niwa, Area: 10500.0 m2

This project creates modern architecture and shiny interiors by maximizing the use of specific natural materials such as basalt, sandstone, bamboo, etc. The facade of the building is covered with soft and pure green plants, the front of the building which turns the building into a calm oasis on the beautiful sand beach of My Khe. This is also another achievement that requires a complicated and meticulous process to research and solve all problems when applying completely new technology in the construction process. The smart combination between plants and natural ingredients will bring an extraordinary experience between comfort and nature.

![Figure 7 Chicland hotel](Image)

**Figure 7** Chicland hotel
Source: [www.Archdaily.com](http://www.Archdaily.com) dan [www.Google Image.com](http://www.Google Image.com)
Visual Connection with Nature. Examples of application forms that can be realized naturally or artificially.
- Natural: Natural flow from water sources, vegetation, animals, insects, fossils, soil.
- Artificial: Artificial water flow, koi pond, aquarium, green wall, natural landscape painting, natural scenery videos, garden landscape design. In this building is different from the previous one where in this building presents natural elements through a balcony that was created by covering the building’s facade.

Non-Visual Connection with Nature (Non-visual connection with nature) Examples of Applications in Buildings:
- Natural: Fragrant spices and flowers, bird sounds, running water, weather, natural ventilation, textured material (stone, wood, feathers)
- Artificial: Digital simulation of natural sounds, fabric textures that mimic natural, horticultural or texture, gardening, verticulture, pets, beehives.
In this building also seen trying to present a new ecosystem which can become a new home for animals such as birds, insects etc. Unconsciously the sound of birds can help the psychological atmosphere of residents become more calm.

Thermal & Airflow Variability (Thermal and air flow variations). Examples of Applications in Buildings:
- Natural: Utilization of heat from sunlight, shadow, surface material capable of emitting light, orientation of space and buildings, vegetation with the formation of seasons.
- Artificial: HVAC distribution strategy, system control, glass windows and their maintenance, window and cross ventilation operations
In this building the air flow is only utilized by the unit inside by making sliding glass doors which when opened can enter the wind without having to use ac.

Presence of Water
- Natural: Rivers, seas, ponds, wetlands, visual access to rainwater and water currents
- Artificial: Water wall, artificial waterfall, aquarium, fountain, artificial river, water reflection (original or simulated) on other surfaces, use of water forms in composition
In this building swimming pool facilities are above the building which makes the atmosphere of the water cannot be immediately felt. However, the location of this building is near the beach which allows direct view facing the beach.

General features: transparent material, balconies, Hallways, bordesk, open floor plans, elevated planes, views including shade trees, bodies of water or evidence of human habitation.
In this building a balcony is made in each unit where residents can immediately feel the atmosphere and also there is no barrier between nature and the building created through a balcony of vegetation.

2. Bosco Verticale Apartment

This project is designed by Architects: Boeri Studio. Location: Milan, Italy. Architects in Charge: Stefano Boeri, Gianandrea Barreca, Giovanni La Varra. Vertical Forest is an architectural concept that replaces traditional materials on urban surfaces using polychrome leaves that change for the walls. Architects rely on vegetation screens, need to create suitable microclimates and filter out sunlight, and reject narrow technological and mechanical approaches to environmental sustainability. Vertical forests increase biodiversity. It promotes the formation of urban ecosystems where different types of plants create separate vertical environments, but which work within existing networks, can be inhabited by birds and insects. In this way, this is a spontaneous factor to replenish the flora and fauna of the city.
• Visual Connection with Nature. Examples of application forms that can be realized naturally or artificially.
- Natural: Natural flow from water sources, vegetation, animals, insects, fossils, soil.
- Artificial: Artificial water flow, koi pond, aquarium, green wall, natural landscape painting, natural scenery video, garden landscape design.
In this building the same as before where in this building presents natural elements through a balcony that was created by covering the building's facade.

• Non-Visual Connection with Nature (Non-visual connection with nature)
Examples of Applications in Buildings:
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• Thermal & Airflow Variability (Thermal and air flow variations). Examples of Applications in Buildings
- Natural: Utilization of heat from sunlight, shadow, surface material capable of emitting light, orientation of space and buildings, vegetation with the formation of seasons.
- Artificial: HVAC distribution strategy, system control, glass windows and their maintenance, window operation and cross ventilation
In this building the air flow is only utilized by the unit inside by making sliding glass doors which when opened can enter the wind without having to use ac.

• Presence of water
- Natural: Rivers, seas, ponds, wetlands, visual access to rainwater and water currents
- Artificial: Water wall, artificial waterfall, aquarium, fountain, artificial river, water reflection (original or simulated) on other surfaces, use of a form of water in the composition
Different from previous buildings in this building, there is no visible presence of water in it, even though this aspect is quite important in the biophilic pattern
General features: transparent material, balconies, Hallways, bordesk, open floor plans, elevated plans, views including shade trees, bodies of water or evidence of human habitation. In this building also made balconies in each unit where residents can immediately feel the atmosphere and also there is no barrier between nature and buildings created through a balcony of vegetation.

4. Conclusion
The application of biophilic architecture comes as a new concept of incorporating plant elements into buildings to be able to help maintain green spaces despite the construction. And in the research discussed there are several apartment buildings that are examined using 5 biophilic patterns that have been selected, namely (1) visual connection to nature, (2) non-visual connection to nature, (3) water, (4) thermal and flow variations air, (5) prospect. This 5 Biophilic Patterns can be applied in the Apartment buildings in specific spaces and elements can be seen in the picture below.

Table 1. All Aspects of Biophilic in Architecture

| Visual Connection with nature | Non-Visual Connection with Nature | Thermal and Airflow Variability | Presence of Water | General features: |
|-------------------------------|---------------------------------|--------------------------------|------------------|------------------|
| - Natural: Natural flow from water sources, vegetation, animals, insects, fossils, soil. | - Natural: Fragrant spices and flowers, bird sounds, running water, weather, natural ventilation, textured material (stone, wood, feathers) | - Natural: Utilization of heat from sunlight, shadow, surface material capable of emitting light, orientation of space and buildings, vegetation with the formation of seasons. | - Natural: Rivers, seas, ponds, wetlands, visual access to rainwater and water currents | transparent material, balconies, Hallways, bordesk, open floor plans, elevated planes, views including shade trees, bodies of water or evidence of human habitation. |
| - Artificial: Artificial water flow, koi pond, aquarium, green wall, natural landscape painting. | - Artificial: Digital simulation of natural sounds, fabric textures that mimic natural, horticultural or texture gardening, verticulture, pets, beehives. | - Artificial: HVAC distribution strategy, system control, glass windows and their maintenance, window and cross ventilation operational. | - Artificial: Water wall, artificial waterfall, aquarium, fountain, artificial river, water reflection (original or simulated) on other surfaces, use of water forms in composition. |
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