



Characteristic Study of Contemporary Architecture in Vertical Forests in The Concept of Green Buildings (Case study by Stefano Boeri's Architectural Work)

Haris Darsono^{1*}, M. Syaom Barliana², Diah Cahyani³

^{1,2,3}Master of Architecture Program, Faculty of Technology & Vocational Education,
Universitas Pendidikan Indonesia, Bandung, Indonesia

*Correspondence: E-mail: harisdarsono@upi.edu

ABSTRACT

Contemporary architecture emerges from the desire and desire to get a new nuance due to the saturation of an architectural work that tends to be monotonous. The contemporary architecture itself has developed in line with technological advances and human needs in solving environmental problems in the future. Along with the development of development, the concept of sustainable development began to be recognized and one of its aspects is in the form of green buildings. The green building itself is part of the arrangement of a sustainable city where it is hoped that green buildings can provide benefits in reducing environmental damage as a result of the development process. One of the green building concepts that have become a trend lately is the vertical forest concept which this concept applies a combination of buildings by prioritizing harmony with nature and is applied vertically. This architectural work has become an anti-mainstream work that has been widely applied in several cities around the world. This evaluation aims to find out how far the application of the vertical forest concept is related from the perspective of contemporary architecture. The method used is descriptive qualitative, with hypotheses derived from a theory which is then tested for validity based on empirical data. This research is expected to be able to evaluate the application of contemporary architectural characteristics to the vertical forest design in the green building concept by Stefano Beori.

ARTICLE INFO

Article History:

Submitted/Received 16 February 2022

First Revised 20 November 2022

Accepted 25 January 2023

First Available online 1 March 2023

2023

Publication Date 1 March 2023

Keyword:

Contemporary architecture,
Vertical forest,
Green building

1. INTRODUCTION

Sustainable development has been an issue that has been heard for a long time and is still hot in development carried out in Indonesia. Various sustainable development concepts are starting to emerge, one of which is related to the concept of green buildings. Green buildings are designed to reduce the impact of buildings on human health and the environment. Green Building is a process that is environmentally responsible and saves resources starting from site planning to build design, both maintenance and renovation or rehabilitation (Ghassani et al., 2019).

In this study, we will try to test the architectural work of Stefano Broeri with the theme of vertical forests using indicators from contemporary architecture. Where in this study we will try to see how far the relationship between the vertical forest concept can be categorized as a work of contemporary architecture in terms of physical/visual characteristics.

2. RESEARCH METHODS

In general, in this research, we use qualitative methods, in which with this method we try to do a comparative study of vertical forest buildings using indicators that are the criteria in contemporary architecture. Data collection techniques are carried out by looking for various data sources in the form of research results, clippings, articles, and others. The above method of collecting source data is maximized by using multiple sources of evidence and creating case study-based data, such as case study notes, case study documents, tabulation materials, and narratives.

3. DISCUSSION AND ANALYSIS

The field of architecture continues to develop along with the increasing complexity of human needs for conducive, safe, and comfortable situations. Architecture is becoming more multi-disciplinary than ever before encompassing not only science or the study of engineering. Issues related to technology, ecology, energy, mitigation, and limited land have the opportunity to become catalysts for architectural development in the future. Nowadays, the word architecture is often used by other disciplines to represent a complex system.

3.1 Contemporary Architecture

Contemporary architecture itself has developed since the early 1920s, beginning as a response to technological advances and changes in society's culture due to the World War. Contemporary architecture itself is often equated with modern and contemporary architecture, but the design is often distinguished.

Contemporary architecture itself marks a design that is more advanced, varied, flexible, and innovative in terms of form, appearance, materials, and technology used. This architecture can be recognized by its practical and functional design character with the processing of simple geometric shapes and neutral and clean color displays (Hapsoro, 2020)

Contemporary architecture is an architectural work that aims to demonstrate a quality of technological progress by expressing an architectural style that is characterized by freedom of expression and is a new flow or a combination of several architectural streams. Based on some of the above understanding, it can be concluded the characteristics of contemporary architecture, namely:

- a. Building expressions are subjective.
- b. Contrast with the surroundings
- c. Highlight a unique shape, out of the ordinary, and attractive.

Contemporary styles can be modified by various other styles such as modern, minimalist, natural, and so on. This needs to be done to be able to produce new building works that are more attractive and follow developing trends. Although it is often combined with other styles, the original character of contemporary architecture will still be emphasized.

Contemporary architecture features unique forms, out of the ordinary, attractive, and very complex (Gunawan and Prijadi, 2011). The characteristics of the contemporary style concept are open, new, dynamic, transparent, up-to-date, new, and ergonomic. These physical characteristics become the principles of contemporary architecture that must be applied in development. That way the building will have a stronger and more elegant impression. Here are some of the features.

Table 1 Characteristics of Contemporary Architecture

No	Aspect	Characteristics of Contemporary Architecture
1	Design	The contemporary style uses curved lines more often, especially on the exterior. This is of course very different from architectural styles in general which use straight-line patterns. But sometimes this style also combines the concept of straight and curved lines to make it look more attractive.
2	Space shape	The contemporary architectural style allows the creation of unique and different combinations of spaces, and can even carry out more creative experiments in the form of asymmetrical spaces. In general, the room will be left open so that it looks spacious and equipped with a few partitions.
3	Windows/openings	The glass element is the main element of the contemporary style. This is what makes contemporary-style buildings have bigger windows. The position of windows is also uniquely placed to give a beautiful impression. The use of large glass windows aims to maximize the natural lighting system and increase air circulation in an effort for energy efficiency.
4	Color	Contemporary architecture tends to use neutral colors such as black, gray, white, and so on. To provide a more pronounced aesthetic element, you can accentuate several elements with more solid colors and designs such as yellow, orange, and attractive. A bold neutral color combination will give a more attractive impression.
5	Material	Generally, contemporary styles use anti-mainstream materials such as metal and glass. This material is usually used for some parts of the walls and roof. Glass material can give the impression of openness and transparency. Very following the current concept of life. This material is relatively new and is made using the latest technology with environmentally friendly materials.
6	Roof	The hallmark of the contemporary style is the use of an open roof. The use of a bolder concept is applied to contemporary architecture so that it can provide an unusual roof appearance. The roof has the benefit of being a shield to protect the building from the hot sun. Some roof styles that can be used are angular roofs, green roofs, and others.
7	Environment	Following the principles of ergonomics, the application of contemporary style is very concerned with environmental aspects. This is what adopts environmentally friendly features to be applied.

Source: <https://japdesign.com/blog/architecture-contemporary-ada>

3.2 Green Building

Environmentally friendly building (green building) is a building concept in which the process of planning, building, operating, maintaining, and demolishing always prioritizes saving natural resources to a minimum, using land wisely, reducing the impact on the environment, maintaining air quality, and prioritizing health. residents by prioritizing sustainable development.

The application of the green building concept is a topic that has been discussed for a long time. This concept has even been applied for a long time in several countries, as a step to prevent global warming. In Indonesia itself, the application of environmentally friendly building concepts has just begun to be encouraged.

Table 2 Characteristics of Green Buildings

No	Aspect	Characteristics of Green Buildings
1	Energy	<i>green building</i> utilizing natural resources to create comfort in the building. For example by adding ventilation and wide windows to the building design.
2	Environment	Open space planted with various green plants is one of the requirements that must be owned by an environmentally friendly building. In addition, green open spaces can help absorb pollution and provide freshness. Not only that, but green open spaces also play a role in absorbing groundwater and maintaining water circulation.
3	Material	The concept of a green building must also be friendly to human health. The construction of green buildings no longer even uses toxic materials that can harm health. For example by not using toxic paint and not using air conditioners which can damage the ozone layer.

Source : (Sudarwani, 2012)

According to the Regulation of the Minister of State for the Environment No. 8 of 2010 concerning Criteria and Certification of Environmentally Friendly Buildings, states that a green building is a building that applies environmental principles in its design, construction, operation, and management and is an important aspect of handling the impacts of climate change. The environmental principle in question is a principle that prioritizes and pays attention to elements of environmental function preservation. (Nuryanto, 2020)

According to (Kats, 2003), the basic concepts or values in green building or environmentally friendly buildings are as follows:

1. Building designs that minimize unnecessary damage to land values, habitats, and green space, promote higher-density urban development, and maintain environmental governance.
2. Conservation and quality of water by maintaining the natural water cycle that already exists, while minimizing unnecessary and inefficient use of drinking water. Meanwhile maximizing the recycling and reuse of water, including the use of rainwater, used bathroom water, and excluding water from toilets.
3. Environment and energy by minimizing the adverse impact on air, water, and natural resources through building land optimization, building design optimization, material selection, and aggressive use of energy conservation measures.
4. The quality of the indoor environment by providing health, comfort, and productivity of the indoor environment for occupants and visitors to the building. To produce a building design that has the best conditions related to indoor air quality, ventilation, comfortable temperature, ventilation access, and natural lighting during the day.
5. Resources and materials namely the use of non-renewable construction materials and other resources such as energy and water through efficient engineering, design, planning, and construction and effective recycling of construction debris. Besides that, it also maximizes the use of recycled materials, efficient modern materials, and efficient composite resources for structural forms

3.3 The Concept of Vertical Forest Development in Buildings

This vertical forest is the essence of an architectural concept that will refresh urban life and uses leaves to create shade. The presence of vertical forests will increase

biodiversity(Goud et al., 2018). Not only that, the vertical forest is a symbol of the re-encroachment of the city by plants and wild animal life. Trees are a key element in understanding this architectural project and planting system. The construction of such a building takes about two years in cooperation with several botanists.



Picture1 Green building with a vertical forest concept

<https://www.stefanoboeriarchitetti.net/en/project/vertical-forest/>

The birth of the vertical forest concept is one solution to the problem of air pollution in urban areas. The vertical forest is a building construction that adds trees as a tool to combat air pollution. This design is considered efficient and does not eliminate its aesthetic elements(Private, Septina, Lugina, & Indartik, 2021)(Wijaya & Permana, 2020)



The plants used in this project will be grown specifically for this purpose. The vertical forest is also a characteristic of the city which can create a new type of landscape diversity that can change shape in every different season, depending on the types of plants that exist. The vertical forest will also add a dynamic view to the metropolis below(Boeri & Insulza, 2010)(I. Susanti et al., 2020).




3.4 Vertical Forest by Stefano Boeri

Today's modern architectural world has experienced many changes, especially changes in the environmental glass. Stefano Boeri, an architect from Milan, Italy, has contributed to many green building-themed projects.

Stefano Boeri's work itself consists of many kinds, ranging from apartments to schools, cities, and many others. Even closer, it turns out that this architect has completed several dwellings in the form of apartments which are referred to as vertical forests in the middle of the city. Then what are these dwellings? Here are some of Stefano Boeri's works.

Table 3. Green Building with Vertical Forest Concept by Stefano Boeri

No	By Stefano Boeri	Information
1	Bosco Verticale 	Bosco Verticale is a pair of skyscrapers with a height of 80 and 112 meters respectively in the center of Milan, Italy. Bosco Verticale itself comes from Italian which, when translated means vertical forest. Located in the Porta Nuova District, this Bosco Verticale was built from 2007 to 2014 and made it Stefano Boeri's first vertical forest.
2	Ca' delle Alzaie 	Still in the same country, namely Italy, Ca' delle Alzaie is a row of 27-meter-high buildings that look simple but beautiful along the Sile River, Treviso, Italy. This one residential complex has 3 buildings consisting of 7 floors with around 120 trees and 400 shrubs planted on various sides of the building.


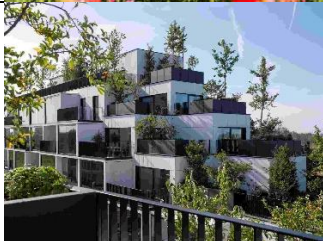

No	By Stefano Boeri	Information
3	Easyhome Huanggang Vertical Forest 	This bamboo curtain country seems to be intensively building green buildings. Recently there was the Huanggang Vertical Forest which stood on about 4.54 hectares of land, in Hubei Province, China. Built from 2017 to 2021, the Huanggang Vertical Forest is one of three vertical forests handled by Stefano Boeri in China. The other two buildings are the Nanjing Tower and 1000 Trees.
4	Trudo Vertical Forest 	Back to one of the countries in Europe, namely the Netherlands, to be precise in the City of Eindhoven there is a vertical forest consisting of 19 floors with 125 apartment units. Each unit measures less than 50 square meters with an additional 4 square meter balcony. These balconies house about 120 trees and 5200 shrubs.
5	Palazzo Verde 	After the Netherlands, now Belgium also has green L-shaped apartments with 67 units in the city of Antwerp. This building has a grid measuring 5 square meters in each unit which manages to accommodate around 1000 bushes, 86 trees, and 1200 other plants which, if likened to the equivalent of 780 square meters of green land.

Source: <https://www.stefanoberichitetti.net/en/project/vertical-forest/>

3.5 Characteristic Analysis of Contemporary Architecture in Vertical Forests

From some of the architectural works of Stefano Boeri, we will make a comparison table using several indicators that are characteristic of contemporary architecture.

Table 4. Comparison of contemporary architectural features with green buildings {vertical forest}

No	Characteristics of Contemporary Architecture	Overview of Vertical Forest Buildings	picture
1	The building facade has a unique appearance	In this work, we can see that the facade of the building has unique characteristics and is included in the criteria for contemporary architectural buildings	
2	Geometric design with curved domination	there is no curved design which is one of the characteristics of contemporary architecture, the building combines more straight lines.	
3	Asymmetrical room shape	from the looks, we can see that the building has the characteristics of a contemporary building seen from the shape of the building is not symmetrical	

No	Characteristics of Contemporary Architecture	Overview of Vertical Forest Buildings	picture
4	Use the big window	Has big windows	
5	Use bold colors	Using natural and neutral colors with protruding green from the trees	
6	Using anti-mainstream material	From the use of metal and glass combined with various plants, we can say that the building uses unusual materials	
7	It has an open, green roof	does not have an open roof, but has a green roof	
8	pay attention to environmental aspects	Environmental aspects are very concern in this building	

Source: <https://www.stefanoerarchitetti.net/en/project/vertical-forest/>

From the 8 indicators above, we can see that the vertical forest has a large enough rating to be categorized as a work of contemporary architecture.

4. CONCLUSION

The concept of a vertical forest in a green building has a characteristic of a contemporary architectural work where in this architectural work we can see some of the characteristics of a building that adheres to a contemporary architectural style. Vertical forests in green buildings already have the characteristics of a contemporary architectural style building based on the characteristics of contemporary buildings as follows:

- a. Building expressions are subjective.
- b. Contrast with the surroundings
- c. Highlight a unique shape, out of the ordinary, and attractive.

The three characteristics mentioned above are already owned by green buildings with a vertical forest concept. Contemporary architecture has no limitations in design, as long as the building has unique characteristics that are different from the surrounding environment. So in general the concept of a vertical forest can be included in contemporary

architectural works because it has a unique style by applying unusual materials so that the building stands out and contrasts with the surrounding environment.

5. REFERENCES

- A Rifqi M, 2021, Arrangement of Regional Activities as a Solution to Congestion on the Otto Iskandardinata Road in Bandung City
- Bambang, R. R., and Sari, Y. (2021). Penerapan Konsep Arsitektur Tropis Pada Bangunan Pendidikan “Studi Kasus Menara Phinisi UNM.” *Journal of Architectural Design and Development*, 2(1), 20. <https://doi.org/10.37253/jad.v2i1.4341>
- Boeri, S., and Insulza, F. (2010). The vertical forest and new urban comfort.
- Cahyani, D., Kusdinar, Y., and Mardiana, R. (2017). KENYAMANAN TERMAL PADA SARANA OLAHRAGA. In *Jurnal Keplatihan Olahraga* (Vol. 10, Issue 2).
- Edyas, A., Daming, T., and Syarif, E. (2017). Konsep Arsitektur Tropis pada Green Building sebagai Solusi Hemat Biaya (Low Cost). *Temu Ilmiah Ikatan Peneliti Lingkungan Binaan Indonesia* 6, H033–H040. <https://doi.org/10.32315/ti.6.h033>
- Fajar, P., and Purwantiasning, A. W. (2021). KAJIAN KONSEP IMAGEABILITY DAN PERMEABILITY DALAM PENGEMBANGAN KAWASAN PUSAT KOTA BARU PARAHYANGAN. *Jurnal Arsitektur Zonasi*, 4(1), 21–33. <https://doi.org/doi.org/10.17509/jaz.v4i1.28307>
- Ghassani, A. I., Permana, A. Y., and Susanti, I. (2019). Konsep Ekowisata Dalam Perancangan Resort di Kabupaten Ciamis. *Jurnal Arsitektur TERRACOTTA*, 1(1), 11–21.
- Goud, R., Chauhan, NK, Lokhande, H., Bohre, S., Kochar, Y., Soni, M., and Pathak, A. (2018). Vertical Forest in multistory residential cum commercial to eliminate pollution by hydroponic method. *int. J.Eng. Res. Adv. Technol*, 4, 72-78.
- Gunawan, DEK, and Prijadi, R. (2011). Reactualization of Variety of Art Deco in Contemporary Architecture. *Matrasain Media*, 8(1).
- Hapsoro, NA (2020). Evolution of architectural science. *Lakar: Journal of Architecture*, 3(01).
- Kats, G. (2003). Green building costs and financial benefits.
- Nuryanto, E. (2020). Utilization of Environmentally Friendly Wood Materials in Buildings Based on the Regulation of the Minister of Public Works and Public Housing Number 02/Prt/M/2015 Concerning Green Buildings Jo. Regulation of the State Minister for the Environment Number 08 of 2010 concerning Criteria and Certification of Environmentally Friendly Buildings and Their Implementation for Buildings in the City of Bandung.
- Pribadi, M., Septina, A., Lugina, M., and Indartik, I. (2021). Vertical forest: alternative green open space in urban area development. Paper presented at the IOP Conference Series: Earth and Environmental Science.
- Sudarwani, MM (2012). Application of green architecture and green building as an effort to achieve sustainable architecture. *Dynamics of Science*, 10(24).
- Susanti, I., Permana, A. Y., Pratiwi, W. D., and Widiastuti, I. (2020). Territorial space: Structural changes in a religious tourism area (The case of Kampung Mahmud in Bandung, West Java, Indonesia). *IOP Conference Series: Earth and Environmental Science*, 447(1). <https://doi.org/10.1088/1755-1315/447/1/012031>
- Wijaya, K., and Permana, A. Y. (2020). Settlement Pattern of the Village of Dayeuh Luhur, Sumedang. *Journal of Architectural Research and Education*, 2(1), 55. <https://doi.org/10.17509/jare.v2i1.24292>