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Analysis of The Implementation of The Smart Living Concept In Panoramic Apartments, Bandung

Nathania Christie Adrianto¹, Lucy Yosita^{2*}, Monika Vonna Ramadhani³, Novita Ayu Pramudita⁴, Seny Nurlianti Insyira⁵, Tiara Nurazizah⁶, Zulva Nazahatul Huda E.H⁷, Anthony Hamzah⁸

^{1,2,3,4,5,6,7}Universitas Pendidikan Indonesia, Indonesia

⁸Nanyang Technological University, Singapore

*Correspondence: Email: lucyyosita@upi.edu

ABSTRACT

Vertical housing has become an important solution in urban land conditions that are increasingly limited. Therefore, vertical housing options can serve as a living solution. Along with the development of the times, digitalization has also begun to permeate residential environments. One of them is the emergence of the smart living concept in apartment environments. This research discusses further about apartments and the implementation of the smart living concept, particularly at Panoramic Apartment, Bandung City. Research and data collection were carried out using qualitative methods. The research team conducted literature reviews, descriptive techniques, direct observations, and direct surveys at the research site to then conduct a research study. Based on the study above, it can be understood that the concept of smart living is not only about the application of technology in high-rise buildings, but also includes aspects of building design and maintenance. From the above, it can be concluded that smart living, if it is to be applied to apartment buildings in the future, needs to start from determining the location and design, using BIM simulation of technology efficiency on design process, the use of AI technology which be planned on management of energy. Then, equally important is the improvement of apartment management, this is crucial for achieving supervision and management of comfort, quality of public facilities, and efficiency of technology use, as well as disaster safety. Essentially from all of above, the concept of smart living in

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design of building must meet the principles of: (1) Comfortability, (2) Safety, and (3) Efficiency and effectiveness.

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1. INTRODUCTION

Currently, the availability of vacant land is increasingly limited, especially in major cities, one of which also in Bandung City. Therefore, vertical housing such as apartments has become the best solution for people as a place to live nowadays, including in the East Bandung area, which is already quite densely populated with housing and increasingly limited land. One of the apartments in Bandung, for example, is located in East Bandung, namely the Panoramic Apartment. Panoramic Apartment is located at Jl. Soekarno-Hatta No.723, Cisaranten Kulon, Kec. Arcamanik, Kota Bandung, West Java 40292, which started to be effectively used by residents in 2015.

Buildings nowadays already demand the need for a smart living concept for the convenience and smoothness of their users' activities. In this regard, a factor that significantly influences its success is the use of technology in its processes and strategies. According to the Great Dictionary of the Indonesian Language (KBBI), technology is a scientific method to achieve practical goals. The application of technology in residential buildings is often referred to as the smart living concept. Smart living is strongly promoted to enhance the quality of life by the application of innovative solutions, and this is driven by domain specialists and policymakers, including designers, urban planners, computer engineers, and property developers (Botchway (2025)). Meanwhile Madakam and Ramaswamy (2016) stated that the notion of perceived smart living pertained to the integration of smart home devices, which were connected through advanced technology to the smart home system, enabling the monitoring and adjustment of the household's environmental system.



Picture 1. Overall view of Panoramic Apartment and visual of Panoramic Apartment on Main Street
Source : Documentation of Researcher and Brochure of Developer (2025)

The concept of smart living is a combination of various systems that are then integrated into various electronic devices in the living environment such as PCs, TVs, audio systems, and so on. By implementing the smart living concept, buildings can increase user comfort while minimizing electricity usage. So with the concept of smart living, humans can gain convenience, efficiency in distance and time, as well as comfort (Soraya (2017)(Jayanti (2020)(Botchway (2025)). Therefore, efficient smart living functions rely on the context of usage of the building, and professionals are recommended to acknowledge when planning, designing, and developing smart living systems along with experts judgment, considering ISO 9241-210. In which ISO 9241-210 provides guidelines for human centered design processes to enhance usability and user satisfaction in interactive systems. Consider the wider environmental effects of implementing widely used smart functionalities, also the functionality is in energy monitoring. (Botchway (2025).

According to Husein (2021), the factors which influencing the fundamental considerations for choosing an apartment are lifestyle changes, economic considerations, and space limitations. Urban communities avoid problems such as high land and housing prices

and the issue of commuting distance from home to work. Thus, lifestyles also change by spending more time in urban areas while still considering comfort and convenience (efficiency) (Yosita et al., 2018)(Dwidayati et al., (2022))(Ramdhani et al., (2022)). Meanwhile, according to Giffinger and Gudrun (2010), smart living as a concept in housing is a form of residential culture that considers social cohesion, neighborhood occupants, health conditions, individual security, housing quality, and also functions as part of learning or development facilities. Therefore, an approach that facilitates these aspects is technology.

Smart living environments refer to smart homes, that is to environments that adopts ICT (Information and Communication Technology) to collect and share information, analyze and monitor residents' behavioral patterns, and improve residents' quality of life (Pacheo (2022)). Subsequently, that perceived of usefulness, ease of use and social presence were discovered to be significantly associated with the intention to put AI-powered smart home devices into use in advance of application for the destination of smart living. The factors that influence Household Energy Consumption (HEC). The personal characteristics, including preferences for life values, social interaction, living environment and lifestyle, as well as physiological characteristics may have significant impacts on energy consumption decisions (Pratiwi et al (2026)) as the table describe below :

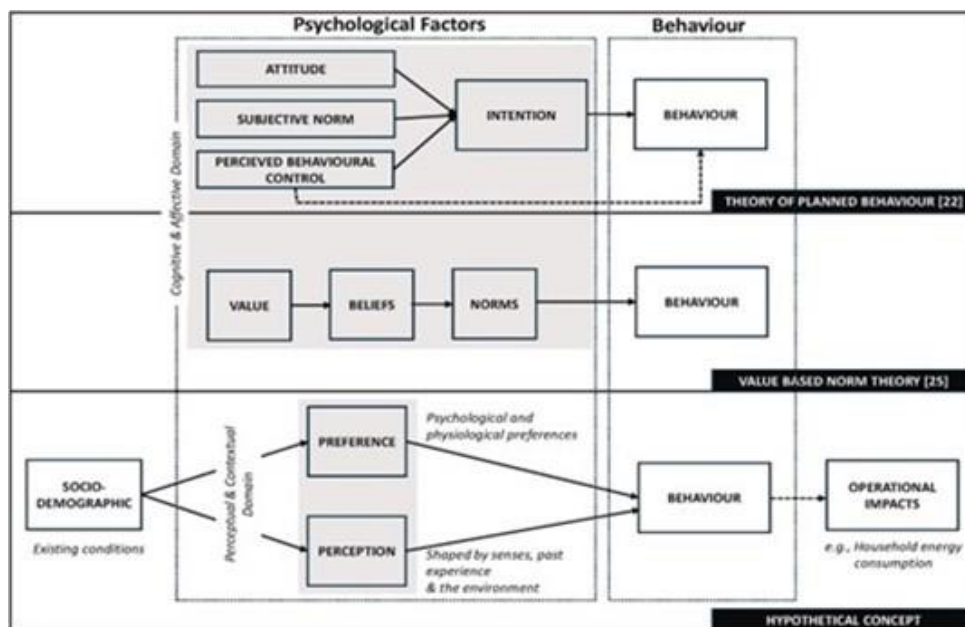


Diagram 1 Psychological and physiological factors influencing Household Energy Consumption (HEC).
Source :(Pratiwi et al (2026)).

There are various types and levels of complexity in applying the smart living concept in apartments, but for Indonesian society, or Bandung in particular, an analysis is needed on how the evaluation of this concept's implementation in high-rise buildings is, especially for apartment functions. In relation to this, this research aims to:

1. Analyze the application of the smart living concept in the Panoramic Apartment environment.
2. Analyze the advantages and disadvantages of implementing the smart living concept in the Panoramic Apartment environment.
3. Finding conclusion and recommendation for the next of apartment planning in applying smart living concept.

2. RESEARCH METHOD

The research method used is a descriptive qualitative and quantitative approach. The qualitative research method is a method based on post-positivist or interpretive philosophical foundations. This method is basically used to study a natural object with the researcher as the key instrument, and qualitative data collection techniques are usually conducted with inductive data analysis and the results include understanding meanings, uniqueness, constructing phenomena, and finding answers to hypotheses (Sugiyono, 2017). The qualitative method techniques used are through the stages of field observation, literature review, and structured qualitative analysis. The research was conducted from March 2025 to December 2026.

The literature review technique was used by reading and summarizing various journals, articles, online papers, and reputable websites, some of which included real-life executions such as research or direct interviews with experts. Next, surveys and direct observations were conducted at Panoramic Apartment. From the survey results, accurate data was obtained regarding brochures, the number of rooms that had been rented or purchased, and other information from the Panoramic Apartment Marketing Team. Direct observation was conducted by observing and documenting in the form of photos of several public areas or areas not using an access card within the Panoramic Apartment premises. Subsequently, all data was analyzed in a structured manner through research variables derived from theoretical studies in qualitative and descriptive quantitative forms.

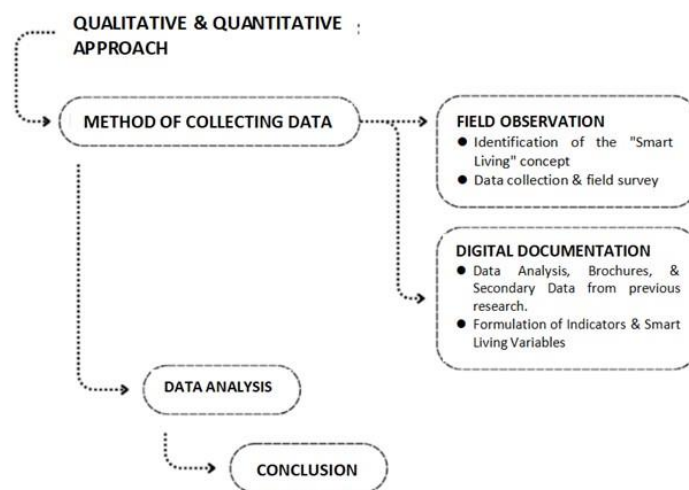


Diagram 2 Research Methods and Stages
Source : (Pratiwi et al (2026)).

3. RESULTS AND DISCUSSION

3.1 Time and Research Location

The research on the analysis of the smart living concept of Panoramic Apartment is located in Jl. Soekarno-Hatta No.723, Cisaranten Kulon, Arcamanik District, Bandung City, West Java 40292. This apartment was built by the developers and contractors PT. Wika Reality, PT. Jasa Sarana, and PT. Jabar Propertindo, with the construction period from 2012 to 2014. The construction process was considered fast for an apartment with 28 floors on a 1.8 hectare of land area and 4,400 m² of building are . The materials used were concrete and precast, in addition to the fast construction, the marketing of Panoramic Apartment was also considered fast because it was promoted through exhibitions and open houses along with

large discounts, so the price of 1 unit was still 130-245 million IDR, while the facilities and apartment concept were luxurious and received 5 stars at that time.

Panoramic Apartments are located in an area that is easily accessible by public transportation such as public transport with 5 travel routes, and it is also in a recreational area as well as dining places with 3.5 stars and above, such as Peta Park, Trans Studio Mall, MIM, etc. According to the Kamus Besar Bahasa Indonesia V (KBBI V), an apartment is a residence consisting of a living room, bedroom, bathroom, kitchen, and so on, located on one floor of a large and luxurious multi-story building, equipped with various facilities (swimming pool, fitness center, shops, and so on). In short, an apartment means a dwelling or residence in a vertical building that has these rooms and facilities.

Nydia, E.W., et al. (2016) in journal "Typology of Apartments Around Educational Facilities in Bandung City and Jatinangor" classified apartments based on their unit types, including studio type; 1, 2, 3-bedroom/family apartments; loft; and penthouse. Meanwhile, the types of apartments according to Kevin Fernando and Martin Halim in Apartment Sewa Smart Living in Jatinegara (2019) are:

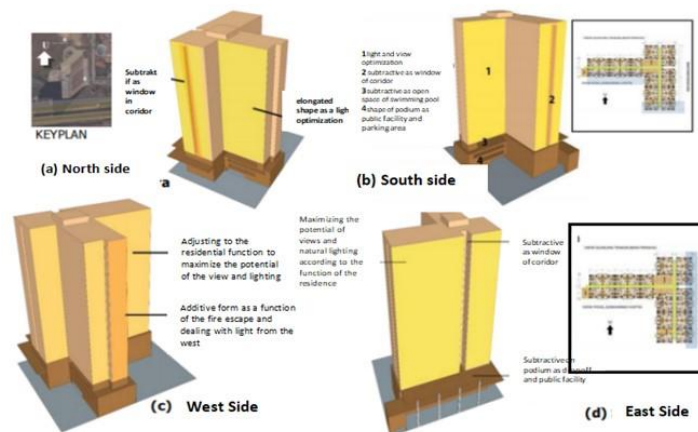
- a. Based on the development purpose:
 - 1) Social apartments, established for social purposes by the government
 - 2) Educational and complementary apartments, established by institutions for their employees' residence or by universities for student housing
 - 3) Commercial apartments, aimed at making a profit
- b. Based on based on class category
 - 1) Luxury apartments, equipped with facilities similar to three-star hotels and above
 - 2) Middle-class apartments, have adequate facilities but not too luxurious
 - 3) Low-cost apartments, have very simple facilities
- c. Based on ownership systems
 - 1) Rental apartment, residents pay rent according to the agreement
 - 2) Cooperative apartments (buy-sell), residents purchase housing units by becoming members of a cooperative
 - 3) Condominium (lease-purchase), the rent is considered as installment payments to buy a unit. The housing unit will become the resident's property once the rent has met the selling price
 - 4) Strata Title (ownership rights), residents directly purchase housing units as usual
- d. Based on service systems
 - 1) Service apartment, provides housing units equipped with services such as security and maintenance
 - 2) Ordinary apartment, only provides housing units and services are limited to technical maintenance
 - 3) Hotel apartment, has services like a star-rated hotel (unit cleaning, etc.)
- e. Based on building height
 - 1) Low rise, consisting of 1-6 floors equipped with stairs/elevator
 - 2) Medium rise, consisting of 6-9 floors equipped with lift/elevator
 - 3) High rise, consisting of more than 9 floors equipped with lift

Panoramic Apartment has a unique T-shaped design with area divisions, there are three podium floors as parking areas and one floor as a commercial area such as a swimming pool, gathering room, mini-market, laundry, and retail area. In addition, there are also management spaces such as the Marketing Gallery and Management Building. Meanwhile, the building above already includes private spaces, namely rooms that are rented or sold and require an access card to enter those areas. The advantage of this T-shaped building mass is

that it makes it easier to distinguish between public and private zones, and each room has a different view or perspective of the residence without obstructing each other, while also receiving optimal natural lighting for areas directly connected to exterior spaces. Based on the results of data collection, the location of the lobby and Marketing Gallery is seen to be on the main entrance road, i.e., above near the main road, while with a difference of 3 floors down there is a parking space and basement that is connected to a residential street.



Picture 2. Floor Plan of Tamansari Panoramic Apartment
Source : Documentation Brochure of Developer Panoramic Apartment (2025)



Picture 3 Analysis of the Mass Form of Tamansari Panoramic Apartment Building
Source : Viridianti et al (2016)



Picture 4. Panoramic Apartment View from the back (parking lot)
Source : Documentation of Researchers (2025-2026)

In the book *Theory and Strategy of Housing Planning in the Contemporary Era*, Yosita (2019), on page 11, it is stated that, along with the development of the times and also the development of income, the standard of living or the level of welfare also increases. Therefore, usually the reference or framework in the housing and settlement development process also improves. In the framework to meet the increasing needs mentioned above, in addition to the conditions and variety of infrastructure, technological devices are also required to facilitate apartment residents, such as the internet, telecommunications facilities, and other supporting and complementary facilities for security and comfort, such as TV channels, air conditioning, electric stoves, and so on. Essentially, in increasingly limited rooms or at least there is a need for better management of quality of life and habits (culture) in a smarter way in a place (Soraya: 2017) stated that in which to meet the principles of smart living as previously proposed by theories.

In terms of the completeness of facilities that support convenience and comfort, Panoramic Apartment appears to be quite good. However, recalling Giffinger's (2007), there are aspects that can be further maximized in terms of smart environment, considering that what needs to be achieved is not just convenience but also health and comfort. The small garden at Panoramic Apartment, as shown in Figure 3, could be further optimized in its design with a vertical garden and a roof garden in the future because the environment still feels barren, especially with quite a high occupancy rate. Vertical gardens or vertical greenery, according to Jayanti (2020), are actually plants arranged vertically to balance the environment, thus capable of creating a specific microclimate around them. Vertical gardens can be used as an idea to make an urban environment appear natural. Davis et al., (2016) in (Lestari et al., 2019) also mentioned that the creation of a vertical garden plays an important role in increasing air humidity and lowering temperature by reducing heat transfer between buildings and the surrounding environment, as well as protecting from solar radiation. Facilities, amenities, and infrastructure available at Tamansari Panoramic Apartment are:

1. ATM Centre
2. Cafe, Laundry
3. Shopping area
4. Swimming pool
5. Rooms with studio and 2-bedroom types
6. Living room
7. Kitchen
8. Private bathroom
9. Smoking room and waiting room
10. Ballroom
11. 24-hour security and reception
12. Restaurant
13. Coffee Shop
14. Conference Room
15. Access Card and Elevator
16. Parking area and garden.



Picture 5. Studio Type Room

Source : Documentation from brochure of developer (2025)



Picture 6. 2 Bedroom Type Room

Source : Documentation from brochure of developer (2025)



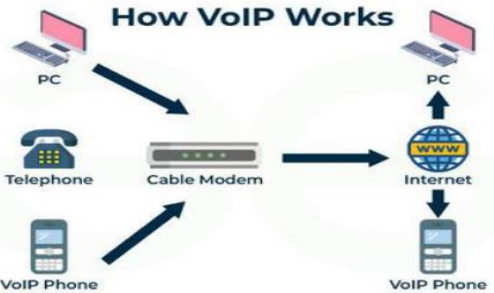
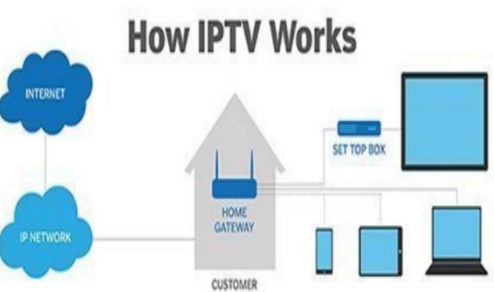

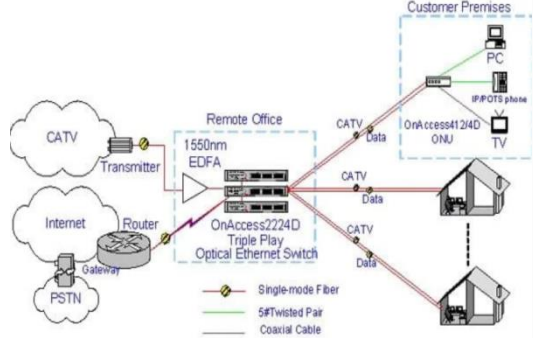
Picture 7. Unit Occupancy and Reserved Data obtained by the Marketing Team.





Source : Documentation from brochure of developer (2025)



3.2 Smart Building Component for Smart Living at Panoramic Apartment

Part of smart living concept is also about application of technology in which should being applied efficiently. This table bellow is several technology which apply in Panoramic Apartment.

Table 1. Component of Smart Building for Smart Living and the Functions

Component of Smart Building for Smart Living	Function
<p>1. IP Phone or VoIP (Voice Over Internet Protocol) - System</p> 	<p>IP Phone or VoIP (Voice Over Internet Protocol) is a voice transmission system over the internet network, where the voice will first be converted into data and then sent. Its advantages include affordable prices, the system is easy to access and can be installed anytime (cloud-based system), clear sound quality, free of charge, speed dial makes it convenient without typing numbers, limit duration, limit destination, and multiple passwords to manage users by password.</p>
<p>2. IP TV or Internet Protocol Television - System</p> 	<p>IP TV or Internet Protocol Television is television broadcasting using an internet network without cable or satellite TV. The advantages are more private, can be used on various devices not just a TV, more channels such as international channels. Example of IPTV is Indihome.</p>
<p>3. High Speed Internet Access is 100%</p> 	<p>High Speed Internet Access is 100% fiber optic technology, with stable internet, with large capacity for all users in the apartment.</p>
<p>4. Triple Play by CYBER Complex - System</p> 	<p>Triple Play by CYBER Complex is a service provided by telecommunications operators for residential customers in the form of a cable TV subscription, landline telephone, and internet access.</p>

Component of Smart Building for Smart Living	Function
<p>5. Access card is an electronic key</p> 	<p>An access card is an electronic key used to open a room's door. The access card is taped</p>
<p>6. CCTV (Closed-Circuit Television)</p> 	<p>CCTV (Closed-Circuit Television) is a security device that utilizes analog signal technology. The signal is used for transmission from the camera to the device. Security is recorded from the surveillance camera to view the surroundings.</p>
<p>7. Water Heater</p> 	<p>A water heater is used to heat water quickly without having to boil the water first. The cold weather in Bandung is very suitable for installing a water heater.</p>
<p>8. AC atau Air Conditioner</p> 	<p>AC or Air Conditioner is a room cooler. It is used to cool a room that feels hot and stuffy. Although Bandung is known for its cool air, in tall buildings such as apartments, the air or ventilation usually feels warmer, so an AC is needed if required.</p>
<p>9. Smoke & Fire Detector</p>	<p>Smoke & Fire Detector is a utility installation for handling fires. The device will detect smoke or fire and then will activate, releasing water and sound as a notification.</p>

Component of Smart Building for Smart Living	Function
	
<p>10. Smart Furniture</p> 	<p>Smart Furniture is furniture or household appliances that are smart. It aims to make it easier for its users. This is supported by the availability of switches for the installation of devices such as: electric stoves, electric kettles, internet routers, and so on.</p>

Source : Analysis of researcher (2026)

On the other hand, based on research by Dwidayati et al (2022), young adults have a fairly high level of interest in vertical housing, around 62%. This result proves that young adults are beginning to think about sustainable quality of life on the flow of urban growth. In addition, this can be an opportunity for vertical housing developers to capture this already quite high demand market. Based on research results with young adult respondents, it was found that building design and quality are the main factors that are very important in choosing vertical housing. As many as 88% of respondents chose these factors. This shows that young adults already quite understand the importance of building reliability, especially affecting health aspects. Over time, this factor becomes very dominant. There are also a number of alternative terms used interchangeably with smart homes for the destination of smart living, such as electronic homes, digital homes, home automation, domestics, connected home and so on. One of the goals of home technology services is to serve the needs of people, improve their quality of lives, and improve efficiency in their homes—in terms of energy use, surveillance, and the like (Balakrishnan (2018)) (Hong (2020)). But, he challenge of the Panoramic apartment is the less secure access and very limited green space. If only the location were not near the top of the viaduct, it might be safer and also more comfortable. This is a shortcoming of this apartment. Along with the public's increasing interest in apartment products, the determination of location, land area and proportion, as well as design, should be planned more optimally at the beginning of the building design process.

3.3 Analysis of Aplication Smart Living Concept in Panoramic Apartemen, Bandung.

The proposed concept of smart living is in brief also must constituted upon three modules: (1) Data acquisition and processing, (2) Knowledge repository, (3) Performance monitoring system including prediction engine, consumption modelling, emissions calculation and decision support. Initial testing results are indicating the potential of electricity savings up to 15% enabled by visualization and awareness about electricity consumption (Sucic et al

(2015))(Botchway et al (2025)). Essentially from all of above, the concept of smart living in design of building must meet the principles of: (1) Comfortability, (2) Safety, and (3) Efficiency and effectiveness.

Smart living is also ultimately requires being composed of a system that integrates several electronic devices such as PCs, TVs, audio systems, and so on, which form a specific product like table-desktop socket systems or floor socket systems. Smart living in residences, particularly apartments, usually uses a smart home system that provides comfort, safety, security, and energy savings automatically and programmably through a building's computer.

Some examples of smart living in a smart home system include air conditioners, TVs, etc. home theatres, light controllers, CCTV, internet, indoor cameras (which can detect movement and send notifications to smartphones if suspicious movement is detected), door/window sensors (which can detect door/window movement), 4-in-1 motion sensors (capable of monitoring movement, temperature, light, and humidity, thus managing lights, air conditioners, and more), and many other smart living devices. Therefore, it is necessary to improve the quality of building design, particularly in lighting, ventilation, as well as using good and quality building materials so that residents of vertical housing can live more comfortably and feel at home in their residences, and can carry out activities more optimally.

This can serve as a recommendation for evaluation for the renovation of Panoramic Apartments in the future and for recommendations in planning other new apartments. When viewed from the perspective of the availability of facilities and infrastructure, Panoramic Apartments have made sufficient efforts to provide ease in the availability of supporting facilities and infrastructure, so residents do not need to travel far to find ATMs, shops, laundries, coffee shops, swimming pools, and the like. Within a radius that is not too far, there are also commercial facilities such as MTC and Trans Studio Mall, allowing residents to reach this area without having to travel a long distance. The drawback is that access to the apartment located in a hilly area is less safe. The assessment of the condition of the Panoramic apartment, when viewed from the research variables derived from the "smart living" theory discussed earlier, can be concluded in the following table:

Table 2. The Quality of Panoramic Apartments is Assessed from a "Smart Living" Concept.

Aspect	Indicators	Score	Category
Comfort	Accessibility	50	G
	Availability of public facilities	90	G
	Quantity and Quality of Green Space	50	L
	Ventilation Standard (temperature)	90	G
	Lighting Standard	90	G
	Completeness of internet facilities	90	G
Safety	Accessibility restrictions	50	L
	Fire prevention and control	90	G
	Availability of CCTV	90	G
	Availability of environmental security	90	G
Efficiency and Effectiveness		70	
	Access to public transportation		E
	Availability and quality of shared space	70	E
	Room design for space flexibility	90	G

Sourcee : Analysis of researcher (2026)

Description of category

G	:	Good	:	90
E	:	Enough	:	70
L	:	Lack	:	50
N	:	Nothing	:	0

4. CONCLUSION

Based on the study above, it can be understood that the concept of *smart living* is not only about the application of technology in high-rise buildings, but also includes aspects of building design and maintenance. Based on the analysis in Table 2, it is evident that the aspects of comfort and access security in the Panoramic apartment are poor. Additionally, there is a deficiency regarding the proportion and quality of green spaces. Given that the land is located on the viaduct of Soekarno Hatta Street, with a railway line running underneath, the Panoramic apartment indeed faces difficulties in obtaining adequate land for this necessity.

However, for technology use as in Table 1, the Panoramic apartment has applied the smart building concept as part of the smart living concept. What needs to be done is how to implement regulations to achieve efficiency and effectiveness in energy use, which can be better managed, for example, with AI technology today. Thus, the aspects of (1). Comfort, (2). Safety, and (3). Efficiency and effectiveness can be better achieved. To accomplish this, the apartment management can further enhance security and comfort, for example, by improving privacy technology by filtering people who can enter with scheduled access card updates, implementing regulatory updates to maintain comfort and security from threats such as crime, fire, or pollution, and improving the response of building control facilities, and so on.

From the above, it can be concluded that smart living, if it is recommend to be applied to apartment buildings in the future, needs to start from determining the location and design, with BIM technology efficiency, the use of technology can be planned. Then, equally important is the improvement of apartment management, this is crucial for achieving supervision and management of comfort, quality of public facilities, and efficiency of technology use, as well as disaster safety. To achieve this, control from the government regarding location determination and regulations on the use of high-rise buildings is also needed. Without these things, the smart living concept can collide with the challenges of the declining environmental sustainability, for example the existence of externality such as pollution, congestion, flooding, and so on. The government needs to manage environmental utility systems more responsively and progressively in relation to the increasing number of high-rise buildings in urban areas.

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