Analysis of Land Value in the Area Surrounding the Central Business District (CBD) of Simpang Lima, Semarang City Using Geographically Weighted Regression (GWR)
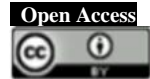
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Abstract

Semarang City is the capital of Central Java Province, which is also the fifth-largest metropolitan city in Indonesia. According to the Regional Spatial Plan (RTRW) for the City of Semarang in 2011-2031, the area around Simpang Lima is part of City Area 1, with a function as the central business district or what is often referred to as the Central Business District (CBD). Losch (1954) suggests that the value of a parcel of land tends to decrease if it is away from the central business area. This has prompted research to investigate the relationship between changes in land values and the presence of the CBD around the Simpang Lima CBD area of Semarang City. The data used in this research includes the 2012 ZNT, 2018 ZNT, 2020 Road Network Map, 2020 Land Use Map, and Administration Map. The method employed in this study is the calculation of the Average Indicated Value (NIR), analyst of changes in land value in 2012-2023, and Geographically Weighted Regression (GWR). Based on an analyst of changes in land value for 2012-2023, it shows that the highest change in land value zone for 2012-2018 was in zone 166, with an increase of IDR 20,446,000, and the lowest change in land value was in zone 163, with a decrease of IDR 3,956,000. Meanwhile, the highest change in land value zone for 2018-2023 was in zone 84, with an increase of IDR 28,852,000, and the lowest change in land value was in zone 37, with an increase of IDR 217,000. Based on the results of statistical tests using Geographically Weighted Regression (GWR), it shows that the influence of the distance from the Central Business District (CBD) on changes in land values in 2012-2023 is 84%, indicating a high correlation. The results of the T-test performed on each variable indicate that the variables significantly influencing changes in land value are shopping centers and road widths. Shopping centers, as a whole, have a negative correlation, meaning that the closer the land value zone is to the shopping center, the higher the change in land value. On the other hand, the width of the road, as a whole, is positively correlated, indicating that the larger the road width, the higher the change in land value.

Keywords: Central Business District (CBD), Land Value Zone (ZNT), ZNT Changes, Geographially Weighted Regression (GWR)

1. Introduction

Losch (1954) cited in (Suryani, 2015), postulates that escalating transportation expenses correlate with reduced rental costs. When applied to land value, this suggests that the farther away from the city center a plot of land is, the lower its value. The existence of a business center with high demand for a business center location with minimum transportation costs means that land closer to the center will be higher (Capello, 2011).

One of the cities with a CBD that is experiencing rapid development is Semarang City. Semarang

City is the Capital of Central Java Province, which is also the fifth largest metropolitan city in Indonesia. Semarang City has the Simpang Lima Area as the Central Business District. The Simpang Lima area is an area that is developing quite rapidly with the addition of facilities in this area. Based on the 2011-2031 Regional Spatial Plan (RTRW) for Semarang City, where the Simpang Lima Area include in the City Area Section (BWK) 1.

The City Region 1 section consists of the Districts of South Semarang, Central Semarang,

and East Semarang, with an area of approximately 16.18 km². The City Region 1 is bordered by North Semarang District to the north, Gayamsari District to the east, Gajahmungkur and Candisari Districts to the south, and West Semarang District to the west. The City Region 1 section, which consists of three sub-districts, consists of 35 Kelurahan. BWK 1 has shopping centers such as Citraland Mall, Plaza Simpanglima, Tentrem Mall, Java Supermall, Paragon Mall, and DP Mall, as well as commercial office buildings such as Citibank and Telkomsel offices. These shopping centers and commercial offices show that the City Area Section 1 is an area with a function as the City Center or the CBD.

The CBD's establishment as a nucleus for business, government, and service activities leads to variable land values throughout the city. Land adjacent to the CBD holds more excellent value compared to that at the city's periphery (Yowaldi, 2012). Nonetheless, Heri's research in 2016 on the relationship between CBD distance and land value in Surabaya offers a contrasting perspective. The research posits an inclination for land value to increase with greater distance from the CBD (Heri et al., 2016). This incongruity between Losch's (1954) theory of decreasing land value away from the city center and Heri's research in 2016 findings in Surabaya underscores the motivation behind this research—to unravel the intricate connection between land value and CBD presence.

The relationship between land values and the presence of CBD can be linked with the GWR method. GWR, a statistical tool analyzing geographic risk variables using a point-based approach offers insight (Fotheringham et al., 2002). The primary output of GWR is a set of location parameter estimates that are mapped and analyzed to yield information about spatial non-stationarity in relationships. The author hopes that the results of this research can strengthen understanding of location theory which is useful for developing further research, and also that the results of processing land values can become input for planners and the Semarang City Government in making the Semarang City Master Plan.

2. Material and Methods

2.1 Study Area

This research was conducted around the Central Business District (CBD) area in the city of Semarang. CBD is a small part or part of an urban area that is the center of all political, socio-cultural, economic, and technological activities (Akromusyuhada, 2020). As a city center, CBD has significant accessibility, while other business centers are relegated to less profitable locations. Areas with maximum accessibility to all parts of the city characterize the CBD. As such, it attracts specialty retailing, large-scale banking, sophisticated medical services, and other functions so unusual that people come from all parts of urban areas. The CBD offers a much greater number and variety of goods and services than any other business area (Murphy, 2017).

Semarang Tengah and Semarang Selatan sub-districts have a CBD area called the Panama Triangle (Pemuda, Pandanaran, Gajahmada) and Simpang Lima, which is the center point of business

activities. As a trade and service center, the Panama CBD area has developed into the more comprehensive Petawangi Area (Peterongan-Tawang-Siliwangi). This study analyzed the area around the Simpang Lima CBD in Semarang City. So the location of this research is the area around the CBD of Simpang Lima City of Semarang, which consists of 10 sub-districts. The following is a map of the administrative boundaries of 10 sub-districts.
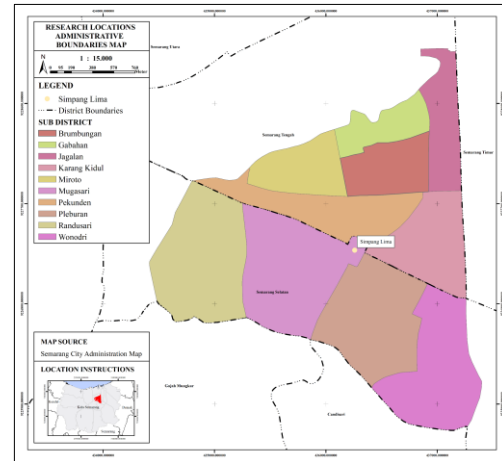

Fig. 1 Study Area Map

The 10 sub-district consist of Wonodri Sub-District, Pleburan Sub-District, Mugasari Sub-District, Randusari Sub-District, Pekunden Sub-District, Karang Kidul Sub-District, Jagalan Sub-District, Brumbungan Sub-District, Miroto Sub-District, and Gabahan Sub-District. Based on statistical data for 2022, these ten sub-districts have an area of approximately 5.34 km².

2.2 Research Tools and Data

The tools employed in this study encompass the following:

1. Hardware
   a. ASUS A442U laptop, used for processing research data.
   b. Smartphone for conducting the 2023 land value data survey.
2. Software
   a. Microsoft Office, utilized for processing znt data and generating reports.
   b. Geoda, employed for processing spatial aspect tests.
   c. ArcGIS, used for visualization and map creation.
   d. GWR 4, applied for statistical test processing.
   e. SW Maps, used for the 2023 land value data survey.

This study employs two types of data: spatial data and attribute data. The attribute data used includes road width data from the Semarang City Public Works Office, and results of the land price survey using the 2023 land appraisal form. The following section presents the spatial data used in this study, which is displayed in Table 1.

Table 1. Spatial Data Research

No	Spatial Data	Year	Source
1	Semarang Administration Map	2020	Semarang City Spatial Planning Office
2	Semarang Road Network Map	2020	
3	Semarang Land Use Map 2020	2020	
4	Land Value Zone Map of Semarang	2012 2018 2022	Semarang City Land Office

2.3 Research Flowchart

In general, the flowchart in this study can be seen in Fig. 2
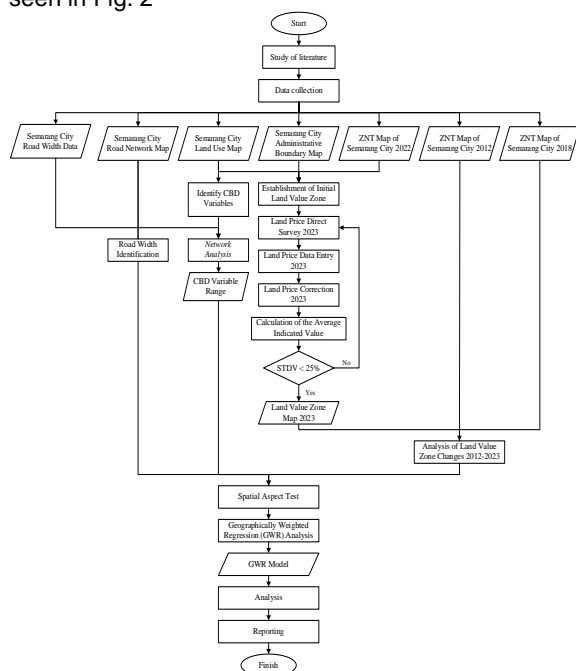

Fig. 2 Research Flowchart

2.4 Research Implementation

The following are the stages of the research:

1. Land Value Zone Map 2023 Creation

Land Value Zones (ZNT) are polygons based on official analysis using market prices and a cost comparison approach, depicting substantially the same land values from collecting land parcels within them (Kinasih et al., 2019). The land value zone map is made every five years by implementing the BPN regional office, which is then updated every year by the land office. The following are the stages in making a land value zone map (Direktorat Penilaian Tanah dan Ekonomi Pertanahan, 2020):

a. Initial Zone Map Creation. Initial zone determination for Land Value Map creation. ZNT was carried out using the Land Use Map, the Administrative Boundary Map obtained from the Semarang City Spatial Planning Office, and the 2022 Land Value Zone Map obtained from the Semarang City Land Office.

b. Field Survey. This activity is in the form of collecting field data, namely market price

samples obtained from land price transactions around the Simpang Lima Semarang CBD area and land location coordinates that can be obtained using the SW Maps application.

c. Land Price Correction. Land price correction is carried out to obtain a corrected land price including rights status correction, data type correction, time correction. Once corrected, the next step is the calculation of the Average Indicated Value per meter of each land zone.

2. Analysis of changes in land value in 2012-2023

The analysis was carried out using the Land Value Zone Map for 2012, 2018 and 2023. The analysis was carried out by looking at changes in land values for 2012-2018 and 2018-2023. Changes in land value are influenced by factors that contribute to the use, capacity and economic productivity of land. The following are factors that can influence the value of land and property according to Betts, Ely (2001) in (Putra, 2011).

1. Physical Factors
   Physical factors have a significant impact on the property value of land because the shape or appearance of a building or piece of land directly determines its value.

2. Social Factors
   Social factors are very effective in influencing the property value of land and buildings because human-created activities can cause environmental changes, especially in social life, which add value to an area such as changes in family size, community age, stability of community life and more.

3. Economic Factors
   Economics and value are closely interrelated, therefore economic factors, such as people's income levels, shifts in currency exchange rates and interest rates, investment returns, supply and demand, and others actively influence changes in land property values.

4. Political Factors
   Political activities that can affect the value of land and property are the general election to replace the president which can have an impact on the value of the currency, which in turn is the level of health services and police services.

3. Determination of Land Value Zone Distance to Central Business District (CBD)

Determining the distance between the Land Value Zone and the CBD uses a Road Network Map and the network analysis method by finding the shortest distance based on the road network from the CBD to the centroid of each zone. Network Analyst is an extension of the ArcGIS application that provides network-based spatial analysis, including route analysis, travel directions, nearest facility analysis, and area service analysis (Ahmed et al., 2017). ArcGIS has various extensions that are part of the

network analyst, including route, service area, closest facility, OD cost matrix, vehicle routing problem, and location-allocation (ESRI, 2021).

4. Geographically Weighted Regression Processing

Geographically Weighted Regression (GWR) is a global regression development where the value of regression parameters varies depending on the study area. Analysis of spatial heterogeneity is possible by varying the value of regression parameters at each study site (Irawan et al., 2020).

Geographically Weighted Regression processing uses the GWR 4 application, before processing the GWR data is tested with a spatial aspect test consisting of a spatial heterogeneity test and a spatial dependency test with the GeoDa application. Spatial dependency testing is a test carried out to determine whether observations at one location affect observations at other spatially adjacent locations. Meanwhile, spatial heterogeneity testing was carried out to check the existence of characteristics or uniqueness at each observation location (Anselin, 1988). GWR allows coefficients to vary continuously over the study area, and a set of coefficients can be estimated at each location typically on a grid so that coefficient surfaces can be visualized and interrogated for heterogeneity relationships (Lu et al., 2014).

In the analysis with GWR, changes in land value are used as the dependent variable. Whereas distance to CBD and road width is used as an independent variable. The boundaries of the CBD cannot be determined with certainty, so the distance to the CBD is represented by buildings with the use of business land located in the Simpanglima CBD area. The existence of the Sub-CBD is also used as an independent variable, and several shopping centers represent business activities in the Sub-CBD. The following are independent variables in the analysis with GWR.

Table. 2 Independent Variable

No	Variable Code	Description	Coeffi-cient
1	Pusat_Perbelanjaan	The centroid distance of the land value zone to the nearest shopping center consisting of Ciputra Mall, Plasa Simpang Lima, Tentrem Mall, Java Mall, Paragon Mall and DP Mall	x1
2	CBDtimur	The centroid distance of the land value zone to BRI Bank which is in the eastern part of the Simpanglima CBD	x2
3	CBDselatan1	The centroid distance of the land value zone to Citibank is in the southern part of the Simpang Lima CBD	x3
4	CBDselatan2	The centroid distance of the land value zone to Telkom Indonesia, which is in the southern part of the Simpang Lima CBD	x4

No	Variable Code	Description	Coeffi-cient
5	Lebar_Jalan	Average road width in each zone	x5

5. Analysis

The analysis was carried out based on the statistical results obtained so that the effect of CBD distance on changes in land values could be found. The results that can be found in GWR processing are the results of AIC and GWR ANNOVA to see whether the use of the GWR method can be significantly better than Global Regression, the value of r^2 to know the effect that the independent variable has on the dependent variable, the estimated value of each variable in each zone, and t-test results for each variable in each zone.

3. Results and Discussion

3.1 Results and Analysis of Land Value Zone Changes 2012-2023

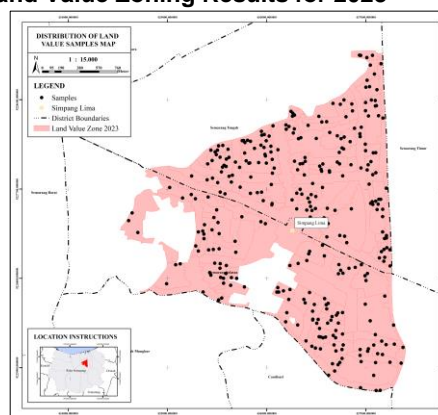#### 1. Land Value Zoning Results for 2023

Fig. 3 Distribution of Samples in Land Value Zones 2023

This zoning produces 96 zones with a minimum sample of three per zone so that there are 335 samples of land parcels. In this study, there was also 1 transaction sample and 334 offer samples.

2. Average Indicated Value and Standard Deviation for 2023

After making corrections for each sample, the NIR calculation is carried out for each zone. The following is the result of the standard deviation for each zone displayed on Table. 3.

Table. 3 Example of Indicated Value Standard Deviation Results

No Zona	Average Indicated Value	Standard Deviation
1	IDR 21,085,000	16%
2	IDR 35,374,000	14%
3	IDR 6,695,000	14%
4	IDR 10,751,000	22%
5	IDR 11,617,000	2%
…	…	…
107	IDR 10,876,000	15%
108	IDR 5,009,000	16%
110	IDR 6,660,000	18%

The results of the 2023 Land Value Zone NIR processing are presented in a map with 8 (eight) classifications in accordance with the 2023 Land Assessment and Land Economics Technical Guidelines with a scale of 1:15,000. The following is a Land Value Zone Map for 2023 for the area around the Central Business District (CBD) of Simpang Lima, Semarang City, shown in Fig. 4.
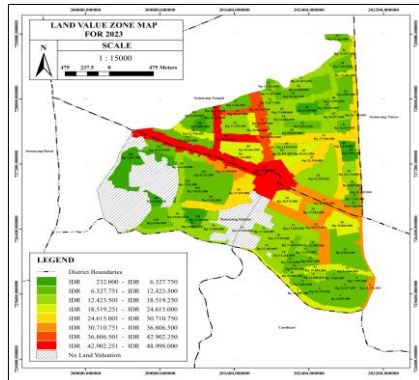

Fig. 4 Land Value Zone Map for 2023

The ZNT map for 2023 is presented in the form of a map with 8 (eight) classifications in accordance with the Technical Guidelines for Land Assessment and Land Economy in 2023. The highest NIR is found in zone 32, which is IDR 48,998,000, which is around the Secondary Collector Street, namely Pandanaran street with land use on a national/regional scale trade zone. Meanwhile, the lowest NIR is in zone 68, namely IDR 4,240,000 which is in Brumbungan Village with high-density residential land use. In accordance with the 2023 Land Assessment Technical Guidelines, the minimum standard deviation for ZNT maps with a scale of 1:10,000 is 25%.

3. Land Value Zoning Results for 2012 and 2018

The 2012 and 2018 ZNT maps of the area around the Simpang Lima CBD of Semarang City were obtained from National Land Agency of Semarang. The 2012 ZNT map of the area around the Simpanglima CBD of Semarang City can be seen in.
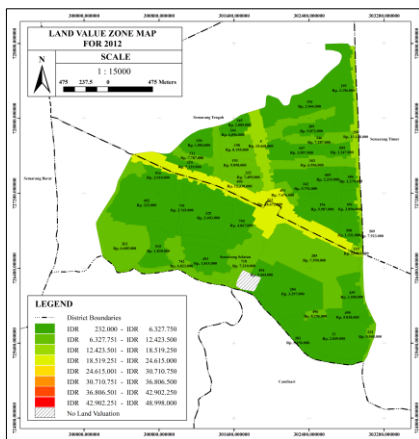

Fig. 5 Land Value Zone Map of 2012

The 2012 ZNT map of the area around the Simpanglima CBD of Semarang City was obtained from the Semarang City Land Office. The ZNT map in 2012 is presented in the form of a map with 8 (eight) classifications in accordance with the Technical Guidelines for Land Assessment and Land Economy in 2023. The 2012 ZNT Map consist of 47 land value zones. The zone with the highest NIR is zone 212, with an NIR of IDR 18,672,000. Zone 212 is located around Ahmad Yani street to Pandanaran street, with land use being a national/regional trade zone and government offices. Meanwhile, the zone with the lowest NIR is located in zone 492, with an NIR of IDR 232,000. Zone 492 is in the Randusari Subdistrict, with high-density housing and a cemetery land use.

Furthermore, the 2018 ZNT Map of the area around the Simpang Lima CBD of Semarang City was obtained from the National Land Agency of Semarang. The 2018 ZNT map can be seen in Fig. 6.
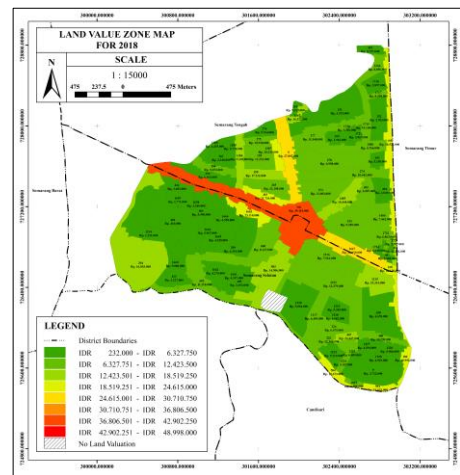

Fig. 6 Land Value Zone Map of 2018

The 2018 ZNT map of the area around the Simpanglima CBD of Semarang City was also obtained from the Semarang City Land Office. The ZNT map in 2018 is presented in the form of a map with 8 (eight) classifications in accordance with the Technical Guidelines for Land Assessment and Land Economy in 2023. The 2018 ZNT Map consist of 88 land value zones. The zone with the highest NIR is zone 166 with an NIR of IDR 39,118,000. Zone 166 is located around Pandanaran street with land use as a trade zone on a national/regional scale. Meanwhile, the zone with the lowest NIR is located in zone 404 with an NIR of IDR 410,000. Zone 404 is in the Randusari Village with land use being a high-density housing and cemetery zone.

4. Land Value Zone Changes 2012-2023

The NIR of each zone in the ZNT changes every year. The results of processing land value zone changes for 2012-2023 are presented in a 2012-2023 land ZNT change map shown in Fig. 7.
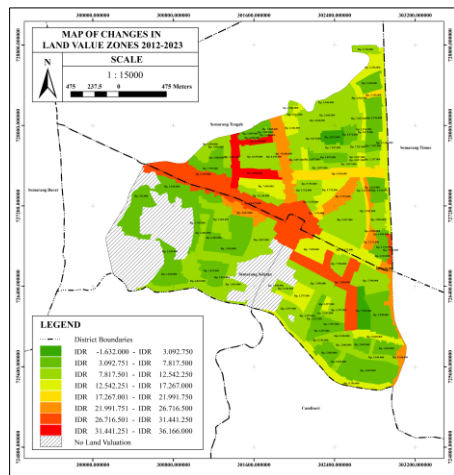
Fig. 7 Land Value Changes Map 2012-2023

The 2012-2023 ZNT Change Map is presented with 8 (eight) classifications following the 2023 Land Economic and Land Assessment Technical Guidelines with a scale of 1:15,000. The following is a change in land value zones around the Central Business District (CBD) Simpanglima City of Semarang in 2012, 2018, and 2023, shown in Table. **4**.

Table. 4 Example of Change in Land Value 2012-2023

Zone			Changes 2012-2018	Changes Persentage	Changes 2018-2023	Changes Persentage	Changes 2012-2023	Changes Persentage
2012	2018	2023						
5	50	76	IDR12,139,000	77%	IDR14,391,000	52%	IDR26,530,000	169%
11	9	3	IDR 873,000	31%	IDR 2,973,000	80%	IDR 3,846,000	135%
	1224	4	IDR 6,258,000	220%	IDR 1,644,000	18%	IDR 7,902,000	277%
	1228	5	IDR 2,080,000	73%	IDR 6,688,000	136%	IDR 8,768,000	308%
193	150	84	IDR 7,314,000	74%	IDR28,852,000	168%	IDR36,166,000	365%
194	1719	58	IDR 8,104,000	396%	IDR 7,757,000	76%	IDR15,861,000	776%
	151	69	IDR 1,209,000	59%	IDR 6,928,000	213%	IDR 8,137,000	398%
		70	IDR 1,209,000	59%	IDR 8,032,000	247%	IDR 9,241,000	452%
198	1387	82	IDR12,134,000	148%	IDR 255,000	1%	IDR12,389,000	151%
	155	83	IDR 3,037,000	37%	IDR 6,138,000	55%	IDR 9,175,000	112%
492	1658	108	IDR 3,108,000	426%	IDR 1,669,000	310%	IDR 4,777,000	2059%
...	...	...	...	...	...	...	...	...
209	1719	58	IDR 4,276,000	73%	IDR 7,757,000	76%	IDR12,033,000	205%
	277	65	IDR 5,676,000	97%	IDR 5,452,000	47%	IDR11,128,000	190%
	1720	67	-IDR 671,000	-11%	IDR 4,942,000	95%	IDR4,271,000	73%
	1721	67	-IDR1,905,000	-32%	IDR 6,176,000	156%	IDR4,271,000	73%
	163	68	-IDR3,956,000	-67%	IDR 2,324,000	121%	-IDR1,632,000	-28%
212	166	32	IDR20,446,000	110%	IDR 9,880,000	25%	IDR30,326,000	162%
	1667	33	IDR 1,347,000	61%	IDR 5,854,000	20%	IDR7,201,000	92%
590	1724	37	IDR 5,594,000	420%	IDR 217,000	3%	IDR5,811,000	437%

Based on the processing of land value changes around the Simpang Lima CBD area, it can be found in 2012-2018 that:
a. Zone 166
Zone 166 is the highest increase zone, with an increase of IDR 20,446,000 with a percentage of 110%. Zone 166 is around Pandanaran street with national/regional scale trade zone land use. In zone 166 there are also two CBDs, namely Mall Ciputra Semarang and Plasa Simpang Lima.
b. Zone 163
Zone 163 is the lowest decrease zone with a decrease of IDR 3,956,000 with a percentage of -67%. Zone 163 is in Brumbungan Village with high-density residential zone land use. Zone 163 also is 1000 meters from the nearest CBD, namely the Tentrem Mall.

Meanwhile, the land value changes around the Simpang Lima CBD area in 2012-2018, it can be found that:
a. Zone 84
Zone 84 is the highest increase zone with an increase of IDR 28,852,000 with percentage of 166%. Zone 84 is around MH Thamrin street with BWK scale trade zone land use. Zone 84 it is also 100 meters from the nearest CBD, namely the Tentrem Mall.
b. Zone 37
Zone 37 is the lowest increase zone with an increase of IDR 217,000 with percentage of 3%. Zone 37 is located in Karang Kidul Village with the land use of trade and service residential zones. Zone 37 is around 100 meters from the secondary collector road, namely MH Thamrin street. Zone 37, it is 700 meters from the nearest CBD, namely Bank BRI.

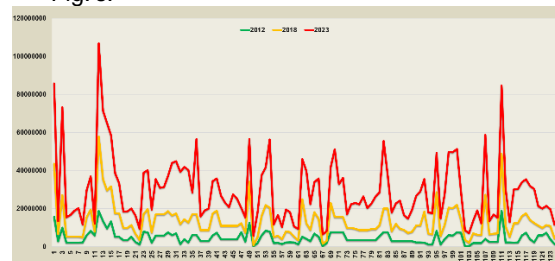Following are the changes in land values for each zone shown in the Fig. 8.

Fig. 8 Changes in Land Value

3.2 Results and Analysis of the Effect of Distance to the Central Business District (CBD) on Land Value

Statistical analysis of GWR was carried out using GWR4 software on changes in land values around the Simpang Lima CBD, Semarang City. The variables used in this study include the distance to the nearest shopping center in meters (x1), the distance to the East CBD in meters (x2), the distance to the South CBD1 in meters (x3), the distance to the South CBD2 in meters (x4) and the width of the road in meters (x5).

1. Results and Analysis of the Spatial Aspect Test of Land Value
The following are the results of spatial dependency and spatial heterogeneity tests on changes in land values show in Table. **5**.

Table. 5 Spatial Aspect Test Results

	MI/DF	VALUE	PROB
Moran's I (*error*)	0.1204	1.9598	0.05002
Breusch-Pagan test	5	23.7726	0.00024

With a significance level of α = 5%, then $p-value > α$ or $0.05002 > 0.05$, then H_0 is accepted and there is no spatial autocorrelation, that is, there is a connection between one land value zone and another land value zone. Meanwhile, the statistical test value used was $p-value = 0.00024$. This indicates that there is spatial heterogeneity, meaning that

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the variance in each location is different or heterogeneity. There is heterogeneity in the spatial aspect testing, so further analysis is carried out using the GWR.

2. Results and Analysis of Geographically Weighted Regression (GWR)

Calculation of the effect of the distance from the Central Business District (CBD) to land values using the GWR method is shown in Table. 6.

Table. 6 Comparison of AIC and R Square results

	AICc	Rsquare
Global Regression	3681.384	0.8166
GWR	3673.533	0.8425

Table. 6 displays the AICc and Rsquare columns. AICc is a diagnostic indicator for the model on global regression and GWR. Based on the results of statistical processing carried out, the AICc for global regression was 3681.384052 while the AICc value for the GWR method was 3673.533113. The AICc value with global regression which is greater than the AICc value of the GWR method indicates that the GWR method is better used in this study than global regression. The Rsquare result with the global regression method is 0.816673 smaller than the Rsquare with the GWR method, which is 0.842544, this shows that the GWR method is better than global regression. Based on the comparison of the values of AICc, Rsquare, and the results of the GWR ANOVA, it can be concluded that the calculation using the GWR method is better than global regression. The Rsquare value also shows how the independent can explain the dependent variable. The Rsquare result using the GWR method is 0.842544 so simultaneously CBD distance has an effect of 84% on land value change and the rest is influenced by other variables

The GWR model is a model that can be used effectively to describe the influence of the Central Business District (CBD) on land values. The following is the GWR model built for each change in land value zones, where each zone has different models and parameters for each variable which can be seen in Table. 7.

Table. 7 Example of GWR Modeling Results in Land Value Zones

Zone	GWR Model in Each Land Value Zone
1	$Y = 6463553.15 - 3730.82(x1) - 491.98(x2) + 3082.93(x3) - 3330.38(x4) + 1973345.76(x5)$
2	$Y = 6489051.99 - 3677.49(x1) - 469.93(x2) + 2966.64(x3) - 3217.61(x4) + 1965522.78(x5)$
3	$Y = 5326327.22 - 3624.59(x1) - 158.71(x2) + 4163.47(x3) - 4363.09(x4) + 2067691.81(x5)$
…	…
112	$Y = 5489885.69 - 3653.63(x1) - 1183.59(x2) + 3955.85(x3) - 4177.01(x4) + 2053720.35(x5)$

Based on the GWR model of change zone 1, it is known that the distance of the ZNT centroid

to the shopping center (x1), CBDTimur (x2) and CBDSelatan2 (x4) is negative, meaning that the distance of the ZNT centroid to the shopping center (x1), CBDTimur (x2) and CBDSelatan2 (x4) are have a close effect on raising land values. Meanwhile, the distance between the ZNT centroid and CBDSelatan2 (x3) and the width of the road (x5) is positive, meaning that the distance between the ZNT and the CBDSelatan2 (x3) is far and the width of the main road (x5) has an impact on increasing land values. The GWR model presents different effects for each change zone.

3. Results and Analysis of the T Test

Significant variables are selected from the magnitude of the T-count value for each variable in each zone. If the T-count is -1.98217 < T-count < 1.98217, then this variable has no significant effect. Meanwhile, if the T-count is -1.98217 > T-count > 1.98217, this variable has a significant impact. Based on the results of the T-test on each variable, the variables that significantly affect changes in land value are the nearest center and the width of the road.

4. Conclusion

The conclusion from the results of the analysis in this study to answer the problem formulation is as follows:

1. Based on the processing of land value changes around the Simpang Lima CBD area in 2012-2023 that has been carried out, it can be concluded as follows.
   a. Changes in land value zones in 2012-2018 experienced increases and decreases. In 2012 there were 45 zones which in 2018 changed to 86 zones. The highest increase was in zone 166, around Pandanaran Street, with an increase of IDR 20,446,000 a zone with national/regional scale commercial land use. While the lowest decrease was in zone 163, which is in Brumbungan Village, with a decrease of IDR 3,956,000 which is a zone with high-density residential land use.
   b. Changes in land value zones for 2018-2023 have increased. In 2018 there were 86 zones, and in 2023, there will be 96 zones. The highest increase was in zone 84, around Jl MH Thamrin, with an increase of IDR 28,852,000, - a zone with BWK scale trade zone land use. While the lowest increase was in zone 37 in Karang Kidul Village, with an increase of IDR 217,000, a zone with trade and service housing land use.
2. Based on the results of statistical tests using Geographically Weighted Regression (GWR) it shows that the effect of the distance from the Central Business District (CBD) to changes in land values in 2012-2023 is 84% or has a high correlation. So this research is in accordance with the theoretical study conducted by Losch. The T-test conducted on each variable

indicating that the significant variables influencing changes in land value are shopping centers and road widths, where shopping centers as a whole have a negative correlation, meaning that the closer the distance to the land value zone to shopping centers, the change in land value will be higher. While the width of the road as a whole is positively correlated, meaning that the larger the road width, the higher the change in land.

Acknowledgements

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