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BIOCLIMATIC ARCHITECTURAL APPROACH IN PLANNING A CO-WORKING SPACE BUILDING WITH URBAN AGRICULTURE IN MEDAN CITY

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Abstract (English)
The availability of food needs has become a new challenge from urbanization activities in Medan City. Until now, the community's food needs are still obtained from import-export activities due to insufficient food production produced by local communities. The city's dependence on other regions makes the community vulnerable to food crises that can occur at any time. On the other hand, urbanization has also resulted in damage to the quality of life of urban communities; lack of green land, industrial activities and unhealthy lifestyles. People are prone to anxiety, stress, depression, fatigue, weakness and other conditions that cause a decrease in the productivity of people's lives. Increased food demand and poor quality of life can provide a negative bounce effect from the current adverse impacts. In this thesis, architecture comes as a reformer of the current form of urbanization. In a further context, architecture will be brought as a form of provocation to generate positivism in the area by uniting green open spaces and commercial public spaces. The architectural design is realized in a blend of coworking space functions with urban agriculture. The bioclimatic architectural approach is chosen to respond to the climate for humans as well as the environment inside the building and become an important part of the catalyst of urban life towards a better life.

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agriculture, coworking space, public space, city, green open space

Introduction

In 2045, an estimated 70% of Indonesia's population will live in cities (World Bank, 2019). The rapid growth of the urban population could pose a threat to the food security of urban communities by 2030 (WHO, 2022). The Food Security Office of Food Crops & Horticulture of North Sumatra Province noted a decline in food production in the form of: rice, corn, soybeans, shallots, garlic, red chili and cayenne pepper (Dinas TPH, 2017-2021). The availability of land for food production has also decreased due to land conversion and environmental damage by industrial housing activities in the city. Declining land availability and uncertain climatic conditions are the main reasons for the decline in community productivity in agriculture. The threat of food crisis is very likely to occur in Medan City.

The uncontrolled population growth accompanied by inappropriate urban planning has resulted in environmental degradation in Medan city. In 2023, the environmental quality index of Medan city will only be 63.67; in the previous year it only reached 60.59 with the worst indicator being the land quality assessment of Medan city (KLHK, 2023). Environmental degradation also affects the quality of life of urban communities, especially in the aspects of education and health, which causes a decrease in community productivity at work. It should be noted that Indonesia only scored 0.53 on the human capital index assessment in 2019 (WorldBank, 2019). The assessment shows that Indonesian people are only able to realize half of all the potential that exists in themselves.

Issue

Urbanization has brought cities to a condition that is not ideal. The increasing population has led to an increase in basic needs such as food. Limited land availability has become an obstacle in fulfilling the food needs of urban communities. This condition creates a city that is dependent on food from other regions; the city becomes vulnerable to a food crisis. This problem is part of the environmental degradation caused by urbanization.

On the other hand, a damaged environment has created a damaged human life. The quality of the environment plays an important role in the quality of human life, specifically in the aspect of human productivity. A decline in human performance in activities can make it difficult for cities to grow economically, infrastructurally, socially and so on. In other words, the city becomes more vulnerable to damage in the future.

Urbanization has become an unstoppable part of city growth. However, cities must be able to respond to the impact of urbanization appropriately to avoid damage to the city.

In 2020-2021 North Sumatra experienced a population growth rate of 1.23% (BPS, 2022). The population growth that occurred was not followed by an even distribution of the population. The distribution of North Sumatra's population is 40% in the Medan city area (BPS, 2022). Projected growth is expected to continue to increase which can affect the growth of the city in the future.

Food security has become a major issue in the era of global urbanization. The decline in global food yields has led to the vulnerability of cities to food crises. Increased food demand and food availability have pushed up the Food Price Index (FPI) to its highest level (FAO, 2022). The decline in food yields tends to lead to people's basic food needs.

The climate uncertainty is one of the main causes of the decline in food yields. In addition, the reduced availability of agricultural land due to industrialization is also a major issue of food problems that occur. On the other hand, the greatest demand for food is found in urban areas where industrialization is the catalyst.

A city's ability to grow is influenced by the activities of its people. The better the productivity of the people, the better the growth of the city. The activities of the city's people are influenced by the identity and area of the city. Variation in community productivity is 75% influenced by urban zoning. The further away from the city center, the lower the variation in productivity. The urban population is unevenly distributed and the drive for industrialization by urbanization has created socio-economic inequalities in the city.

In 2019, Indonesia received a score of the human capital index assessment of 0.53 (WorldBank, 2019). The assessment shows that Indonesian people do not have enough productivity to utilize all natural resources. One of the main factors in the assessment is the education and health of urban communities.

Method

The method used in the final project is a qualitative method. Planning and design are obtained through repeated studies and observations. Case exploration and data collection are obtained through observation and literacy related to the real conditions in the city. Understanding the local context in the area with theoretical studies, functions and themes is key in architectural design solutions to the problems discussed.

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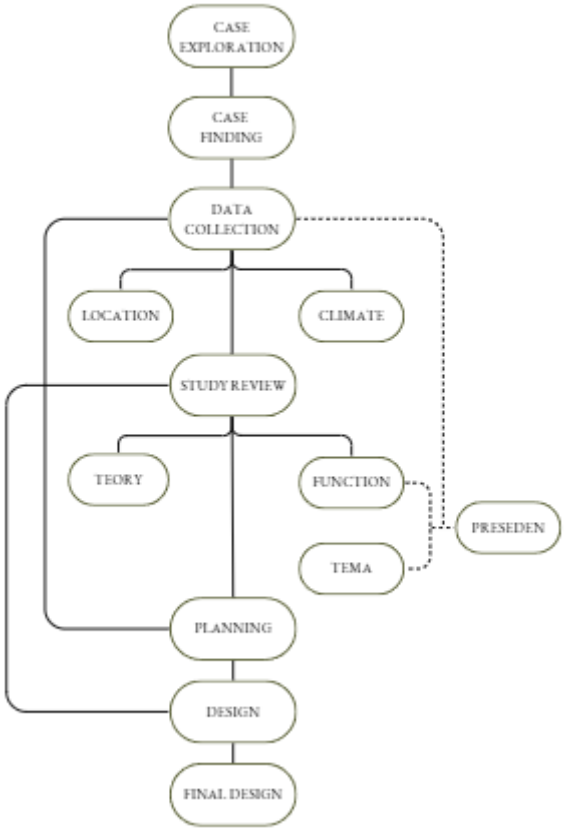

2.1 Theory

2.1.1 Urban Farming

Urban farming comes from two foreign words “urban” and “farming”, which when translated into Indonesian means “urban” and “agriculture”. In general, urban farming can be understood as urban agriculture. The understanding of urban farming has a diversity in definitions that are known as follows ;

- Urban farming is the cultivation of crops and livestock within and on the outskirts of metropolitan areas (Oxford Dictionary, 2024).
- Urban farming is an industry that encompasses the production, rearing, and marketing of plant-based products primarily in response to daily consumer demand within urban areas that apply intensive production methods, utilizing and recycling urban resources and wastes to produce diverse crops and livestock (Food and Agriculture Organization, Smit et al., 1996).

2.1.2 Co-working Space

Co-working space comes from the foreign equivalent of the word “working” with the addition of the affix “co” and the word “space” which when translated into Indonesian means “working together” and “space or place”. In general, co-working space can be understood as a place to work together. The understanding of co-working space has a diversity in definitions that are known as follows;

2.1.3 Bioklimatik

Bioclimatics comes from the foreign language Bioclimatology. In general, bioclimatics is a principle of creating ideal conditions for users of the climate and environment. In the aspect of architecture, bioclimatic principles are realized in the context of building forms equipped with building management mechanisms and technologies. The understanding of bioclimatic has diversity in definitions that are known as follows;

- Bioclimatics is concerned with the relationship between climate and the activities of living organisms (Oxford Dictionary, 2024).
- Bioclimatology is the study of the relationship between climate and life, especially the effect of climate on the health of living things (Ken Yeang, 1994).
- Bioclimatic design is a design process that combines the disciplines of human physiology, climatology, and building physics (Richard Hyde, 2000).

2.2 Theme Review

In terminology, the word bioclimatic is formed from two words "bio" which means related to living things and "climate" which means regular weather patterns in a certain place (homby, 2000). The bioclimatic approach in the field of architecture was first introduced by Victor Olgyay in 1962 which became a new response as an effort to create a microclimate that is suitable for space users using architectural design. Furthermore, the bioclimatic approach is also understood as a science that studies the relationship between climate and life manifested The application of bioclimatic architectural design forms a relationship between biological elements and climatic conditions and a balanced environment for the life of space users.in architectural aspects (Ken Yeang, 1994). Bioclimatic design can be applied by using the understanding of human physiology, climatology, and building physics (Richard Hyde, 2000).

In the bioclimatic approach, building design is seen as a way to produce a good place to live for users characterized by improved quality of life and environmental quality. Design solutions are obtained through the process of finding optimal space comfort strategies and effective building energy consumption. In general, the main mechanism in the application of bioclimatics lies in controlling the microclimate, determining the user's lifestyle and creating environmental conditions. The form of bioclimatic application in architectural design includes the scope of site design, arrangement of landscape elements, building orientation, building mass, building form, building envelope, sun shading design, window/façade design, and opening design for ventilation (Larasati, 2012).

The bioclimatic approach has strong links with the micro and macro aspects of architectural design, so the form of application tends to be flexible. The form of design can vary greatly, according to the context of climate, vegetation and multiple users. The varied solutions demonstrate the effectiveness of the bioclimatic approach to remain relevant to diverse social, climatic and environmental conditions. Based on this, it can be seen that the bioclimatic approach is realized in contextual passive design.

Bioclimatic architecture is a new form of architecture that applies passive solutions that are contextual to social, climatic and environmental circumstances.

The application of the bioclimatic approach to architectural design has no specific provisions for the shape or typology of the building. The design is based on passive design efforts that are applied to achieve optimal space comfort in buildings according to environmental conditions and climatic conditions. There are design principles that can be followed in an effort to produce the right bioclimatic response in building architecture.

Bioclimatic design principles in building design:

- Building Site Selection and Development
- Building Orientation
- Climate Grouping
- Shape and Zoning
- Building Envelope
- Building Elements

In general, the bioclimatic architecture approach in today's architecture tends to be influenced by Ken Yeang's way of thinking. The architectural principles applied in his design are as follows:

- Building Orientation
- Building Openings
- Transition Space
- Integrated Landscape
- Cross Circulation
- Use of Building Envelope

Based on two statements related to the design principles of bioclimatic architecture in buildings, a pattern can be seen in its application as follows:

Architectural planning and design with a bioclimatic approach sees the region's climate and environmental conditions as potential that can be utilized to achieve user comfort. The building has a microclimate that is realized from the combination of architectural elements within it. The following framework can be followed in the design process:Data Iklim : Pengetahuan data kondisi iklim yang secara teratur terjadi pada wilayah tapak. Analisa data meliputi; temperatur udara, kelembapan relatif, radiasi, dan efek angin.

- User Evaluation: Space user needs obtained from the user's lifestyle. The evaluation obtained must be based on the user's experience of the space that they want to realize during their activities.
- Technology Solution: Operation of the building with the use of active and passive technology in accordance with the needs of the building. Analysis that needs to be done: site selection, orientation, shadow calculation, building shape, air movement, and air temperature balance.
- Architectural Application: Architectural planning and design must realize a design that produces a balance in each user's needs with the climate and environment.

2.2.1 Data Collecting

	Architecture Building	Bioclimatic Architecture Parameter						
		Life Cycle Thinking	Health and Wellness	Enhanced Passive Systems	Renewable Energy	Low Impact Mobility	Water - Sustainable Material	Regenerating Ecological Value
Architecture Building Response	**Urban Farming Office, Vietnam**	Office - Farm	Natural lighting and cooling system	Use of atrium, balcony and filter facades	Smart lighting - cooling system	Use of stairs and corridors	Rainwater Harvesting	Green facade and rooftop
	Pasona Headquarters, Japan	Office - Farm		Use of filter facades	Smart lighting system	Use of stairs and corridors		Green facade and farm building
	Lankuaikei Headquarters, China	Office - Farm		Use of balcony and filter roof facades	Solar panel and smart cooling system	Use of stairs and terrace		Green terrace and farm building
	Funan, Singapore	Mall - Garden		Use of atrium and filter facades	Smart lighting - cooling system	Use of stairs, bicycle path, and terrace		Green rooftop and farm building
	La Cite Maraichere , Romainville, France	Farm Building				Use of stairs, and corridors		Green balcony and farm building
	Mesiniaga Tower , Kuala Lumpur, Malaysia	Office - Garden		Use of balcony and filter facade		Use of stairs, and balcony		Green rooftop and balcony
	Solaris Fusionopolis , Singapore	Hotels - Garden		Use of atrium, balcony and filter facades	Solar panel and smart lighting - cooling system	Use of stairs, and terrace		Green rooftop and terrace. Eco cell
	One Central park , Chippendale, Australia	Apartment - Park		Use of atrium and filter facades	Solar reflection system	Use of stairs, and corridors		Green terrace, rooftop, and facade.
	Gardenia, San José, Costa Rica	Apartment- Garden		Use of balcony open corridor and	Smart lighting - cooling system	Use of stairs, and corridors, balcony		Green facade and balcony
	Vil.la Urània Civic Center, Barcelona	House - Park		Use of balcony and terrace	Solar panel and smart cooling system	Use of stairs, and balcony, terrace		Green balcony and terrace

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The site is located on Jalan Ngumbar Surbakti, Medan City, North Sumatra Province. The site has an area of ± 13,500m2 which is far from the center of Medan City and has access to be reached by city and out-of-town residents via provincial roads and city arterial roads. Zoning on the site includes K/K2 functions which include agricultural activities, offices, shops, shopping centers, markets, parks and so on. In addition, there are agricultural lands scattered around the site.

Site Lighting Analysis
The north-facing position of the site allows sufficient lighting. Optimal lighting can be obtained from the east side but on the west side of the front of the site is not very optimal because there is a middle-level building close to the boundary of the site.

Site Air Analysis
Air circulation on the site tends to be good. The existence of parks, rice fields and vacant land around the site allows fresh air to flow on the site even though the site position is in front of the highway.

Site Noise Analysis
The site, which is located in the city area, has the potential for noise disturbance due to traffic and community activities. Noise generated by surrounding activities occurs with low intensity.

Site Circulation Analysis
Circulation on the site is in the north facing the highway and the south side facing agricultural land. The movement path on the site includes large roads and small roads so that it tends to be optimal to reach.

Building Around Analysis
The site is in the K/K2 zone. In the surrounding area there are buildings with the same zone including universities, shops, and community service facilities.

Vegetation Analysis
The site has a function as agricultural land by the surrounding community. Vegetation in the area includes low shrubs and medium shrubs. No significant contours are found on the site.

Space program

RECEPTION AREA					
Room Needs	Space Capacity	Space Standard	Data Source	Room Quantity	Dimension Area
Hall Utama	25 orang	1,9 m²/orang	TSS	1	50 m²
Information Centre	25 orang	1,5 m²/orang	TSS	2	75 m²
Total Area					125 m²
Sirculation Effective (30%)					37,5 m²
Total Area + Sirculation					165 m²

CO-WORKING SPACE AREA					
Room Needs	Space Capacity	Space Standard	Data Source	Room Quantity	Dimension Area
Open Office					
- Dedicated Desk	1 orang	2 – 5 m²/orang	NAD	40	200 m²
- Comunal Desk Medium	5 orang	2 – 5 m²/orang	NAD	20	500 m²
- Comunal Desk Large	8 orang	2 – 5 m²/orang	NAD	10	400 m²
Private Office					
- Private Office Large	8 orang	2 – 5 m²/orang	NAD	4	160 m²
- Private Office Big	16 orang	2 – 5 m²/orang	NAD	4	320 m²
- Private Full One Floor	30 orang	2 – 5 m²/orang	NAD	2	300 m²
Meeting Room	8 orang	1,5 – 2 m²/orang	NAD	4	70 m²
Conference Room	40 orang	1,5 – 2 m²/orang	NAD	2	160 m²
Total Area					2110 m²
Sirculation Effective (30%)					633 m²
Total Area + Sirculation					2743 m²

FARMING SPACE AREA					
Room Needs	Space Capacity	Space Standard	Data Source	Room Quantity	Dimension Area
Indoor Farm					
- Planting Area	-	15 m²	A	4	60 m²
- Acclimatisation Area	-	15 m²	A	4	60 m²
- Dermination Area	-	15 m²	A	4	60 m²
- Production Area	-	15 m²	A	4	60 m²
Outdoor Farm					
- Growing Area	-	3700 m²	A	1	3700 m²
Service - Control Room	-	90 m²	TSS	1	90 m²
Total Area					4030 m²
Sirculation Effective (30%)					1209 m²
Total Area + Sirculation					5239 m²

MANAGEMENT AREA					
Room Needs	Space Capacity	Space Standard	Data Source	Room Quantity	Dimension Area
Administration					
Head Office	3 orang	2,3 - 3,9 m²/orang	NAD	1	12 m²
Administration Staff Office	10 orang	2 - 5 m²/orang	NAD	1	50 m²
Arsip & Documentation Office	10 orang	2 - 5 m²/orang	NAD	1	50 m²
Meeting Room	6 orang	1,5 - 2 m²/orang	NAD	2	24 m²
Rest Room	2 orang	1,5 m²/orang	NAD	2	6 m²
Total Area					192 m²
Sirculation Effective (30%)					57,6 m²
Total Area + Sirculation					250 m²

SOCIAL AREA					
Room Needs	Space Capacity	Space Standard	Data Source	Room Quantity	Dimension Area
Education Room	25 orang	2 – 5 m²/orang	NAD	2	100 m²
Workshop Room	25 orang	3 – 5 m²/orang	A	2	150 m²
Library	30 orang	2,3 – 3 m²/orang	NAD	2	180 m²
Prayer Room	40 orang	0,85 m²/orang	NAD	2	68 m²
Cafetaria	30 orang	1,5 - 2 m²/orang	NAD	2	120 m²
Open Pantry	10 orang	1,7 m²/orang	HPD	5	85 m²
Total Area					703 m²
Sirculation Effective (30%)					210,9 m²
Total Area + Sirculation					920 m²

SERVICE AREA					
Room Needs	Space Capacity	Space Standard	Data Source	Room Quantity	Dimension Area
Lavatory					
Male Lavatory	2 unit	6 m²/unit	NAD	10	120 m²
Female Lavatory	4 unit	6 m²/unit	NAD	10	240 m²
Utility Room					
- Genset Room	-	40 m²/unit	A	1	40 m²
- Pump Room	-	40 m²/unit	A	1	40 m²
- IPAL Room	-	40 m²/unit	A	1	40 m²
- Ground Water Tank	-	60 m²/unit	A	1	60 m²
Security Room	-	10 m²/unit	A	3	30 m²
Storage Room	-	30 m²/unit	A	2	60 m²
Total Area					630 m²
Sirculation Effective (30%)					189 m²
Total Area + Sirculation					819 m²

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The approach to activities that occur in the area environment can be divided into several types of activity groups that the author bases on activity actors, including;

- Agriculture

Activities of actors in the agricultural aspect of the area include maintenance, preservation and protection activities.

2. Office
Activities of managers and workers include co-working space activities.
3. Education
Plant preservation and maintenance workshop activities by environmentalists for visitors.
4. Management
Maintenance and service activities carried out to care for and maintain facilities / infrastructure on the site.
5. Visitors
Tourism activities related to the process of maintaining a variety of agriculture
6. Marketing
The activity of selling agricultural products that have been obtained to the general public.

Design Result

The design is carried out to transform the relationship between the old habits of the community in farming and the new habits of the community in working so that it can be relevant forever.

Space planning is carried out by combining office functions with agricultural functions as the main function of the building which is included with other supporting and complementary functions. The building design applies effective building and landscape processing in response to the environmental conditions of the area through a bioclimatic architecture approach.

The design criteria to be reached in the building include:

1. Resilience
   The use of building elements in architectural and structural aspects that are adaptive to site and climate conditions. Resilience is defined as the strength of the building to protect the lives of the users inside.
2. Sustainability
   Preservation of life in the site by maintaining the environment gradually and repeatedly. Sustainability in architecture is obtained through the utilization of resources that are friendly to the lives of users.
3. Comfort
   Formation of microclimate in macro to micro scale buildings through architectural compositions. The parameter of space comfort leads to the quality of ventilation and lighting for building users.
4. Proximity
   Intergrated spatial arrangement and circulation paths are key to the effectiveness of space affordability for users. The proximity of space provides a clear relationship between the building and the landscape with the user.

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- Agriculture : Activities of actors in the agricultural aspect of the area include maintenance, preservation and protection activities.
- Office : Activities of managers and workers include co-working space activities.
- Education : Plant preservation and maintenance workshop activities by environmentalists for visitors.
- Management : Maintenance and service activities carried out to care for and maintain facilities / infrastructure on the site.
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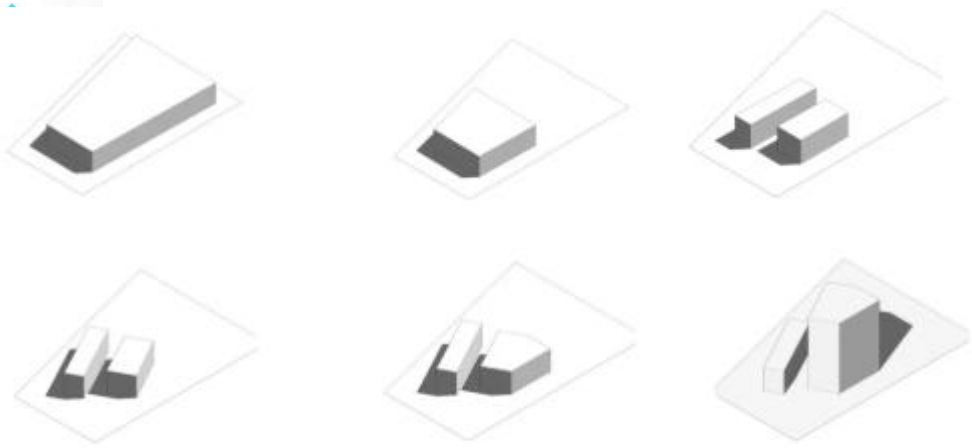
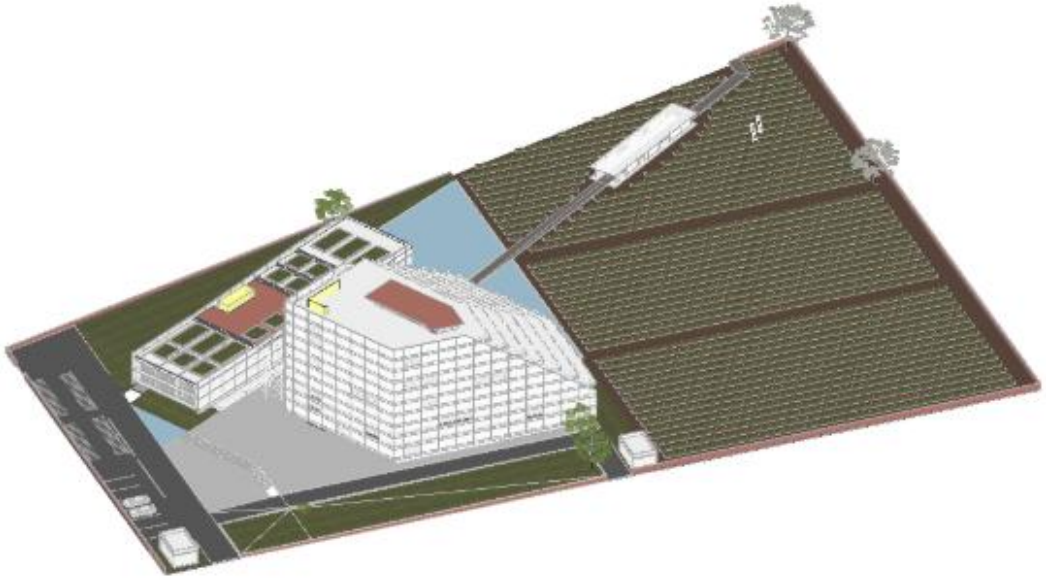
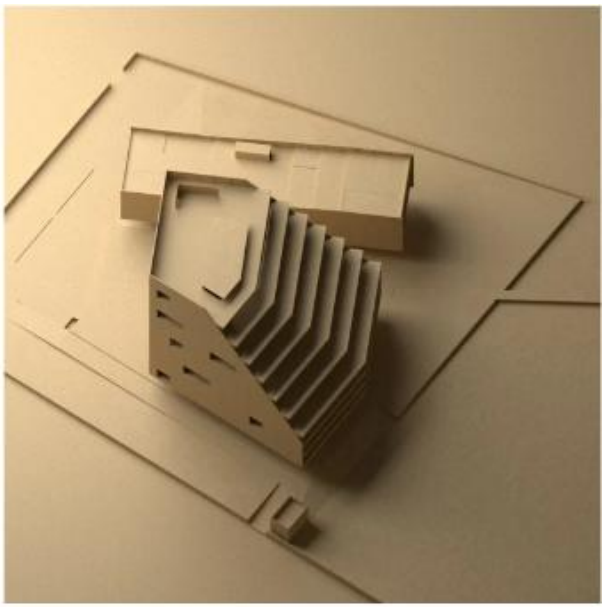


Konsep Massa
Source : Pribadi

The mass takes the shape of the available site as a whole.. The massing forms a path of movement towards the site. The mass elevation is formed by dividing the mass to form an initial roof. Masses form details that blend into the environment..





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