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Origami Architecture of an Office Tower in Mega Kuningan, Jakarta

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Abstract: Mega Kuningan, as a business district, has a vision for the future. Applying Postmodern Architecture theory to one of its styles is one option. This design study aims to redefine conventional office buildings, offering forward-thinking solutions that meet the evolving needs of modern businesses. A growing economy is creating more workers renting offices in high-rise buildings through innovative workplaces. By exploring new design approaches, we propose a building facade inspired by folded architectural origami.

Keywords:architecture folded, origami architecture, innovative, development, office, business

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Introduction

The competitive business climate in Indonesia improved in 2021. This was recorded in the 2021 annual report of the Business Competition Supervisory Commission (KPPU), published on its official website. Data for 2021 was available as of April 2022. This year's IPU score is also approaching the National Target set in the 2024 Medium-Term Development Plan, namely a Business Competition Perception Index of 5.0 points. According to the KPPU, high business competition will indirectly boost labor productivity and, at the same time, drive higher wages (Databooks, 2024).

Based on Government Regulation No. 24 of 2022 concerning the Implementing Regulations of Law No. 24 of 2019 concerning the Creative Economy, the creative economy makes a significant economic contribution to gross domestic product, employment, and exports. Data from the Ministry of Tourism and Creative Economy (Kemenparekraf) from 2013 recorded that the creative economy quantitatively contributed 7.05% to gross domestic product (equivalent to IDR 641.8 trillion), 7.8% to the number of businesses, and 6.8% to employment opportunities. (Government Regulation No. 24, 2022).

Changing fashion trends stem from the increasing prevalence of idealism in social life. For example, the term "work-life balance" is frequently heard today. A survey of over 9,000 British workers showed that 65% of job seekers prioritize work-life balance over salary and benefits. A similar trend is observed in the US: of 4,000 respondents to the 2022 Flex Jobs Career Survey, 63% said they would choose balance over a higher salary (BBC Work life, 2025). This term was coined and adopted as an ideal standard for human life. This idealism is certainly different from the past, when people faced more serious situations, and their mindsets and perspectives on life changed. This is especially true in office architectural design, as

revealed by the correlation between functional requirements and architectural design processes and programs (Nurwasih, 2017).

According to Marlina's explanation, a rental office is a building that accommodates business transactions and services professionally, that a rental office is an office facility grouped in one building that is rented as a response to the rapid economic growth, especially in big cities (development of industry, building/construction, trade, banking, etc.) (Marlina, 2008).

In office property products, several factors are key to success in reaching the target market. These factors are (Marlina, 2008): 1. Space flexibility, 2. Occupancy rate, 3. Rental price, 4. Service charge, and 5. Image.

Like other commercial buildings, the design of rental office buildings takes efficiency and effectiveness into account. These two aspects will impact several things, including: 1) Efficient design in terms of financing. 2) Efficient spatial planning, meaning maximizing profitable rental space; a minimum of 60% of the total area must be rentable. 3) Effectiveness, meaning the building design must be appropriate to the function it accommodates, minimizing non-functional spaces. 4) Spatial planning, circulation routes, and service facilities must be equitable to meet the needs of all tenants.

The complexity of the functions and activities within a spatial program. Next, it will be determined whether the building has a single mass or a complex mass. The placement of a building indicates the status level of its function, as well as the activities that occur within it. To determine the placement of functional groups according to their hierarchical status and requirements, it is necessary to classify the activities within those functions. This classification is adjusted according to the status level of the activity actors, both in number and type (Laksito, 2014). To plan the correlation of functions outlined in the programming, architects must consider the type of data, how it is needed, and in what format it should be presented. Data compilation is essential to obtain the most useful information. Architects must choose an approach to data collection based on the above considerations, sketching an outline and summarizing the data for analysis purposes.

Based on organization, rental offices are divided into several categories: 1. Commercial offices, such as offices used for trade and insurance. 2. Industrial offices, which are connected to factories. 3. Professional offices, which are used only for a specific period of time. 4. Institutional offices, which are used for long-term purposes (Mukhtar & Dwiyanto, 2024).

The theme and concept serve as the overall design ideas that guide the entire process from start to finish. They provide insights into how the design will be executed and how it is intended, ensuring that the entire design process adheres to the established theme and concept. Many innovative ideas have been implemented in the world of architecture, inspiring examples to consider.

Precedent studies were conducted on several international buildings below.

IAC Head quaters	Nakagin Capsule Tower	Google Bay View, California
		
Location: New York, USA Area: 4.56 hectares Architect: Frank Gehry Theme: White Sail Deconstructive	Location: Tokyo, Japan Size: 3,091 m² Architect: Kisho Kurokawa Theme: Metabolist Architecture	Location: California, USA Size: 4.56 hectares Architect: BIG Theme: Green Adaptive
The façade uses frits, ceramic dots applied to the glass. The pattern of dots is dense near the top and bottom of each panel and transparent in the middle—at eye level—framing the cityscape with blurred edges. It serves to reflect light and glare.	The Nakagin Capsule Tower is Kisho Kurakawa's attempt to address the temporary nature of buildings by designing them to be adaptable to different situations, with a modular system. The purpose of this building can be seen from the interior of the capsule, which is compact yet innovative.	Google Campus Bay is a creative office building with a biophilic approach. Its open concept blends with its surroundings, including nature and social interaction within and outside the building.

Table 1. Identification of technical regulation site area

Aspect	Description
Zone	K
Subzone	K-1
Sub-district	East Kuningan
City	South Jakarta
Land Area	15,886 m2
KDB 55%	8,737 m2
KDH 20%	3,177 m2
KLB	6.84

Methodology

Baris Pendet dance can be analyzed through various theoretical approaches This design method is based on qualitative methods to obtain data related to the design of rental offices in Mega Kuningan, South Jakarta, referring to Ardhiati (2017). This study consists of four stages: data collection, analysis, concept, and design.

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Results and discussion

Design Location

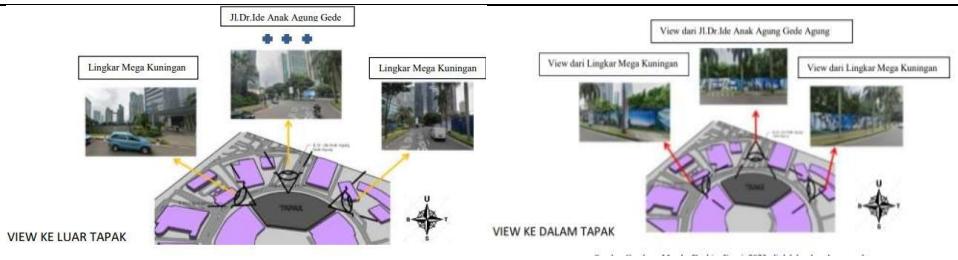
The selected design location is in Mega Kuningan on Jalan Dr. Ide Anak Agung Gede Agung, RT.1/RW.2, Kuningan, East Kuningan, Setia Budi District, South Jakarta. This location is a well-known business zone and is highly strategic for office development. The area is included in the "Golden Triangle," which represents 28 major business, financial, and diplomatic areas in this area, which also serves as the city center of Jakarta.

Site Area Identification

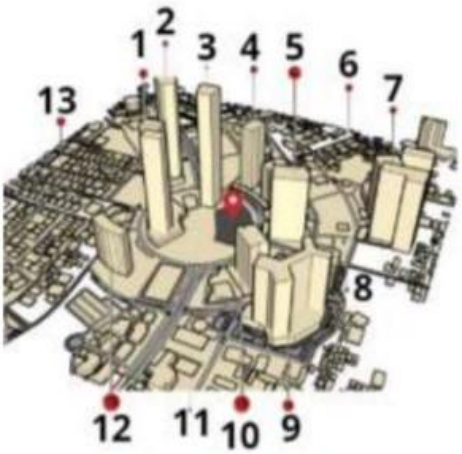
Located on the Mega Kuningan Ring Road with Jalan Dr. Ide Anak Agung Gede Agung in the front center of the site. One-way traffic (yellow arrow) is used on the Mega Kuningan Ring Road and Jalan Dr. Ide Anak Agung Gede. Two-way traffic (black arrow) is used on Jalan West Mega Kuningan. Each road has a pedestrian walkway. Congestion occurs during commuter hours (1), (2), (3), and (4) (6:00 AM – 8:00 AM) and commuter hours (5:00 PM – 7:00 PM), as the site is located in an office district.

The site's location, which has several alternative access roads, provides a relatively mild traffic jam during peak hours, allowing for continued traffic flow.

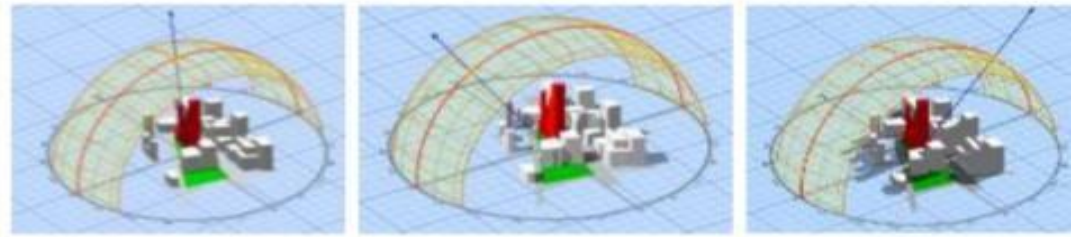
1. View Data

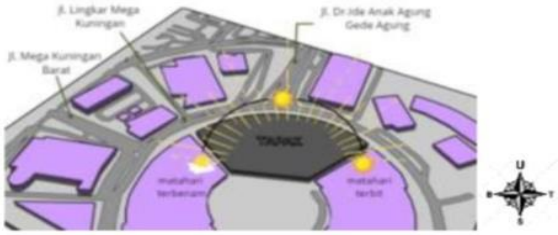
Data

Design response
The site faces one side of the road in front of it, namely the Mega Kuningan Ring Road and Jalan Dr. Ide Anak Agung Gede Agung. The building's focal point is located in the center, creating an attractive image. The center is a strategic viewpoint, directly overlooking the two-way road, namely Jalan Dr. Ide Anak Agung Gede Agung and the Mega Kuningan Ring Road.

2. Site Data

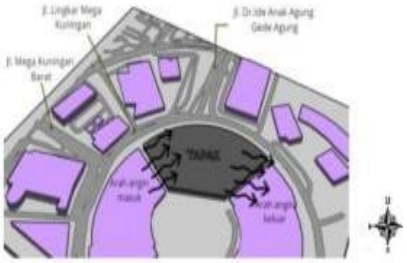
Data	
 Gambar 4.15 Analisis Site 1	Legend: 1. The Ritz-Carlton (Hotel) 2. World Capital Tower (Office) 3. PT. AISIN ASIA (Office) 4. NET (Office) 5. Noble House (Office) 6. Culinary 7. Dea Tower (Office) 8. Loewe (Restaurant) 9. Bellagio Boutique (Mall) 10. VOffice Tower (Office) 11. Shopping 12. JW Marriott 13. Trade Services
The site is located in a central office area with a bustling business district in Jakarta. The site is surrounded by modern high-rise buildings, with trees separating the buildings and helping to freshen the air.	
Design response	
The influence of environmental values on buildings designed from the view and adaptation of the building's character to the environment: 1. The character of the surrounding area's buildings fulfills the balance of design with the environment, so the elements of modern building style based on the style of buildings around the area are used as a reference. 2. Site Management: The exterior area of the building requires a design that becomes the attraction of the office for the surrounding environment and also adds to the beauty of the road can be done. 3. Façade Processing: As an effort to attract the building, façade processing is one of the main factors. With the modern style of the surrounding buildings, this style element becomes one of the references in the design.	

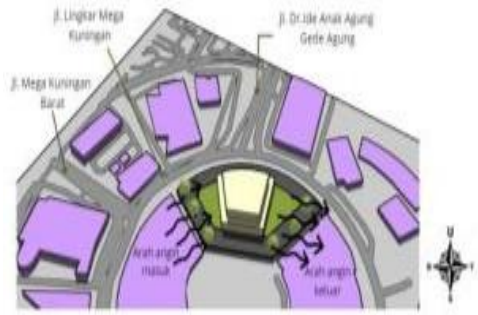
3. Sun path orientation

Data
 (1) Jam 08.50 (2) Jam 12.00 (3) Jam 14.00 Sumber gambar : Andrewmarsh-openstreetmap, 2023

High-intensity sunlight exposure occurs on the east side (7:00 AM - 12:00 PM) and the west side (12:00 PM - 5:00 PM). The site is oriented north and south. The average temperature is 30°C.
Design response
 Sumber gambar : Marsha Dzakira Fauzi, 2023 diolah berdasarkan google maps
1. According to SNI-14-1993-03, the optimal cool to comfortable temperature ranges from 20.8 to 25.8 degrees Celsius, a solution is needed to reduce the heat radiation to achieve an optimal cool and comfortable room: 1. Double Façade Technology Excessive use of AC will have a negative impact by causing a greenhouse effect, the use of façade technology can reduce the outside temperature by 4% and reduce energy emissions. 2. Selecting Solar Gard/Thermal Glass is one way solar radiation enters, so reducing solar radiation should begin with selecting the type of glass. Using Solar Gard and thermal energy storage has long-term benefits in buildings.

Wind and Climate

Data	
 **Gambar 4.18 Analisis Angin** Sumber Gambar : Marsha Dzakira Fauzi, 2023 diolah berdasarkan google maps	
According to Ventusky's research, in 2023, the strongest wind direction on Jalan Lingkar Mega Kuningan was from Southwest to East, with a wind speed of 3 mm at an altitude of 10 m above the ground, a wind gust of 7 mph, and an air pressure of 29.8 Hg.	According to Ventusky, the 2023 climate in Mega Kuningan was 40% humidity, a high temperature of +30°C, a thunderstorm intensity of 300 J/kg, and an air quality score of 119 on the Air Quality Index (AQI), which is considered unhealthy for sensitive groups.
Design response	



Gambar 4.18 Analisis Angin
Sumber Gambar : Marsha Dzakira Fauzi, 2023 diolah berdasarkan google maps

Based on the analysis, the strongest wind direction is from the southwest to the east side of the site. Therefore, vegetation can be placed to break up the wind direction, ensuring even circulation and reducing the force of gusts directed into the site. Having different building heights is beneficial for avoiding turbulence caused by strong winds.

Jakarta, as a tropical climate with hot temperatures and high rainfall, requires shading to protect buildings from solar radiation and rainfall. Wide overhangs prevent rain splashes on buildings and protect them from direct sunlight. The layout of a building will determine the indoor temperature.

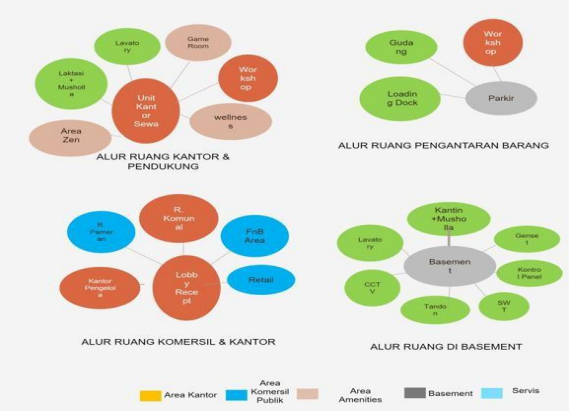
Installing windows directly facing the East and West, which are high-intensity, will result in heat entering the room, so the room temperature will depend on the direction of the facade. Using vegetation will act as natural shading and regulate air humidity

Noise

Data

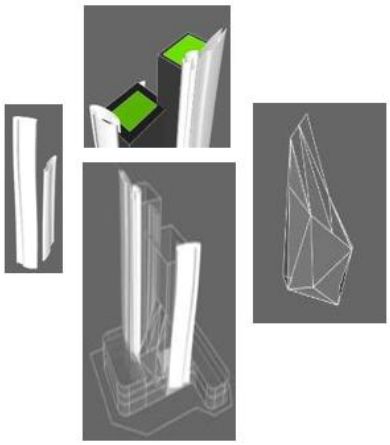
Located in the Mega Kuningan commercial area, the strongest noise (red) on the site comes from road activity with vehicle noise, namely on Mega Kuningan Ring Road, West Mega Kuningan Road, and Dr. Ide Anak Agung Gede Agung Road. While moderate noise (blue) comes from neighboring buildings, namely PT. Aisin and the Ritz-Carlton.
Design response


Gambar 4.20 Analisis Kebisingan
Sumber Gambar : Marsha Dzakira Fauzi, 2023



Memory of 'Paper Material' as a Conceptual Idea for Form

This building's theme refers to one of Charles Jencks' 13 theories on postmodern architecture (Jenck, 1985). The use of 'paper material,' known as a functional material, correlates with the function of offices in the past, now replaced by digital devices, and is presented as a 'memory of paper.' Paper's functionality and its closeness to symbols are closely interconnected. Paper is smooth and flexible yet firm, lightweight, simple, and sustainable, and possesses strength when folded. Architectural theories that take advantage of the properties of paper folding have become popular (Torondek et al., 2017). The design, named the Paper Tower, aims to create a harmonious blend between the office workspace/office spirit and urban architecture. Because the design of tall buildings will impact the city's aesthetics (Karimimoshaver & Winkemann, 2018), careful planning is required.



The basic idea behind the design of "paper architecture"

The design of the Paper Tower required knowledge of tall building structures (Larsen, 2016), as a bridge between architects and engineers.

High-Rise Building Structure Concept

In addition to referring to the CTBUH (2025) standard regulations, in practice, tall building designs are required to comply with several safety standards, including: (a) National Standardization Agency of Indonesia. Structural Concrete Requirements for Buildings and Commentary, (b) Nugroho, Sagara, and Imran, 2023), (c) Sucipto and Sucipto, 2023, (d) Worku and Hsiao, 2021), (e) FEMA 440, 2023.

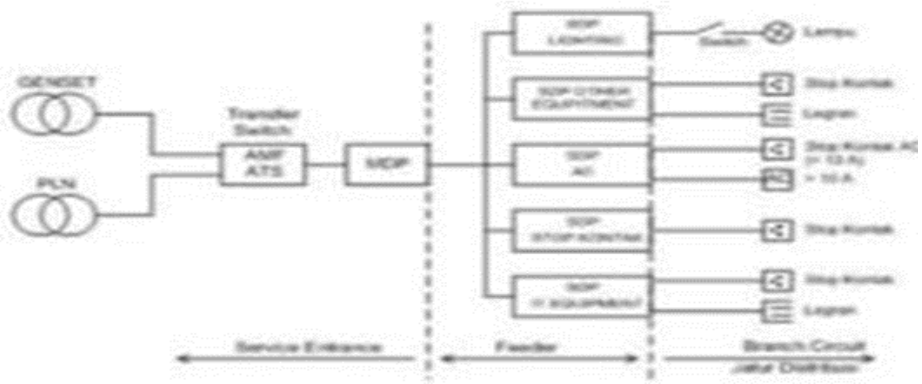
The building is a multi-story structure with a fairly heavy load, so bored pile foundations are used to support the load and strengthen the building's foundation structure. The pile depth and length will be adjusted based on the soil hardness level determined by the soil test.

Reinforced concrete structures use a mixture of concrete and steel reinforcement. The advantages of reinforced concrete structures include fire and water resistance, structural strength, low maintenance costs, high durability, and cost-effective materials.

Utility Concept

Heating, Ventilation, and Air Conditioning (HVAC) system installations are commonly used in office buildings. HVAC systems effectively regulate temperature and air circulation in large office areas, providing three main functions: heating, ventilation, and cooling (SNI 8153, 2015).

The electrical system in commercial multi-story buildings is divided into two sources: the main electricity source from PLN (State Electricity Company) and a backup power source from a generator. The components of the building's electrical system are as follows.

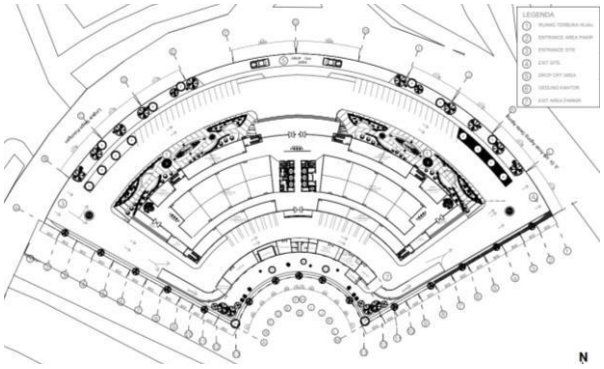


Plumbing

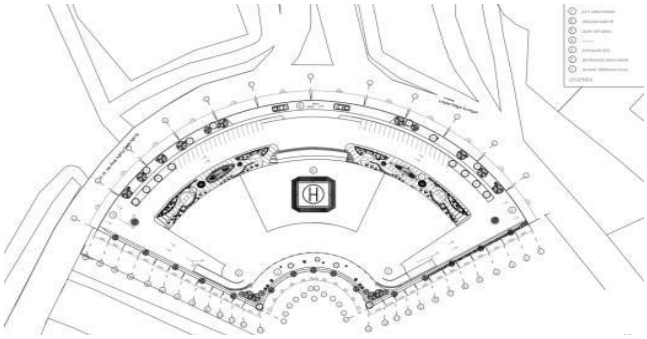
The plumbing system serves to distribute clean water and provide a drainage channel for wastewater to designated locations, preventing environmental pollution.

The Water Treatment Plant (WTP) clean water supply system sources water from wells (Deep Wells) and the Regional Drinking Water Company (PDAM). Water pumped from the well is collected in a raw water tank and processed through the WTP. Once clean, the water is collected back into the clean water tank, along with the PDAM. The collected water is then distributed to the parts of the building that need it. 61 b. Waste Water Supply System Wastewater from toilets and kitchens is generally collected in separate locations. Wastewater must first go through a filtration process to remove impurities. Next, the wastewater is processed again in the Sewage Water Treatment (SWP) before being discharged into the city drains.

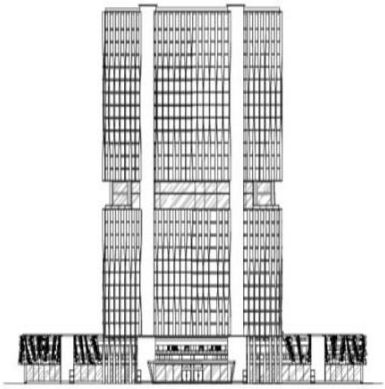
Plan Pictures



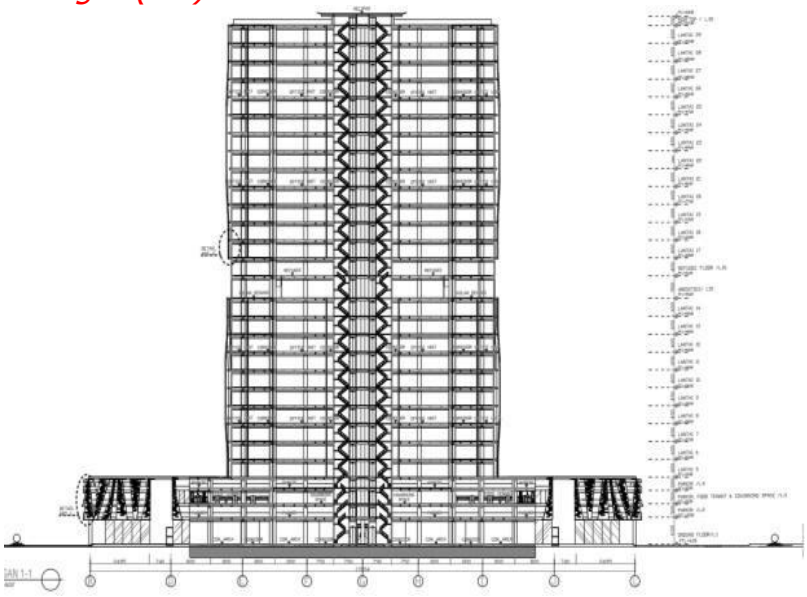
Block Plan Image



Siteplan Image



One of the Cut Images (1-1)



Conclusion

Like other commercial buildings, the design of rental office buildings takes efficiency and effectiveness into account.

The growing economy is creating more workers renting offices in high-rise buildings through innovative workplaces. By exploring new design approaches, a building facade inspired by folded architectural origami has been proposed.

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