

SPATIAL-BASED PROPERTY INVESTMENT FEASIBILITY ANALYSIS USING GEOGRAPHIC INFORMATION SYSTEM APPROACH

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Abstract

Property investment is vital for economic growth but often raises spatial and environmental challenges. This study evaluates property investment feasibility in the Special Region of Yogyakarta (DIY) using a GIS-based Weighted Overlay Method. Four key parameters were analyzed: accessibility (arterial and collector roads), land use, land utilization, and multi-hazard risk (including earthquakes, volcanic eruptions, floods, and others). The results classify areas into five feasibility levels, showing that central Sleman, Yogyakarta City, and Bantul are suitable due to high accessibility and low disaster risk, while areas near Mount Merapi, the Opak Fault, and the southern coast are unsuitable due to high risk. The findings highlight that investment feasibility depends on accessibility, disaster risk, and spatial planning conformity. Thus, GIS-based spatial analysis serves as an effective tool for supporting safe, efficient, and sustainable property investment decisions.

Keywords: property investment, land suitability, Geographic Information System (GIS), Weighted Overlay.

INTRODUCTION

Property investment is one of the strategic sectors that plays an important role in driving national economic development (Kompas.id, 2025). However, the selection of investment locations often raises issues related to spatial planning (Mahendra & I Made Juniastra, 2023). The study conducted by (Hakim et al., 2021) shows that the incompatibility between investment locations and spatial plans has the potential to create land-use problems and increase environmental and social risks. These findings indicate that the issue of investment location is not merely technical but also relates to sustainability aspects within the context of regional development.

At the national level, the property industry contributes significantly to Indonesia's economic growth. Based on data from the Ministry of Investment/Investment Coordinating Board (BKPM), total realized investment in the property sector in 2024 reached IDR 122.9 trillion, surpassing the target set by the government (BKPM). This realized investment includes several key subsectors, namely housing, industrial estates, and office buildings. This achievement indicates that investment in the property sector continues to show a positive growth trend, in line with increasing market demand and national development activities.

The national investment growth trend is also reflected in the Special Region of Yogyakarta (DIY), which is known as a center of education, culture, and tourism. According to data from the Investment and One-Stop Integrated Service Office (DPMPTSP DIY), property sector investment increased by 11.7% during the 2022–2023 period, with the main concentration in Sleman Regency and Yogyakarta City (DPMPTSP DIY). This increase reflects the high attractiveness of property investment in the DIY region, particularly in meeting the demand for housing and tourism-supporting facilities. This trend aligns with the findings of (Putri, 2024), which indicate that the growth of investment and the intensity of economic activities in urban areas of DIY contribute to

the conversion of productive land, particularly in Sleman Regency. This phenomenon leads to the reduction of agricultural land, environmental imbalance, and changes in spatial patterns marked by the expansion of built-up areas.

Investment growth in the Special Region of Yogyakarta (DIY) is inseparable from various spatial challenges that are complex and multidimensional. The findings of (Setyoko, 2025) indicate that investment activities in the property, trade, and service sectors drive the conversion of agricultural land into residential and commercial areas, especially in high-accessibility regions such as Caturtunggal, Depok, and Mlati. This condition results in the reduction of productive agricultural land and creates inconsistencies between spatial plans and actual land use, reflecting tensions between economic interests and environmental conservation efforts (Setyoko, 2025). On the other hand, the southern coastal area of Gunungkidul Regency faces development pressure from the tourism sector, even though the area has a high vulnerability to abrasion and landslides. This phenomenon reflects an imbalance between the economic potential of investment and the spatial planning capacity and environmental carrying capacity in the DIY region.

A concrete manifestation of this issue can be seen in the tourism and accommodation facilities along the coastal areas of Gunungkidul (Bagaskara, 2023). Most of these buildings are located on karst areas that are highly vulnerable to landslides (Wicaksono & Khafid, 2022), and some have not yet fully met environmental permit requirements (Bagaskara, 2023). This phenomenon indicates weak supervision and low compliance with spatial planning regulations, which in turn can pose threats to visitor safety and the sustainability of coastal ecosystems. This case highlights the urgency of developing a more comprehensive, adaptive, and spatial data-based model for assessing investment location feasibility.

Property investments that are not aligned with spatial plans have the potential to cause various environmental, social, and land governance problems. Such conditions are also found in the Special Region of Yogyakarta (DIY), thus requiring a more comprehensive analytical approach in determining investment locations. The use of Geographic Information Systems (GIS) through the application of weighted and scoring-based overlay methods can serve as an evaluative tool capable of objectively assessing land suitability levels while supporting sustainable and environmentally conscious development.

LITERATURE REVIEW AND HYPOTHESIS FORMULATION

Property investment feasibility is increasingly understood as a spatial decision-making problem rather than a purely financial calculation. Location determines market access, development cost, legal certainty, environmental exposure, and long-term asset resilience. GIS has therefore become an important tool in real estate and land suitability studies because it enables the integration of spatial variables such as accessibility, land use, environmental constraints, and disaster risk into a single analytical framework (Droj et al., 2024; Kumar et al., 2019). Recent studies show that GIS-based models can reduce uncertainty in property investment by identifying locations with stronger accessibility, lower environmental constraints, and higher conformity with planning regulations (Arfiansyah et al., 2024; Namangle & Dunga, 2022).

Accessibility is one of the most consistent determinants of property value and investment attractiveness. Jin et al. (2022) found that public transport accessibility has a significant but nonlinear effect on housing prices, meaning that the value of accessibility differs across property market segments. Similarly, Kumar et al. (2019) demonstrated that location identification for real estate investment can be improved through spatial and data-driven analysis, particularly when transportation access and surrounding urban facilities are considered. These findings support the use of arterial and collector road proximity as a key parameter in property investment feasibility analysis.

However, accessibility alone is insufficient. Sustainable property investment must also consider land-use suitability and spatial planning conformity. Arfiansyah et al. (2024) emphasize

that residential development in ecologically sensitive areas requires GIS-based multi-criteria analysis to balance development demand with environmental protection. Su et al. (2021) further show that land-use change can increase disaster risk when development expands into unsuitable or vulnerable areas. In this context, property investment feasibility should not only identify economically strategic locations but also assess whether development is compatible with spatial plans and environmental carrying capacity.

Disaster risk has become a critical variable in property investment analysis, especially in multi-hazard regions such as the Special Region of Yogyakarta. Chen et al. (2019) found that built-up land and population exposure to natural hazards increased significantly in China between 1995 and 2015, showing how urban expansion can intensify disaster exposure. In Yogyakarta, Saputra et al. (2017) demonstrated the importance of GIS in assessing seismic vulnerability of residential buildings, while Ningsih and Mutaqin (2024) highlighted multi-hazard threats in the Kulon Progo coastal aerotropolis area. These studies indicate that property investment decisions in DIY must integrate earthquake, volcanic eruption, landslide, flood, drought, liquefaction, and coastal hazard considerations.

The literature also confirms the relevance of weighted overlay and GIS-based multi-criteria decision analysis in spatial suitability studies. Weighted overlay allows different spatial variables to be scored and combined based on their relative importance, producing suitability classes that support planning decisions (Anastasia et al., 2021; Kadhimi et al., 2023). Ali et al. (2019) applied GIS-based AHP and frequency ratio models for flood vulnerability mapping, while Leonardi et al. (2022) used GIS-multicriteria analysis to evaluate landslide risk along road lifelines. These studies support the methodological logic of integrating road accessibility, land use, planning conformity, and multi-hazard risk into a spatial property feasibility map.

In the context of property and urban development, disaster-aware investment planning is essential for long-term sustainability. Abd Hamid et al. (2020) showed that flood risk affects property value, while Takabatake and Hasegawa (2022) found that people demonstrate preferences for safer residential locations when disaster risk is considered. Cheong (2022) also shows that disaster experiences can influence risk preferences in Indonesia, suggesting that disaster exposure may shape future investment and settlement choices. Therefore, property investment feasibility should include not only current land value and accessibility but also future risk sensitivity.

Overall, previous studies indicate that GIS-based spatial analysis provides a strong foundation for property investment feasibility assessment. The combination of accessibility, land use, spatial conformity, and multi-hazard risk reflects a more comprehensive approach than conventional investment analysis. For the Special Region of Yogyakarta, this approach is particularly relevant because the region combines high property demand, strong urban growth, tourism pressure, agricultural land conversion, and significant disaster exposure. Therefore, this study contributes to the literature by applying a GIS-based weighted overlay model to identify property investment locations that are not only economically attractive but also spatially appropriate, disaster-aware, and environmentally sustainable.

RESEARCH METHODS

The research method used in determining spatial-based property investment feasibility employs the Weighted Overlay Method, with data derived from parameters that influence property investment suitability. The method integrates multiple layers with assigned weights to produce favourability maps and identify potential areas for specific applications based on spatial data (Kadhimi, Alhaditi, & Ismail, 2023). Each spatial parameter carries different scores and weights that affect the overall investment feasibility value. The parameters used include land cover, arterial and collector road networks, multi-hazard factors, and land use. The multi-hazard parameter is obtained from the average score of several disaster types, namely volcanic eruptions, landslides, floods,

earthquakes, droughts, and liquefaction. The weighting formula used in the spatial modeling for determining property investment feasibility is as follows:

$$KIP = (0,25*[Skor_JJ] + (0,5*[Skor_TL]) + (0,35*[Skor_MB]) + (0,5*[Skor_GL])$$

Description:

KIP : Property Investment Feasibility
 JJ : Arterial and Collector Road Network
 TL : Land Cover
 MB : Multi-Hazard
 GL : Land Use

The road network indicator (JJ) was derived from the Rupa Bumi Indonesia (RBI) dataset published by the Geospatial Information Agency (BIG). This dataset includes arterial and collector road networks across the Special Region of Yogyakarta Province. A buffering technique was applied to assess proximity to major roads, where areas closer to arterial or collector roads received higher scores due to better accessibility. Accessibility serves as a key determinant in evaluating the suitability of property investment locations.

The multi-hazard indicator (MB) was sourced from the Indonesian Disaster Risk Index (IRBI) 2021 published by the Regional Disaster Management Agency (BPBD) of Yogyakarta. The dataset covers six major hazards: landslides, Mount Merapi eruptions, liquefaction, droughts, earthquakes, and flash floods. Each hazard was classified according to its level of vulnerability and assigned a score ranging from 0 to 3. These layers were then combined through an overlay process to produce a multi-hazard map indicating the spatial distribution of disaster risk across the province.

The land cover (TL) indicator was also obtained from the Rupa Bumi Indonesia (RBI) dataset by BIG, representing variations in land cover such as settlements, rice fields, plantations, drylands, forests, and coastal areas. Each category was scored based on its suitability for property investment activities. Settlement areas and open lands received higher scores due to their development potential, while forested or productive agricultural lands were assigned lower scores due to land use restrictions.

The land use (GL) indicator was developed based on Law No. 9 of 1955, which governs the establishment of autonomous regions and land-use regulation in the Special Region of Yogyakarta. This dataset was used to assess the conformity between actual land use and the legally designated spatial function. Scoring ranged from 0 to 3, where a score of 0 represents “non-conforming land use” and 3 represents “fully conforming land use.” These values were then utilized to assess the degree of spatial suitability relative to regional development directions.

All indicators were integrated to produce a property investment feasibility map generated through the Weighted Overlay analysis in the Geographic Information System (GIS). Each parameter was weighted according to its influence on investment feasibility. The final scores from the scoring and weighting process were then classified using the equal interval method. This classification was divided into five categories of property investment feasibility: very unsuitable, unsuitable, moderately suitable, suitable, and highly suitable. The classified results were then laid out and displayed spatially. This final spatial output represents the optimal combination of accessibility, spatial conformity, and disaster risk levels, serving as a strategic reference for determining property investment locations in the Special Region of Yogyakarta.

RESULTS AND DISCUSSION



Figure 1. Road Score Map

The road score map is derived from the buffer analysis of arterial and collector roads in the Special Region of Yogyakarta (DIY). The data source for this map is the Geospatial Information Agency (BIG). The map was created based on road accessibility analysis, considering the distance to arterial and collector roads. The closer an area is to major road networks, the higher its accessibility level. This map illustrates how the road network distribution forms patterns of connectivity between districts within the Special Region of Yogyakarta.

The mapping results show that urban areas such as Depok, Gamping, Mlati, and districts within Yogyakarta City have excellent road access due to the dense network of arterial and collector roads. The central to southern regions, including Bantul, Sewon, Pandak, Sanden, and parts of Pundong, are also relatively well-connected, although mainly through collector roads. In contrast, hilly and southern coastal areas such as Panggang, Tepus, Rongkop, and Girisubo have more limited access, as indicated by their greater distance from main road networks. Areas around the Menoreh Hills, including Samigaluh, Girimulyo, and Kokap, are not traversed by arterial or collector roads at all. This pattern highlights disparities in accessibility between regions, which should be considered in infrastructure development and equitable regional planning.

Previous research findings emphasize that accessibility is a key factor in property investment decision-making (Kumar et al., 2019) and (Jin et al., 2022). Areas with a high level of road connectivity, such as urban zones around Depok, Gamping, Mlati, and Yogyakarta City, have greater investment potential. However, as stated by (Namangle & Dunga, 2022) and (Abd Hamid et al., 2020), investment feasibility assessments should not solely focus on ease of access and proximity to economic activity centers. Consideration of disaster risk and spatial planning suitability is also necessary to ensure the long-term sustainability of property investments.



Figure 2. Disaster Score Map

The disaster score map is based on data from the Indonesian Disaster Risk Index (IRBI) of the Special Region of Yogyakarta in 2021, published by the Regional Disaster Management Agency (BPBD DIY). This map is the result of an overlay of several disaster threats, including volcanic eruptions, landslides, floods, earthquakes, droughts, and liquefaction. Each disaster was assigned a vulnerability class with specific scores, and the overlays were combined to form spatial patterns. The map shows four score categories, where a score of 0 indicates “high disaster vulnerability,” while a score of 3 represents “low vulnerability” or relatively safe conditions.

The mapping results reveal variations in disaster scores among districts in DIY, but most areas fall within the “feasible” (score 2) and “highly feasible” (score 3) categories. The eastern part of DIY, particularly Gunungkidul Regency, is dominated by green zones, indicating low exposure to disaster threats. The northern, central, and southern areas tend to be light green, still relatively safe from multiple hazards. Only a few districts, such as Girisubo, Semin, and Rongkop, contain small zones categorized as high-risk. Therefore, this map can serve as a basis for disaster risk-based spatial planning and mitigation at the district level.

These findings are consistent with the results of the study conducted by (Priyono & Rosari, 2023), which indicate that the Sleman Regency area is predominantly characterized by a very low level of Mount Merapi disaster risk. In addition, most of the cultivation areas in the region are located within zones with low to moderate levels of disaster threat. Thus, both the mapping results and previous research findings show that most areas in the Special Region of Yogyakarta are considered safe and highly suitable for development, as long as disaster mitigation aspects are taken into account in development planning.

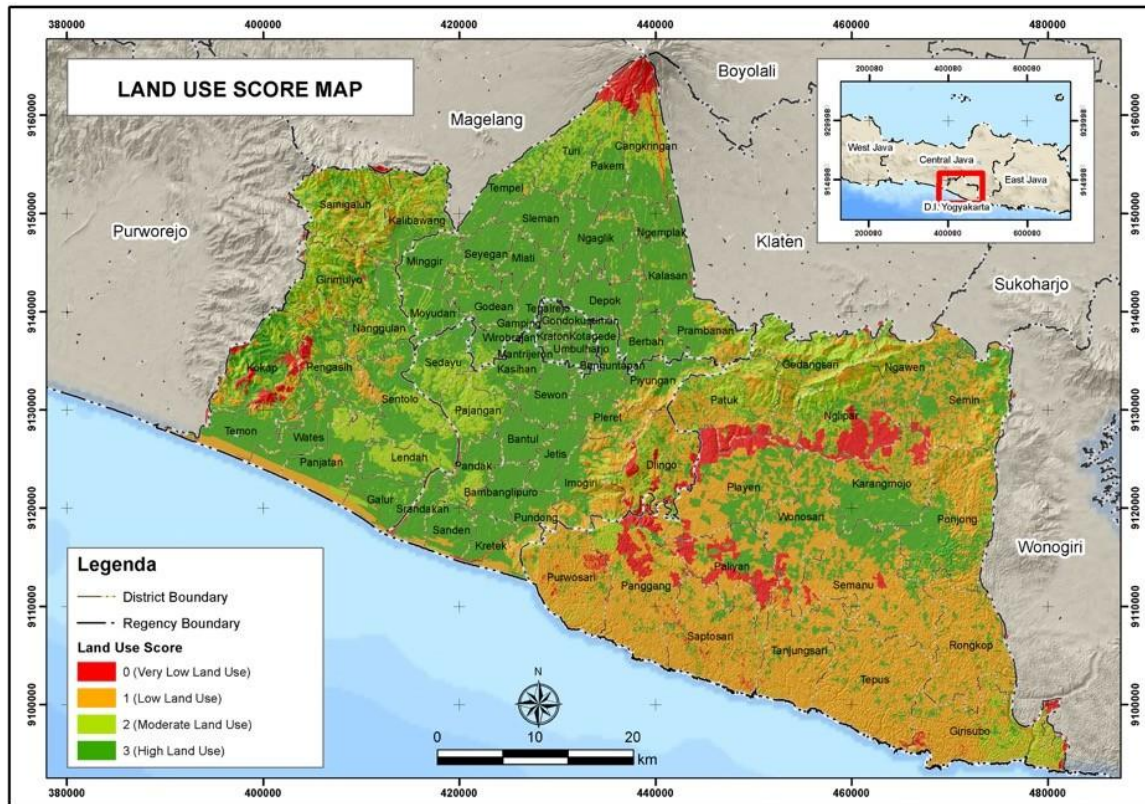


Figure 3. Land Use Map

This map is based on land use data from the Geospatial Information Agency (BIG). It illustrates the spatial distribution of land use across the Special Region of Yogyakarta, classified into categories such as residential, rice fields, dry fields, plantations, forests, and coastal zones. The mapping results reveal diverse land-use patterns ranging from urban and rural areas to agricultural and coastal zones, which were subsequently scored.

Urban areas such as Yogyakarta City, Depok, Gamping, Mlati, and parts of Sleman are dominated by residential land use. Southern districts such as Pundong, Sanden, Pandak, and Paliyan are characterized mainly by rice fields and agricultural land. Meanwhile, the hilly regions of Panggang, Tepus, Rongkop, and GiriSubo are largely covered by plantations or dry farmland. In the northernmost areas, Turi, Pakem, and Cangkringan, land use consists primarily of forests and agricultural zones, making them unsuitable for property investment. This spatial distribution clearly reflects land-use differentiation across districts according to their regional characteristics.

These findings are in line with the results of the study by (Kim et al., 2025), which state that infrastructure development and economic activities tend to concentrate in areas with strategic geographical conditions, thereby attracting greater demand for property investment. However, as noted by (Saputra et al., 2017), the increase in demand and expansion of built-up areas has the potential to raise disaster vulnerability levels, especially in regions with limited environmental carrying capacity.

This map is based on land-use regulations derived from Law No. 9 of 1955, which forms the legal foundation for the establishment of autonomous regions within the Special Region of Yogyakarta, including administrative spatial arrangements. The map classifies land-use suitability using scores from 0 to 3, where a score of 0 represents “non-conforming land use” due to high incompatibility, while a score of 3 denotes “conforming land use” or areas utilized according to spatial plans. This framework enables the identification of regions based on their conformity to spatial plans and development potential.

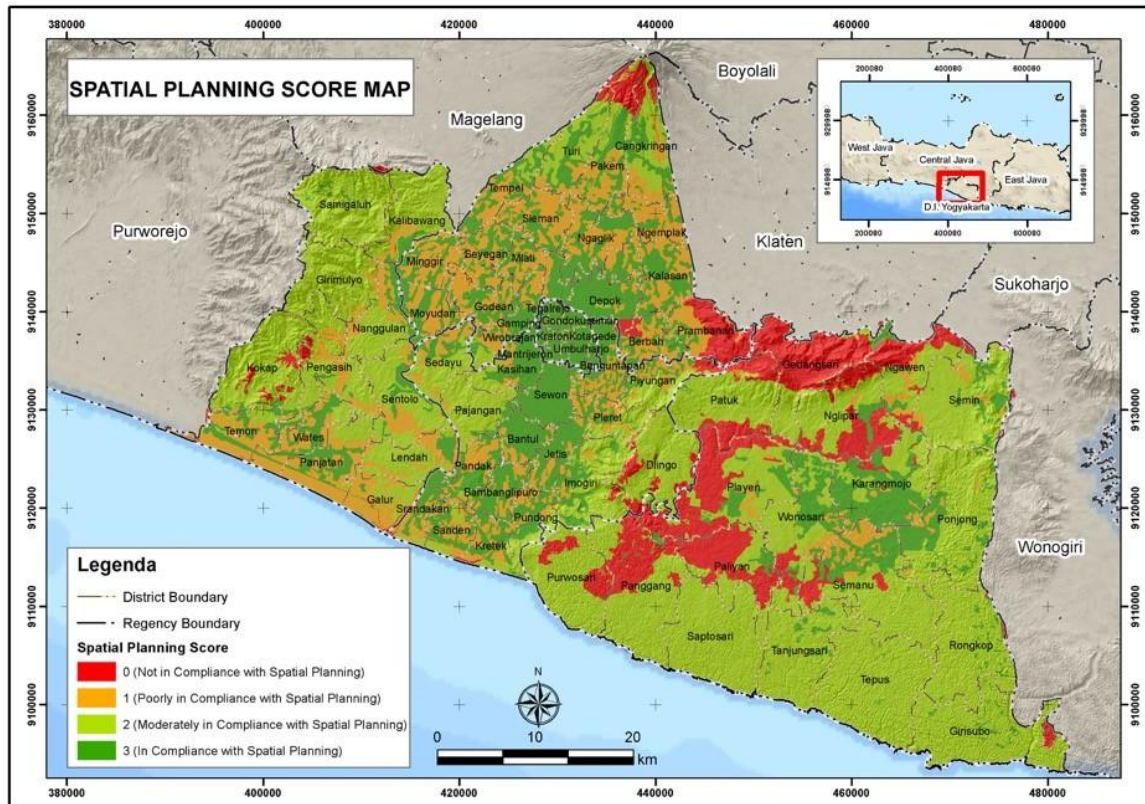


Figure 4. Land Use Planning Map

Mapping results reveal spatial disparities in scores between districts. Eastern areas such as Gedangsari, Patuk, Paliyan, Panggang, and parts of Playen are dominated by score 0, indicating very low suitability for property development. In contrast, southern districts such as Tepus, Tanjungsari, Rongkop, and Girisubo tend to have higher scores (2–3), making them relatively more suitable. Western areas, including Kalibawang, Samigaluh, Girimulyo, Lendah, and Panjatan, generally show score 2, while urban districts such as Sewon, Depok, Gamping, and Yogyakarta City display mixed distributions, with a predominance of score 3. These results provide a foundation for spatial planning aligned with land carrying capacity and sustainability.

According to the study by (Wibowo et al., 2021), land-use change or misuse highlights the importance of environmentally conscious development to maintain proper land-use suitability, where any change in land function must consider environmental carrying capacity so that property development does not degrade spatial quality and continues to support sustainability principles.

Improper land use will negatively impact the long-term sustainability of property investment, particularly in terms of legal security and disaster risk mitigation. These findings are consistent with the results of (Golung et al., 2023), which emphasize that “the goal of spatial planning is to achieve environmental sustainability through harmonized, balanced, and sustainable spatial planning and implementation,” and that “land-use inconsistency with planning is a common symptom arising from differences between spatial directives and market participants considerations.” Therefore, the variation in scores appearing on the map reflects differing levels of spatial-use suitability across districts, while also reinforcing the importance of spatial control to ensure that development remains oriented toward harmony and regional sustainability principles.

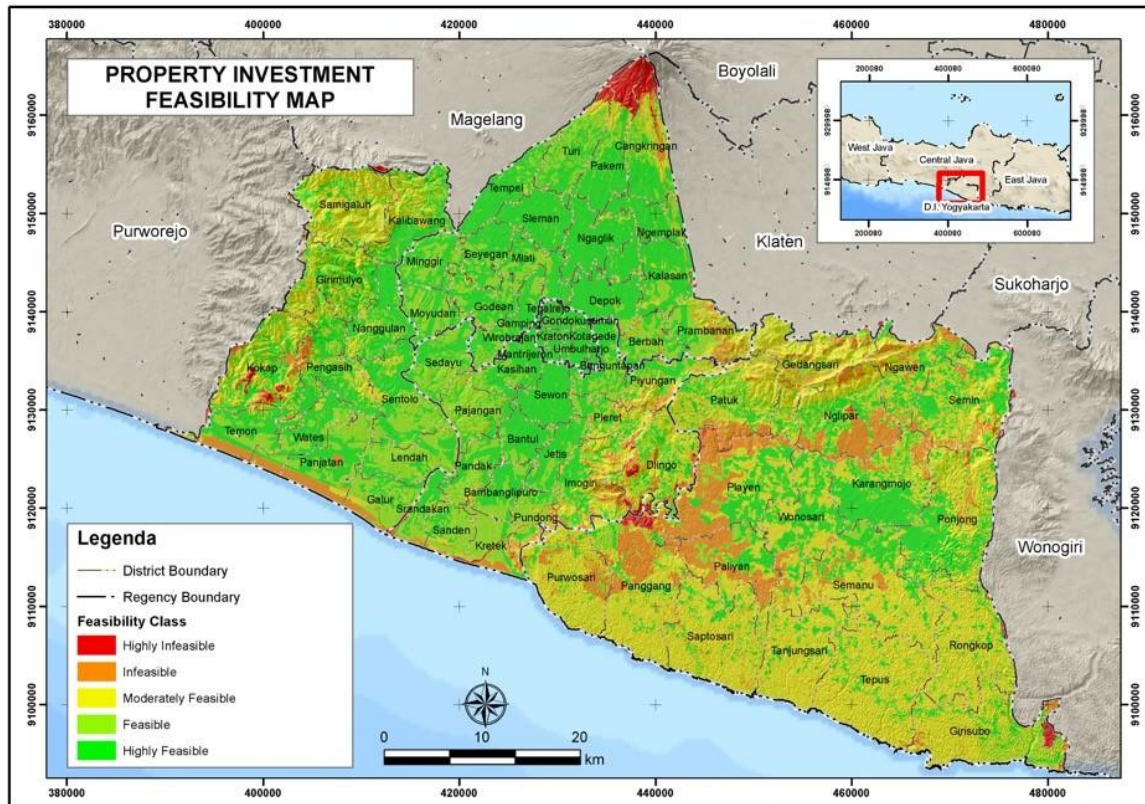


Figure 5. Property Investment Feasibility Map

The results of thematic map overlays including disaster risk, land-use suitability, land use, and road accessibility produce the property investment feasibility classification. The combined parameters yield five categories: very unsuitable, unsuitable, moderately suitable, suitable, and highly suitable. This map provides a comprehensive overview of property investment potential across the Special Region of Yogyakarta.

The mapping results indicate that highly suitable to suitable zones are predominantly located in the central to southern parts of DIY, including Ngaglik, Depok, Yogyakarta City, Bantul, and Banglanglipuro. Moderately suitable zones are largely concentrated in the karst hills of Gunungkidul Regency such as Saptosari, Tanjungsari, Gedangsari, and Rongkop, while the Menoreh Hills region (Samigaluh, Kalibawang, Girimulyo, and Kokap) shows varying levels of suitability, from very low to moderate. Low to very low suitability areas are mainly found in disaster-prone zones, such as the slopes of Mount Merapi (Cangkringan, Pakem, Turi), along the Opak Fault (Imogiri and Dlingo), and near the Progo River estuary (Kretek). Consequently, this map can serve as a strategic reference for identifying safe and high-potential locations for future property investment.

The overlay results of thematic maps encompassing disaster scores, land use, land utilization, and road accessibility produced property investment feasibility classes. Areas with high feasibility levels are generally located in the central to southern regions of the Special Region of Yogyakarta, such as Ngaglik, Depok, Yogyakarta City, Bantul, and Banglanglipuro, which are characterized by high accessibility and proximity to economic activity centers. These findings are consistent with the studies of (Kumar et al., 2019) and (Jin et al., 2022), which demonstrate that strategic location and ease of transportation access have a positive influence on property investment potential. Meanwhile, areas with low feasibility tend to be located in disaster-prone zones, such as the slopes of Mount Merapi, along the Opak Fault, and around the mouth of the Progo River, aligning with the findings of (Saputra et al., 2017) and (Chen et al., 2019) regarding the increased disaster risks resulting from development expansion in vulnerable areas. This condition reinforces the view of

(Namangle & Dunga, 2022) that accessibility factors need to be balanced with considerations of disaster risk and spatial suitability to support the long-term sustainability of property investments.

CONCLUSION

Based on the research findings, it can be concluded that the determination of **spatial-based property investment feasibility in the Special Region of Yogyakarta (DIY)** must consider a balance between economic potential and spatial planning risks. Through the application of the Weighted Overlay Method within a Geographic Information System (GIS) framework, the study revealed that areas with high accessibility and low disaster risk such as central Sleman, Yogyakarta City, and Bantul are categorized as suitable to highly suitable for property investment, whereas disaster-prone areas on the slopes of Mount Merapi and along the southern coast are deemed unsuitable. These findings emphasize the importance of utilizing spatial analysis in investment planning to ensure property development that is safe, efficient, and sustainable, in accordance with environmental carrying capacity and regional spatial planning.

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