A Study of Vertical Landscape Application for Apartment in Jakarta

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Abstract. Jakarta as the capital city of the country is the center of business administrative with high population and density and keeps growing. This resulted in the limited amount of land available for housing. One solution is to builds an apartment which is a vertical residential building that can accommodate many heads of households. In addition to limited land for residential, there is also less land for green open space. Greening can be entered in apartments vertically with the application of vertical landscape. Vertical landscape is applied by utilizing vertical spaces in the apartment, can reduce ambient air temperature, reduce the heat of sunlight, absorb dust and pollution, and increase the aesthetic value. Therefore, the design of the apartment with the application of vertical landscape is needed to produce a vertical residential building with a comfortable and ideal environment to live in.

Keywords: Apartment, Vertical Landscape

1. Introduction

This study was raised based on one of United Nations Sustainable Development Goals for 2030. All of the goals are interconnected, one of the goals used for this study is goal number 11, about “Sustainable Cities and Communities”. Each goal have specific targets, one of the target used for this study is target 11.6 that states ‘By 2030, reduce the adverse per capita environmental impact of cities, including by paying attention to air quality and municipal and other waste management’. [1]

Jakarta as the Capital City of Indonesia generates many Indonesian people to come to live in Jakarta and its surroundings. In 2020 according to the Inter-Census Population Survey (SUPAS), the city of Jakarta has a projected population of 10.57 million people with population growth increasing 0.7% from the previous year and is expected to continue to increase every year. This raises the problem of meeting housing needs which resulted the amount of land available for residential buildings increasingly limited. One solution is to create a vertical residential building that can accommodate many heads of families, namely apartments.
Apartment is a vertical residence. Many people in Jakarta choose to live in apartments. This is shown in the number of apartments in Jakarta. According to a 2016 Chusman&Wakefield Indonesia study, South Jakarta is the region with the highest number of apartments in Jabodetabek, 25% of the total apartments in Jabodetabek, then North Jakarta with a percentage of 20.8%.

Apartment development as a residence or a residential multi-storey building today is inevitable amid rapid economic development and rapid urbanization. But many apartments pay less attention to environmental and greening aspects as an important component in the urban ecosystem, to increase user comfort, such as thermal comfort by using air conditioners, and generating air pollution. This results in a variety of ongoing environmental problems. One solution to minimize the adverse effects of high-rise building construction on the environment is to increase the green space of the building vertically or utilize the vertical spaces contained in apartment buildings. At present the number of green open spaces is decreasing so that urban greening continues to decrease. Green open space is an area where plants grow, both naturally and intentionally grown. (Perda DKI Jakarta Regional Spatial Plan 2030 article 1 no. 65) According to a study conducted by City Planning Observer, Nirwono Yoga, in 2000 green open space was 13.94% of the city area, then dropped to 9.8% in in 2010, and in 2015 9.98%. Supported by the minimal application of greening in buildings.

Alternative to replace green open space as city greening that can be applied to tall buildings with the concept of vertical landscape. Vertical landscape according to Ken Yeang is the arrangement of greening in tall buildings that pay attention to aspects of the strategy of planting vegetation and its component elements to the environment of high buildings. Vertical landscape can be in the form of sky courts which are planted continuously from the ground floor to the roof of high buildings. Vertical landscape can be used to reduce ambient air temperatures. Planting plants in building facades can reduce ambient temperature and the evaporation process that occurs in plants can also be an effective cooling device for building facades. According to Ken Yeang, there are 3 strategies for planting vertical landscapes, there are centralized planting and juxtaposition; dispersed planting and intermixing; and continuous planting and integration. There are 4 devices that form vertical landscape on tall buildings, there are roof garden, sky-court, planting trellis, and planter boxes.

![Figure 1](source)

a). Vertical landscape in Sky Green, b). Vertical landscape in Bosco Verticale, c). Vertical landscape in Kampung Admiralty

Source: Archdaily

Essentially, this paper presents the initial study and it contain the study of: (1) to study vertical landscape devices, (2) to study the planting strategies of vertical landscaping, and (3) to study the concept of vertical landscape for vertical residential building. (Table 1) [2]
2. The methodology

2.1. The method of study
The methods of this study is literature review and case study of the integrated vertical greening for high-rise building, the vertical landscape devices, and vertical landscape planting strategies. Based on the result of the study is a concept of integrating vertical greening for vertical residential building. Primary data obtained from various sources of information such as books, journals, online media, official online pages, relate to apartment design and vertical landscape theory. Secondary data obtained from direct observations to the selected site and conduct experimental building mass design using software, SketchUp.

2.2. The case study
The site selected for the study is located in Setiabudi, a sub-district in South Jakarta. The site is located within the Golden Triangle of Jakarta, an elite area where there are tall buildings. Based on the 2014 PERDA zoning map of DKI Jakarta, the site is in sub-zone R.7 which is a vertical housing zone. With an area of 4065 m² located in a flat land topography. Around the site, where there are many office buildings and business center buildings. Many of Jakarta’s urban citizens choose to live closely to their workplace. Meanwhile the availability of land for residential and green space as one of the important aspects in urban city planning. So, it is needed for greening to be integrated vertically by utilizing the vertical spaces in high-rise buildings. Therefore, apartments building in this site is a potential building for applying the concept of vertical landscape.

Figure 2. The site located at the south of Jakarta
Source: google maps

Figure 3 a). Site and environment condition
Source: personal documentation
3. Result and Discussion

3.1. The devices of vertical landscape
Based on The Skyscraper Bioclimatically Considered: A Design Primer [2] vertical landscape is the greening of the high-rise building, involves the introduction of planting and vegetation into the tall building. The analysis focused on the implementation of vertical landscape in high-rise building. In the concept theory there are devices of vertical landscape (Fig. 4, 5a, 5b, 5c, 5d). These devices form vertical landscape in high-rise building.

![Vertical landscape devices](image)

**Figure 4. The vertical landscape devices [2]**

![Vertical landscape examples](image)

**Figure 5 a. Roof garden [4]**
**5 b. Sky courts [5]**
**5 c. Planting trellis [5]**
**5 d. Planting boxes [6]**

3.2. The planting strategies of vertical landscaping
There are 3 strategies for planting greenery integrated vertically in high-rise building like apartments with the concept of vertical landscape. There are, centralized planting and juxtaposition; dispersed planting and intermixing; and continuous planting and integrated (Fig. 6). All of these planting strategies can be applied to apartments building.
Based on the planting strategies above, all of the three planting strategies can be applied to apartments building. The most appropriate planting strategy is dispersed planting and intermixing that integrated with building mass shape and site condition. This strategy could maximizing the greening in the building and the greening benefits as the vertical landscape devices applied in various part of the building so every occupant could get and feel the benefits.

3.3 The concept of vertical landscape for vertical residential building
Based on the theory above, experiments conducted by using SketchUp software to for analyzed in apartments building. As such, the study deployed five building mass with three planting strategies to analyzed and they can be described as follows (Fig 7, 8, 9, 10, 11):

1. U-shaped building mass with centralized and juxtaposition planting strategy
2. U-shaped building mass with dispersed planting and intermixing planting strategy
3. H-shaped building mass with dispersed planting and intermixing planting strategy
4. T-shaped building mass with dispersed planting and intermixing planting strategy
5. L-shaped building mass with continuous planting and integrated planting strategy

Figure 7. U-shaped building mass with centralized and juxtaposition planting strategy
Figure 8. U-shaped building mass with dispersed planting and intermixing planting strategy

Figure 9. H-shaped building mass with dispersed and intermixing planting strategy

Figure 10. T-shaped building mass with dispersed planting and intermixing planting strategy

Figure 11. L-shaped building mass with continuous planting and integrated planting strategy
From the experiments with the building mass using SketchUp, the most potential planting strategy with the application of vertical landscape devices is the T-shaped building mass with dispersed planting and intermixing planting strategy applied the vertical landscape devices to various part of the building such as sky courts placed in several different floor levels, roof garden on the top of the podium building, planting trellis covered several parts of the building facades, and planting boxes placed in several part of the building to maximized the greening and its benefits on the building and the environment surround the site area. U-shaped and H-shaped building mass with centralized and juxtaposition planting strategy only focusing the greening on a certain part of the building area. The U-shaped building mass with dispersed planting and intermixing planting strategy applied the vertical landscape devices to various part of the building. The L-shaped building mass with continuous planting and integrated planting strategy also applied the vertical landscape devices to various part of the building but with placing the roof garden on the top of the building.

Indeed, the hypothetical concept of applying vertical landscape on apartment building could be a T-shaped building with dispersed planting and intermixing or the second building shape mass with second planting strategy. The concept of designing a T-shaped building with dispersed planting and intermixing can be considered the closest on the application of greening in tall building such as apartments and maximizing the benefits from the vertical landscape concept.

4. Concluding Remarks
The study of vertical landscape for high-rise building in order to be applied in an apartment building has been conducted and the remarks can be conclude as follows:

- There are four devices of vertical landscape that could be applied in apartments building, such as roof garden, sky courts, planting trellis, and planting boxes.
- The appropriate planting strategy is dispersed planting and intermixing. The strategy could maximizing the greening in the building and the greening benefits as the vertical landscape devices applied in various part of the building so every occupant could get and feel the benefits.
- The most potential planting strategy with the application of vertical landscape devices is the T-shaped building mass with dispersed planting and intermixing planting strategy.

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