An Overview of High-Rise Buildings in Jakarta since 1967 to 2020

M F Effendi¹, I F Ridzqo¹, and S W Dharmatanna²

¹ Architecture Department, Institut Teknologi Indonesia, Jl. Raya Puspiptek Serpong, Tangerang Selatan, Banten 15314, Indonesia
² Architecture Department, Petra Christian University, Jl. Siwalankerto No. 121-131, Wonocolo, Surabaya, East Java 60236, Indonesia

intan.findanavy@iti.ac.id;

Abstract. High-rise buildings in big cities are crucial for business, economic, educational, residential, and entertainment activities in recent times. The technology discoveries in various fields that support high-rise building construction such as structure, mechanical, electrical, and materials have opened up opportunities for comfortable and environmentally safe architectural work. The first milestone of high-rise building construction knowledge in Indonesia was the completion of the thirteen-floors Sarinah retail building in 1967. Indonesia, especially in Jakarta, then experienced rapid growth of high-rise buildings construction. However, there is limited research on the development of high-rise building designs in Indonesia, especially from an architectural design perspective. It leads to the lack of literature on high-rise building design in Indonesia. By utilizing a publicly accessible database from the Council of Tall Buildings and Urban Habitat and recent literature called Designing Tall Building by Mark Sarkisian, this paper explores the design development of high-rise buildings in Jakarta from time to time in the aspects of architecture, structure and sustainability.

1. Introduction

High-rise buildings in big cities are crucial for business, economic, educational, residential, and entertainment activities in recent times. There is a change in the development pattern from horizontal buildings to vertical buildings due to the limited land in a city. It leads to high-rise buildings. High-rise buildings are not only about meeting the space requirement, it’s also about the technology discoveries in various fields that support high-rise building construction such as structure, mechanical, electrical, and materials. They have opened up opportunities for comfortable and safe architectural work. Moreover, the rapid innovations also make high-rise designs more environmentally friendly, efficient, and effective during operation and maintenance. Nowadays, there is a requirement to reduce the negative impact on the environment, making high-rise building design more complex than before [1]. These developments and requirements are essential for the learning process of those who want to learn from the existing buildings.

The first milestone in Indonesian high-rise building history was marked by the completion of the thirteen-floors Sarinah retail building in 1967. There was also a steady development in structural knowledge due to Ir. Wiratman Wangsadinata, with his in-depth understanding of high-rise building structure as written in many of his books [2]. He also played an important role in developing various loading standards and regulations in Indonesia. Subsequently, the interest in high-rise buildings continued to rise in many big cities in Indonesia.
However, recently there are not many publications that discuss the Indonesian high-rise buildings design from an architectural perspective. As the capital city of Indonesia and a famous metropolitan, a study of high-rise buildings in Jakarta is important as a representation in the knowledge development and the practice of high-rise buildings in Indonesia. It leads to a lack of literature on high-rise building design in Indonesia that can be used for learning purposes. Many research publications on high-rise building, either in Jakarta or Indonesia, on architectural perspective recently are directing to building performance [3] and green building, such as indoor thermal comfort [4].

The lack of research is also because of the limited database of high-rise buildings in Jakarta and Indonesia. Fortunately, there is an international high-rise building database that is relatively complete and easy to access. It is provided by the Council of Tall Buildings and Urban Habitat (CTBUH) [5]. By utilizing this publicly accessible database and assisted with recent literature on high-rise building called Designing Tall Building by Sarkisian [6], this paper explores the development that occur in the high-rise building design in Jakarta from time to time.

2. Materials and Methods
We began by reviewing the literature to formulate the key aspects of high-rise building designs. We used Designing Tall Buildings: Structure as Architecture written by Mark P. Sarkisian [6] as our main literature. It explicitly explains the general principles in designing high-rise buildings within an architectural scope. Other literature about high-rise buildings used in this research is more technical. They talk about building foundations [7], the structural materials [8], green buildings [9], or other complex structural systems [10]. In the book chapter II titled Fundamentals, Sarkisian explored some key aspects in the high-rise building design. We then put the aspects into general categories. Furthermore, we reviewed the categories and their implementation on high-rise buildings in Jakarta. We established three aspects of high-rise building design, namely architectural, structural, and sustainability.

| High-rise Building Design Aspect [6] | General Category    |
|------------------------------------|---------------------|
| Simplicity                         | Architectural       |
| Form & Response                   |                     |
| Concept                            |                     |
| Designing Loads                   | Structural          |
| Stiffness & Softness              |                     |
| How Tall                          |                     |
| Material                          |                     |
| Structural Clarity                |                     |
| Sustainability                    | Sustainability      |

Table 1. Categories formulation of high-rise building design aspects.

Our objective is to make an overview of high-rise buildings in Jakarta from architectural perspective, consisted of three aspects as listed in the table above. Council of Tall Buildings and Urban Habitat (CTBUH) provided a complete database of every registered high-rise building available on their official website. An account is required to access the database. CTBUH database is relatively more informative compared to other existing Indonesian databases. It is also integrated with the international high-rise society database, which is constantly updated through research and development. The buildings listed on that database has been carefully curated and meet the current definition of the high-rise building. The data we collected from this website consists of the building general information, number of floors, year of construction completion, building function, materials, and architect or the firm name (Figure 1).
Even though CTBUH database provides a lot of information, it doesn’t cover the sustainability aspect of a building. We consulted Green Building Council Indonesia (GBCI) official website [11]—as an institution that may issue certification of green implementation in building—and Jakarta Green Building (JGB) website [12]—as a governmental institution mandated to assess green feasibility of a new building. However, as of October 2020, the two institutions haven’t published their database to the public. We then gathered more information of green implementation on building from news portals cited by the two institutions’ official website.

An overview of high-rise building design development required comparing every high-rise building built in Indonesia from the first building to the current one. We collected the data from September to October 2020, which set the timeframe from 1967 to 2020. We then compiled it into a comprehensive database that displays the year of completion, the number of floors with color codes related to the discussion about high-rise building design aspects.

3. Result and Discussion

3.1. The growth of high-rise buildings

As of data until October 2020, there are 103 high-rise buildings in Jakarta. However, the time span from 1967-2020 is too long, rendering it difficult to read the development of design trends from time to time. Therefore, we split the timeframe into several periods. By 1967 to 2020, there are five decades and three years. Therefore, we grouped them into six periods. The first period spans from 1967 to 1977 while the second is from 1977 to 1987. The third period is from 1987 to 1997. The fourth period is from 1997 to 2007. The fifth period is from 2007 to 2017. Finally, the sixth period is from 2017 to 2020 (Figure 2).
In the first period, Jakarta had five to seven new high-rise buildings completely constructed which was reaped from the work of President Soekarno's leadership from 1945 to 1967. The construction of new buildings was encouraged to realize President Soekarno Indonesia's vision Indonesia, the newly independent nation, as the new emerging forces in global. Development in Jakarta as the nation's capital, therefore was conducted under the command of the president [13]. Various high-rise buildings began to construct. The first high-rise building in Jakarta was so well-known the Sarinah Retail Center.

The building, which was completed the construction in 1967 with a total of fifteen floors, certainly became one of Soekarno's legacy in realizing his vision of creating a modern market [14] and became a milestone for knowledge on the construction of high-rise buildings in Indonesia—moreover, the use of escalator technology for vertical transportation was the first use on building in Indonesia [15]. It should be understood in the following periods that the construction of new high-rise buildings in the first three decades was relatively not much—compared to the fourth until six periods. The construction of new buildings and other infrastructure at that time was not only in high-rise buildings, but also wide-span type buildings under President Soekarno's Lighthouse Program (Program Mercusuar), such as sports building, namely buildings in Gelora Bung Karno complex, and conventions, such as the Coneo Building—or what is now known as the House of Representatives (Gedung MPR/DPR) [16] [17].

In the second and third periods, where the leadership of the Indonesian state was under President Soeharto, the construction of new buildings was still continuing. Development in this era was more diverse which includes civil infrastructure, such as roads and dams. New high-rise buildings were built with locations further south of Jakarta and with more various building functions [13]. The results of the construction of high-rise buildings in the era of President Soeharto in 1967-1998 were enjoyed in these two periods. Along with the improved economic conditions, easier exchange of information and knowledge, and increasing demand for space, Jakarta started to build more floors buildings to accommodate more occupancy capacity. There is a surge of new high-rise buildings in the following period with twenty-two new buildings, which is three times more than the third period. This fourth period is inseparable from the tendency of superblock development for the upper middle class social society [13]. In this period, the new buildings emerged due to the increasingly supported by the process of globalization and the opening of the private sector to participate in the city development.

In the next periods, development was not too different in terms of social aspects, but with a larger number of new buildings, namely forty-two new buildings were constructed in the next period, which is twice the fourth period. The current period which is 2017 until 2020, there has twenty-two new buildings already constructed. However, the number is still possible to grow until the end of the decade.
However, it is necessary to note that the COVID-19 pandemic may reduce the economic situation and capital to fund construction. Furthermore, during 2020 to 2021 the instructions from the government to work from home made occupancy in office buildings decrease significantly. This causes the need for buildings to decrease which makes the value in the property market tends to devaluate [18]. As a result, the construction process for new buildings is hampered.

3.2. Development in architectural aspect: building function

The information about building functions displayed in CTBUH did not comprehensively explain the building design concept. However, building function could tell the typology of the building. In the first to the third period, the construction of new high-rise buildings was dominated by office buildings and owned by government (Figure 3).

![Figure 3. timeline of high-rise buildings related to its function.](image)

With the growth of housing demand in the city center in the late 1990s, new residential buildings were introduced at the end of the third period, completely constructed in the fourth period. The building functions also started to diverse in the fourth period. There were offices, residential, and also hotels. In this current period, these types of building functions merged into mixed-used buildings. Furthermore, until the last period, high-rise building construction was dominated by residential function.

3.3. Development in structural aspect: number of floors and benchmark

Sarinah and Hotel Indonesia, initiated by President Soekarno with his civil engineering education background, were famous for being the first practical applications of high-rise building structural knowledge not only in Jakarta but also in Indonesia. The knowledge of gravitational load and lateral load, a good understanding of soil capacity and building loads gained by many architects and civil engineers in the following time, made it possible to construct more floors building [19]. Moreover, as Jakarta became busier as time went by, the demand for the city center development had increased as well.

In the first period, the number of floors was between fifteen to thirty floors (Figure 4). It was also not that much different in the second period, which was between fourteen and thirty-four floors. The number of building floors was around twenty-four floors, with the highest was up to 46 floors in the third period. In the fourth period, the lowest number of floors was twenty-six floors, and the highest was on fifty-five floors. Figure 4 shows that along the third and fourth periods, high-rise buildings have more than twenty floors. However, it is important to keep in mind that it does not mean that there were no new buildings with less than twenty floors. However, we can see that the benchmark for high-rise buildings floor numbers has increased.
The fifth period has the highest building measured by the number of floors with sixty-four floors. The lowest building had twenty-nine floors. While in the sixth period, the current highest and lowest number of floors are sixty-one floors and thirty floors. These numbers, however, are subjected to change along with the development of structural knowledge and material. The height of a building is not only supported by the structural system, but also by the materials used for its structural components. Three widely used materials in high-rise building constructions are reinforced concrete, steel, and composite concrete, and steel. A tall building needs composite material for the structural component to increase its load carrying capacity. High-rise buildings in Jakarta mostly used reinforced concrete as their main structural component. Composite materials have actually been introduced and applied to some high-rise buildings in Indonesia. The tallest building that used composite material is Wisma Nusantara with thirty floors. The next period only uses composite materials in few projects with a number of floors ranging between twenty-nine to fifty-one floors.

3.4. Development in sustainability aspect: green building certification

Large amounts of resource consumption in high-rise buildings for material, water, and energy, causes an environmental issue that raises environmental awareness. Some approaches have been developed to address these problems became more comprehensive [20] [21]. Among those are green design and sustainable design. Green design emphasizes resource efficiency. Sustainable design covers broader issues in building design, such as social, environmental, and economic issues. Green building design has been used high-rise building in Jakarta. The most prominent example is Wisma Dharmala. Many publications claim that it is a good example of a well-executed green design that took the context of the site into consideration. Jakarta has a tropical climate, so Wisma Dharmala used large stacked roofs to resist thermal from the direct sunlight [22]. However, designing a suitable building form is no longer enough to lessen the negative environmental impact of a high-rise building. Nowadays, green practices need to be rated through a quantitative measurement using assessment tools. The fifth period is an important milestone for the implementation of green building principles in Indonesia. In 2009, Indonesian Green Building Council was established, using Greenship for its assessment tool. Some years after, the Jakarta government issued the Jakarta Green Building regulation in 2012. New and existing buildings alike start to implement a green design that can give them GBCI certification (Figure 5). Although the era of sustainable design has come, the assessment tools from GBCI and JGB are still focused on the green concept. They only focus on resource efficiency.
Instead, they do collaborations to exchange knowledge and technology to build high theoretical and practical knowledge, some of them, were Prof. Ir. Roosseno and Prof. Ir. Wiratman. Buildings require rising, and the politics of that era. He then started a bold movement to construct new buildings, including high-rise buildings. Helped by some Japanese structural engineers and architects who remained in Indonesia, they provided insightful knowledge in structure, especially since high-rise buildings require stronger structures.

The first Indonesian names in the initial high-rise buildings construction, thanks for their great theoretical and practical knowledge, some of them, were Prof. Ir. Roosseno and Prof. Ir. Wiratman Wangsadinata. The ability to construct high-rise buildings cannot be separated from both of their education background, the civil engineering, so that load calculations were possible and successfully implemented [2] [19]. As time went by, Indonesian architects and engineers started to understand how to build high-rise buildings so they no longer need to solely depend on international architecture firms. Instead, they do collaborations to exchange knowledge and technology (Figure 6).

In the third period, there was a collaboration between an international-based architecture firm, led by Paul Rudolph and Prof. Ir. Wiratman Wangsadinata. They both worked on Wisma Dharmala project.
After this period, Wiratman contributed greatly on developing structural requirements in high-rise buildings in Indonesia. There was also an Indonesia-based architecture firm that manage a high-rise building design on their own. However, there is not enough valid information about this firm contribution to the building construction process. Over time, buildings designed by international-based architecture firms dominated the fourth period. Indonesia-based architecture firms began to take control in the fifth period even though there were also some projects handled by only foreign firm or collaboration.

4. Conclusion
As the capital city of Indonesia, the construction of high-rise buildings in Jakarta is constantly in the spotlight. Unfortunately, detailed information of high-rise buildings available in the public domain is limited. Though, it should not discourage people from exploring high-rise building design knowledge. By utilizing basic buildings information collected from CTBUH, we are able to make an overview of the development of high-rise buildings in Jakarta. Furthermore, we split the timeline into shorter periods of time to makes the analysis process easier to determine the patterns in high-rise building development from 1967 to 2020.

From the architectural aspect, the database can tell us about building functions. High-rise buildings in Indonesia started from a single function building to a mix-used building. From the structural aspect, there is an increase of building capacity and height, as seen from the number of floors of each building. The number of floors also determined the height benchmarks for high-rise buildings.

We found out that the benchmark kept getting higher every two periods. Furthermore, high-rise buildings have been expected to be more aware of the environment. After the establishment of the Green Building Council and Jakarta Green Building, building owners and also the Jakarta government are more committed to the green design approach. Finally, from the architect aspect, collaboration between foreign and Indonesia-based architectural firms is inevitable to transfer knowledge and create better buildings.

References
[1] AEH, A. E. A., Cole, D. N., and Dewidar, K., Sustainable Vertical Urbanism as a design approach to change the future of hyper density cities, Journal of Advance Research in Mechanical & Civil Engineering; 2018; 5 (7), 1-12.
[2] Akmal I 2010 Wiratman: Momentum & Innovation, 1960-2010 (Jakarta: Mitrawira Aneka Guna)
[3] Astarini, S. D. and Utomo, C., Performance-Based Building Design of High-Rise Residential Buildings in Indonesia, Sustainability; 2020; 12 (17) 7103. DOI: https://doi.org/10.3390/su12177103
[4] Sani, H. A., Kubota, T., Surahman, U., and Erwindi, C, indoor air quality and health in newly constructed apartments of Indonesia: case study on the effect of modification, Journal of Architecture&ENVIRONMENT; 2021; 20(1), 55-74. DOI: http://dx.doi.org/10.12962/j2355262x.v20i1.a9035
[5] Skyscraper Center. Accessed via https://www.skyscrapercenter.com/explore-data on September to October 2020.
[6] Sarkisian, M 2016 Designing tall buildings: Structure as architecture (Routledge)
[7] Poulos, H G 2017 Tall building foundation design (CRC Press)
[8] Taranath, B S 2016 Tall Building Design: Steel, Concrete, and Composite Systems (CRC Press)
[9] Oldfield, P 2019 The sustainable tall building: a design primer (Routledge)
[10] Fu, F 2018 Design and analysis of tall and complex structures (Butterworth-Heinemann)
[11] Green Building Council Indonesia. Accessed via https://www.gbcindonesia.org/ on September to October 2020.
[12] Jakarta Green Building. Accessed via https://greenbuilding.jakarta.go.id/ on September to October 2020.
[13] Simatupang, S, Social production of space di Jakarta: Modernisasi, dan globalisasi, dan keberlanjutan, Scale; 2014; 2 (2), 36 – 47.
[14] Ferricha, D. and Fauzan, F., How the policy and empowerment of traditional markets in Indonesia? International Journal of Scientific & Technology Research; 2020; 9 (04), 3649-3652.

[15] Ardhiati, Y., The Idea of "Architecture Stage": A Non-material Architecture Theory, Journal of Civil Engineering and Architecture; 2013; 7 (10), 1323. DOI: 10.17265/1934-7359/2013.10.015

[16] Silaban, N. W., Nainggolan, J. L., and Pane, I. F., Kajian pengaruh kekuasaan pemerintah era poskolonial terhadap arsitektur di Medan, Jurnal Koridor; 2018; 9 (2), 345-353. DOI: 10.32734/koridor.v9i2.1377

[17] Kurniawan, H., The Indonesian pavilion in the 1964 New York world’s fair as summary of nation-building projects, Journal of Architecture and Planning (Transactions of AIJ); 2019; 84 (757), 703-712. DOI: https://doi.org/10.3130/aijt.25.977

[18] Sari, H. Q., and Rahman, A., Analisis Pengaruh Pandemi Covid 19 Terhadap Emiten Properti: Studi Kasus Emiten Properti Dalam LQ-45, Jurnal Ekonomi, Manajemen, Bisnis, dan Sosial; 2021; 1 (3), 250-254.

[19] Wangsadinata, W. and Suprayitno, G. (Editors) 2008 Roossono, jembatan dan menjembatani (Yayasan Obor Indonesia)

[20] Al-Kodmany, K., The sustainability of tall building developments: A conceptual framework, Buildings; 2018; 8 (1), 7. DOI: https://doi.org/10.3390/buildings8010007

[21] Berawi, M. A., et al., Stakeholders’ perspectives on green building rating: A case study in Indonesia, Helio; 2019; 5 (3) e01328. DOI: https://doi.org/10.1016/j.helio.2019.e01328

[22] Sukada, N. Q., & Salura, P., Paul Rudolph’s design principles on high-rise office buildings in Indonesia case study: Wisma Dharmala Sakti Jakarta and Wisma Dharmala Sakti Surabaya, Riset Arsitektur (RISA); 2018; 2 (4), 376-393. DOI: https://doi.org/10.26593/risa.v2i04.3048.376-393