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Characteristics of Land-Use Structure and Land-Use Intensity Based on Livability and Environmentally Friendly Indicators, Case Study: Glodok Area, Jakarta, Indonesia

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ABSTRACT: The characteristics of land-use structure and land-use intensity are important aspects influencing the level of livability and environmental quality in urban areas. As one of Jakarta's historic districts, the Glodok Area has developed with a strong mixed-use character that integrates residential, commercial, and service functions, resulting in a complex pattern of spatial utilization. This study aims to identify the characteristics of land-use structure and land-use intensity in the Glodok Area based on livability and environmentally friendly indicators. The research employed a quantitative descriptive-analytical approach through spatial identification using area maps, Google Earth, and Google Street View, which were subsequently validated through field observations. The analysis was conducted on 16 sub-areas delineated according to administrative boundaries and area characteristics. Land-use structure was evaluated using indicators of residential function compatibility, facility accessibility, and mixed-use functions, while land-use intensity was assessed using the Green Coverage Ratio (KDH), Building Coverage Ratio (KDB), and Basement Coverage Ratio (KTB). The results indicate that most sub-areas exhibit a strong mixed-use character and relatively good facility accessibility, thereby supporting intensive urban activities. However, several sub-areas demonstrate high land-use intensity, characterized by the dominance of built-up areas, limited green spaces, and reduced water infiltration areas. These findings suggest that the Glodok Area possesses a relatively favorable level of livability but continues to face challenges in achieving a more sustainable urban environment. The results of this study are expected to contribute to the management and development of urban areas based on livability and environmentally friendly principles.

Keywords – land-use structure, land-use intensity, livability, environmental friendliness, Glodok.

I. INTRODUCTION

The rapid growth of urban areas has increased the demand for space to accommodate residential, commercial, service, and various supporting activities. This condition has led to changes in land-use patterns that influence both environmental quality and the quality of life of urban communities. In the context of sustainable urban development, the success of an urban area is determined not only by its ability to accommodate economic and social activities but also by its capacity to provide a comfortable, healthy, accessible, and sustainable environment for its residents. Therefore, urban environmental quality has become an increasingly important concern in urban planning and design studies that emphasize a balance among social, economic, and environmental functions [1], [2].

The concept of livability has emerged as an important approach for assessing the quality of urban environments based on an area's ability to support the daily needs of its residents. Livability is not limited to the physical comfort of the environment but also encompasses accessibility to facilities, connectivity among land-use functions, ease of mobility, environmental quality, and the capacity of an area to facilitate social interaction within the community [1], [2], [3]. At the neighborhood scale, livability can be measured through various indicators that enable a more objective and systematic evaluation and comparison of urban environments [4]. Furthermore, several studies have shown that the implementation of mixed-use development, good accessibility, and pedestrian-friendly environments contributes significantly to improving urban livability [5], [6].

In addition to livability, urban development is also expected to incorporate environmentally friendly principles. This concept emphasizes the importance of balancing human activities with environmental carrying capacity through spatial management that considers ecological aspects, efficient land use, the provision of

green open spaces, and the sustainability of natural resources [7], [8]. Environmentally friendly urban areas are not only oriented toward fulfilling spatial and functional needs but also toward maintaining environmental quality to support community well-being in the long term [9]. In recent years, the green infrastructure approach has become one of the most widely adopted strategies for enhancing environmental quality through the provision of green spaces and the strengthening of urban ecological functions [7], [8].

Livability and environmentally friendly principles are complementary concepts in shaping the quality of urban environments. Areas characterized by high accessibility, easily reachable facilities, and integrated spatial functions tend to exhibit a higher level of livability [5], [6]. However, such quality should be supported by healthy and sustainable environmental conditions through the provision of open spaces, water infiltration areas, and other ecological elements to ensure long-term benefits for urban residents [7], [8]. Therefore, urban area evaluation should be conducted not only from a functional perspective but also from an environmental perspective that considers ecological quality.

One of the factors influencing the livability of an urban area is its land-use structure. Land-use structure reflects how residential, commercial, service, social facility, and public facility functions are arranged and interact within an area. A well-organized land-use structure can create functional connectivity, enabling residents' needs to be met effectively and efficiently. Accessibility to facilities, the presence of mixed-use functions, and compatibility among land-use functions are important factors that contribute to improving urban activities and residents' quality of life [4], [10]. The implementation of mixed-use development has also been recognized for enhancing land-use efficiency while supporting the social and economic dynamics of urban areas [10].

In addition to land-use structure, environmental quality is influenced by land-use intensity. Land-use intensity reflects the degree of land development within an area and can be observed through the dominance of built-up areas, the availability of green spaces, and the presence of areas that still allow rainwater infiltration. High development intensity that is not balanced by adequate green open spaces and infiltration areas may reduce environmental quality, increase surface runoff, and diminish the ecological functions of urban environments [11]. Previous studies have demonstrated that the provision of green spaces and environmentally responsive drainage systems plays an important role in maintaining a balance between physical development and urban environmental quality [12], [13].

The Glodok Area in West Jakarta was selected as the study area because it is one of Jakarta's historic districts that has developed as a center of commerce, services, and residential activities with a strong mixed-use character. Intensive economic activities have shaped a complex land-use pattern and a relatively high building density. On the one hand, these conditions create a vibrant environment that supports urban activities and community life. On the other hand, high development intensity may exert pressure on environmental quality, particularly regarding the availability of open spaces and environmental carrying capacity. These characteristics make the Glodok Area a relevant case for examining the relationship between land-use structure, land-use intensity, and urban environmental quality.

Previous studies have examined livability at both city and neighborhood scales [1], [2], [3], [4], the relationship between mixed-use development and urban environmental quality [5], [10], and the development of environmentally friendly urban areas through green infrastructure and sustainable land management approaches [7], [8], [11]. Other studies have also investigated the quality of commercial districts from the perspectives of livability and placemaking [14]. However, studies that specifically evaluate the characteristics of land-use structure and land-use intensity simultaneously using livability and environmentally friendly indicators in organically developed historic mixed-use areas remain limited. Therefore, research that integrates these two aspects within a single evaluation framework is still needed.

Based on this background, this study aims to evaluate the characteristics of land-use structure and land-use intensity in the Glodok Area using livability and environmentally friendly indicators. The analysis was conducted by assessing land-use structure through indicators of residential function compatibility, facility accessibility, and mixed-use functions, as well as land-use intensity through the Green Coverage Ratio (KDH), Building Coverage Ratio (KDB), and Basement Coverage Ratio (KTB). The findings are expected to provide insights into the livability and environmental quality of the area while contributing to the management and development of more sustainable urban environments.

II. METHODS OF RESEARCH

This study employed a quantitative descriptive-analytical approach to evaluate the characteristics of land-use structure and land-use intensity in the Glodok Area based on livability and environmentally friendly indicators. The descriptive method was used to describe the existing conditions of the study area, while the analytical method was applied to assess the degree of conformity between the observed conditions and the established indicators through observation and spatial interpretation. The quantitative approach was implemented through the development of assessment indicators derived from theoretical studies and previous

research, resulting in measurable criteria that enabled a systematic comparison among sub-areas.

The research indicators were developed using the concept matrix development approach, which involves the synthesis of theoretical concepts related to livability, environmentally friendly principles, land-use structure, and land-use intensity. In architectural research, theory serves as the foundation for constructing an analytical framework that can be operationalized into research variables and indicators [15]. Therefore, the indicators employed in this study were formulated based on the synthesis of relevant theories and literature and subsequently translated into observable parameters within the study area.

The data collection process began with area identification using area maps, the Detailed Urban Design and Environmental Plan (RTBL) documents, Google Earth, and Google Street View to understand the spatial characteristics of the Glodok Area. The identification process focused on land-use patterns, road networks, building functions, neighborhood administrative boundaries (RW), and activity characteristics. Based on the results of this identification, the study area was divided into sixteen sub-areas that served as the units of analysis.

Field observations were subsequently conducted to validate the existing conditions identified through spatial data interpretation and digital imagery. The observations involved direct examination of building functions, facility accessibility, mixed-use characteristics, the dominance of built-up areas, the availability of green spaces, and areas that still had the potential to function as rainwater infiltration spaces. In addition, photographic documentation was undertaken to provide supporting data for the evaluation and interpretation of the research findings.

The collected data were analyzed using an assessment matrix developed based on the research indicators. Each indicator was evaluated comparatively across the sixteen sub-areas to generate a classification of area conditions, which was subsequently used as the basis for identifying the characteristics of land-use structure and land-use intensity within the Glodok Area.

The assessment results for each indicator were then converted into area condition classifications consisting of five categories: low, low-medium, medium, medium-high, and high. These classifications were used to facilitate the interpretation of the characteristics of each sub-area based on its level of conformity with the established livability and environmentally friendly indicators.

2.1 Study Area

The study was conducted in the Glodok Area, West Jakarta, one of Jakarta's historic urban districts characterized predominantly by commercial, service, and high-density residential functions. The area is widely recognized as Jakarta's oldest Chinatown, possessing significant historical, cultural, and economic value and having developed as a major center of commercial activity since the colonial era [16]. The gradual and organic development of the area has resulted in a complex spatial structure with a high diversity of land-use functions. This condition is reflected in the coexistence of commercial activities, residential functions, supporting facilities, and socio-cultural activities that interact within the same urban environment, creating a strong mixed-use character [17]. In addition to serving as a center of economic and cultural activities, the Glodok Area faces challenges in maintaining environmental quality and urban sustainability due to the high intensity of urban activities, increasing pressure on public spaces, and limitations in environmental carrying capacity [18]. These characteristics make the Glodok Area a relevant case for examining the relationship between land-use structure, land-use intensity, and urban environmental quality.

Figure 1. Glodok Area Research Location
Source: Google Street View, 2026

To facilitate the analytical process, the study area was divided into several sub-areas based on neighborhood administrative boundaries (RW), major road networks, and the physical and activity characteristics of the area. The delineation of sub-areas was carried out through the interpretation of area maps, Google Earth satellite imagery, and Google Street View, which were subsequently validated through field observations. This subdivision was intended to establish more specific units of analysis, enabling a more systematic, measurable, and comprehensive assessment of area conditions.

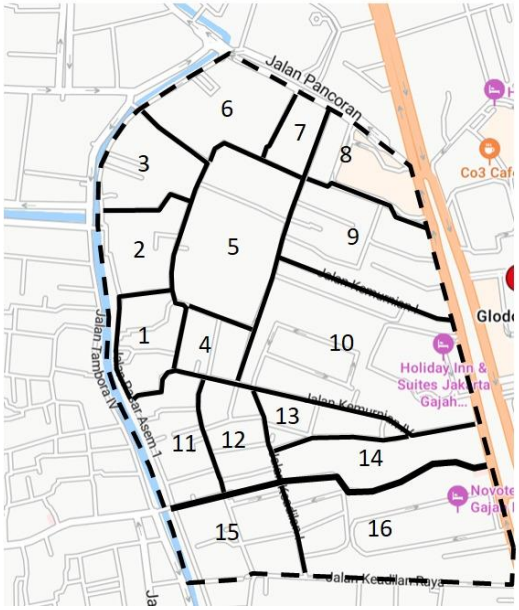

Figure 2. Division of Research Sub Areas
Source: Google Street View, 2026

2.2 Concept Matrix Development

The concept matrix was developed through the synthesis of livability and environmentally friendly neighborhood theories, which were subsequently linked to the RTBL components of land-use structure and land-use intensity. The results of this synthesis were used to establish the indicators, parameters, and assessment instruments relevant to the physical characteristics of the study area. The concept matrix served as the foundation for developing the area assessment framework, ensuring that each indicator was supported by clearly defined parameters and measurement criteria that could be applied consistently across all study sub-areas.

Table 1. Concept Matrix Development of Land-Use Structure and Land-Use Intensity

RTBL Physical Component	Criteria	Indicator	Parameter
Land-Use Structure	The balance between human needs and environmental considerations serves as the foundation for creating adaptive residential environments	Compatibility between residential land-use allocation and the provision of surrounding public and social facilities	The availability of public and social facilities is proportional to population density
		Accessibility of residents to facilities that support daily needs	Walking distance to neighborhood facilities is ≤ 400 meters
	Multidimensional integration	Implementation of mixed-use development both horizontally and vertically	The presence of supporting public or commercial functions within residential zones
		Compatibility among mutually supportive land-use functions	No negative impacts, such as pollution or excessive noise, affecting residential areas

RTBL Physical Component	Criteria	Indicator	Parameter
	Sustainable contextual adaptability (site responsiveness, climate responsiveness, and long-term health considerations)	Suitability of residential block allocation to site and climatic conditions	Area development minimizes alterations to natural topography (cut and fill activities)
		Protection of environmentally sensitive areas from building conversion	Micro-conservation areas and setback zones remain free from massive building development
Land-Use Intensity	Ecologically based planning promotes resource efficiency and sustainability	Control of surface water infiltration capacity within residential plots	KDH values comply with zoning regulations (minimum 20–30%)
		Limitation of total built-floor area	KDB values do not exceed the carrying-capacity threshold of the area
	Ecologically based residential space management	Provision of alternative green open spaces in medium- to high-density buildings	Availability of roof gardens, podium gardens, or vertical green spaces
		Limited utilization of underground space	KTB values maintain sufficient unbuilt ground area for groundwater infiltration

2.3 Determination of Assessment Indicators

Based on the developed concept matrix, assessment indicators were established to evaluate the characteristics of land-use structure and land-use intensity. Each indicator was further translated into specific parameters and assessment instruments derived from field observations, digital imagery interpretation, and analysis of the existing conditions of the study area. The selected indicators were based on the principles of livability and environmentally friendly neighborhoods and were adapted to the characteristics of the Glodok Area.

Table 2. Measurement Indicators

Variable	Indicator	Parameter	Measurement Tool
Land-Use Structure	Residential Function Compatibility	Availability of social and public facilities	Field observation and map interpretation
	Facility Accessibility	Ease of access to daily facilities (walking distance)	Google Earth and field observation
	Mixed-use	Presence of mixed-use functions	Field observation
Land-Use Intensity	KDH	Availability of green spaces	Imagery interpretation and field observation
	KDB	Dominance of built-up areas	Imagery interpretation and field observation
	KTB	Availability of unbuilt infiltration spaces	Field observation

2.4 Data Analysis Technique

Data analysis was conducted using a descriptive-analytical approach to identify the characteristics of land-use structure and land-use intensity based on livability and environmentally friendly indicators in the Glodok Area. Data obtained from field observations, map interpretation, Google Earth satellite imagery, and Google Street View were analyzed by comparing the existing conditions of the study area with the parameters established in the research indicator matrix.

The analysis was performed for each sub-area designated as a unit of analysis. Each indicator was evaluated according to its level of conformity with the physical conditions of the area. For the land-use structure component, the analysis focused on the compatibility between residential functions and supporting facilities, accessibility to daily needs, the implementation of mixed-use functions, compatibility among land-use functions, and the suitability of land utilization with environmental conditions. Meanwhile, for the land-use intensity component, the analysis focused on the dominance of built-up areas, the availability of green spaces, unbuilt infiltration areas, and land-use characteristics related to environmental sustainability.

The identification and evaluation results for each indicator were subsequently presented in the form of assessment tables and descriptive explanations to illustrate the characteristics of each sub-area. A comparative analysis was then conducted to examine differences among sub-areas and identify overall trends in land-use structure and land-use intensity within the Glodok Area. The findings were further used to identify the potentials, challenges, and level of conformity of the area with the principles of livability and environmentally friendly neighborhoods.

III. RESULTS AND DISCUSSION

The research findings were compiled based on the analysis of existing conditions within each sub-area of the Glodok Area that had been designated as a unit of analysis. The evaluation focused on two RTBL physical components, namely land-use structure and land-use intensity, using the livability and environmentally friendly indicators established in the previous stage. The analysis was conducted through field observations, satellite imagery interpretation, Google Street View examination, and area documentation to identify the physical characteristics, land-use patterns, and environmental conditions of each sub-area.

The characteristics of each sub-area were subsequently compared to determine the level of conformity between existing conditions and the research indicators, as well as to identify the potentials and challenges affecting the quality of the residential environment within the Glodok Area.

3.1 Land-Use Structure in the Glodok Area

The land-use structure of the Glodok Area reflects the characteristics of a historic urban district dominated by commercial, service, and residential functions that have evolved organically over time. The resulting land-use pattern demonstrates a relatively high level of functional integration, particularly along the main road corridors that serve as the economic centers of the area. The coexistence of residential functions with shophouses, traditional markets, restaurants, religious facilities, and various service activities indicates the implementation of a mixed-use concept that has developed naturally in response to local community needs.

Based on field observations and spatial interpretation, each sub-area exhibits distinct characteristics in terms of residential function compatibility, accessibility to daily facilities, and the diversity of land-use functions. Sub-areas located along the primary commercial corridors tend to have better accessibility and a greater variety of mixed-use functions than those predominantly characterized by residential activities. These differences influence the degree to which each sub-area fulfills the livability and environmentally friendly indicators established in this study.

Table 3. Evaluation of Land-Use Structure in the Glodok Area Based on Livability and Environmentally Friendly Indicators

Sub Area	Residential Function Compatibility	Facility Accessibility	Mixed-use	General Evaluation
1	High	High	High	Dominated by commercial and service functions with easily accessible daily facilities, thereby supporting intensive urban activities.
2	High	High	High	Exhibits strong integration between residential and neighborhood-scale commercial functions, with good accessibility to supporting facilities.
3	Medium–High	High	Medium–High	Characterized predominantly by residential functions mixed with small-scale businesses, maintaining mixed-use functions although at a lower intensity than the main commercial corridors.
4	Medium	High	Medium	Functions as a transition area between residential and commercial activities. Commercial and service functions are present at the neighborhood scale, supporting residents' daily needs without dominating the residential character of the area.
5	Medium	High	Medium	Predominantly residential, with commercial and service activities concentrated along major road corridors, supporting residents' daily needs.
6	High	High	High	Located along Pancoran Street, characterized by intensive commercial activities. The integration of residential and commercial functions creates an active and highly accessible mixed-use environment.

Sub Area	Residential Function Compatibility	Facility Accessibility	Mixed-use	General Evaluation
7	High	High	High	Dominated by commercial and service functions directly connected to the area's primary activity center. The availability of supporting facilities contributes to a high level of livability.
8	High	High	High	Characterized by strong mixed-use functions with a predominance of economic activities. Its strategic location enhances accessibility and supports commercial and service activities.
9	High	High	High	Located near the Glodok commercial center and characterized by a dominant commercial function. The diversity of land-use functions supports mobility and the fulfillment of residents' daily needs.
10	Medium–High	High	High	Dominated by commercial, service, and accommodation functions that have developed along the main corridor. Mixed-use functions are highly intensive; however, the concentration of activities may create pressure on environmental quality.
11	Medium	Medium	Medium	Predominantly residential, with neighborhood-scale economic activities. Accessibility remains relatively adequate, although less intensive than in the primary commercial areas.
12	Medium	High	Medium	Characterized mainly by residential functions supported by public facilities and local commercial activities. Its proximity to the main corridor provides good accessibility to daily needs.
13	Medium–High	High	Medium–High	Serves as a link between residential neighborhoods and economic activity centers. The presence of various supporting functions creates a balance between residential and commercial activities.
14	Medium	Medium–High	Medium	Characterized by a relatively quieter environment dominated by residential and local commercial functions. Mixed-use functions remain present but are less intensive than those found in the northern and eastern parts of the area.
15	Medium	Medium	Low–Medium	Predominantly residential, with relatively limited economic activities. The area functions more as a residential neighborhood than as a commercial activity center.
16	Medium	Medium–High	Medium	Combines residential and neighborhood-scale service functions with relatively good access to the main corridor. The intensity of mixed-use functions is lower than in the core area of Glodok but still supports residents' daily needs.

3.1.1 Residential Function Compatibility with Supporting Facilities

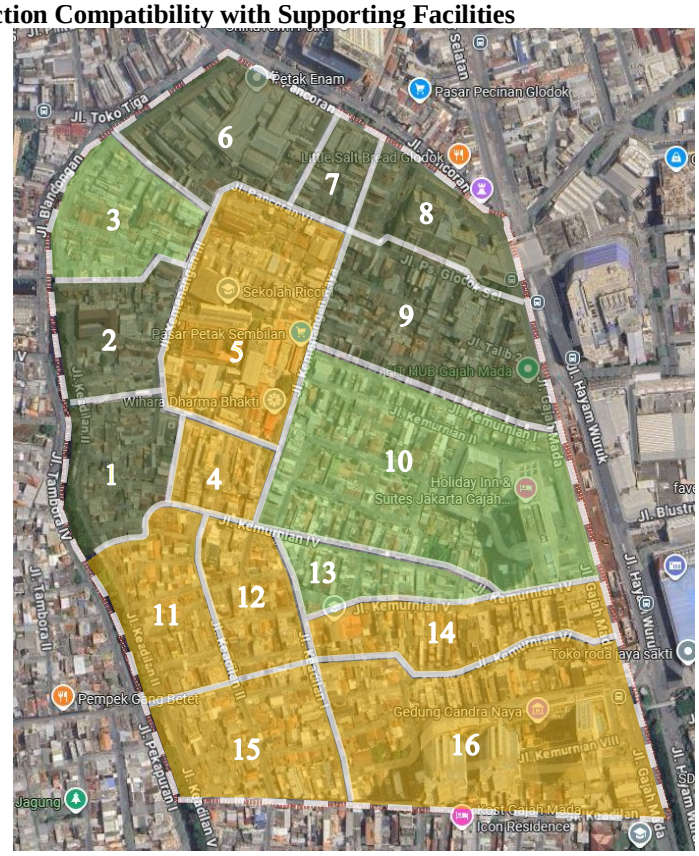

Figure 3. Residential Function Compatibility Map of the Glodok Area

Legend:
- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

Based on the identification results, most sub-areas in Glodok exhibit high to moderate levels of residential function compatibility. This condition is indicated by the presence of commercial facilities, service establishments, places of worship, and social facilities that are integrated with residential areas. Sub-areas 1, 2, 6, 7, 8, and 9 demonstrate a high level of compatibility because residential functions have developed alongside a variety of supporting facilities capable of meeting residents' daily needs. Meanwhile, Sub-areas 4, 5, 11, 12, 14, 15, and 16 exhibit a moderate level of compatibility, as residential functions remain dominant and are supported by neighborhood facilities on a more limited scale.

The widespread distribution of supporting facilities throughout the area indicates that the land-use structure of Glodok has evolved organically and is capable of supporting community activities in a sustainable manner. From a livability perspective, this condition facilitates access to daily needs and services. From an environmentally friendly perspective, it can reduce the need for long-distance travel, thereby potentially decreasing dependence on motorized transportation and its associated environmental impacts.

3.1.2 Accessibility to Daily Facilities

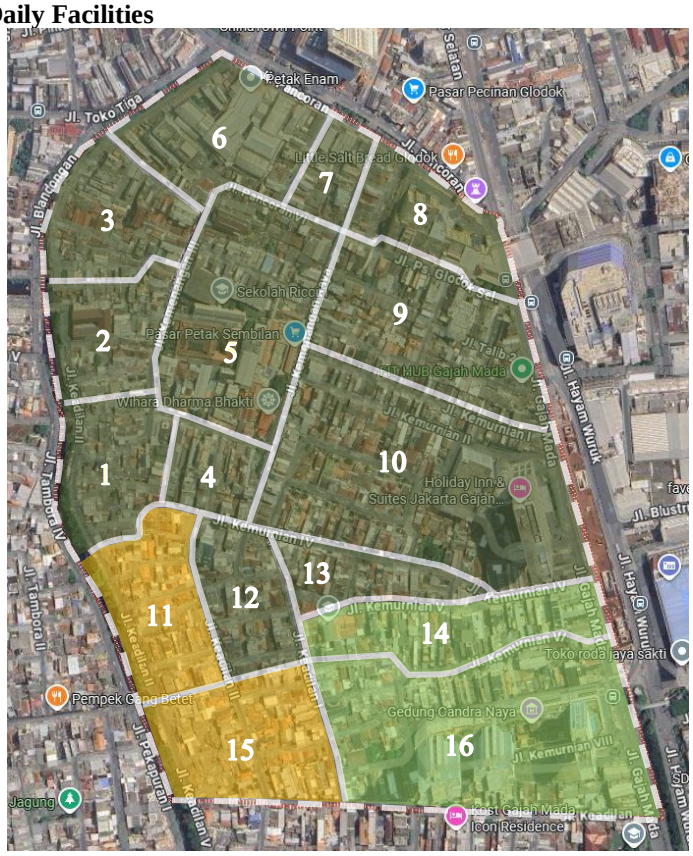

Figure 4. Accessibility Level Map of Daily Facilities in the Glodok Area

Legend:
- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

The analysis results indicate that almost all sub-areas exhibit a high level of accessibility to daily facilities. The compact urban form of the Glodok Area, combined with its interconnected street network, enables residents to reach markets, educational facilities, places of worship, commercial areas, and other public facilities within walking distance. This condition is particularly evident in sub-areas located along the Jalan Pancoran corridor, Jalan Gajah Mada, and the local road network connecting the area's primary activity centers.

The high level of accessibility represents one of the key indicators of livability in the Glodok Area, as residents are not entirely dependent on motorized transportation to meet their daily needs. In addition to improving mobility efficiency, this condition contributes to reduced energy consumption and lower transportation-related emissions at the neighborhood scale. Furthermore, the close proximity between residential areas and supporting facilities encourages walking activities, thereby enhancing the overall convenience and functionality of the urban environment.

3.1.3 Implementation of Mixed-Use Functions

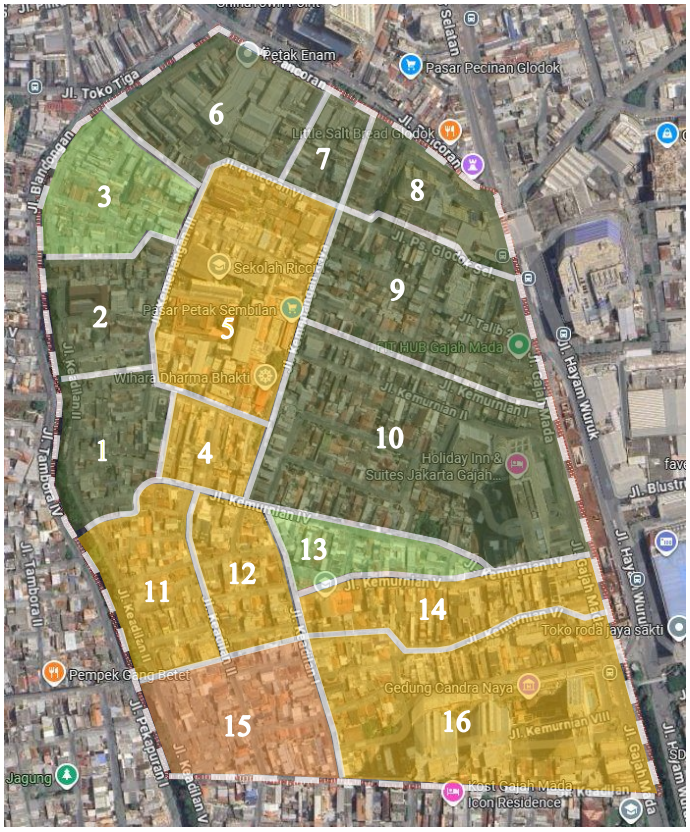

Figure 5. Mixed-Use Implementation Level Map of the Glodok Area

Legend:

- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

The implementation of mixed-use functions represents one of the defining characteristics of the land-use structure in the Glodok Area. The integration of residential, commercial, service, and supporting functions creates an active urban environment while enhancing the efficiency of residents' daily movements. Sub-areas 1, 2, 6, 7, 8, 9, and 10 exhibit a high level of mixed-use development, characterized by the intensive coexistence of residential functions and economic activities. Meanwhile, Sub-areas 3 and 13 fall within the medium–high category, as residential functions remain dominant while still being supported by relatively significant commercial activities.

In Sub-areas 4, 5, 11, 12, 14, and 16, the level of mixed-use development is classified as medium because commercial and service activities are generally concentrated along specific road corridors. In contrast, Sub-area 15 is categorized as low–medium due to the stronger dominance of residential functions and the relatively limited presence of commercial activities. Overall, the presence of mixed-use functions in the Glodok Area contributes positively to livability by improving accessibility and facilitating the fulfillment of residents' daily needs. However, in areas characterized by intensive economic activities, more effective environmental management is required to maintain environmental quality and ensure the long-term sustainability of the urban environment.

3.2 Land-Use Intensity

Land-use intensity is an important aspect in assessing the quality of residential environments because it is closely related to the degree of built development, the availability of open spaces, and the capacity of an area to support ecological functions. In densely populated urban areas such as Glodok, the high demand for space to accommodate commercial, service, and residential activities often results in the increasing dominance of built-up areas and the reduction of open spaces that function as water infiltration areas and environmental buffers. These conditions influence environmental comfort, the visual quality of the urban landscape, and the

long-term sustainability of land utilization.

Based on livability and environmentally friendly indicators, the evaluation of land-use intensity was conducted using three main indicators: the dominance of built-up areas, the availability of green spaces, and the availability of unbuilt infiltration areas. These indicators were employed to identify the level of land-use intensity within each sub-area and to assess the extent to which existing conditions are capable of maintaining a balance between development needs and environmental functions. The results of the land-use intensity evaluation for all sub-areas in the Glodok Area are presented in Table 4.

Table 4. Evaluation of Land-Use Intensity in the Glodok Area Based on KDH, KDB, and KTB Indicators

Sub Area	KDH	KDB	KTB	General Evaluation
1	Low	High	Low	Dominated by commercial and service buildings with high density. The availability of green spaces and infiltration areas is very limited, resulting in less optimal ecological performance.
2	Low	High	Low	Characterized by a very high degree of built development, with buildings covering most of the land area. Green spaces and infiltration areas are relatively scarce.
3	Low–Medium	Medium–High	Low–Medium	Although still dominated by buildings, the area contains limited open spaces that contribute to environmental functions.
4	Low–Medium	Medium–High	Low–Medium	Building density is relatively high, with limited open spaces. Environmental conditions are slightly better than those found in the core commercial areas.
5	Low–Medium	Medium–High	Low–Medium	Dominated by residential functions and neighborhood-scale economic activities, with relatively dense development and limited open spaces.
6	Low	High	Low	Located along an active commercial corridor characterized by a high concentration of buildings and paved surfaces. Green spaces and infiltration areas are almost absent.
7	Low	High	Low	Land-use intensity is very high due to the dominance of commercial functions. The availability of green spaces is extremely limited.
8	Low	High	Low	The commercial character of the area results in most land being occupied by buildings, leading to relatively low water infiltration capacity.
9	Low	High	Low	A densely developed commercial area with minimal open space and a very high dominance of built-up land.
10	Low	High	Low	Intensive commercial and service activities have resulted in a very high proportion of built-up areas and limited vegetation cover.
11	Medium	Medium	Medium	This residential area exhibits a lower degree of built development than the commercial center, resulting in relatively better environmental conditions.
12	Medium	Medium	Medium	Predominantly residential, with relatively better availability of open spaces and vegetation compared to the core area of Glodok.
13	Low–Medium	Medium–High	Low–Medium	A mixed-use area experiencing increasing development pressure, resulting in a gradual reduction of open spaces.
14	Medium	Medium	Medium	A residential area with a moderate level of development intensity and the presence of neighborhood-scale open spaces.
15	Medium	Medium	Medium	Dominated by residential functions with lower building density than the commercial areas, thereby supporting better environmental performance.
16	Medium	Medium	Medium	Characterized by residential and neighborhood-scale service functions, with relatively better open-space conditions than the core area of Glodok.

3.2.1 Green Coverage Ratio (KDH)

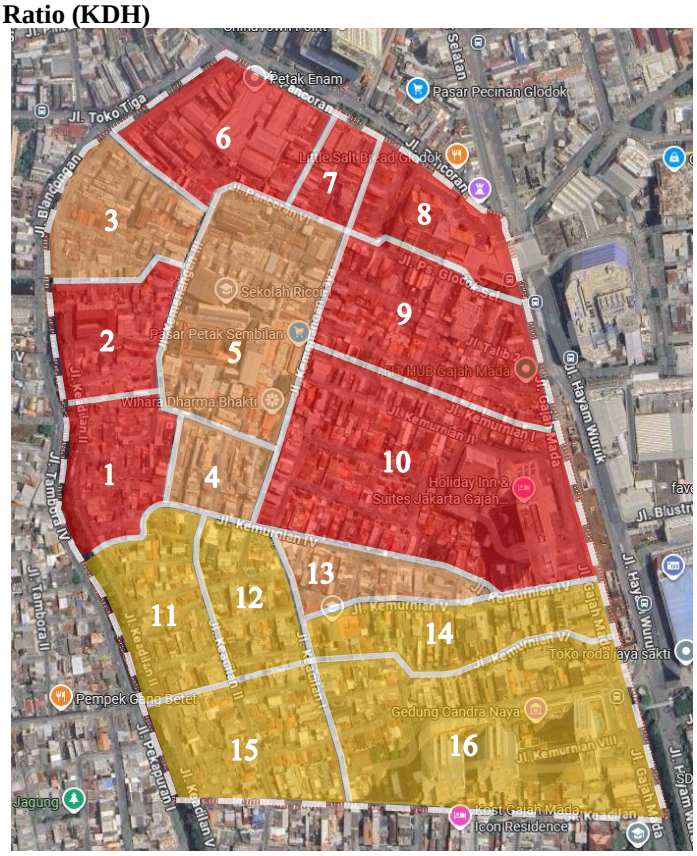

Figure 6. Green Space Availability Map of the Glodok Area

Legend:
- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

Based on the identification results, most sub-areas in Glodok fall within the low to low–medium KDH categories. This condition is characterized by the limited availability of green open spaces due to the dominance of commercial, service, and residential buildings that have developed at a high density. Sub-areas 1, 2, 6, 7, 8, 9, and 10 are classified as having low KDH values because almost all land is occupied by buildings and paved surfaces, with vegetation found only in very limited quantities. Meanwhile, Sub-areas 3, 4, 5, and 13 are categorized as low–medium, as they still contain limited open spaces that contribute to the ecological functions of the area.

Sub-areas 11, 12, 14, 15, and 16 exhibit relatively better KDH conditions than the core commercial areas, as vegetation and open spaces are still present within the residential environment. Nevertheless, the overall availability of green spaces in the Glodok Area remains limited, reducing the area's capacity to support thermal comfort, air quality, and ecological functions. These findings indicate the need to enhance green space provision through neighborhood greening programs, community parks, and building-integrated vegetation to better support environmentally friendly urban development principles.

3.2.2 Building Coverage Ratio (KDB)

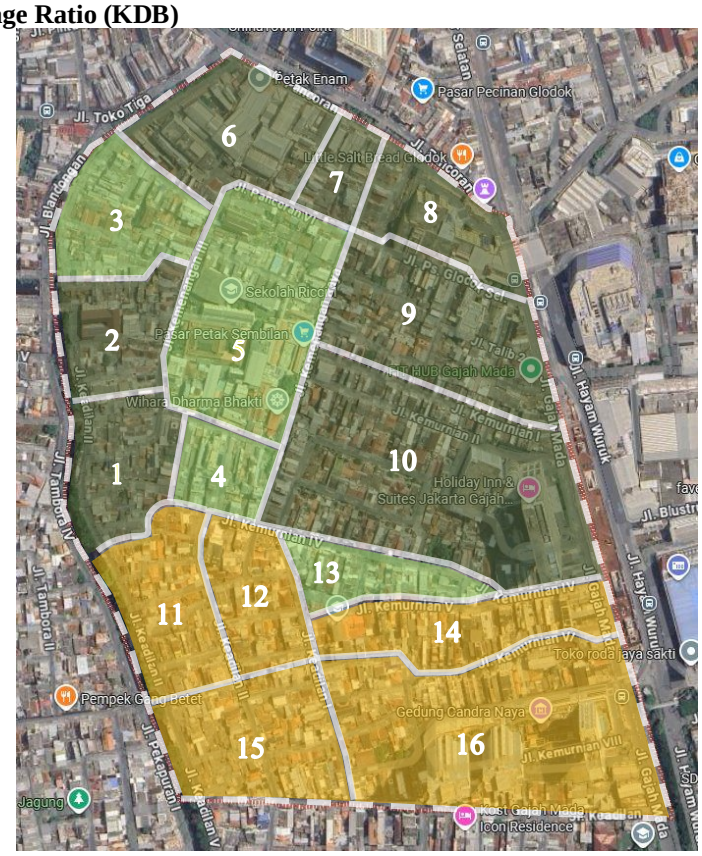

Figure 7. Built-Up Area Dominance Map of the Glodok Area

Legend:
- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

The analysis results indicate that most sub-areas exhibit high to medium–high KDB levels, characterized by the dominance of built-up areas across the majority of land parcels. This condition is particularly evident in Sub-areas 1, 2, 6, 7, 8, 9, and 10, which have developed as the primary commercial and service centers of the Glodok Area. The high development intensity in these sub-areas reflects the efficient utilization of land for economic activities; however, it simultaneously reduces the availability of open spaces that function as water infiltration areas and environmental buffers.

In Sub-areas 3, 4, 5, and 13, KDB levels fall within the medium–high category, while Sub-areas 11, 12, 14, 15, and 16 are classified as medium. These conditions indicate that residential areas generally exhibit a lower degree of built development than the core commercial districts. From a livability perspective, high KDB values support efficient land utilization and intensive urban activities. However, from an environmental perspective, development intensity should be carefully managed to maintain an appropriate balance between built-up areas and open spaces, thereby supporting the long-term sustainability of the urban environment.

3.2.3 Basement Coverage Ratio (KTB)

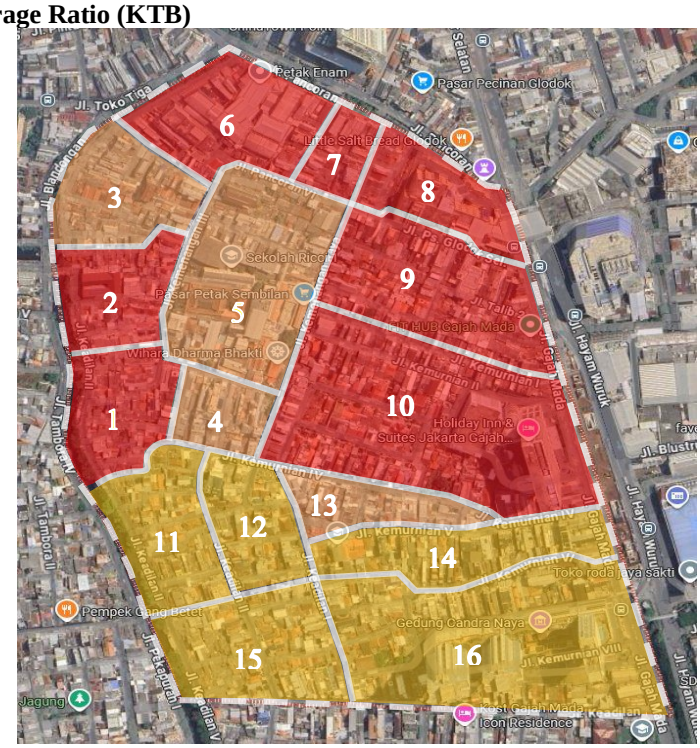

Figure 8. Infiltration Space Availability Map of the Glodok Area

Legend:
- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

The KTB evaluation was conducted by identifying the availability of unbuilt spaces that still allow rainwater to infiltrate into the ground. The analysis results indicate that sub-areas characterized by high development intensity generally fall within the low KTB category, as most land surfaces have been covered by buildings and impervious pavements. This condition is evident in Sub-areas 1, 2, 6, 7, 8, 9, and 10, where the limited availability of open spaces results in low infiltration capacity.

Meanwhile, Sub-areas 3, 4, 5, and 13 are classified as low–medium, while Sub-areas 11, 12, 14, 15, and 16 fall within the medium category because they still contain open areas capable of functioning as infiltration spaces. Nevertheless, the overall infiltration capacity of the Glodok Area remains constrained by the high density of buildings and the dominance of impervious surfaces. Consequently, the provision of infiltration areas, the use of permeable materials, and the expansion of open spaces represent important strategies for improving environmental quality and supporting the long-term sustainability of the area.

IV. CONCLUSION

This study evaluated the characteristics of land-use structure and land-use intensity in the Glodok Area based on livability and environmentally friendly indicators. The results indicate that most sub-areas exhibit a high level of residential function compatibility, accessibility to daily facilities, and implementation of mixed-use functions. These findings suggest that the land-use structure of the Glodok Area effectively supports livability by providing convenient access to daily services, integrating diverse urban functions, and facilitating the intensive social and economic activities that have evolved organically within the area.

On the other hand, the evaluation of land-use intensity reveals that most sub-areas are characterized by a high degree of built development, accompanied by limited availability of green spaces and infiltration areas. These conditions indicate that the environmentally friendly aspect of the area still faces significant challenges, particularly within sub-areas dominated by commercial and service activities. The high intensity of development may reduce the area's capacity to support essential ecological functions, including stormwater infiltration, thermal comfort, and overall environmental quality.

Overall, the Glodok Area possesses strong characteristics as a vibrant, accessible, and highly functional urban environment that effectively supports community activities. Nevertheless, efforts to enhance

environmental quality through the provision of additional green spaces, optimization of open spaces, and improvement of rainwater infiltration capacity should be prioritized in future area management and development strategies. Such measures are essential to achieving a sustainable balance between social, economic, and environmental functions within the area.

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Characteristics of Land-Use Structure and Land-Use Intensity Based on Livability and Environmentally Friendly Indicators, Case Study: Glodok Area, Jakarta, Indonesia

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ABSTRACT: The characteristics of land-use structure and land-use intensity are important aspects influencing the level of livability and environmental quality in urban areas. As one of Jakarta's historic districts, the Glodok Area has developed with a strong mixed-use character that integrates residential, commercial, and service functions, resulting in a complex pattern of spatial utilization. This study aims to identify the characteristics of land-use structure and land-use intensity in the Glodok Area based on livability and environmentally friendly indicators. The research employed a quantitative descriptive-analytical approach through spatial identification using area maps, Google Earth, and Google Street View, which were subsequently validated through field observations. The analysis was conducted on 16 sub-areas delineated according to administrative boundaries and area characteristics. Land-use structure was evaluated using indicators of residential function compatibility, facility accessibility, and mixed-use functions, while land-use intensity was assessed using the Green Coverage Ratio (KDH), Building Coverage Ratio (KDB), and Basement Coverage Ratio (KTB). The results indicate that most sub-areas exhibit a strong mixed-use character and relatively good facility accessibility, thereby supporting intensive urban activities. However, several sub-areas demonstrate high land-use intensity, characterized by the dominance of built-up areas, limited green spaces, and reduced water infiltration areas. These findings suggest that the Glodok Area possesses a relatively favorable level of livability but continues to face challenges in achieving a more sustainable urban environment. The results of this study are expected to contribute to the management and development of urban areas based on livability and environmentally friendly principles.

Keywords – land-use structure, land-use intensity, livability, environmental friendliness, Glodok.

I. INTRODUCTION

The rapid growth of urban areas has increased the demand for space to accommodate residential, commercial, service, and various supporting activities. This condition has led to changes in land-use patterns that influence both environmental quality and the quality of life of urban communities. In the context of sustainable urban development, the success of an urban area is determined not only by its ability to accommodate economic and social activities but also by its capacity to provide a comfortable, healthy, accessible, and sustainable environment for its residents. Therefore, urban environmental quality has become an increasingly important concern in urban planning and design studies that emphasize a balance among social, economic, and environmental functions [1], [2].

The concept of livability has emerged as an important approach for assessing the quality of urban environments based on an area's ability to support the daily needs of its residents. Livability is not limited to the physical comfort of the environment but also encompasses accessibility to facilities, connectivity among land-use functions, ease of mobility, environmental quality, and the capacity of an area to facilitate social interaction within the community [1], [2], [3]. At the neighborhood scale, livability can be measured through various indicators that enable a more objective and systematic evaluation and comparison of urban environments [4]. Furthermore, several studies have shown that the implementation of mixed-use development, good accessibility, and pedestrian-friendly environments contributes significantly to improving urban livability [5], [6].

In addition to livability, urban development is also expected to incorporate environmentally friendly principles. This concept emphasizes the importance of balancing human activities with environmental carrying capacity through spatial management that considers ecological aspects, efficient land use, the provision of green open spaces, and the sustainability of natural resources [7], [8]. Environmentally friendly urban areas are

not only oriented toward fulfilling spatial and functional needs but also toward maintaining environmental quality to support community well-being in the long term [9]. In recent years, the green infrastructure approach has become one of the most widely adopted strategies for enhancing environmental quality through the provision of green spaces and the strengthening of urban ecological functions [7], [8].

Livability and environmentally friendly principles are complementary concepts in shaping the quality of urban environments. Areas characterized by high accessibility, easily reachable facilities, and integrated spatial functions tend to exhibit a higher level of livability [5], [6]. However, such quality should be supported by healthy and sustainable environmental conditions through the provision of open spaces, water infiltration areas, and other ecological elements to ensure long-term benefits for urban residents [7], [8]. Therefore, urban area evaluation should be conducted not only from a functional perspective but also from an environmental perspective that considers ecological quality.

One of the factors influencing the livability of an urban area is its land-use structure. Land-use structure reflects how residential, commercial, service, social facility, and public facility functions are arranged and interact within an area. A well-organized land-use structure can create functional connectivity, enabling residents' needs to be met effectively and efficiently. Accessibility to facilities, the presence of mixed-use functions, and compatibility among land-use functions are important factors that contribute to improving urban activities and residents' quality of life [4], [10]. The implementation of mixed-use development has also been recognized for enhancing land-use efficiency while supporting the social and economic dynamics of urban areas [10].

In addition to land-use structure, environmental quality is influenced by land-use intensity. Land-use intensity reflects the degree of land development within an area and can be observed through the dominance of built-up areas, the availability of green spaces, and the presence of areas that still allow rainwater infiltration. High development intensity that is not balanced by adequate green open spaces and infiltration areas may reduce environmental quality, increase surface runoff, and diminish the ecological functions of urban environments [11]. Previous studies have demonstrated that the provision of green spaces and environmentally responsive drainage systems plays an important role in maintaining a balance between physical development and urban environmental quality [12], [13].

The Glodok Area in West Jakarta was selected as the study area because it is one of Jakarta's historic districts that has developed as a center of commerce, services, and residential activities with a strong mixed-use character. Intensive economic activities have shaped a complex land-use pattern and a relatively high building density. On the one hand, these conditions create a vibrant environment that supports urban activities and community life. On the other hand, high development intensity may exert pressure on environmental quality, particularly regarding the availability of open spaces and environmental carrying capacity. These characteristics make the Glodok Area a relevant case for examining the relationship between land-use structure, land-use intensity, and urban environmental quality.

Previous studies have examined livability at both city and neighborhood scales [1], [2], [3], [4], the relationship between mixed-use development and urban environmental quality [5], [10], and the development of environmentally friendly urban areas through green infrastructure and sustainable land management approaches [7], [8], [11]. Other studies have also investigated the quality of commercial districts from the perspectives of livability and placemaking [14]. However, studies that specifically evaluate the characteristics of land-use structure and land-use intensity simultaneously using livability and environmentally friendly indicators in organically developed historic mixed-use areas remain limited. Therefore, research that integrates these two aspects within a single evaluation framework is still needed.

Based on this background, this study aims to evaluate the characteristics of land-use structure and land-use intensity in the Glodok Area using livability and environmentally friendly indicators. The analysis was conducted by assessing land-use structure through indicators of residential function compatibility, facility accessibility, and mixed-use functions, as well as land-use intensity through the Green Coverage Ratio (KDH), Building Coverage Ratio (KDB), and Basement Coverage Ratio (KTB). The findings are expected to provide insights into the livability and environmental quality of the area while contributing to the management and development of more sustainable urban environments.

II. METHODS OF RESEARCH

This study employed a quantitative descriptive-analytical approach to evaluate the characteristics of land-use structure and land-use intensity in the Glodok Area based on livability and environmentally friendly indicators. The descriptive method was used to describe the existing conditions of the study area, while the analytical method was applied to assess the degree of conformity between the observed conditions and the established indicators through observation and spatial interpretation. The quantitative approach was implemented through the development of assessment indicators derived from theoretical studies and previous research, resulting in measurable criteria that enabled a systematic comparison among sub-areas.

The research indicators were developed using the concept matrix development approach, which involves the synthesis of theoretical concepts related to livability, environmentally friendly principles, land-use structure, and land-use intensity. In architectural research, theory serves as the foundation for constructing an analytical framework that can be operationalized into research variables and indicators [15]. Therefore, the indicators employed in this study were formulated based on the synthesis of relevant theories and literature and subsequently translated into observable parameters within the study area.

The data collection process began with area identification using area maps, the Detailed Urban Design and Environmental Plan (RTBL) documents, Google Earth, and Google Street View to understand the spatial characteristics of the Glodok Area. The identification process focused on land-use patterns, road networks, building functions, neighborhood administrative boundaries (RW), and activity characteristics. Based on the results of this identification, the study area was divided into sixteen sub-areas that served as the units of analysis.

Field observations were subsequently conducted to validate the existing conditions identified through spatial data interpretation and digital imagery. The observations involved direct examination of building functions, facility accessibility, mixed-use characteristics, the dominance of built-up areas, the availability of green spaces, and areas that still had the potential to function as rainwater infiltration spaces. In addition, photographic documentation was undertaken to provide supporting data for the evaluation and interpretation of the research findings.

The collected data were analyzed using an assessment matrix developed based on the research indicators. Each indicator was evaluated comparatively across the sixteen sub-areas to generate a classification of area conditions, which was subsequently used as the basis for identifying the characteristics of land-use structure and land-use intensity within the Glodok Area.

The assessment results for each indicator were then converted into area condition classifications consisting of five categories: low, low-medium, medium, medium-high, and high. These classifications were used to facilitate the interpretation of the characteristics of each sub-area based on its level of conformity with the established livability and environmentally friendly indicators.

2.1 Study Area

The study was conducted in the Glodok Area, West Jakarta, one of Jakarta's historic urban districts characterized predominantly by commercial, service, and high-density residential functions. The area is widely recognized as Jakarta's oldest Chinatown, possessing significant historical, cultural, and economic value and having developed as a major center of commercial activity since the colonial era [16]. The gradual and organic development of the area has resulted in a complex spatial structure with a high diversity of land-use functions. This condition is reflected in the coexistence of commercial activities, residential functions, supporting facilities, and socio-cultural activities that interact within the same urban environment, creating a strong mixed-use character [17]. In addition to serving as a center of economic and cultural activities, the Glodok Area faces challenges in maintaining environmental quality and urban sustainability due to the high intensity of urban activities, increasing pressure on public spaces, and limitations in environmental carrying capacity [18]. These characteristics make the Glodok Area a relevant case for examining the relationship between land-use structure, land-use intensity, and urban environmental quality.

Figure 1. Glodok Area Research Location
Source: Google Street View, 2026

To facilitate the analytical process, the study area was divided into several sub-areas based on neighborhood administrative boundaries (RW), major road networks, and the physical and activity characteristics of the area. The delineation of sub-areas was carried out through the interpretation of area maps, Google Earth satellite imagery, and Google Street View, which were subsequently validated through field observations. This subdivision was intended to establish more specific units of analysis, enabling a more systematic, measurable, and comprehensive assessment of area conditions.

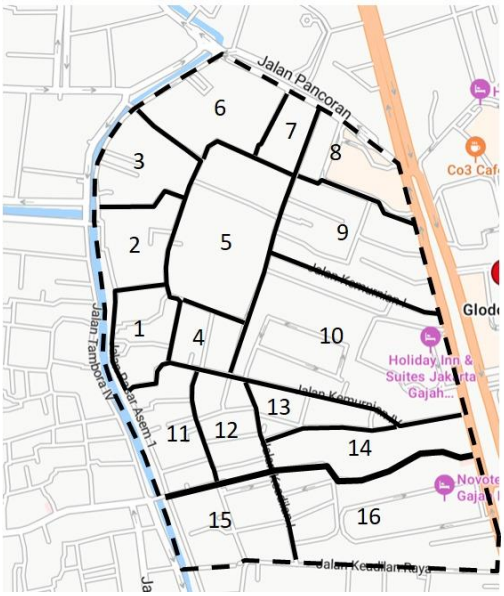

Figure 2. Division of Research Sub Areas
Source: Google Street View, 2026

2.2 Concept Matrix Development

The concept matrix was developed through the synthesis of livability and environmentally friendly neighborhood theories, which were subsequently linked to the RTBL components of land-use structure and land-use intensity. The results of this synthesis were used to establish the indicators, parameters, and assessment instruments relevant to the physical characteristics of the study area. The concept matrix served as the foundation for developing the area assessment framework, ensuring that each indicator was supported by clearly defined parameters and measurement criteria that could be applied consistently across all study sub-areas.

Table 1. Concept Matrix Development of Land-Use Structure and Land-Use Intensity

RTBL Physical Component	Criteria	Indicator	Parameter
Land-Use Structure	The balance between human needs and environmental considerations serves as the foundation for creating adaptive residential environments	Compatibility between residential land-use allocation and the provision of surrounding public and social facilities	The availability of public and social facilities is proportional to population density
		Accessibility of residents to facilities that support daily needs	Walking distance to neighborhood facilities is ≤ 400 meters
	Multidimensional integration	Implementation of mixed-use development both horizontally and vertically	The presence of supporting public or commercial functions within residential zones
		Compatibility among mutually supportive land-use functions	No negative impacts, such as pollution or excessive noise, affecting residential areas

RTBL Physical Component	Criteria	Indicator	Parameter
	Sustainable contextual adaptability (site responsiveness, climate responsiveness, and long-term health considerations)	Suitability of residential block allocation to site and climatic conditions	Area development minimizes alterations to natural topography (cut and fill activities)
		Protection of environmentally sensitive areas from building conversion	Micro-conservation areas and setback zones remain free from massive building development
Land-Use Intensity	Ecologically based planning promotes resource efficiency and sustainability	Control of surface water infiltration capacity within residential plots	KDH values comply with zoning regulations (minimum 20–30%)
		Limitation of total built-floor area	KDB values do not exceed the carrying-capacity threshold of the area
	Ecologically based residential space management	Provision of alternative green open spaces in medium- to high-density buildings	Availability of roof gardens, podium gardens, or vertical green spaces
		Limited utilization of underground space	KTB values maintain sufficient unbuilt ground area for groundwater infiltration

2.3 Determination of Assessment Indicators

Based on the developed concept matrix, assessment indicators were established to evaluate the characteristics of land-use structure and land-use intensity. Each indicator was further translated into specific parameters and assessment instruments derived from field observations, digital imagery interpretation, and analysis of the existing conditions of the study area. The selected indicators were based on the principles of livability and environmentally friendly neighborhoods and were adapted to the characteristics of the Glodok Area.

Table 2. Measurement Indicators

Variable	Indicator	Parameter	Measurement Tool
Land-Use Structure	Residential Function Compatibility	Availability of social and public facilities	Field observation and map interpretation
	Facility Accessibility	Ease of access to daily facilities (walking distance)	Google Earth and field observation
	Mixed-use	Presence of mixed-use functions	Field observation
Land-Use Intensity	KDH	Availability of green spaces	Imagery interpretation and field observation
	KDB	Dominance of built-up areas	Imagery interpretation and field observation
	KTB	Availability of unbuilt infiltration spaces	Field observation

2.4 Data Analysis Technique

Data analysis was conducted using a descriptive-analytical approach to identify the characteristics of land-use structure and land-use intensity based on livability and environmentally friendly indicators in the Glodok Area. Data obtained from field observations, map interpretation, Google Earth satellite imagery, and Google Street View were analyzed by comparing the existing conditions of the study area with the parameters established in the research indicator matrix.

The analysis was performed for each sub-area designated as a unit of analysis. Each indicator was evaluated according to its level of conformity with the physical conditions of the area. For the land-use structure component, the analysis focused on the compatibility between residential functions and supporting facilities, accessibility to daily needs, the implementation of mixed-use functions, compatibility among land-use functions, and the suitability of land utilization with environmental conditions. Meanwhile, for the land-use intensity component, the analysis focused on the dominance of built-up areas, the availability of green spaces, unbuilt infiltration areas, and land-use characteristics related to environmental sustainability.

The identification and evaluation results for each indicator were subsequently presented in the form of assessment tables and descriptive explanations to illustrate the characteristics of each sub-area. A comparative analysis was then conducted to examine differences among sub-areas and identify overall trends in land-use structure and land-use intensity within the Glodok Area. The findings were further used to identify the potentials, challenges, and level of conformity of the area with the principles of livability and environmentally friendly neighborhoods.

III. RESULTS AND DISCUSSION

The research findings were compiled based on the analysis of existing conditions within each sub-area of the Glodok Area that had been designated as a unit of analysis. The evaluation focused on two RTBL physical components, namely land-use structure and land-use intensity, using the livability and environmentally friendly indicators established in the previous stage. The analysis was conducted through field observations, satellite imagery interpretation, Google Street View examination, and area documentation to identify the physical characteristics, land-use patterns, and environmental conditions of each sub-area.

The characteristics of each sub-area were subsequently compared to determine the level of conformity between existing conditions and the research indicators, as well as to identify the potentials and challenges affecting the quality of the residential environment within the Glodok Area.

3.1 Land-Use Structure in the Glodok Area

The land-use structure of the Glodok Area reflects the characteristics of a historic urban district dominated by commercial, service, and residential functions that have evolved organically over time. The resulting land-use pattern demonstrates a relatively high level of functional integration, particularly along the main road corridors that serve as the economic centers of the area. The coexistence of residential functions with shophouses, traditional markets, restaurants, religious facilities, and various service activities indicates the implementation of a mixed-use concept that has developed naturally in response to local community needs.

Based on field observations and spatial interpretation, each sub-area exhibits distinct characteristics in terms of residential function compatibility, accessibility to daily facilities, and the diversity of land-use functions. Sub-areas located along the primary commercial corridors tend to have better accessibility and a greater variety of mixed-use functions than those predominantly characterized by residential activities. These differences influence the degree to which each sub-area fulfills the livability and environmentally friendly indicators established in this study.

Table 3. Evaluation of Land-Use Structure in the Glodok Area Based on Livability and Environmentally Friendly Indicators

Sub Area	Residential Function Compatibility	Facility Accessibility	Mixed-use	General Evaluation
1	High	High	High	Dominated by commercial and service functions with easily accessible daily facilities, thereby supporting intensive urban activities.
2	High	High	High	Exhibits strong integration between residential and neighborhood-scale commercial functions, with good accessibility to supporting facilities.
3	Medium–High	High	Medium–High	Characterized predominantly by residential functions mixed with small-scale businesses, maintaining mixed-use functions although at a lower intensity than the main commercial corridors.
4	Medium	High	Medium	Functions as a transition area between residential and commercial activities. Commercial and service functions are present at the neighborhood scale, supporting residents' daily needs without dominating the residential character of the area.
5	Medium	High	Medium	Predominantly residential, with commercial and service activities concentrated along major road corridors, supporting residents' daily needs.
6	High	High	High	Located along Pancoran Street, characterized by intensive commercial activities. The integration of residential and commercial functions creates an active and highly accessible mixed-use environment.

Sub Area	Residential Function Compatibility	Facility Accessibility	Mixed-use	General Evaluation
7	High	High	High	Dominated by commercial and service functions directly connected to the area's primary activity center. The availability of supporting facilities contributes to a high level of livability.
8	High	High	High	Characterized by strong mixed-use functions with a predominance of economic activities. Its strategic location enhances accessibility and supports commercial and service activities.
9	High	High	High	Located near the Glodok commercial center and characterized by a dominant commercial function. The diversity of land-use functions supports mobility and the fulfillment of residents' daily needs.
10	Medium–High	High	High	Dominated by commercial, service, and accommodation functions that have developed along the main corridor. Mixed-use functions are highly intensive; however, the concentration of activities may create pressure on environmental quality.
11	Medium	Medium	Medium	Predominantly residential, with neighborhood-scale economic activities. Accessibility remains relatively adequate, although less intensive than in the primary commercial areas.
12	Medium	High	Medium	Characterized mainly by residential functions supported by public facilities and local commercial activities. Its proximity to the main corridor provides good accessibility to daily needs.
13	Medium–High	High	Medium–High	Serves as a link between residential neighborhoods and economic activity centers. The presence of various supporting functions creates a balance between residential and commercial activities.
14	Medium	Medium–High	Medium	Characterized by a relatively quieter environment dominated by residential and local commercial functions. Mixed-use functions remain present but are less intensive than those found in the northern and eastern parts of the area.
15	Medium	Medium	Low–Medium	Predominantly residential, with relatively limited economic activities. The area functions more as a residential neighborhood than as a commercial activity center.
16	Medium	Medium–High	Medium	Combines residential and neighborhood-scale service functions with relatively good access to the main corridor. The intensity of mixed-use functions is lower than in the core area of Glodok but still supports residents' daily needs.

3.1.1 Residential Function Compatibility with Supporting Facilities

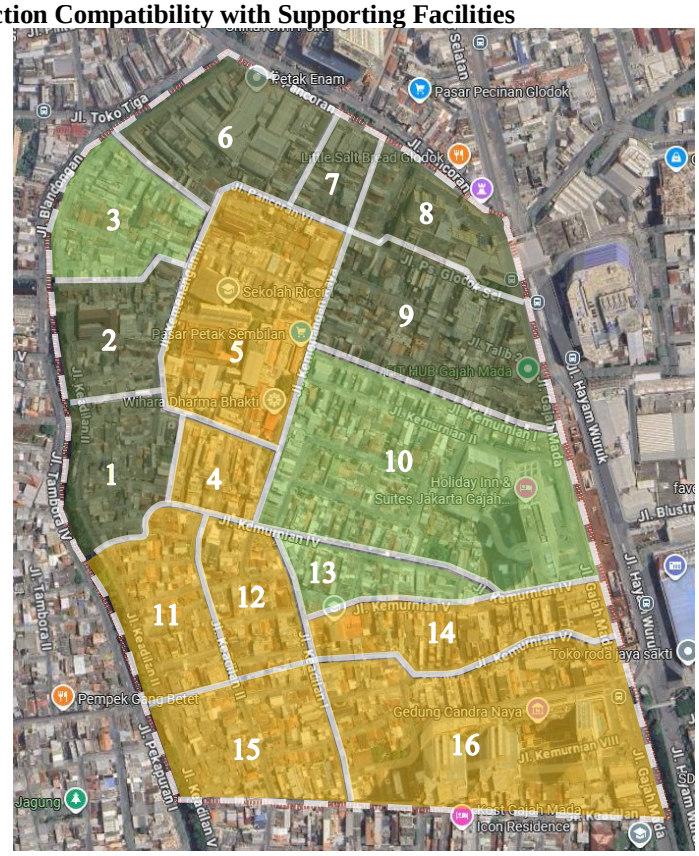

Figure 3. Residential Function Compatibility Map of the Glodok Area

Legend:
- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

Based on the identification results, most sub-areas in Glodok exhibit high to moderate levels of residential function compatibility. This condition is indicated by the presence of commercial facilities, service establishments, places of worship, and social facilities that are integrated with residential areas. Sub-areas 1, 2, 6, 7, 8, and 9 demonstrate a high level of compatibility because residential functions have developed alongside a variety of supporting facilities capable of meeting residents' daily needs. Meanwhile, Sub-areas 4, 5, 11, 12, 14, 15, and 16 exhibit a moderate level of compatibility, as residential functions remain dominant and are supported by neighborhood facilities on a more limited scale.

The widespread distribution of supporting facilities throughout the area indicates that the land-use structure of Glodok has evolved organically and is capable of supporting community activities in a sustainable manner. From a livability perspective, this condition facilitates access to daily needs and services. From an environmentally friendly perspective, it can reduce the need for long-distance travel, thereby potentially decreasing dependence on motorized transportation and its associated environmental impacts.

3.1.2 Accessibility to Daily Facilities

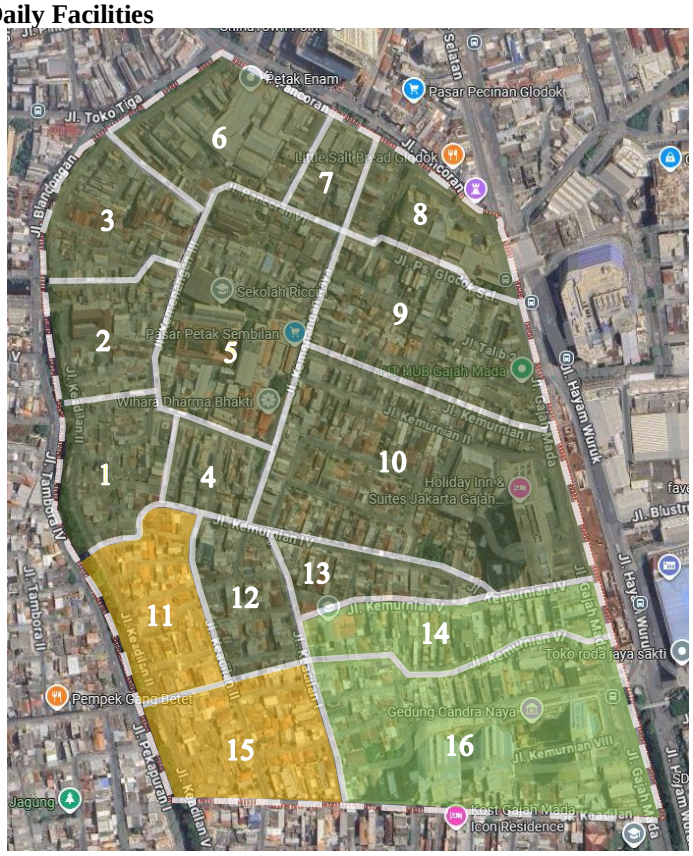

Figure 4. Accessibility Level Map of Daily Facilities in the Glodok Area

Legend:

- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

The analysis results indicate that almost all sub-areas exhibit a high level of accessibility to daily facilities. The compact urban form of the Glodok Area, combined with its interconnected street network, enables residents to reach markets, educational facilities, places of worship, commercial areas, and other public facilities within walking distance. This condition is particularly evident in sub-areas located along the Jalan Pancoran corridor, Jalan Gajah Mada, and the local road network connecting the area's primary activity centers.

The high level of accessibility represents one of the key indicators of livability in the Glodok Area, as residents are not entirely dependent on motorized transportation to meet their daily needs. In addition to improving mobility efficiency, this condition contributes to reduced energy consumption and lower transportation-related emissions at the neighborhood scale. Furthermore, the close proximity between residential areas and supporting facilities encourages walking activities, thereby enhancing the overall convenience and functionality of the urban environment.

3.1.3 Implementation of Mixed-Use Functions

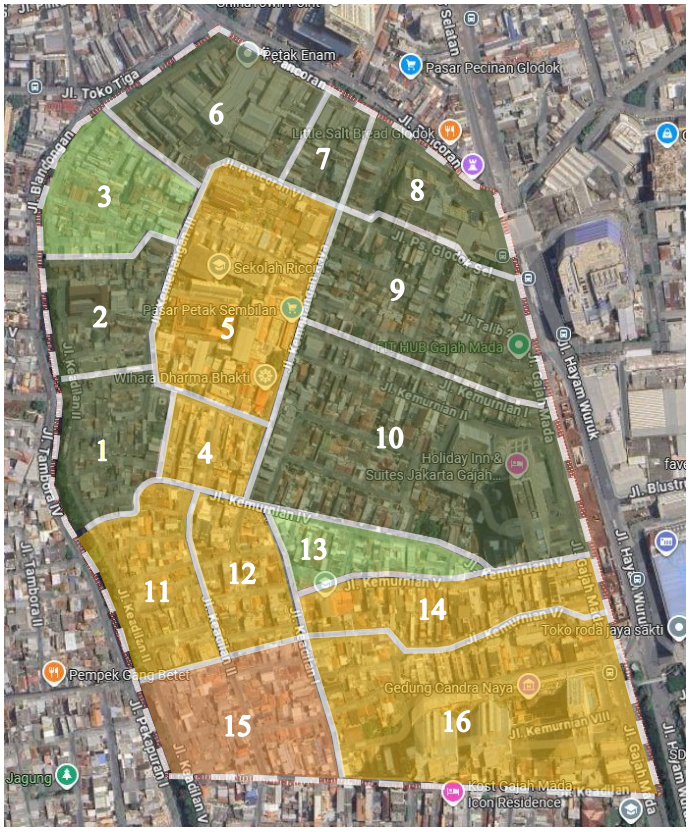

Figure 5. Mixed-Use Implementation Level Map of the Glodok Area

Legend:

- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

The implementation of mixed-use functions represents one of the defining characteristics of the land-use structure in the Glodok Area. The integration of residential, commercial, service, and supporting functions creates an active urban environment while enhancing the efficiency of residents' daily movements. Sub-areas 1, 2, 6, 7, 8, 9, and 10 exhibit a high level of mixed-use development, characterized by the intensive coexistence of residential functions and economic activities. Meanwhile, Sub-areas 3 and 13 fall within the medium–high category, as residential functions remain dominant while still being supported by relatively significant commercial activities.

In Sub-areas 4, 5, 11, 12, 14, and 16, the level of mixed-use development is classified as medium because commercial and service activities are generally concentrated along specific road corridors. In contrast, Sub-area 15 is categorized as low–medium due to the stronger dominance of residential functions and the relatively limited presence of commercial activities. Overall, the presence of mixed-use functions in the Glodok Area contributes positively to livability by improving accessibility and facilitating the fulfillment of residents' daily needs. However, in areas characterized by intensive economic activities, more effective environmental management is required to maintain environmental quality and ensure the long-term sustainability of the urban environment.

3.2 Land-Use Intensity

Land-use intensity is an important aspect in assessing the quality of residential environments because it is closely related to the degree of built development, the availability of open spaces, and the capacity of an area to support ecological functions. In densely populated urban areas such as Glodok, the high demand for space to accommodate commercial, service, and residential activities often results in the increasing dominance of built-up areas and the reduction of open spaces that function as water infiltration areas and environmental buffers. These conditions influence environmental comfort, the visual quality of the urban landscape, and the

long-term sustainability of land utilization.

Based on livability and environmentally friendly indicators, the evaluation of land-use intensity was conducted using three main indicators: the dominance of built-up areas, the availability of green spaces, and the availability of unbuilt infiltration areas. These indicators were employed to identify the level of land-use intensity within each sub-area and to assess the extent to which existing conditions are capable of maintaining a balance between development needs and environmental functions. The results of the land-use intensity evaluation for all sub-areas in the Glodok Area are presented in Table 4.

Table 4. Evaluation of Land-Use Intensity in the Glodok Area Based on KDH, KDB, and KTB Indicators

Sub Area	KDH	KDB	KTB	General Evaluation
1	Low	High	Low	Dominated by commercial and service buildings with high density. The availability of green spaces and infiltration areas is very limited, resulting in less optimal ecological performance.
2	Low	High	Low	Characterized by a very high degree of built development, with buildings covering most of the land area. Green spaces and infiltration areas are relatively scarce.
3	Low–Medium	Medium–High	Low–Medium	Although still dominated by buildings, the area contains limited open spaces that contribute to environmental functions.
4	Low–Medium	Medium–High	Low–Medium	Building density is relatively high, with limited open spaces. Environmental conditions are slightly better than those found in the core commercial areas.
5	Low–Medium	Medium–High	Low–Medium	Dominated by residential functions and neighborhood-scale economic activities, with relatively dense development and limited open spaces.
6	Low	High	Low	Located along an active commercial corridor characterized by a high concentration of buildings and paved surfaces. Green spaces and infiltration areas are almost absent.
7	Low	High	Low	Land-use intensity is very high due to the dominance of commercial functions. The availability of green spaces is extremely limited.
8	Low	High	Low	The commercial character of the area results in most land being occupied by buildings, leading to relatively low water infiltration capacity.
9	Low	High	Low	A densely developed commercial area with minimal open space and a very high dominance of built-up land.
10	Low	High	Low	Intensive commercial and service activities have resulted in a very high proportion of built-up areas and limited vegetation cover.
11	Medium	Medium	Medium	This residential area exhibits a lower degree of built development than the commercial center, resulting in relatively better environmental conditions.
12	Medium	Medium	Medium	Predominantly residential, with relatively better availability of open spaces and vegetation compared to the core area of Glodok.
13	Low–Medium	Medium–High	Low–Medium	A mixed-use area experiencing increasing development pressure, resulting in a gradual reduction of open spaces.
14	Medium	Medium	Medium	A residential area with a moderate level of development intensity and the presence of neighborhood-scale open spaces.
15	Medium	Medium	Medium	Dominated by residential functions with lower building density than the commercial areas, thereby supporting better environmental performance.
16	Medium	Medium	Medium	Characterized by residential and neighborhood-scale service functions, with relatively better open-space conditions than the core area of Glodok.

3.2.1 Green Coverage Ratio (KDH)

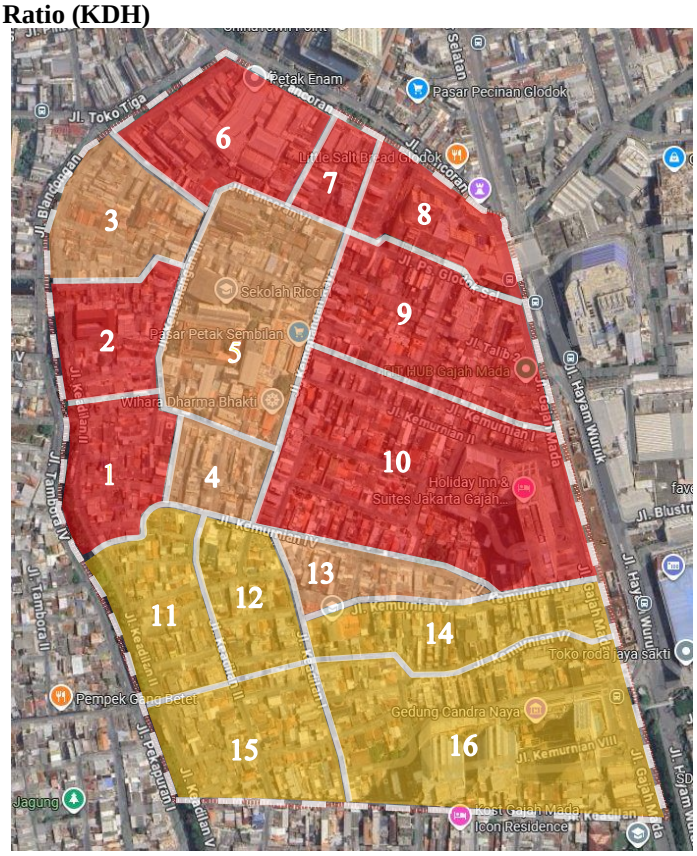

Figure 6. Green Space Availability Map of the Glodok Area

Legend:

- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

Based on the identification results, most sub-areas in Glodok fall within the low to low–medium KDH categories. This condition is characterized by the limited availability of green open spaces due to the dominance of commercial, service, and residential buildings that have developed at a high density. Sub-areas 1, 2, 6, 7, 8, 9, and 10 are classified as having low KDH values because almost all land is occupied by buildings and paved surfaces, with vegetation found only in very limited quantities. Meanwhile, Sub-areas 3, 4, 5, and 13 are categorized as low–medium, as they still contain limited open spaces that contribute to the ecological functions of the area.

Sub-areas 11, 12, 14, 15, and 16 exhibit relatively better KDH conditions than the core commercial areas, as vegetation and open spaces are still present within the residential environment. Nevertheless, the overall availability of green spaces in the Glodok Area remains limited, reducing the area's capacity to support thermal comfort, air quality, and ecological functions. These findings indicate the need to enhance green space provision through neighborhood greening programs, community parks, and building-integrated vegetation to better support environmentally friendly urban development principles.

3.2.2 Building Coverage Ratio (KDB)

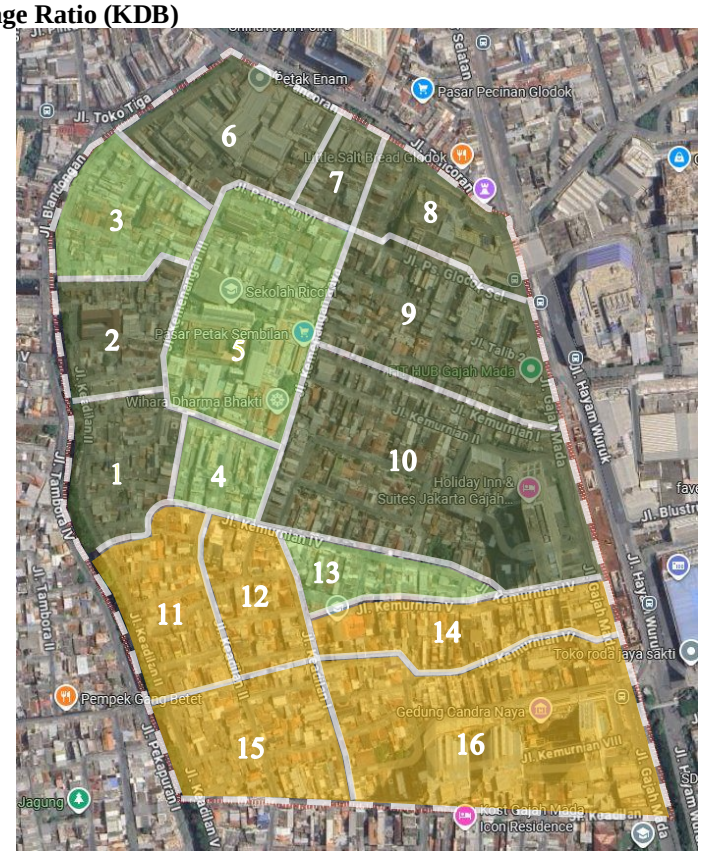

Figure 7. Built-Up Area Dominance Map of the Glodok Area

Legend:
- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

The analysis results indicate that most sub-areas exhibit high to medium–high KDB levels, characterized by the dominance of built-up areas across the majority of land parcels. This condition is particularly evident in Sub-areas 1, 2, 6, 7, 8, 9, and 10, which have developed as the primary commercial and service centers of the Glodok Area. The high development intensity in these sub-areas reflects the efficient utilization of land for economic activities; however, it simultaneously reduces the availability of open spaces that function as water infiltration areas and environmental buffers.

In Sub-areas 3, 4, 5, and 13, KDB levels fall within the medium–high category, while Sub-areas 11, 12, 14, 15, and 16 are classified as medium. These conditions indicate that residential areas generally exhibit a lower degree of built development than the core commercial districts. From a livability perspective, high KDB values support efficient land utilization and intensive urban activities. However, from an environmental perspective, development intensity should be carefully managed to maintain an appropriate balance between built-up areas and open spaces, thereby supporting the long-term sustainability of the urban environment.

3.2.3 Basement Coverage Ratio (KTB)

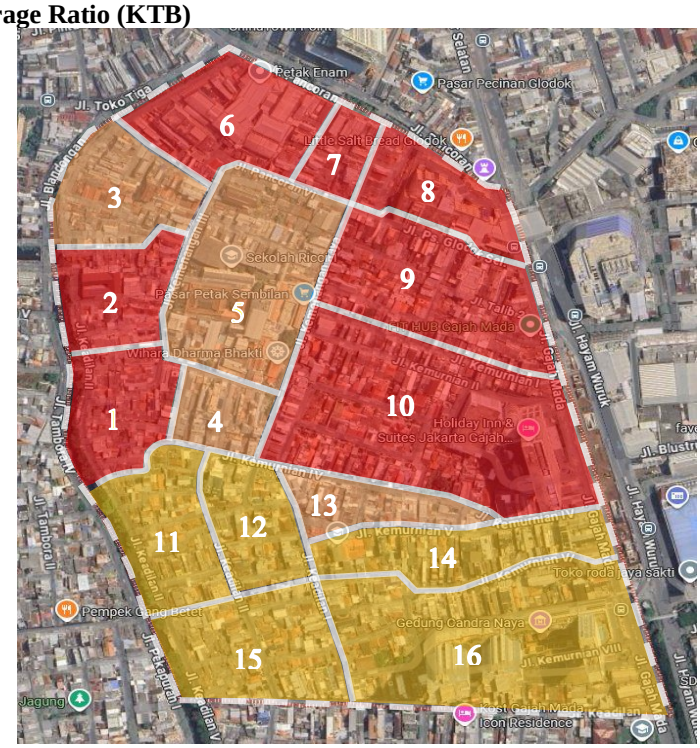

Figure 8. Infiltration Space Availability Map of the Glodok Area

Legend:

- Dark Green = High
- Light Green = Medium–High
- Yellow = Medium
- Orange = Low–Medium
- Red = Low

The KTB evaluation was conducted by identifying the availability of unbuilt spaces that still allow rainwater to infiltrate into the ground. The analysis results indicate that sub-areas characterized by high development intensity generally fall within the low KTB category, as most land surfaces have been covered by buildings and impervious pavements. This condition is evident in Sub-areas 1, 2, 6, 7, 8, 9, and 10, where the limited availability of open spaces results in low infiltration capacity.

Meanwhile, Sub-areas 3, 4, 5, and 13 are classified as low–medium, while Sub-areas 11, 12, 14, 15, and 16 fall within the medium category because they still contain open areas capable of functioning as infiltration spaces. Nevertheless, the overall infiltration capacity of the Glodok Area remains constrained by the high density of buildings and the dominance of impervious surfaces. Consequently, the provision of infiltration areas, the use of permeable materials, and the expansion of open spaces represent important strategies for improving environmental quality and supporting the long-term sustainability of the area.

IV. CONCLUSION

This study evaluated the characteristics of land-use structure and land-use intensity in the Glodok Area based on livability and environmentally friendly indicators. The results indicate that most sub-areas exhibit a high level of residential function compatibility, accessibility to daily facilities, and implementation of mixed-use functions. These findings suggest that the land-use structure of the Glodok Area effectively supports livability by providing convenient access to daily services, integrating diverse urban functions, and facilitating the intensive social and economic activities that have evolved organically within the area.

On the other hand, the evaluation of land-use intensity reveals that most sub-areas are characterized by a high degree of built development, accompanied by limited availability of green spaces and infiltration areas. These conditions indicate that the environmentally friendly aspect of the area still faces significant challenges, particularly within sub-areas dominated by commercial and service activities. The high intensity of development may reduce the area's capacity to support essential ecological functions, including stormwater infiltration, thermal comfort, and overall environmental quality.

Overall, the Glodok Area possesses strong characteristics as a vibrant, accessible, and highly functional urban environment that effectively supports community activities. Nevertheless, efforts to enhance

environmental quality through the provision of additional green spaces, optimization of open spaces, and improvement of rainwater infiltration capacity should be prioritized in future area management and development strategies. Such measures are essential to achieving a sustainable balance between social, economic, and environmental functions within the area.

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