Central Business District Likeliness Determination Using GIS, Volunteered Geographic Information, and Analytic Hierarchy Process: The Case of Quezon City, Philippines

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Abstract

Central Business Districts (CBDs) are often described in qualitative terms, focusing on their function as urban centers of commerce, governance, and public activity. However, a standardized, data-driven method to delineate CBDs spatially and quantitatively remains a challenge in urban studies. This study addresses this gap by developing a quantifiable model to assess the likeliness of an area functioning as a CBD, using Quezon City—one of the largest and most economically dynamic cities in the Philippines—as the study area. Eleven (11) indicators were identified as the most significant criteria: proximity to primary roads, government offices, healthcare facilities, marketplaces, commercial establishments, recreational and social facilities, financial institutions, public transportation, average building height and volume, and population density. Using the Analytic Hierarchy Process to assign weights, a Weighted Overlay Analysis was implemented to produce the CBD-Likeliness Map. Results show that 37.19% of the land area of Quezon City exhibits CBD characteristics, the majority of which are non-commercial zones, suggesting economic activity is expanding beyond designated commercial areas. Unlike previous studies that primarily focused on either accessibility or physical morphology using remote sensing data, this study uniquely integrates both spatial configuration and functional characteristics. The result is a replicable framework for CBD likeliness assessment that can contribute to more informed urban policy and land-use planning decisions in rapidly urbanizing contexts.

1. Introduction

The Central Business District (CBD) is the core of a city's economic activity, marked by dense development, high land, values, and major infrastructure (Remus, 2018) and functions as the city's main hub, shared by a dense population and connected through a major transportation network (Abad et al., 2016). Identifying CBDs is critical in rapidly urbanizing areas, where new centers emerge and existing ones evolve.

Approaches to delineating CBDs vary by data type, including land prices, building and population density, road networks, and functional land use (Seo, 2014). Previous studies have employed diverse methods to define CBDs. Land price remains a common indicator due to its strong correlation with economic activity (Colwell & Munneke, 1999). Herlawati et al. (2020) used GIS-based multi-criteria decision-making (MCDM) in Indonesia, considering road access, facility proximity, and hazard zones. Tarigan et al. (2020) emphasized strategic location, density, and planning integration in Medan. Remote sensing has also proven effective, with Taubenböck et al. (2013) analyzing physical and morphological characteristics, while Aljoufie et al. (2013) linked urban expansion and transport using spatial indicators. Collectively, these studies demonstrate that CBD delineation involves a complex interplay of economic, spatial, and functional indicators.

While numerous studies have explored CBD identification through either functional characteristics or remote sensing-derived spatial metrics, few have integrated both. This gap is especially critical in evolving urban environments, where spatial form and function are increasingly decoupled due to uneven development. Thus, this study proposes a comprehensive approach that combines both to offer a more robust and nuanced understanding of urban centrality and dynamic growth processes.

Quezon City, the largest city in Metro Manila, serves as a key gateway from the north and east, making a planned and purpose-built CBD important for linking the metro to nearby provinces (Ballesteros, 2010). As shown in Figure 1, a QC-CBD was designated to support economic growth and enhance the city's profile. It is also defined as where business activity is most intense, with high accessibility and land value. Other growth centers have also been identified—Cubao, Batasan-NGC, Novaliches-Lagro, and Balintawak-Munoz (Quezon City Planning and Development Office, 2016). However, fair market values show that the highest land prices are found outside these areas, such as District 13-Eastwood City and District 16-Ortigas Edsa Corridor (Quezon City Council, 2016). This indicates that areas outside designated growth centers have developed significantly and may function as emerging CBDs.

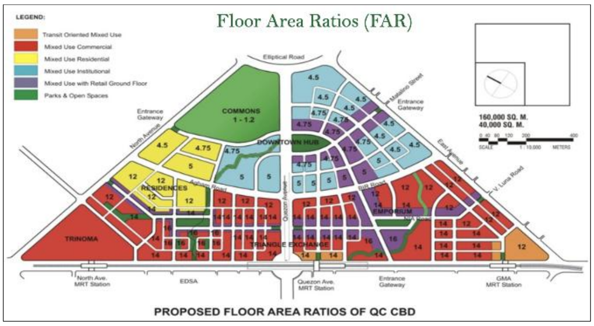

Figure 1. Quezon City Proposed CBD Map (Quezon City Planning and Development Office, 2016)

This variation highlights the need to re-examine CBD definitions and explore emerging economic centers in Quezon City based on both spatial configuration and functional characteristics. Thus, this study aims to identify areas with high CBD-likeness based on proximity to services, roads, public transportation, and built environment characteristics. To achieve this, the study (1) identifies key contributing factors in identifying CBDs; (2) computes criteria weights using the Analytic Hierarchy Process (AHP); (3) formulates quantifiable criteria; (4) implements a weighted overlay analysis; and (5) validates the results against the Quezon City CBD Masterplan.

2. Methodology

2.1 Study Area

Quezon City, located in the northeastern part of the National Capital Region (NCR) of the Philippines, was selected as the study area due to its status as the largest city in terms of population, land area, at over 16,112 hectares, and one of the most economically active cities in Metro Manila. Figure 2 shows the administrative boundaries of the study area and its relative location within the National Capital Region (NCR). Its ongoing urban expansion, infrastructure development, and the emergence of business districts such as Cubao and Eastwood further enhance its relevance as the setting of the study.

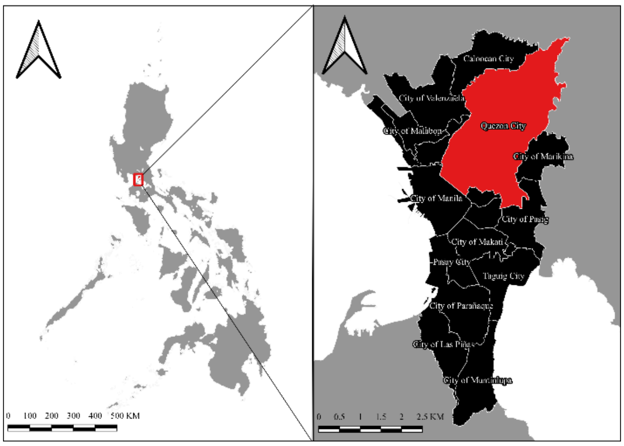

Figure 2. Quezon City Administrative Boundaries

2.2 Conceptual Framework

Figure 3 outlines the conceptual framework of the study. It begins with the shortlisting of criteria through a literature review and a survey of stakeholders. Once the criteria were finalized, reclassification ratings were developed, thematic criteria maps were generated, and the AHP survey was conducted. The resulting reclassified maps and criteria weights were then used as inputs for the weighted overlay analysis, which produced the CBD Likeliness Map.

2.3 Criteria Shortlisting

A survey was conducted to refine the initial criteria identified through a literature review. The questionnaire was structured into three thematic sections: (1) accessibility to key points of interest (POIs), (2) accessibility and availability of public transportation, and (3) physical characteristics. Respondents indicated whether a criterion influences CBD-likeliness using a Yes/No format. The first section assessed access to primary roads, government offices, healthcare facilities, marketplaces, commercial areas, recreational spaces, residential zones, and educational institutions. The second focused on major public transport modes, including MRT/LRT, buses, UV Express, and Public Utility Jeepneys (PUJs). The third evaluated urban form indicators such as average building height, building volume, population density, and proximity to sloped terrain. An 80% threshold was applied to determine which criteria would be retained, following established content validation practices. This consensus level, based on Lawshe's (1975) content validity model, ensures the inclusion of only the most relevant indicators and aligns with methodological standards in multi-criteria decision analysis (MCDA).

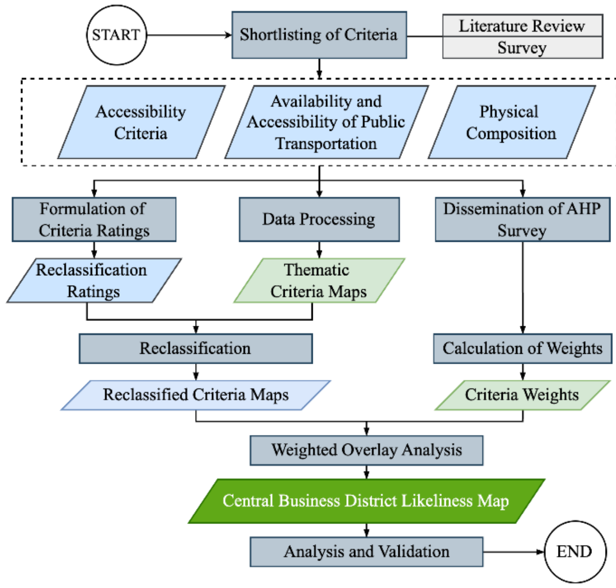

Figure 3. Conceptual Framework of the Study

2.4 Data Collection, Preparation, and Processing

2.4.1 Volunteered Geographic Information: Volunteered Geographic Information (VGI) is an increasingly accessible and cost-effective source of geospatial data contributed by individuals worldwide, often including precise geographic coordinates. It has been widely applied in studies related to transportation modeling, decision-making support, identification of point-of-interest (POI) functions, and land cover map validation (Fonte et al., 2018). In this study, Open Street Map (OSM) was utilized as the primary source for POI locations and road networks, as it offers vector-format datasets that are readily usable for GIS analysis.

2.4.2 Global Human Settlements Layer (GHSL): This study utilized the GHSL dataset, developed by the European Commission's Joint Research Centre (JRC) in collaboration with the European Space Agency (ESA), to analyze the spatial footprint of human settlements, including built-up characteristics and population density. The Average Net Building Height (ANBH) estimates the mean building height within a cell, excluding non-building elements. At the same time, the Average Gross Building Height (AGBH) captures the total built volume per unit of built-up area (m^3/m^2), reflecting built-up intensity. These metrics are derived by integrating satellite elevation models (AW3D30, SRTM) with built-up area data from the GHS-BUILT layer (Pesaresi et al., 2023). Population data are produced through dasymetric mapping, redistributing census figures across built-up areas detected via satellite imagery, resulting in high-resolution (100 m) population grids for multiple years (1975–2030) (Schiavina et al., 2023). These datasets collectively provide a robust foundation for quantifying urban form and settlement dynamics, making them well-suited for assessing spatial characteristics relevant to CBD delineation.

2.4.3 Thematic Criteria Maps Processing and Reclassification: A 1.3-kilometer buffer was applied to the study area boundaries to ensure adequate data coverage at the edges. This distance reflects the maximum walkable range within 15 minutes at the fastest average walking speed, as identified by Mañago et al. (2025). Figure 4 summarizes the geoprocessing steps to generate the thematic and reclassified criteria maps.

The OSM POI dataset includes three key fields—amenity, shop, and tourism—which were used to categorize POIs into six functional groups: Government Offices & Facilities, Healthcare Facilities, Marketplaces, Commercial Establishments, Recreational and Social Facilities, and Financial Institutions. These categories served as the basis for generating 1-meter resolution distance rasters, enabling detailed spatial analysis of accessibility patterns. The use of high-resolution data in urban accessibility studies is well supported, as demonstrated by Mañago et al. (2025) in their development of a Fifteen-Minute City Index using a hexagonal grid with 0.65 m^2 cells for fine-grained urban assessment. For the OSM Road Network layer, the *fclass* attribute was used to extract trunk, trunk_link, primary, and primary_link roads, which represent major road types. Trunk roads were retained due to their significance as key thoroughfares, such as Quezon Avenue and Commonwealth Avenue.

The Average Building Height, Average Building Volume, and Population Count layers were reprojected and resampled. Area-weighted resampling was applied to the building height and population layers to preserve data accuracy and avoid value distortion, ensuring proportional distribution across higher-resolution cells. These thematic layers were then reclassified based on established criteria and integrated using Analytic Hierarchy Process (AHP) weights to generate the Central Business District Likeliness Map.

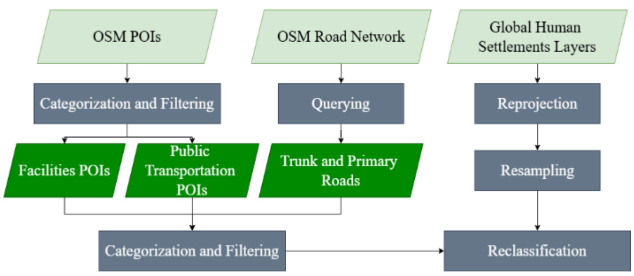

Figure 4. Thematic Criteria Maps Generation and Reclassification

2.5 AHP Survey and Sensitivity Analysis

Multi-criteria decision-making (MCDM), a set of techniques used in evaluating multiple criteria important in decision-making processes, was applied to investigate the hierarchy of priorities in identifying the likeliness of an area to be a CBD. Analytic Hierarchy Process (AHP) is one of the tools of MCDM where each factor is weighted based on its relative importance in determining CBD potential using pairwise comparisons. The AHP survey was conducted and answered by 16 respondents through Google Forms and computed using an online AHP calculator developed by Business Management Performance Singapore (Goepel, 2018). Through pairwise comparisons, AHP derives the weights based on the relative importance of the criteria. Leave-one-out Sensitivity Analysis was then used to determine the stability of group criteria weights by investigating the effect of removing an individual weight of a respondent at a time while leaving all other inputs fixed to the overall group weight (Hamby, 1994). To quantify the sensitivity scores of the results, the mean absolute deviation (MAD) of the individual weights of each respondent of each criterion was calculated from the original group criteria weight and the new leave-one-out group weight.

3. Results and Discussion

3.1 Central Business District Criteria

From the initial set of 13 proposed indicators, a final selection of 11 criteria was established based on the results of a shortlisting survey conducted among 21 respondents from diverse professional backgrounds. The selected indicators include accessibility and proximity to public transport, accessibility to primary roads, and proximity to various points of interest such as government offices, markets, commercial establishments, financial institutions, healthcare facilities, and recreational or social spaces. Additional criteria include average building height, building volume, and population density. The respondents who participated in the survey represented a range of fields, including environmental planning (4), engineering (8), nursing (2), architecture (2), hotel and restaurant management (1), research (1), entrepreneurship (1), and private sector employment (2), reflecting a multidisciplinary perspective in the final selection process.

Table 1 summarizes the survey results, showing that respondents prioritized accessibility to government offices, healthcare, markets, commercial areas, and recreational facilities—consistent with Pacione's (2005) characterization of a CBD. Respondents also recommended distinguishing financial institutions from general commercial establishments, emphasizing the distinct role of financial services in urban centers and the need for a separate POI category.

	Yes	No	Percentage
Accessibility Criteria			
Primary Roads	21	0	100.00%
Government Offices and Facilities	20	1	95.24%
Healthcare Facilities	20	1	95.24%
Marketplaces	20	1	95.24%
Commercial Establishments	20	1	95.24%
Recreational and Social Facilities	20	1	95.24%
Residential Areas	16	5	76.19%
Educational Institutions	14	7	66.67%
Public Transportation Mode			
MRT/LRT	20	1	95.24%
Bus	20	1	95.24%
UV Express	17	4	80.95%
Public Utility Jeepneys (PUJs)	13	8	61.90%
Physical Characteristics			
High Average Building Height	19	2	90.48%
High Average Building Volume	18	3	85.71%
High Population Density	17	4	80.95%
Far from Highly Sloping Areas	16	5	76.19%

Table 1. Criteria Shortlisting Survey Results

Primary roads and access to multiple public transportation modes were also identified as essential characteristics of CBDs. As the focal point of economic activities, CBDs typically experience high volumes of commuter traffic, underscoring the importance of transport accessibility. Their high connectivity supports the efficient movement of people and goods, aligning with descriptions of CBDs as central nodes in transport networks (Rice, 2020).

The physical and demographic characteristics of an area were also found to contribute significantly to its CBD potential. High average building height (Taubenböck et al., 2013), high average building volume (Taubenböck et al., 2013), and high population densities (Eurostat, 2019) were consistently associated with central business functions.

3.2 Thematic Criteria Maps

Figure 5 presents the pre-processed OSM POIs grouped into broader functional categories along with public transportation POIs, as well as the Global Human Settlements Layer (GHSL) datasets. Distance rasters were generated from the categorized OSM POIs and primary roads, while the GHSL layers were reprojected and resampled using an area-weighted method to ensure spatial consistency.

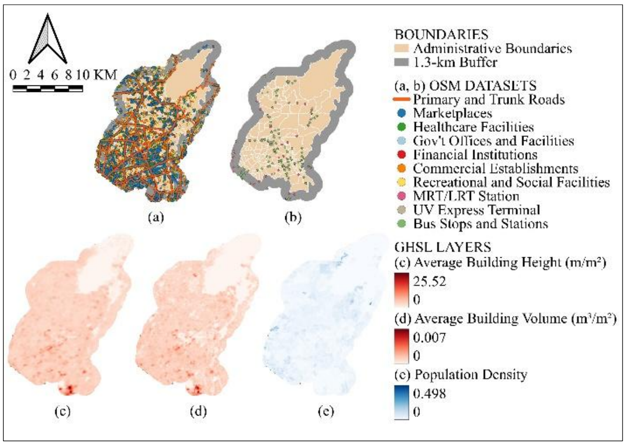

Figure 5. Thematic Criteria Map Preparation

3.3 Reclassification Criteria Values

Table 2 presents the conversion of qualitative CBD characteristics—such as high accessibility, dense development, and the presence of key facilities—into quantifiable spatial criteria for analysis. These traits were translated into measurable variables, including proximity to roads and facilities, building height and volume, and population density, allowing for standardized comparisons across urban blocks. The criteria were informed by principles of urban planning, transit-oriented development, and relevant literature.

Proximity to primary roads was identified as a critical factor for urban accessibility, with areas within 250 meters classified as having high CBD-likeness, reflecting thresholds in transport and suitability studies (Saha & Roy, 2021). Healthcare facilities were assigned a 300-meter threshold, supported by WHO (2020) recommendations on access to primary care. Government offices, marketplaces, commercial establishments, and financial institutions followed thresholds of 400 meters, aligning with walkability and economic access standards (Litman, 2025; Cervero & Kockelman, 1997). Recreational and social facilities were evaluated using a 500-meter threshold, drawing from Gehl's (2011) principles on walkability and accessible public space.

Urban form was evaluated using average building height, volume, and population density as indicators of vertical intensity and mixed-use development. Following Taubenböck et al. (2013), areas exceeding 59.82 meters in height and 1,495 m³ in volume per 4 hectares were classified as high. Population density thresholds adhered to Eurostat's (2019) urban center criterion of 10,000 people/km².

Criteria	High Likeliness (3)	Moderate Likeliness (2)	Low Likeliness (1)
Primary Roads	≤ 250 m	> 250 - ≤ 500 m	> 500 m
Healthcare Facilities	≤ 300 m	> 301 - ≤ 600 m	> 600 m
Government Offices and Facilities	≤ 400 m	> 400 - ≤ 800 m	> 800 m
Marketplaces			
Commercial Establishments			
Financial Institutions			
Recreational and Social Facilities	≤ 500 m	> 501 - ≤ 1000 m	> 1000 m
Average Building Height	≥ 59.82 m/4 ha	≥ 24.37 - < 59.82 m/4 ha	< 24.37 m/4 ha
Average Building Volume	≥ 1,495 m³/4 ha	≥ 609 – < 1,495 m³/4 ha	< 609 m³/4 ha
Population Density	≥ 10,000 people/km²	≤ 5,000 – < 10,000 people/km²	< 5,000 people/km²

Table 2. Reclassification Criteria Values

Table 3 presents the reclassification values used to evaluate accessibility to public transportation. A distinct scoring system was developed for this criterion, incorporating both the proximity to and the presence of multiple transportation modes. Areas located within 400 meters of several transit options—such as MRT, buses, and UV—received the highest scores, aligning with international standards for transit-oriented development (Institute for Transportation and Development Policy, 2017). Moderate scores were assigned to zones with access to a single mode or situated beyond the recommended walking distance. Conversely, the lowest scores correspond to areas with limited or inconvenient transport access, which can significantly reduce the likelihood of regular transit use (UN-Habitat, 2013; JICA, 2014). This classification framework enables a more detailed assessment of public transport accessibility, reflecting its critical role in shaping urban mobility and CBD viability.

Score	Condition
High (3)	All three ≤ 400 m
Moderate-High (2.5)	Any two modes ≤ 400 meters
Moderate (2)	Anyone mode ≤ 400 meters OR all three between 400–800 meters
Low-Moderate (1.5)	Any two between 400–800 m
Low (1)	All modes > 800 m

Table 3. Reclassification Criteria for Accessibility and Presence of Public Transportation

3.4 AHP Criteria Weights and Sensitivity Analysis

Table 4 presents the criteria weights and sensitivity scores derived from 16 expert responses, of which 15 passed the 10% consistency ratio threshold and were included in the consolidated results. The aggregated group weights yielded a consistency ratio of 0.6%. Accessibility and the presence of public transportation emerged as the most influential factor, consistent with transit-oriented development principles and literature identifying public transit as a defining characteristic of CBDs (Cervero &

Kockelman, 1997; Suzuki et al., 2013). Primary roads ranked second, reflecting their importance in enabling mobility and shaping CBD structure (Taubenböck et al., 2013).

	Criteria	Weight (%)	MAD		R^2
			Original	New	
1	Accessibility to Public Transportation	18.22	0.00548	0.00544	0.978
2	Primary Roads	13.36	0.00528	0.00534	0.984
3	Healthcare Facilities	12.37	0.00603	0.00618	0.954
4	Marketplaces	9.88	0.00348	0.00343	0.963
5	Financial Institutions	8.64	0.00243	0.00256	0.988
6	Commercial Establishment	8.54	0.00290	0.00297	0.984
7	Government Offices and Facilities	7.58	0.00260	0.00257	0.998
8	Population Density	7.06	0.00267	0.00268	0.910
9	Recreational and Social Facilities	6.18	0.00285	0.00264	0.980
10	Average Building Volume	4.25	0.00175	0.00177	0.883
11	Average Building Height	3.93	0.00092	0.00092	0.990

Table 4. Criteria Weights, Mean Absolute Deviation (MAD), and Sensitivity Analysis Scores

Sensitivity analysis of the criteria weights was conducted using the Leave-One-Out method, which recalculates group weights by removing one respondent at a time. Regression analysis compared the original and adjusted sensitivity scores based on the deviation of individual weights from both group averages. Results showed R^2 values close to 1 for all criteria, indicating that individual deviations followed similar patterns relative to both the original and revised group weights. Additionally, the Mean Absolute Deviation (Table 4) values were low across all criteria, suggesting minimal variation among individual responses. These findings confirm the stability and robustness of the group weightings, demonstrating that the results are not significantly influenced by any single respondent.

3.5 Central Business District Likeliness Map

Figure 6a shows the direct output of the analysis, with values ranging from 1 to 3, while Figure 6b presents the reclassified map, regrouping the values into primary CBD-likeliness ratings of 1, 2, and 3. Initial observations reveal that the majority of the La Mesa Dam watershed—a designated protected area—exhibits uniformly low values. In contrast, the southern part of the city shows a dense concentration of high-likeliness scores. This spatial pattern highlights the influence of urban density, infrastructure, and service availability in shaping CBD development potential. The assessment revealed that 37.19% of Quezon City's total land area has high CBD-likeliness scores. Table 5 shows the area distribution of the reclassified CBD scores.

Likeliness	Area (ha)	Percentage (%)
High (3)	6,042.141	37.19
Moderate (2)	7,724.267	47.54
Low (1)	2,482.063	15.28

Table 5. CBD-likeliness Score Area Distribution

3.6 Urban Spatial Block-level CBD-Likeliness

Urban Spatial Blocks were derived from the OSM Road Network to aggregate CBD scores at a scale that captures meaningful urban patterns. Unlike entire districts, which may mask local variation, or individual buildings, which overlook spatial context, blocks provide a balanced unit of analysis. Defined by dense street networks, they reflect consistent morphological and functional characteristics, making them ideal for assessing CBD potential (Taubenböck et al., 2013). These blocks were intersected with Quezon City's Zoning Map to identify high-scoring areas outside designated Commercial Zones. Summary statistics were then performed using the spatial blocks as zones and the CBD Likeliness Map as the input raster. Figure 7 summarises the workflow used to generate the spatial blocks.

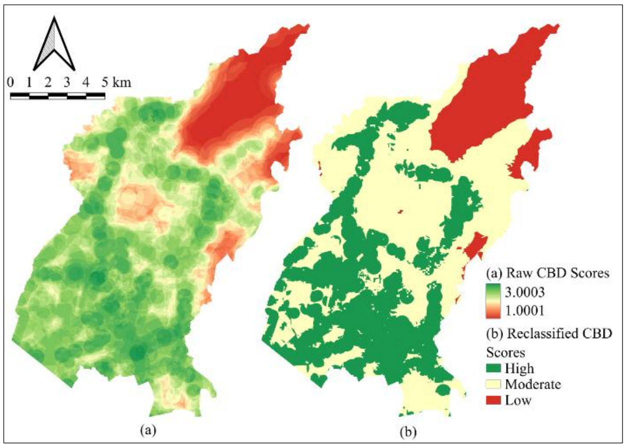

Figure 6. (a) Raw and (b) Reclassified CBD-Likeliness Map

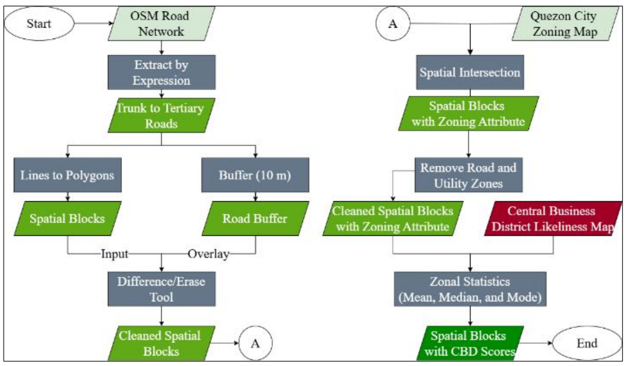

Figure 7. Urban Spatial Block Generation

Figure 8 presents the mean, median, and mode CBD-likeliness scores at the block level, with the mean used as the primary basis for classification due to its effectiveness in capturing overall intensity. Scores ranged from 1.56 to 3.00 and were categorized using Natural Breaks (Jenks), revealing distinct spatial patterns of high CBD-likeliness.

High-scoring blocks were predominantly located in R-3 High-Density Residential Zones, followed by C-2 Major Commercial Zones. As shown in Figure 9a, these blocks spanned diverse zoning types—including Residential, Commercial, Industrial, Socialized Housing, and even Cemetery zones. The presence of cemeteries among high-scoring areas, though unexpected, can be explained by their proximity to major roads and key services, highlighting overlooked spatial advantages.

This broad distribution indicates a functional overlap across land uses and reflects the mixed-use nature of urban development. Figure 9b shows that while 1,212.22 hectares of high-scoring blocks lie within commercial zones, other areas totalling to 1,495.05 hectares were located in non-commercial zones. This suggests the emergence of new economic clusters driven by accessibility and service proximity, reinforcing the idea that CBD functions can evolve beyond formally zoned commercial areas.

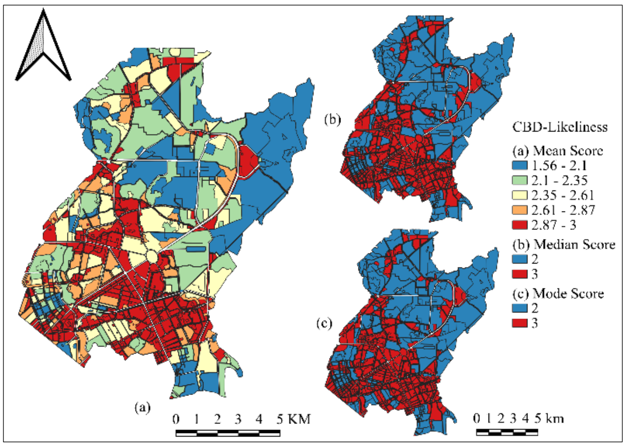

Figure 8. (a) Mean, (b) Median, and (c) Mode Block-level CBD-Likeliness Scores

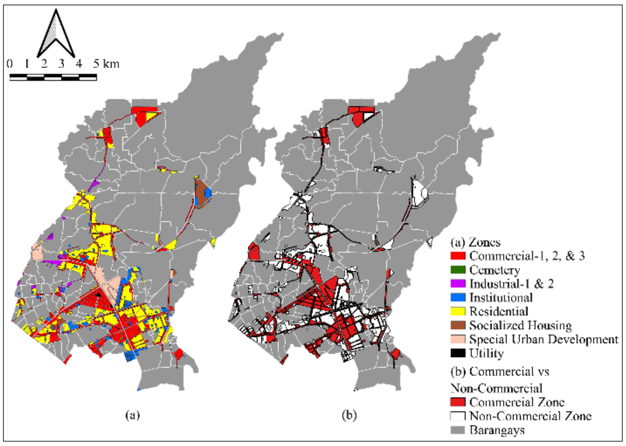

Figure 9. (a) Block Zone Distribution and (b) Commercial and Non-Commercial Zone Distribution

3.7 Validation with QC Comprehensive Land Use Plan

The proposed Quezon City Central Business District (CBD) in the North and East Triangles recorded high CBD-likeness scores (Figure 10), affirming its strategic potential and alignment with the city's planning objectives. Other high-scoring blocks were also concentrated in identified growth centers outlined in the Quezon City Comprehensive Land Use Plan (CLUP), as shown in Figure 11, indicating strong consistency between model outputs and existing urban development priorities.

Beyond spatial alignment with formal plans, the model also revealed a significant overlap between high CBD-likeness areas and informal settler family (ISF) communities. According to Singh (2015), 6.05% of Metro Manila's informal settlements are in Quezon City—many located within these high-scoring zones. This overlap reinforces the model's validity, as informal settlements often emerge in areas with high accessibility and economic opportunity—core features of CBDs. Rather than anomalies, ISFs in these areas may indicate latent urban value. However, without inclusive planning, these dynamics could result in displacement and tenure conflicts. These findings highlight the need for integrated strategies that address both spatial potential and social equity to ensure that future CBD development is inclusive and sustainable.

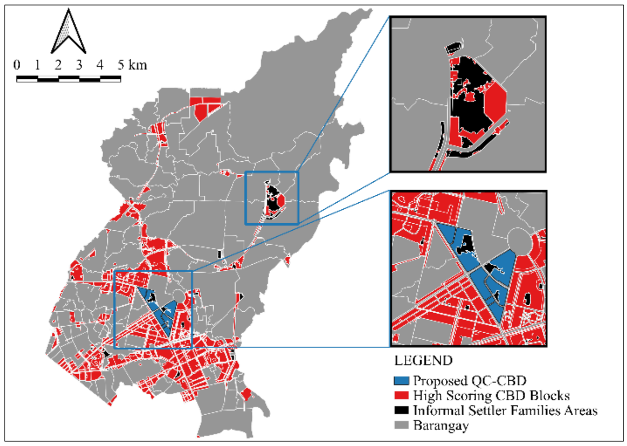

Figure 10. Quezon City Proposed CBD & Detected Informal Settler Families

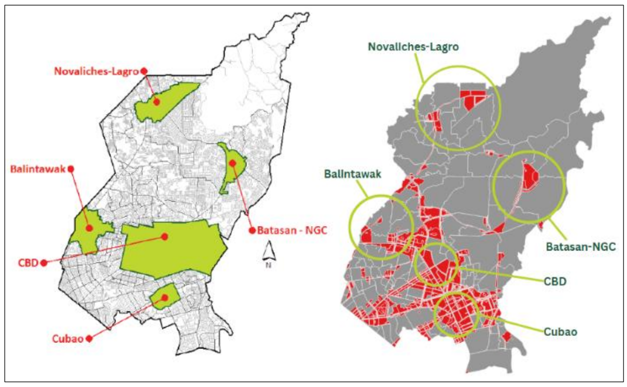

Figure 11. QC Growth Centers and High-Scoring Blocks

4. Conclusions and Recommendations

The criteria for assessing CBD-likeliness were grouped into three thematic categories: accessibility to key urban functions (e.g., roads, government offices, healthcare, markets, commercial and recreational facilities, and financial institutions), access to public transportation, and physical characteristics such as building height, volume, and population density. These criteria capture both the functional and spatial dimensions of urban cores, offering a robust basis for identifying areas with CBD-like characteristics.

Findings from the AHP survey identified Accessibility to Public Transportation as the most influential factor (18.2%), followed by Accessibility to Primary Roads (13.36%). The presence of transport infrastructure—such as QCity Bus services and the MRT-3 and MRT-7 lines—was seen as essential in enhancing connectivity and driving economic activity. This supports UN-Habitat's (2013) emphasis on accessibility as a key determinant of urban transformation. Interestingly, several high CBD-likeliness scores were recorded in residential and non-commercial zones, indicating that business centers can emerge beyond formally designated commercial areas. This aligns with Yuki's (2016) observation of investment-driven CBD growth and its potential socio-economic implications, such as informal settler displacement.

Validation of the CBD Likeliness Map showed strong alignment with Quezon City's proposed CBD in the North and East Triangles, as well as recognized growth areas like Cubao, Batasan-NGC, Novaliches-Lagro, and Balintawak-Munoz. The identification of additional high-scoring areas beyond these zones suggests the rise of new economic clusters. While these findings affirm the development potential of key areas, the presence of informal settler families in high-potential zones underscores the need for inclusive urban strategies—prioritizing affordable housing, tenure security, and socially responsive planning alongside economic growth.

In addition, future planning should also account for the implications of climate change, disaster risks, and geohazards—particularly considering the CLUP's mainstreaming of Disaster Risk Reduction and Management (DRRM) and Climate Change Adaptation (CCA). High-likeness areas should be evaluated against existing hazard maps, such as those for flooding and seismic risks, to ensure that proposed developments are not only economically strategic and socially inclusive but also climate-resilient and disaster-ready. Overall, the results emphasize the need to revisit and potentially revise the Quezon City Comprehensive Land Use Plan (CLUP) to better reflect these emerging urban patterns and ensure that future development is robust, inclusive, and sustainable.

A key recommendation is to generate service areas for each facility and transport POI using real-world travel paths and impedance, offering a more realistic measure of accessibility than simple Euclidean distance. The methodology should also be tested in other Metro Manila cities to evaluate its consistency across varied urban contexts. Validation against established CBDs like Makati and Bonifacio Global City is recommended to assess the model's robustness. Future refinements could assign differentiated weights to POIs within each functional category, allowing a more nuanced evaluation of their influence on CBD-likeness and improving the model's precision for urban planning.

The use of more accurate, localized datasets for average building height and volume is also recommended, as the GHSL's 10-meter spatial resolution can oversimplify complex urban morphology. At this resolution, smaller structures such as low-rise residential buildings or informal settlements may be merged or averaged with surrounding features, leading to generalized or inaccurate representations of the built environment (Pesaresi et al., 2021; Li et al., 2022). Additionally, as a global product, GHSL may not reflect local variations in construction typologies or development density, further limiting its reliability for fine-grained urban analysis (Pesaresi et al., 2021). Lastly, replacing GHSL's population density data with locally sourced census data redistributed across built-up areas could yield more reliable estimates.

The findings of this study provide valuable insights for the Quezon City Planning and Development Department, particularly in guiding rezoning decisions based on actual land use patterns. Areas exhibiting high CBD-likeliness scores but currently falling outside designated commercial zones may be considered for upzoning to mixed-use classifications, thereby encouraging investment and stimulating economic activity. As the city's Comprehensive Land Use Plan (CLUP) approaches the end of its planning horizon, these insights can support evidence-based revisions that align land use strategies with Quezon City's evolving urban dynamics and development priorities.

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