Spatial Variation of Land Values in the Colombo District, Sri Lanka Using Geographic Information System

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Abstract

Land value mapping is crucial for urban planning and decision-making, particularly as Sri Lanka undergoes rapid urbanisation. This study focuses on the Colombo district and aims to accurately interpret land values and identify their patterns for effective planning. Using Geographic Information Systems (GIS), the research investigates the spatial variation of land values and the factors influencing them and categorises land value bands. Through geospatial analysis, employing inverse distance-weighted analysis and the geometric interval method, the study gathers land value data and analyses spatial patterns. The research outcomes are expected to offer valuable insights for policymakers, urban planners, and stakeholders involved in land management and development in Colombo. The findings will contribute to an improved land evaluation system, enabling informed planning decisions and sustainable regional urban development.

Keywords: Land Value; Spatial Variation; GIS Analysis, Interpolation; IDW

Introduction

This research article focuses on analysing the spatial variation of land value in the Colombo district of Sri Lanka. Land value guidance maps, divided into land value bands, are used to visualise the variability of land value across the area, providing valuable insights for decision-making regarding investment, taxation, planning, and development. The district exhibits significant variation in land value due to factors such as population density, economic growth, infrastructure development, and foreign investment. This study, grounded in citations from Smith and Johnson (2018), Brown et al. (2019), Lee and Wong (2020), and Kumar et al. (2021), identifies and analyses these contributing factors. The demand for land in Colombo has resulted in notable increases in land values in certain regions. By employing spatial analysis methods, this study aims to identify the significance of spatial variation in land values within the Colombo district. The research findings will be beneficial for policymakers and stakeholders interested in gaining a deeper understanding of the land market dynamics in Colombo.

The Objective of the Study

The study of land values in the Colombo district of Sri Lanka faces several challenges and gaps, resulting in an inaccurate assessment and understanding of spatial variation.

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These challenges include limited data availability, the absence of a land value guidance map, difficulty in identifying influencing factors, and the lack of a comprehensive land evaluation system.

These limitations lead to inaccurate land value estimates, hindrances in land-use planning, unfair taxation, and inefficient land utilization. The research problem lies in the absence of comprehensive studies addressing these aspects related to land values in the Colombo district. The general objective of this study is to identify land value bands using spatial variation analysis in the Colombo district. To achieve this goal, the process involves assessing data availability and quality, developing a land value guidance map, identifying and analysing influencing factors, and proposing a comprehensive land evaluation system.

Literature Review

Scholars have examined the influence of natural features on residential land values in Belgium, considering factors such as elevation and noise (Goffette-Nagot et al., 2011). In Sri Lanka, Balakumar (2014) focused on the relationship between land value and variables such as Life Cycle Phases, distance from the City Centre, and year of the deal. Land values play a crucial role in real estate market fluctuations, with land value being more volatile than the value of structures (Gedal, 2018). Previous studies have shown that land value patterns are shaped by the competition among different land uses, reflecting the relative benefits and demands of specific locations. The development of valuation methods and automated valuations has progressed significantly, leveraging technology and geographic spatial data (Anselin, 1998; Oud, 2017). GIS and spatial analysis provide tools for estimating land prices and creating accurate maps based on mathematical models (Derdouri Ahmed, 2020). Land value maps, generated through spatial analysis, serve as decision-making support tools for property taxation and other purposes (Cellmer et al., 2014). The literature review also highlights the use of Multi-Criteria Analysis (MCA) as a decision-making tool that considers physical, socioeconomic, environmental, and ecological factors (E. Ustaoglu, 2020). The development of land value maps requires the analysis and interpretation of large amounts of biophysical and socio-economic data using GIS and statistical techniques (W. G. Sombroek', 1994). The review emphasizes the significance of distance from the Central Business District (CBD) in land value analysis, with China exploring land value progression based on distance from the CBD and public facilities (Liu et al., 2007). The creation of land value maps involves categorising areas into sectors and using methods like Inverse Distance Weighted Analysis (IDWA) to interpolate values based on known points and their distances (Muzein, 2006).

Methods

This study employs a GIS-based land value spatial pattern approach, focusing on investigating the spatial variation in land value through spatial interpolation analysis. In 2018, data collection involved the gathering of 3,000 land values from various sources encompassing all GNDs within the Colombo district. These sources included private valuation firms, land registries, local authorities' rating divisions, and valuation departments. Base maps, obtained from government organizations and open sources, served as foundational data.

The methodology consisted of several crucial stages. It commenced with data collection, which encompassed the acquisition of pertinent information such as parcel ID, location, land use, and land value. Subsequently, the collected data underwent meticulous cleaning and pre-processing procedures to ensure its suitability for subsequent spatial analysis. Spatial interpolation, specifically employing the inverse distance weighting (IDW) technique, was then applied to

estimate land values for locations without sampled data. IDW leverages nearby point values to estimate values at unsampled locations. The outcomes of the spatial analysis were visually represented on a map, offering a clear depiction of the spatial variation in land value across the Colombo district.

In terms of research type, this study is primarily quantitative, as it focuses on numerical data analysis and spatial patterns. The research relies on secondary data gathered from various sources. The utilization of GIS facilitated a comprehensive analysis of spatial variation in land value, while the application of IDW allowed for the estimation of values in areas without sampled data. This visualization of results on a map significantly enhances the comprehension of spatial patterns and variations in land value within the Colombo district.

Results and Discussion

The study examines the variation of land values in the Colombo district, considering the interpretation of land values within each local administrative boundary. The Colombo district consists of 13 local authorities, including 5 MCs, 5 UCs, and 3 PSs To provide more specific details, the analysis focuses on each Local Authority boundary separately for precise observations. Geometrical interval classification is used to categorise land values based on a geometric progression, allowing for a better understanding of the differences between high-value, medium-value, and low-value areas. The study identifies spatial patterns of land value variation in the Colombo district using ten levels of Geometric Intervals, which are visualised on a map and described in Figure 01.

Figure 01: Spatial Land Value Variation – Colombo District

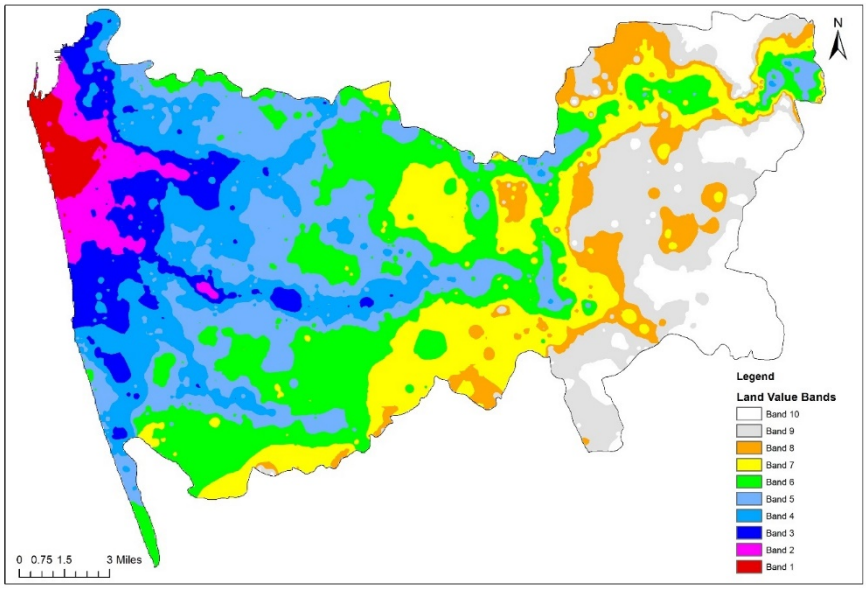


Table 01: Summary of land value variation – Colombo District.

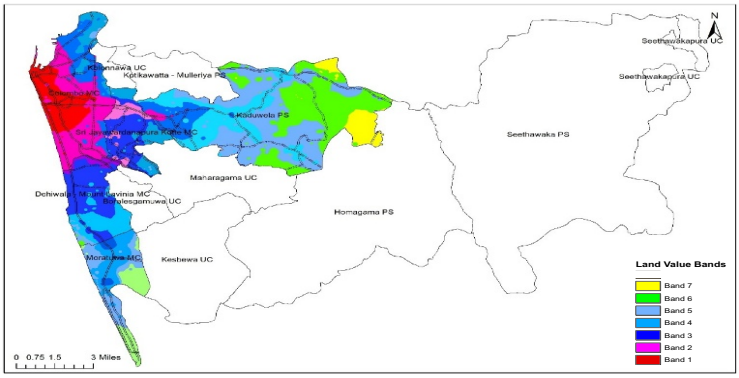
Land value Band	Nature of Land value	Max Value	Min Value	Prominent land use of the band
Band 1	Highest	30 million	13 million	High yield Commercial
Band 2	Higher	13 million	6 million	Commercial
Band 3	High	6 million	2.8 million	Mixed Development
Band 4	Moderately High	2.8 million	1.2 million	Mixed Residential
Band 5	Moderate	1.2 million	0.6 million	Primary Residential
Band 6	Moderately Low	0.6 million	0.3 million	High Density Residential
Band 7	Low	0.3 million	0.15 million	Moderate Density Residential
Band 8	Lower	0.15 million	0.1 million	Low Density Residential
Band 9	Lower Low	0.1 million	0.05 million	Rural Residential
Band 10	Minimal	0.05 million	<0.05 million	Forrest area

The delineation of these land value bands was established through a meticulous process that considered the dominant land use in each respective area, guided by both researcher observations and expert opinions. Furthermore, these classifications considered the planning guidelines provided by the Urban Development Authority.

Spatial Land Value Variation of MC, UC and PS areas in the Colombo District

The land value bands within the five Municipal Councils in the Colombo district are described. The Colombo Municipal Council (CMC) has four land value bands, with the highest ranges covering significant areas. The Dehiwala Mount Lavinia Municipal Council (DMMC) is mainly represented by the 3rd and 4th bands, with the highest band located in the Dehiwala north to Ratmalana north area. The Moratuwa Municipal Council (MMC) has the 4th band dispersed along Galle Road and surrounding areas, excluding Katubedda and Borupana junctions, while the 5th and 6th bands extend towards the boundary. The Sri Jayewardenepura Kotte Municipal Council (SJKMC) features three land value bands, with the highest band found around Sri Jayewardenepura Road. The Kaduwela Municipal Council (KMC) has a different distribution with six land value bands, with the highest and second-highest bars located around the Battaramulla junction. The lowest bar is in areas susceptible to floods and metal quarries which are visualised on a map and described in Figure 02.

Figure 02: Spatial Land Value Variation of MCs

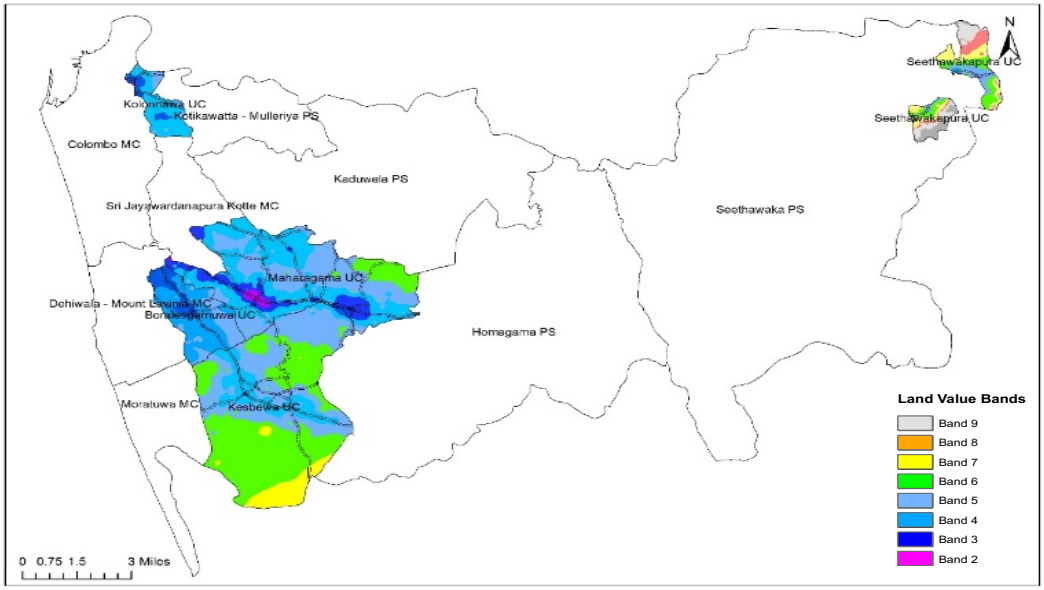


The analysis focuses on the spatial variation of land values within the Colombo District's Urban Councils (UCs). UCs are the second-tier local authorities governing smaller urban town centres

compared to main towns. In the Colombo District, there are five gazetted UCs. While UCs have high population density, they generally have fewer commercial activities compared to Municipal Council areas. The discussion will provide insights into the variations in land values within these UCs.

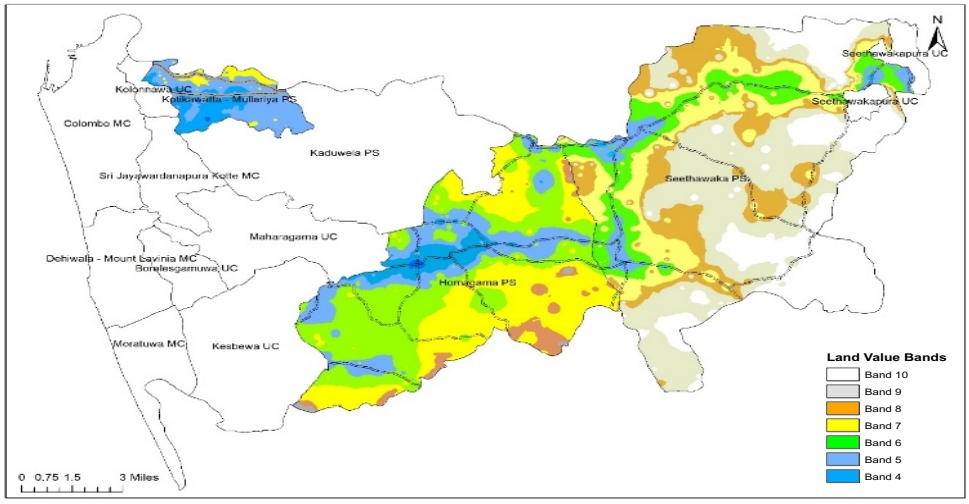
Among the five Urban Councils (UCs) in the Colombo District, only Maharagama Urban Council (MUC) has the second land value band within its town centre. The town centres and commercial road frontage of Kolonnawa, Boralesgamuwa, Delkanda, and Kottawa in Kolonnawa Urban Council (KUC) have the third land value band. The seventh land value band, indicating the lowest land values, is found in the southern corner of KUC and some Seethawaka Urban Council (SUC) areas. Boralesgamuwa Urban Council (BUC) and KUC have only three land value bands, while MUC and KUC have an additional band towards their boundaries, where primary residential activities are concentrated which are visualised on a map and described in Figure 03.

Figure 03: Spatial Land Value Variation of Urban Councils.



Three gazetted PS areas exist in Pradeshiya Sabhas (PSs) in the Colombo District. Kotikawatta Mulleriyawa Pradeshiya Sabha (KMPS) has three land value bands, excluding the 6th band. The Homagama junction and its immediate surroundings fall within the 3rd to 5th land value bands, while other primary residential and industrial areas are categorised in the 6th and 7th bands. Seethawaka Pradeshiya Sabha (SPS) represents the 5th to 6th land value bands along Avissawella Road and at commercial junctions, while other remote areas have the lowest land value bands which are visualised on a map and described in Figure 04.

Figure 04: Spatial Land Value Variation of Pradeshiya Sabhas.



Summary of spatial analysis: The CMC has only four land value bands with the highest value ranges; the first two cover the most significant areas. The DMMC mainly represents the 3rd and 4th bands, while the MMC's 4th band is dispersed along Galle Road and surrounding areas. Kaduwela MC has six land value bands, with Battaramulla junction boasting the highest bar. Among the five UCs, only MUC has the second land value band within the town centre. SJKMC has three land value bands, the highest band around Sri Jayewardenepura Road. Regarding the PSs, KMPS has only three value bands ranging from the 4th to the 7th, while SPS represents the 5th to 6th land value bands solely along Avissawella Road and at commercial junctions.

Conclusion

In this research, a comprehensive analysis of land values in the Colombo district was conducted, with a primary focus on developing a land value map using a GIS-based methodology. The objective was to identify the variation of land values across the entire district and provide an interpretation of these values within specific local administrative boundaries, including Municipal Councils, Urban Councils, and Pradeshiya Sabhas.

The findings of the study demonstrated significant variation in land values throughout the Colombo district. Analysis of land value variation within different local authority areas revealed distinct patterns. The Colombo Municipal Council (CMC) area, particularly along Galle Road in the southern part, exhibited high land values. Other Municipal Councils such as Dehiwala Mount Lavinia Municipal Council (DMMC), Moratuwa Municipal Council (MMC), Sri Jayewardenepura Kotte Municipal Council (SJKMC), and Kaduwela Municipal Council (KMC) showcased variations in land values influenced by specific geographic locations and the types of activities within their boundaries. The Urban Council areas also displayed varying land values based on the positioning of their town centres and commercial areas. Similarly, the Pradeshiya Sabha areas exhibited unique patterns of land value variation.

The implications of this study are significant for various stakeholders including landowners, developers, government agencies, and researchers. Landowners can utilise the land value map to gain insights into the value of their land, aiding in informed decision-making regarding its usage. Developers can identify areas with potential for future increases in land value, guiding their investment strategies. Government agencies can leverage the land value map to develop policies

and programmes that promote equitable land use and development across the district. Lastly, researchers can expand their understanding of spatial variation in land value, contributing to the broader knowledge of land market dynamics.

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