



Strategy For Optimizing State-Owned Enterprise (SOE) Vacant Land On Karya Wisata Street, Medan, Using The Highest And Best Use (HBU) And Value-Based Decision (VBD) Approaches

Fahrurrozi Manalu¹⁾, Udisubakti Ciptomulyono²⁾

Magister Manajemen Teknologi, Institut Teknologi Sepuluh Nopember, Indonesia

fahrurrozimanalu26@gmail.com

Abstrak

Penelitian ini menganalisis strategi optimalisasi lahan kosong milik BUMN di Jalan Karya Wisata, Medan, menggunakan pendekatan *Highest and Best Use* dan *Value-Based Decision*. Penelitian menerapkan metode deskriptif dengan data primer dan sekunder yang diperoleh melalui observasi, wawancara, kuesioner, dokumen perusahaan, regulasi tata ruang, serta data pasar. Empat alternatif pengembangan dianalisis, yaitu rumah hunian, perkantoran dan komersial, sarana olahraga, dan kawasan *mixed-use*. Hasil menunjukkan bahwa seluruh alternatif layak secara legal dan fisik, tetapi hanya perkantoran-komersial dan *mixed-use* yang layak secara finansial. Perkantoran-komersial menghasilkan NPV tertinggi sebesar Rp8,50 miliar, sedangkan *mixed-use* menghasilkan IRR tertinggi 14,12% dan *payback period* tercepat 8,85 tahun. Sintesis AHP menempatkan *mixed-use* sebagai pilihan utama dengan skor 0,3178, sedangkan *Satisficing Option* menghasilkan nilai V 7,8446. Dengan demikian, *mixed-use* merupakan strategi paling optimal karena menyeimbangkan fungsi, biaya, produktivitas, dan keberlanjutan pendapatan aset. Pendekatan tersebut mempertahankan kepemilikan dan membuka sumber pendapatan berulang melalui integrasi fungsi hunian, bisnis, olahraga, serta layanan pendukung.

Kata kunci : *Optimalisasi lahan; Highest and Best Use; Value-Based Decision; Mixed-use.*

Abstract

This study analyzes strategies for optimizing vacant land owned by a state-owned enterprise on Jalan Karya Wisata, Medan, using the *Highest and Best Use* and *Value-Based Decision* approaches. A descriptive method was employed using primary and secondary data obtained through observations, interviews, questionnaires, company documents, spatial planning regulations, and market data. Four development alternatives were analyzed: residential housing, office and commercial development, sports facilities, and a *mixed-use* development. The results indicate that all alternatives are legally and physically feasible; however, only the office-commercial and *mixed-use* alternatives are financially feasible. The office-commercial alternative generates the highest net present value (NPV) of IDR 8.50 billion, whereas the *mixed-use* alternative produces the highest internal rate of return (IRR) of 14.12% and the shortest *payback period* of 8.85 years. The Analytical Hierarchy Process synthesis ranks *mixed-use* development as the preferred alternative, with a score of 0.3178, while the *Satisficing Option* analysis yields a V value of 7.8446. Therefore, *mixed-use* development represents the optimal strategy because it balances functionality, cost, productivity, and the sustainability of asset-generated income. This approach retains land ownership while creating recurring revenue streams through the integration of residential, commercial, sports, and supporting service functions.

Keywords: Land optimization; Highest and Best Use; Value-Based Decision; Mixed-use development.



INTRODUCTION

The optimization of vacant land owned by State-Owned Enterprises (SOEs) constitutes a strategic issue because high-value assets may become financial burdens when they fail to generate commensurate economic, social, or operational benefits. The literature on vacant-land revitalization indicates that underutilized land is not merely undeveloped space but an urban resource that requires integrated condition mapping, potential assessment, decision-making, and monitoring to prevent the deterioration of its utility value (Mohamad Selamat et al., 2023). In the Indonesian context, recent research on state-owned assets has also demonstrated that a considerable amount of public land remains underutilized, generates limited revenue, and is frequently allocated without adequate analytical support (Dalimunthe, Suhendar, et al., 2024; Pribadi et al., 2026). This issue is evident in a vacant parcel owned by an SOE operating in the oil and gas sector on Karya Wisata Street, Medan. The land covers an area of 21,617 m² and had a 2025 Tax Object Sales Value (Nilai Jual Objek Pajak/NJOP) of IDR 74,064,375,000, yet it remains unproductive. The asset continues to incur tax, security, and maintenance obligations, while the potential rental income lost over five years is estimated to exceed IDR 4.9 billion. It is strategically located in the rapidly developing Medan Johor area, has access to two roads, is surrounded by residential and commercial activities, and is supported by urban utilities. The disparity between the land's strategic value and its actual contribution highlights the need for a development decision capable of transforming a passive asset into a recurring source of revenue without disregarding spatial-planning compliance and the interests of the surrounding community.

Studies on land utilization have provided several analytical frameworks; however, each framework has limitations when applied to SOE assets involving regulatory requirements, investment decisions, long-term costs, and the preferences of multiple stakeholders. Conceptually, the Highest and Best Use approach evaluates potential uses based on legal permissibility, physical possibility, financial feasibility, and maximum productivity. Nevertheless, contemporary urban-development decisions increasingly require a combination of functions that cannot always be explained through a single market-value indicator. Danilina et al. (2024) demonstrated that determining the functions of urban redevelopment projects requires the integration of spatial-planning constraints, site characteristics, user needs, and the feasibility of available alternatives within a structured decision-making process. Hammond et al. (2024) similarly found that decision-support systems employed only at the final stage tend to overlook socioeconomic dimensions. Therefore, land-use assessments should integrate functional potential, site risks, economic feasibility, and stakeholder engagement from the earliest stages. In the context of mixed-use assets, Valero (2024) emphasized that valuation becomes more complex because success is determined not only by financial metrics but also by connectivity, design, management experience, adaptability, community benefits, and long-term strategies. Meanwhile, Estévez et al. (2021) review revealed that Multi-Criteria Decision Analysis (MCDA) applications frequently remain deficient in stakeholder involvement, preference documentation, and the translation of modelling results into practical implementation. The existing literature has not fully explained how HBU functions, life-cycle costs, asset productivity, and stakeholder values can be simultaneously synthesized to determine the optimal utilization of vacant SOE land.

This study aims to identify and determine the most optimal utilization alternative for vacant SOE land on Karya Wisata Street, Medan, so that the previously unproductive asset can be developed into a profit centre while remaining consistent with regulatory requirements and the characteristics of the surrounding area. This objective is operationalized by identifying several development alternatives, including residential housing, office and commercial areas, sports facilities, and a mixed-use development, based on field observations, market conditions, ownership documents, and spatial-planning directives. Each alternative is assessed according to the Highest and Best Use principles of legal permissibility, physical possibility, financial feasibility, and maximum productivity, and is subsequently compared in terms of initial investment requirements and Life Cycle Cost. Shamai & Ghaleheimouri (2024) demonstrated that assessing land-use capacity requires the integration of environmental characteristics, infrastructure,



connectivity, and weighted factors to ensure that development choices are not based solely on land area or nominal profitability. To establish a priority ranking, this study employs the Analytical Hierarchy Process because this method can convert decision-makers' relative judgments into criterion weights and a hierarchy of alternatives whose consistency can be examined. The application of AHP in location-selection processes has also been proven capable of systematically integrating variables such as population density, road accessibility, topography, land cover, environmental conditions, and user needs (Bakolo et al., 2024; Munthe et al., 2026). The resulting weights are subsequently combined with the Satisficing Option method to compare each alternative's capacity to generate functional benefits against the costs incurred. Through this design, the study does not merely seek to identify the most financially profitable alternative but also to determine the option that provides the greatest value to the company by balancing feasibility, productivity, costs, and stakeholder preferences (Ritonga, Thamrin, et al., 2024; Siregar et al., 2025).

This study is important because the optimization of SOE assets cannot be reduced to a decision to sell, lease, or develop land solely on the basis of the highest estimated revenue within a single period. The relationship between land rights, spatial-utilization arrangements, and land performance indicates that asset-management outcomes are strongly influenced by institutional compatibility and the manner in which spatial functions are translated into development configurations (Dalimunthe, 2022; Xu et al., 2024). Land value is also derived not merely from its capacity to generate rent but from the asset's ability to support welfare, sustainability, and a broader distribution of benefits (Özdilek, 2024). The expansion of the digital economy has further complicated such decisions because remote-working patterns, electronic commerce, and changing mobility behaviours may alter the demand for office, retail, residential, and service spaces (Harun & Yigitcanlar, 2025; Ritonga et al., 2024). Accordingly, the mixed-use alternative should be examined not as an initial assumption that is automatically superior but as an option whose viability must be demonstrated through legal compliance, physical capacity, cash-flow performance, life-cycle costs, productivity, and stakeholder acceptance. Research on sustainable urban form also emphasizes that functional diversity, spatial vitality, accessibility networks, and area configuration must be evaluated collectively to avoid developments that are partially efficient but structurally weak as a whole (Zhang et al., 2024). Considering the land's existing conditions and the objectives of this study, the integration of HBU and Value-Based Decision provides the basis for arguing that the optimal decision is one that retains ownership of the asset, generates recurring revenue, distributes risk across multiple functions, and remains manageable in terms of both costs and environmental impacts.

METHODS

The object of this study is a vacant parcel of land owned by a State-Owned Enterprise (SOE) operating in the oil and gas sector that has not yet been utilized productively, despite its strategic location and high economic value. The land is located on Karya Wisata Street, Pangkalan Masyhur Urban Village, Medan Johor District, Medan City, and covers an area of 21,617 m², with a 2025 Tax Object Sales Value (Nilai Jual Objek Pajak/NJOP) of IDR 74,064,375,000. According to the ownership documents, the property is controlled by the company under a Right to Build Certificate (Sertipikat Hak Guna Bangunan/HGB). Physically, the site is relatively rectangular, has approximately 125 metres of frontage, features relatively flat topography, and can be accessed from both Karya Wisata Street and Karya Kasih Street. Its vacant condition provides considerable flexibility for development; however, any proposed utilization alternative must remain consistent with the land-title status, zoning requirements, infrastructure capacity, environmental risks, market demand, and the objectives of SOE asset management. The study was conducted from April to September 2025 and focused on selecting a form of utilization capable of transforming idle land into a productive asset without relinquishing corporate ownership. A qualitative case-study design is relevant to land-management issues because it enables physical, institutional, policy-related, and land-use transformation conditions



to be examined as an integrated whole within a real-world context (Salsabila et al., 2025). Accordingly, the research object is not treated merely as a parcel of land but as a strategic asset requiring evidence-based development decisions.

This study employs an applied research design using descriptive analysis and a qualitative approach, with the assessment results quantified through multicriteria decision-making tools. The qualitative approach is used to understand the condition of the land, organizational interests, the views of asset managers, the spatial-planning context, and the rationale for selecting particular development functions. Quantification is applied to financial analysis, Life Cycle Cost, land productivity, Analytical Hierarchy Process weighting, and the Satisficing Option method. The research data are classified into primary and secondary data according to their sources and methods of acquisition. Primary data include site-observation results, documentation of environmental conditions, interviews with asset managers, pairwise-comparison questionnaires, and information on comparable properties surrounding the site. Secondary data include ownership documents, NJOP and Land and Building Tax records, professional valuation reports, spatial-planning regulations, economic and demographic data, property-market information, construction costs, rental rates, and scientific literature supporting the formulation of assessment criteria. The integration of both types of data is necessary because HBU evaluates alternatives through interrelated legal, physical, financial, market, and productivity dimensions. Recent HBU studies have likewise combined legal, physical, market, and financial-projection assessments to ensure that the proposed use can be implemented and generate an adequate rate of return (Creswell, 2021). This combination prevents the decision from relying solely on a single narrative or calculation, thereby ensuring that the resulting recommendations remain practical, measurable, and traceable.

The sources of research information include internal SOE stakeholders, the land site itself, government agencies, valuation institutions, corporate documents, and statistical and market sources relevant to property development. Internal informants were selected through purposive sampling because the study required assessments from individuals with the authority, experience, and direct knowledge necessary to evaluate asset utilization. The four respondents consisted of one department-level official equivalent to a manager, one assistant manager, and two officers responsible for land-management or leasing processes. Physical information was obtained through site inspections and observations of comparable properties, while legal information was derived from land certificates, the Detailed Spatial Plan (Rencana Detail Tata Ruang/RDTR), zoning regulations, and provisions concerning the Building Coverage Ratio (KDB), Floor Area Ratio (KLB), Green Open Space Ratio (KDH), Building Setback Line (GSB), building-height limits, and related licensing documents. Economic, demographic, inflation, investment, and market-development data were obtained from government publications and statistical agencies, while the estimated market value was supported by a valuation report prepared by KJPP Febriman Siregar and Partners. Financial data were developed based on assumptions regarding investment costs, financing structures, rental rates, occupancy levels, operating income, maintenance costs, and cash-flow projections. The involvement of selected stakeholders in AHP is necessary to transform competing objectives and interests into transparent decision priorities whose consistency can be examined. The sources were selected based on their relevance to each variable and stage of analysis so that the alternatives could be evaluated through field evidence, formal documents, market conditions, and decision-maker preferences.

The research process was conducted through the stages of preparation, identification, data collection, analysis, validation, and preparation of the findings so that the relationship between the asset-management problem and its development alternatives could be traced systematically. The preparation stage included developing the research background, formulating the objectives, selecting the methods, determining the research object, and designing the survey instruments. The identification stage involved a literature review, policy analysis, secondary-data collection, site-context mapping, and identification of the property functions developing around



the location. Primary data were subsequently collected through direct observation, physical inspection, photographic documentation, interviews with asset managers, and the distribution of AHP questionnaires to purposively selected respondents. Interviews were used to obtain considerations regarding corporate needs, utilization constraints, preferred functions, and management readiness, while the questionnaires were used to compare the relative importance of the criteria and alternatives. Secondary data were collected through the examination of ownership documents, valuation reports, spatial-planning regulations, market data, statistical publications, and scientific references. Semi-structured interviews with directly involved stakeholders are appropriate for identifying implementation constraints in land management from a professional perspective, particularly when policy-related and practical information is not fully available in documentary sources (Pin et al., 2024). Data collection was conducted sequentially so that field findings could be cross-checked against documents and respondent assessments before the data were classified into legal, physical, market, financial, cost, and productivity dimensions.

The analytical techniques were applied in several stages by integrating Highest and Best Use, financial analysis, Life Cycle Cost, the Analytical Hierarchy Process, Value-Based Decision, and the Satisficing Option method. The analysis began with an assessment of the location and market to identify four alternatives: residential housing, office and retail development, sports facilities, and mixed-use development. Each alternative was screened using the four HBU tests: legal permissibility based on land rights and zoning; physical possibility based on site characteristics and utility availability; financial feasibility based on projected revenues and costs; and maximum productivity based on the land value generated. The investment analysis calculated the Net Present Value, Internal Rate of Return, and Payback Period using ten-year cash-flow projections, while LCC converted investment, operating, maintenance, replacement, and residual-value costs into present values. LCC is required to prevent decision-making from being biased toward initial construction costs and to ensure that ownership expenses throughout the asset's life cycle are taken into consideration (Oh et al., 2023). Subsequently, the AHP structure was developed based on the objective, function and cost criteria, subcriteria, and the four alternatives. Pairwise assessments were normalized to generate local and global weights. Consistency was tested using the Consistency Ratio, with an acceptance threshold of $CR \leq 0.10$, after which the weights were synthesized to establish the ranking of the alternatives. Function and cost values were normalized into Preference Scores and Rejection Scores, and the V ratio was then used as the acceptance criterion, whereby $V > 1$ indicated acceptance and $V < 1$ indicated rejection. Finally, sensitivity analysis and the Business Model Canvas were employed to test the robustness of the selected alternative and translate the preferred option into an implementation strategy.

RESULTS AND DISCUSSION

Results

The study found that the vacant SOE-owned land on Karya Wisata Street possesses site characteristics that support large-scale property development, yet it has not generated any economic contribution because it remains idle. The 21,617 m² parcel had a 2025 Tax Object Sales Value (Nilai Jual Objek Pajak/NJOP) of IDR 74,064,375,000 and is registered under Right to Build Certificate No. 02.01.000025139.4. Physically, the land is relatively rectangular, with approximately 125 metres of frontage, a depth of around 180 metres, and relatively flat topography level with the road surface. The western boundary directly adjoins Karya Wisata Street, which serves as the main access point, while the northern boundary connects to Karya Kasih Street, which may function as a secondary access route or service road. Electricity, clean-water, telecommunications, drainage, pavement, street-lighting, and public-facility networks are already available around the site. The surrounding area also comprises residential developments, retail establishments, schools, banks, places of worship, urban parks, supermarkets, and higher-education facilities. Based on the 2024-2044 Medan City Detailed Spatial Plan and Zoning

Regulations, the site is located within the R-2 zone, designated for high-density residential use, with a maximum Building Coverage Ratio of 80%, a minimum Green Open Space Ratio of 15%, and a maximum height of four storeys or 18 metres for the primary function. Collectively, these conditions indicate that the land offers a high degree of development flexibility; however, its utilization must remain consistent with spatial-planning requirements and preserve the comfort and environmental quality of the surrounding residential area.

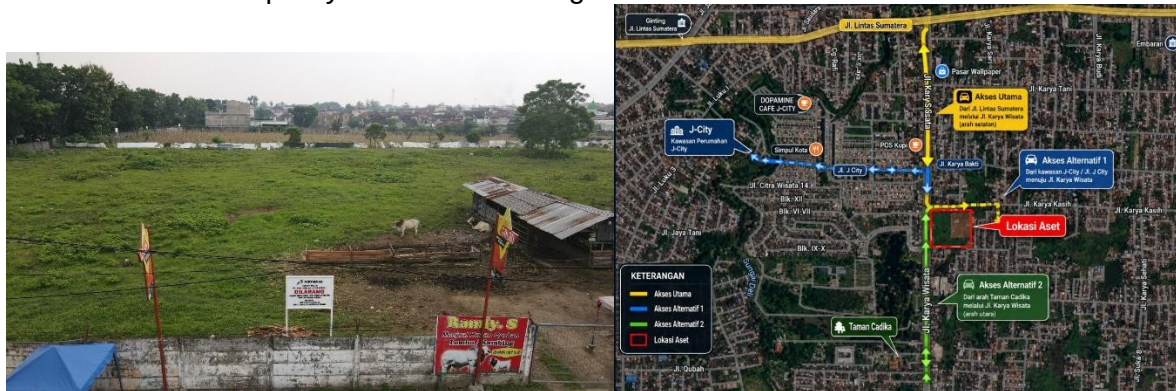


Figure 1. Location, physical characteristics, accessibility, and land boundaries

The market analysis indicates that the economic and demographic environment of Medan City provides a sufficiently strong demand base for developing the asset on Karya Wisata Street. Medan's economy grew by 5.10% in 2025, with Gross Regional Domestic Product at current prices reaching IDR 353.29 trillion, while realized investment amounted to IDR 14.599 trillion and exceeded the annual target established by the municipal government. In 2024, Medan had a population of 2,486,283, of whom approximately 1,253,416 people, or 50.41%, were within the productive age range of 25–59 years. This demographic structure generates sustained demand for housing, workspaces, commercial facilities, services, recreation, and sports amenities. At the site level, the presence of J-City Residential Estate, Citra Wisata, Diamond Supermarket, Cadika Park, schools, banking facilities, places of worship, a petrol station, and the UISU Johor Campus creates daily user flows comprising residents, students, employees, business operators, and visitors to public facilities. Existing supply around the location is dominated by residential houses, individually operated shophouses, retail outlets, and independent commercial spaces that have not yet been integrated within a single development area. This condition creates an opportunity for differentiation through a development concept combining residential, office, retail, sports, parking, and green-space functions. The demand-and-supply analysis therefore indicates that single-use developments continue to have market potential, but an integrated development offers a greater opportunity to attract multiple user segments simultaneously and sustainably over the medium and long term.

Based on observations, interviews, market analysis, and spatial-planning provisions, the study established four land-utilization alternatives that were subsequently evaluated using the Highest and Best Use framework. The first alternative is a modern Type 70 residential development consisting of 96 housing units, a single-gate system, a place of worship, a community hall, a playground, a basketball court, guest parking, internal roads, and green open space. The second alternative is an office and commercial development combining a four-storey office building, two-storey retail units or shophouses, an outdoor culinary plaza, a service area, parking facilities, internal circulation, and green space. The third alternative is an integrated sports complex comprising a mini-soccer field, a multifunctional sports building, three padel courts, four badminton courts, a basketball or volleyball court, a prayer room, sports-related tenants, a café, a jogging path, and parking facilities. The fourth alternative is a mixed-use development integrating a 3,200 m² office building, 24 Type 70 housing units, eight retail units or shophouses covering 1,260 m², a 2,400 m² mini-soccer facility, 650 m² of supporting facilities, parking areas, internal circulation, an entrance gate, and green space. Under the mixed-use concept, the retail area is designed to face Karya Wisata Street, while access for residents and

other users is controlled through a single-gate system. These four alternatives represent both single-use and mixed-use development options that can be compared in terms of legal permissibility, physical feasibility, financial viability, productivity, and life-cycle costs.

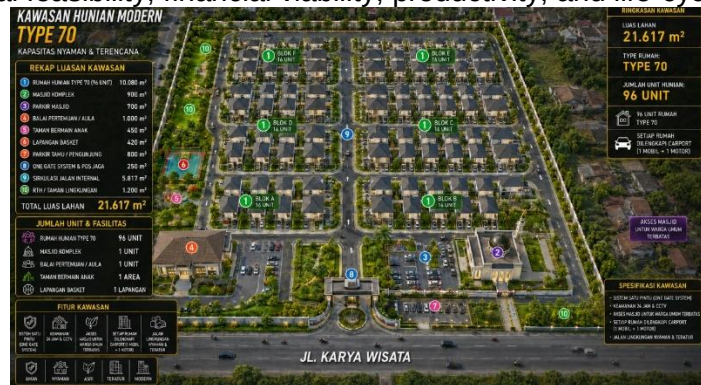


Figure 2. Comparison of four alternative development plans-Residential Housing, Office and Commercial, Sports Facilities, and Mixed-Use

The HBU assessment of the legal and physical aspects indicates that all alternatives are, in principle, feasible for development, although they require different levels of regulatory and design control. The residential housing alternative is the most directly compatible with the R-2 zoning designation because its primary function is consistent with the intended use of a high-density residential area. The office and commercial development, sports facilities, and mixed-use development are classified as conditionally permitted because their nonresidential functions must remain supportive of the surrounding residential area and comply with the applicable building-intensity regulations. All alternatives are consistent with the Right to Build (HGB) ownership status and can be designed in accordance with the Building Setback Line (GSB), Building Coverage Ratio (KDB), Floor Area Ratio (KLB), Green Open Space Ratio (KDH), and prescribed building-height limits.

From a physical perspective, the site area, plot configuration, topography, utility availability, frontage, and access from two roads enable the implementation of all proposed concepts. However, higher-intensity alternatives require more stringent arrangements for parking, internal circulation, service access, drainage capacity, stormwater management, and noise control. Retail areas should be oriented toward the main corridor to prevent public activities from extending into the residential zone, while service vehicles may be directed through Karya Kasih Street to reduce traffic conflicts. Although the site is not located within a high-flood-risk zone, the development plan should still incorporate improved drainage systems and adequate water-infiltration areas. These screening results confirm that none of the alternatives was eliminated at the legal and physical assessment stage. Accordingly, all alternatives may proceed to the financial and productivity analyses, subject to different design requirements in the subsequent stages.

Table 1. Legal Criteria Acceptance Test

No.	Sub-Criteria for Legal Feasibility Test	(a1) Residential House	(a2) Offices and Commercial Areas	(a3) Sports Facilities	(a4) Mixed-Use Area
1	Ownership status / HGB	Allowed	Allowed	Allowed	Allowed
2	Zoning determination R-2	Allowed	Conditionally permitted	Conditionally permitted	Conditionally permitted
3	Building regulations: GSB, KDB, KLB, KDH, height	Allowed	Allowed	Allowed	Allowed
4	Environmental regulations: drainage, parking, noise, and residential amenities	Allowed	Conditionally permitted	Conditionally permitted	Conditionally permitted
5	Area access and control	Allowed	Allowed	Allowed	Allowed

The financial analysis was developed using uniform assumptions to ensure a balanced comparison of the performance of the four alternatives. All scenarios adopt a build-and-hold scheme, are financed entirely through company funds, and use a ten-year projection period, a construction period of 12–18 months, a corporate tax rate of 22%, operating costs equivalent to 32% of revenue, maintenance capital expenditure equal to 1% of the initial investment, a discount rate of 12%, and terminal growth of 3%. Land costs were excluded because the site is already owned by the SOE; therefore, the initial investment includes only construction, infrastructure, utilities, permits, planning, and contingency costs. The investment estimates indicate that the mixed-use alternative requires the lowest initial expenditure, amounting to IDR 56.72 billion, followed by residential housing at IDR 58.31 billion, sports facilities at IDR 62.36 billion, and the office and commercial alternative at IDR 64.72 billion. The office and commercial alternative generates the highest stabilized annual revenue of IDR 13.86 billion, while the mixed-use alternative produces IDR 12.30 billion, residential housing IDR 5.76 billion, and sports facilities IDR 5.04 billion. The revenue projections apply a ramp-up rate of 65% in the first year, 80% in the second year, 90% in the third year, and 100% in the fourth year, followed by annual growth of 4%. Differences in investment structures and revenue sources indicate that the mixed-use alternative offers a more diversified income base, whereas the single-use alternatives depend more heavily on a single primary market. This condition positions occupancy strategies and rental-rate adjustments as critical factors in maintaining the stability of projected development revenues.

The financial feasibility evaluation shows that only the office and commercial and mixed-use alternatives satisfy the investment requirements at a 12% discount rate. The office and commercial alternative generates the highest Net Present Value (NPV), amounting to IDR 8.50 billion, with an Internal Rate of Return (IRR) of 13.92% and a payback period of 8.94 years. The mixed-use alternative produces an NPV of IDR 8.24 billion but records the highest IRR of 14.12% and the shortest payback period of 8.85 years. Total free cash flow over the ten-year period reaches IDR 74.35 billion for the office and commercial alternative and IDR 65.96 billion for the mixed-use alternative. By contrast, the residential housing alternative generates a negative NPV of IDR 28.49 billion, an IRR of 2.69%, and a payback period exceeding ten years, despite its relatively stable rental income. The sports-facility alternative records a negative NPV of IDR 36.60 billion, an IRR of only 0.07%, and a payback period of more than ten years because the investment costs associated with the sports building, long-span structural systems, sports flooring, lighting, and supporting facilities cannot be recovered through operating revenue during the analysis period. This comparison demonstrates that higher revenue does not necessarily correspond to the highest rate of return, as the mixed-use alternative requires a lower initial investment and benefits from multiple income streams. From a purely financial perspective, the office and commercial alternative performs best in terms of NPV and cash flow, whereas the mixed-use alternative offers a more balanced combination of return, capital-recovery speed, and revenue diversification. These findings also highlight the importance of assessing capital efficiency alongside the overall magnitude of projected project profits.

Table 2. Financial feasibility summary containing initial investment, NPV, IRR, payback period, and feasibility decision

Alternatif	Initial Cost (Miliar Rp)	PV FCF 10 Tahun (Miliar Rupiah)	PV Terminal Value	NPV @12%	IRR	Payback Period	Conclusion
a1 Residential House	58,31	16,19	13,63	-28,49	2,69%	>10 year	Not financially viable
a2 Office and Commercial	64,72	39,81	33,41	8,50	13,92%	8,94 year	Worthy
a3 Sports Facilities	62,36	13,93	11,82	-36,60	0,07%	>10 year	Not financially viable
a4 Mixed-Use	56,72	35,12	29,84	8,24	14,12%	8,85 year	Worthy

Life Cycle Cost and land productivity calculations demonstrate a trade-off between long-term cost efficiency and the ability to increase asset value. Residential homes have the lowest LCC of IDR 71.16 billion due to their relatively simple operational, energy, maintenance, and replacement needs. Sports facilities are next in line with an LCC of IDR 75.92 billion, but require significant replacement costs for synthetic turf, sports flooring, lighting, and sports hall components. Mixed-use properties generate an LCC of IDR 81.56 billion, while offices and commercial properties record the highest LCC of IDR 92.77 billion due to the need for building management, elevators, mechanical-electrical systems, fire protection, security, cleaning, and tenant management. In terms of productivity, offices and commercial properties generate the highest land value of IDR 82.57 billion or IDR 3,819,566 per m², an increase of 11.48% from the initial value of IDR 3,426,210 per m². Mixed-use is very close, with a value of Rp82.31 billion or Rp3,807,560 per m² and an increase of 11.13%. Residential housing and sports facilities actually decrease land value by 38.47% and 49.43%, respectively, due to negative NPV. These results indicate that residential housing is the most cost-efficient but economically unproductive, while office and commercial use are the most productive but have the highest life-cycle costs. Mixed-use occupies a middle ground with high productivity and a more manageable LCC. The closeness of the productivity results of these two feasible alternatives demonstrates that the final decision requires considerations beyond land value alone.

The Analytical Hierarchy Process synthesis produced a decision ranking that differed from the financial ranking because the model simultaneously considered HBU functions and costs. The decision structure comprised the criteria of legal permissibility, physical feasibility, financial feasibility, maximum productivity, initial cost, and Life Cycle Cost. The highest weight was assigned to LCC at 0.3453, followed by financial feasibility at 0.1855, physical feasibility at 0.1665, productivity at 0.1408, initial cost at 0.0819, and legal permissibility at 0.0801. All pairwise-comparison matrices achieved a Consistency Ratio below 0.10. The highest value was recorded in the initial-cost matrix at 0.0915, while the remaining matrices ranged from 0.0000 to 0.0227.

The synthesis results ranked the mixed-use alternative first, with a score of 0.3178 or 31.78%, followed by residential housing at 0.2827, sports facilities at 0.2527, and the office and retail alternative at 0.1468. The mixed-use alternative obtained the highest local weights for physical feasibility, financial feasibility, and productivity, while residential housing performed best in terms of legal permissibility and life-cycle cost efficiency. Although the office and commercial alternative generated the highest NPV, it did not rank first because its high initial cost and LCC reduced its aggregate value. These findings indicate that the best value-based option is not necessarily the alternative with the strongest financial indicators, but rather the one that maintains the most appropriate balance between function and cost. The difference in rankings also highlights the role of stakeholder preferences in transforming technical evaluation results into more comprehensive decision priorities.

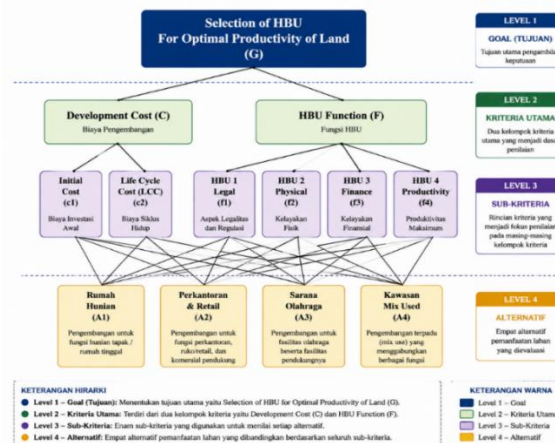


Figure 3. HBU–VBD–AHP decision hierarchy structure



The Satisficing Option assessment, sensitivity analysis, and business model evaluation reinforced the mixed-use alternative as the final preferred option while also identifying the conditions required for its successful implementation. The mixed-use alternative obtained a total function score of 0.2903 and a total cost score of 0.0276. Following normalization, it achieved a Preference Score of 0.5068, a Rejection Score of 0.0646, and a V ratio of 7.8446. Because the V ratio exceeded one, the alternative was accepted. By contrast, residential housing obtained a V ratio of 0.5983, the office and retail alternative 0.9568, and the sports-facility alternative 0.3100; therefore, all three were rejected.

The sensitivity analysis demonstrated that the mixed-use alternative remained in first place when the weights assigned to legal permissibility, physical feasibility, financial feasibility, productivity, and initial cost were increased by up to 30%. Its ranking declined to second place only when the LCC weight increased by 20%–30%, indicating that long-term operating and maintenance costs constitute the most significant decision risk. The Business Model Canvas subsequently mapped potential revenues from office, retail, residential, mini-soccer, parking, and supporting-facility rentals under a build-and-hold scheme. Implementation requires a cross-functional task force comprising legal, finance, engineering, commercial, procurement, risk-management, and operational personnel. The team must prepare legal due diligence, market validation, a master plan, detailed engineering design, a cost budget plan, a tenant-acquisition strategy, partnership arrangements, and a cost-control system. Accordingly, the mixed-use alternative was selected not merely because it achieved the highest score, but because it is capable of integrating productivity, revenue diversification, asset ownership retention, and managerial flexibility within a measurable long-term investment horizon.

Discussion

The findings on legal and physical feasibility indicate that the optimization of public assets should be positioned as a regeneration process rather than merely an initiative to develop vacant land. Research on public real estate in Italian cities demonstrates that unused assets can serve as drivers of urban regeneration when their management is aligned with planning instruments, local needs, and the public interest, rather than being directed solely toward short-term asset disposal (Dalimunthe et al., 2024; Floris, 2024). The findings of the present study reinforce this perspective because the Karya Wisata Street site possesses adequate access, utilities, site configuration, and a supportive market environment, although its utilization remains constrained by the R-2 zoning designation and requirements concerning parking, drainage, noise, and building intensity. HBU studies of government-owned assets have also demonstrated that economic, social, and environmental dimensions should be incorporated into the assessment process to ensure that uses with high market value do not disregard public objectives or asset sustainability (Rymarzak et al., 2022). In this case, residential housing is the most readily acceptable alternative from a zoning perspective, whereas commercial, sports, and mixed-use functions require stricter controls. This condition explains why legal feasibility cannot be established merely through a designation of “permitted” but must be translated into spatial configurations, access arrangements, and operating systems that are acceptable to the surrounding community. Accordingly, the legal and physical assessment is not merely a screening stage but a foundation for ensuring that improvements in economic value remain consistent with spatial-planning compliance and social legitimacy.

The superiority of the mixed-use alternative in this study can be explained by its ability to connect several sources of demand that were previously dispersed across the residential, office, retail, and recreational markets. A review of the development of the land-use mix concept indicates that functional integration can improve accessibility, spatial efficiency, interactions among activities, and area vitality; however, these benefits are influenced by the configuration and compatibility of the functions implemented (Zhuo et al., 2022). This pattern is evident in the proposed design for the Karya Wisata Street site, where residents provide a stable demand base, office facilities generate weekday activities, retail spaces serve both development users and the



surrounding community, and the mini-soccer facility attracts visitors during the afternoon, evening, and weekends. A study of mixed-land-use patterns in Changsha similarly demonstrated that the quality of mixed land use is determined not merely by the number of functions but also by the diversity, compatibility, and accessibility of those functions within the spatial structure of an area (Huang et al., 2025). This finding is important because the combination of incompatible functions may generate parking, noise, and circulation conflicts. The design developed in this study responds to these risks through the separation of public and restricted access, the orientation of retail areas toward the main road, and the utilization of Karya Kasih Street as a supporting access route. Therefore, the superiority of the mixed-use alternative does not arise automatically from functional diversity but from the capacity of its spatial composition to create mutually supportive relationships without reducing residential comfort. This interpretation positions functional integration as a value-creation mechanism rather than merely an addition of different building types.

The differences between the financial-analysis results and the AHP ranking confirm that development decisions cannot be based on a single investment indicator. The office and commercial alternative generated the highest NPV and cash flow, whereas the mixed-use alternative achieved the highest IRR, the shortest payback period, a lower initial investment, and more diversified sources of revenue. Research on the impact of mixed-use development in major cities indicates that development evaluations should incorporate financial measures alongside connectivity, adaptability, design, management experience, community benefits, and the ability to respond to changing market conditions (Dalimunthe et al., 2023; Valero, 2024). This framework explains why an NPV difference of IDR 0.26 billion was insufficient to establish the office and commercial alternative as the final choice when its LCC was IDR 11.21 billion higher than that of the mixed-use alternative. Research on decision-making for urban land use has also demonstrated that rational choices emerge when social functions, spatial constraints, site conditions, user needs, and economic feasibility are analysed simultaneously through a multicriteria approach (Danilina et al., 2024). In this study, diversification not only increases the number of revenue sources but also reduces dependence on office occupancy or retail absorption as a single market. Nevertheless, diversification also increases operational complexity and requires coordination in relation to tenants, security, parking, and maintenance. Accordingly, mixed-use development is more appropriately understood as a portfolio of functions with distributed risk and benefit profiles. Its advantage therefore lies in the balance between returns and revenue resilience rather than the dominance of a single profitability measure.

The Life Cycle Cost findings demonstrate that initial construction expenditure represents only part of the economic consequences of asset development. The LCC method in infrastructure management is used to integrate investment, operating, maintenance, replacement, and residual-value costs so that decision-making does not result in the selection of an alternative that is inexpensive at the beginning of a project but costly throughout its operational life (Oh et al., 2023). The findings of this study reveal a pattern consistent with this principle: residential housing has the lowest LCC but cannot generate a positive NPV, whereas the office and commercial alternative is the most productive but also has the highest LCC. The mixed-use alternative occupies an intermediate position, with an LCC of IDR 81.56 billion and productivity of IDR 3,807,560 per m², only slightly below that of the office and commercial alternative. Research on life-cycle costing for building structures also emphasizes that comparisons among alternatives should use equivalent technical characteristics and performance levels so that global costs can fairly represent the available design options (Granata et al., 2024). The implication is that controlling the LCC of the mixed-use alternative cannot be achieved merely by reducing the budget, because lowering the quality of utilities, fire-protection systems, drainage, or public facilities may reduce both functionality and revenue. More appropriate strategies include modular design, the selection of durable materials, energy efficiency, performance-based maintenance contracts, and phased development based on occupancy levels. The sensitivity analysis, which lowered the ranking of the mixed-use alternative when the LCC weight increased, demonstrates



that life-cycle cost discipline is a principal requirement for ensuring that the recommendation remains superior after the project enters the operational stage.

The AHP and Satisficing Option results demonstrate that transparent weighting can transform a set of technical indicators into a decision that can be clearly explained to stakeholders. A critical review of MCDA applications to environmental problems indicates that the strength of this method lies in its capacity to manage uncertainty and conflicting objectives; however, its practical relevance depends on actor involvement, preference documentation, and a clear connection between the model and its implementation. This study addresses these elements through assessments by internal respondents, consistency testing, weight synthesis, and sensitivity analysis, although the limited number of respondents continues to restrict the diversity of perspectives represented. All CR values were below 0.10, indicating that the matrices were acceptable; however, mathematical consistency does not automatically guarantee that all external interests have been represented. Studies of site selection that combine AHP and TOPSIS have also demonstrated that the use of multiple assessment stages assists in ranking alternatives according to different criteria and strengthens the traceability of decisions (Ayuketah et al., 2025). In this study, the Satisficing Option method provided an additional layer of validation because the mixed-use alternative was the only option to generate a function-to-cost ratio greater than one. This result prevented the decision-making process from ending with a merely relative ranking and assessed whether the benefits of an alternative genuinely exceeded its associated sacrifices. Therefore, the model employed can be considered sufficiently robust for an initial decision; nevertheless, further validation should involve the local government, prospective tenants, surrounding communities, and technical experts before final investment approval is granted.

From a managerial perspective, the mixed-use recommendation transforms land optimization from a property decision into an SOE asset-transformation agenda requiring cross-functional governance. Research on the optimization of state-owned assets using a multicriteria approach indicates that mixed-use development can become the dominant alternative when legal compliance, investment feasibility, and stakeholder preferences are analysed in an integrated manner (Pribadi et al., 2026). This similarity strengthens the relevance of the findings concerning the Karya Wisata Street site, although implementation must remain aligned with the organizational structure, investment-authorization mechanisms, and regulations applicable to SOEs. A value framework for infrastructure asset management emphasizes that decisions should connect benefits, costs, risks, performance, organizational objectives, and stakeholder expectations throughout the asset life cycle (Almeida et al., 2022). On this basis, the proposed task force should not function merely as a construction team but should manage legal due diligence, market validation, tenant strategy, technical design, financing, risk, operations, and performance evaluation. The build-and-hold scheme retains asset ownership and creates recurring revenue opportunities, but it also positions the SOE as a long-term manager that must possess commercial and facilities-management capabilities. Implementation should begin with market sounding and detailed design, followed by development based on the prioritization of functions capable of generating cash flow most rapidly, and should subsequently be evaluated through indicators of occupancy, revenue, costs, user satisfaction, and environmental impact. Accordingly, the principal contribution of this study lies in providing a decision framework that integrates HBU, VBD, AHP, LCC, and the business model into a measurable asset-implementation strategy.

CONCLUSION

This study concludes that the vacant SOE-owned land on Karya Wisata Street, Medan, is suitable for optimization as a productive asset because it is supported by a total area of 21,617 m², good accessibility, relatively flat topography, the availability of utilities, and a surrounding environment that is developing as a residential, commercial, service, educational, and public-facility area. The legal and physical assessments indicate that all alternatives are feasible for



development, although the office, commercial, sports, and mixed-use functions require controls related to zoning, parking, drainage, noise, circulation, and environmental comfort. The financial analysis shows that only the office and commercial and mixed-use alternatives are feasible. The office and commercial alternative generates the highest NPV of IDR 8.50 billion, while the mixed-use alternative produces the highest IRR of 14.12% and the shortest payback period of 8.85 years. However, the AHP synthesis ranks mixed-use as the best alternative, with a score of 0.3178 or 31.78%, while the Satisficing Option analysis produces a V value of 7.8446, indicating that mixed-use is the only accepted alternative.

The principal advantage of mixed-use development lies in its capacity to integrate office space, retail units or shophouses, residential housing, a mini-soccer facility, parking areas, green space, and supporting facilities within a single development. This integration creates recurring revenue streams and reduces dependence on a single market segment. The implementation of this recommendation requires effective Life Cycle Cost control, the establishment of a cross-functional team, and the preparation of legal due diligence, a master plan, Detailed Engineering Design, a detailed cost estimate, market sounding, a tenant strategy, and phased development aligned with market absorption capacity. Accordingly, mixed-use development constitutes the most rational strategy for improving the productivity, flexibility, and long-term value of the SOE asset. Future research should involve a broader range of stakeholders, test scenarios involving changes in occupancy rates, rental rates, inflation, construction costs, and financing schemes, and compare the findings across other SOE-owned assets to strengthen the external validity and practical applicability of the decision-making model.

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