



# Dominant Influential Factors on Land Price in the Suburb Areas of Semarang

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## Abstract

Today suburban area development of Semarang as a result of the development area since a few decades ago tends to influence land prices. It changed by city center distance and connected by better accessibility. Other factors related to the concentration population, socio-economic activities have also influenced it. This research aims to find out what factors on land prices in the Suburbs area of Semarang. The method used in this study is quantitative analysis include descriptively spatial analysis with a regression model. The results showed that land prices in each Sub-Urban area were not only influenced by distance to the city center but more local factors of suburban characteristics.

**Disciplinary:** Urban and Regional Planning, Architecture and Sustainable Urban & Real Estate Development.

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## 1 Introduction

The increase in city population led to increasing socio-economic activities. This influences the scarcity of land. The dense city development affects declining environmental quality, such as air quality, water availability, the availability of green space, and so forth. City density gives rise to the development of the suburb. This condition causes the dynamics of vacant land to be land built up in the suburbs area to meet the needs of activities. The development of the suburban regions into new cities that have mutually supporting functions within the town (Wen & Goodman, 2013).

According to the theory, the distance decay principle from the center Von Thunen that the value of land will be higher when the distance to the city center is closer (Ha, 2011). Cause the existence close with facilities and infrastructure can affect land prices. The presence of the transport infrastructure will lead to urban growth characterized by changes in land value, land prices, and land utilization along the lines associated with mobility and high levels of accessibility. The transportation route had a role in the development of the city. However, Von Thunen's theory is not fully applicable, because the land price in the intersection (radial and ring road) will be higher than close to the city center. The area has located far from the city center also has to increase the land price because it has a sub-center in the respective area. So the price of land is not only seen proximity to the city center but proximity to other infrastructure that makes it strategic of location.

Indonesia is a developing country in Southeast Asia. The population is increasing every year, but the availability of their land is limited. Where land use influences land prices. (Du & Mulley, 2012) Many big cities in Indonesia are on the island of Java, one of which is the city of Semarang. Semarang City has a strategic location, which is a city that connects the three biggest cities in Indonesia, namely Jakarta, the capital city of the country, Surabaya City, and Yogyakarta City. This strategic location is one of the triggers for the development of Semarang and urbanization. Population development and activities not only occur in the downtown area but also in the suburbs. Rapid growth has happened in all sub-urban areas, both westward towards Jakarta, eastward, Surabaya, and also southward, namely, Jogjakarta. The Semarang city plan makes sub-centers to serve the needs of the community in suburban areas. Besides that, each sub-urban has different functions to support the role and function of Semarang City as the capital of Central Java Province. This phenomenon has pushed the city of Semarang to have a multicenter.

Suburbs development is also influenced by the expansion of the city center, population dynamics, and activities. The dynamics of the most considerable land-use changes occur due to changes in the function of vacant land to the built area to meet community needs. Increased dynamics also happen due to the increased provision of facilities and urban infrastructure. The availability of these facilities and infrastructure drives an increase in community activities. In addition to enhancing community activities, the construction of transportation infrastructure will increase the accessibility of sub-urban areas. This increase in business and availability has a profound effect on land prices. The Semarang City's phenomenon is what raises the research question of whether the land price in Semarang city is still strongly influenced by the city center or there has begun to be an even distribution of land prices between the city center and urban sub-center. What are the dominant factors that affect land prices in sub-urban areas in Semarang City?

## **2 Literature Review**

Land value is always associated with the function, site or location, land productivity, and other factors that provide economic benefits. In practice, the bidding process carried out by individuals and companies who try to acquire land through the market will directly take into

account the integral attributes or completeness, namely location, service distance, facilities, supporting activities, environmental quality, social conditions, and transportation. Some theories say the same thing that land prices based on soil fertility (Ricardo-Marx theory), land prices based on metric distances to the center of socio-economic activity (Von Thunen's theory), and the hedonic value theory expressed by Muth, Lancaster, and Rosen, where land prices are determined by intrinsic factors (land area, status), location factors (proximity to centers of activity/socio-economic facilities) and surrounding environmental factors (pollution, noise, ethnicity, landscape, etc.) including accessibility (Orford, 2002; Tochaiwat et al., 2021).

Hedonistically determined land prices meet many obstacles, such as structural attributes (Simans et al., 2006), whose effects on land prices are less tangible and poorly understood. In line with the statement that most of the hedonic models failed to record crucial spatial information in layouts such as network connectivity, network distance, and angular distance, which in turn, has been shown to have a strong influence on land prices (Chiaradia et al., 2013). Land prices are difficult to conceptualize and measure because land prices have a spatial scale; and are influenced by many external factors that are interrelated (Orford, 2002). In the study of land prices, using the hedonic approach produces almost the same attribute effect at different locations so that the measurement results are inconsistent. To overcome this problem, researchers have adopted concepts related to urban configurations. In the initial study, accessibility to CBD is usually the primary determinant of site-specific land values. Land location in urban theory has provided a multicentric nuance as well as the location advantage of the urban configuration network/topology (McDonald & McMillen, 1998). This is also in line with Ellegard & Vilhelmson (2004) that land use that causes changes in land prices is also influenced by other variables, including zoning policies, regional planning, geographical conditions, and topography. This reinforces that in addition to the spatial configuration resulting from zoning policies and local planning, influences land prices.

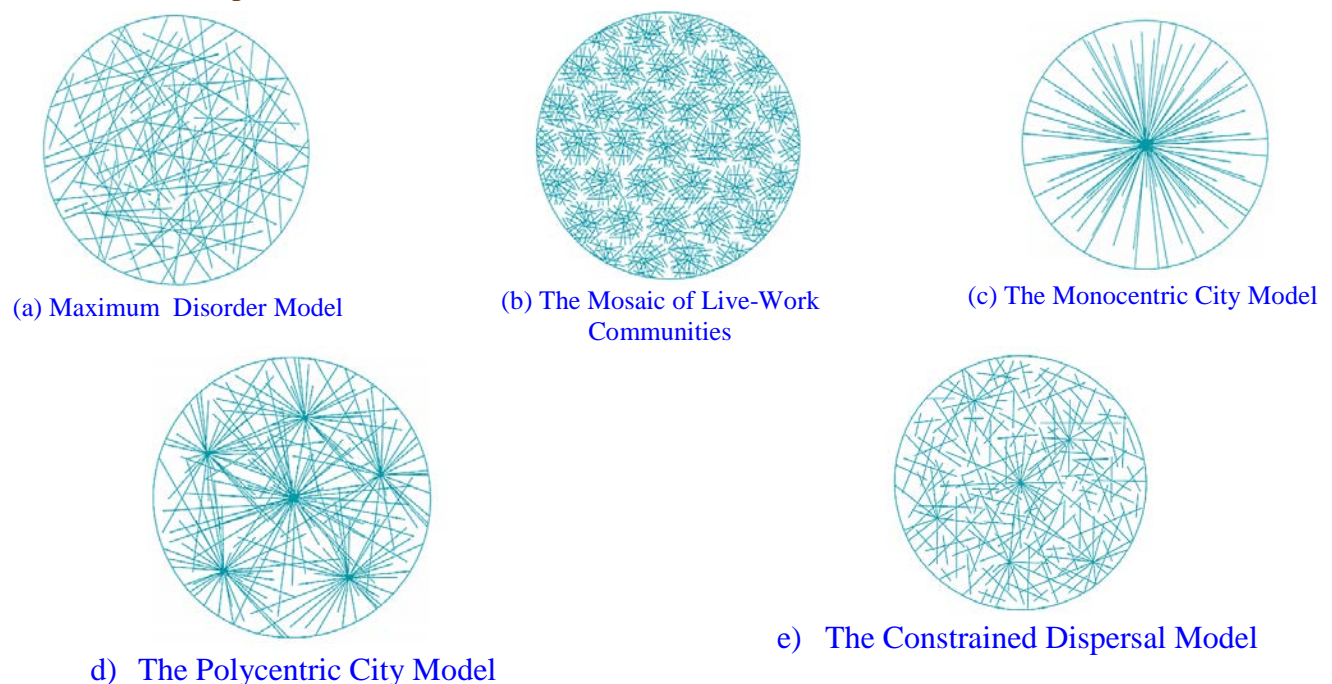
Like research in the UK (Du & Mulley, 2012), states that the Hedonic Model is a traditional multiple regression model that assumes that independent variables are not dependent on each other. The assumption is likely to be damaged if the data are spatially correlated (correlation between variables in space), as is familiar with geographical data. Geographical data tend to follow the law of geography, which is "everything is related to everything, things that are near are more related than things that are far away." Thus, Geographically Weighted Regression (GWR) is used to calculate spatial autocorrelation by adding coordinates to each point that has an influence, which is then explained by several spatially defined factors, including the accessibility of home location transport. Quantification of transport accessibility in this way helps identify increases in value and potential capture of land value associated with spatial with the support of transportation infrastructure.

The spatial configuration in seeing its effect on land prices is to know the distance of other land uses to land as an external variable (Xiao et al., 2015). The distance variable can be used for calculating the measurement of the locational externality effect. To complement the characteristics

of research that measures accessibility to benefit points, that is the specific configuration of the study area. Location externalities affect functional relationships with land prices. In the multicentric conceptualization of urban configurations, several variables are needed to capture each of the effects of externalities, and this can cause multicollinearity problems if these variables are correlated throughout space. Besides, it can be used to see the true nature of urban configurations with land markets and their impact on processes spatially.

According to Dursun and Saglamer (2003), spatial relations are relationships that occur between the two areas. A configuration exists when the relationship between the two spaces changes according to how it is connected. Therefore, the description of the configuration relates to how the space system is interrelated to form a pattern, not the more localized nature of a particular space. Spatial configuration affects the pattern of movement in space, and the movement of shapes that influence the use of space. Through the impact of this movement, spatial configuration naturally stands to determine patterns that occur in socio-economic conditions of the population in and around an area. There are spatial patterns introduced as five models of urban spatial structure in the movement of work from the residence to the workplace (Angel & Blei, 2016), among others (Figure 1):

- a) The maximum Disorder Model, where the place of residence and destination of work is distributed randomly throughout the area, and workers returning from random places to work are also random.
- b) The Mosaic of Live-Work Communities Model, i.e., the pull between settlements and workplaces, is very strong. Commuter costs are very high because of limited transportation technology or because of a strong preference for working at home or walking or cycling to work, so everyone who works lives near the workplace.



**Figure 1:** Spatial Pattern (Angel & Blei (2016) - reuse under a Creative Commons license).

- c) The Monocentric City Model, where all workplaces gather at one location and at locations that are close to one another and maybe near tourist areas, ports, mines, places of worship, or transportation



centers. All work is concentrated in the Central Business District (CBD). Workers who live out of the city circle far from CBD will travel back and forth on the radial route to their work in the CBD.

- d) The Polycentric City Model, i.e., the workplace is still united by a strong pull and is concentrated in several centers spread throughout urban areas, not only in the CBD (Lee, 2006)
- e) The Constrained Dispersal Model that is in this model the weak centripetal power that still exists in most workplaces such as the CBD in the Monocentric City Model and the inability to create employment sub-centers in the Polycentric City Model to attract workplaces that leave the CBD. The majority of workplaces are spread outside the sub-center or from the CBD.

Many studies have analyzed the polycentric city as a way to improve the efficiency of spatial configuration. For example, Beijing City has tried to decentralize spatial configuration by implementing a series of policies (He et al., 2017). Beijing focuses on creating polycentric space structures by promoting subcenters in the suburbs, including industrial development zones, satellite cities, and new cities. By implementing this strategy, the Beijing government hopes to reduce employment in the city center and make suburb areas more attractive to companies and residents. Polycentricity is also considered a normative tool to achieve important goals in terms of environmental sustainability and social cohesion (Davoudi, 2003). However, some research shows that polycentric cities can result in a loss of economic efficiency due to large public investments in decentralized development (Ding & Bethka, 2005). Generically, multicenter development can fail to reduce worker travel even though there is a considerable commuter distance (Tamin, 2000). Thus, the polycentric impact on urban development is still a very simplified topic (Veneri, 2013). Knowing the factors that affect land prices in Semarang City by linking various interests that affect land prices will be able to help determine whether the city center is still increasing land prices. Variables to be tested are analyzed by multiple linear regression.

## 3 Method

### 3.1 Study Area

This research was conducted in the suburban area of Semarang (Figure 2). The suburban area of Semarang is divided into three areas, namely the Suburbs East of Semarang, Suburbs South of Semarang, and West of Semarang. The East of Semarang consists of the Genuk sub-district and the Pedurungan sub-district. The South of Semarang consists of the Gunungpati sub-district and the Tembalang sub-district. The West of Semarang Barat consists of the Mijen sub-district, Ngaliyan sub-district, and Tugu sub-district. Each of these Sub-Urban areas at this time has also been being passed route of public bus transportation was called BRT Trans Semarang.

### 3.2 Data Collection

This study collects data about factors that affect land prices in the Semarang City area during 2019. The collected data are land prices, the distance between city center locations, distance between locations and Trans Semarang BRT stops, the distance between locations and health facilities, the distance between locations and education facilities, the distance between

locations and recreational facilities, and the distance between locations and trade facilities. Data is collected through observation. Distance data from these facilities is used as an independent variable in the process of multiple linear regression analysis to determine what factors affect land prices. Besides, demographic data is also needed, including the total population, type of work, and the number of private vehicle ownership. This data was obtained by examining documents such as BPS documents. All of these data will provide a general description related to the socio-economy in the Suburbs of Semarang.

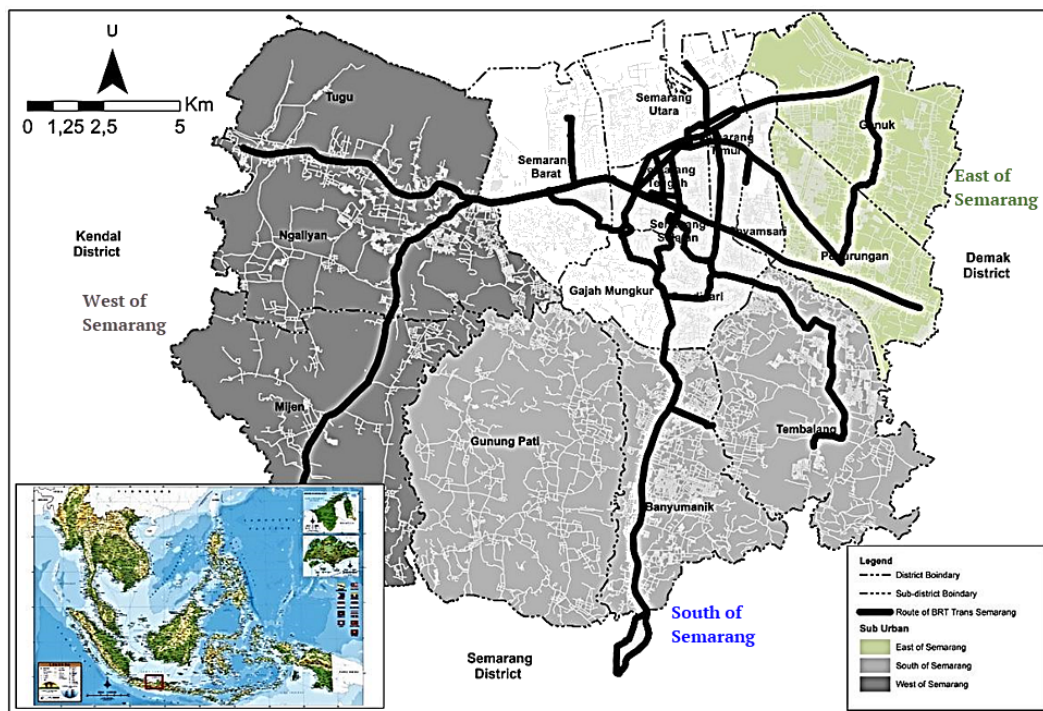


Figure 2: Sub Urban Area Map (using the shapefile from Bappeda Semarang City (2011)).

### 3.3 Methods

#### 3.3.1 Quantitative Analysis

Quantitative analysis of the study used multiple linear regression analyses using SPSS. This analysis is to find the effect of infrastructure on land prices. These influences can be seen based on infrastructure distances that are variables in the analysis. While the dependent variable used is the price of land in the suburbs area sold or rented. The result of this analysis is to define an independent variable that influences the land price and relationship value between the independent variable and the dependent variable. Through several linear regression analysis methods, it will be answered what factors can affect the price of land in the city of Suburbs Semarang. This study uses the regression model

$$Y = a + B X_1, C X_2, D X_3 + E X_4 + F X_5 + G X_6 \quad (1).$$

Description:

a: Constants

X1: Distance of City Center

X2: Distance of Shelter BRT Trans Semarang

X3: Distance to Health facilities

X4: Distance of Education facilities

X5: Distance of Recreational facilities

X6: Distance to Trading facilities

Y: Land Price (Indonesian rupiah/m<sup>2</sup>)

(B, C, D, E, F, G): Coefficient of the independent variable

### 3.3.2 Spatial Descriptive Analysis

The spatial descriptive analysis of this study consisted of the identification of the characteristic distribution of suburban areas aimed at determining the characteristics of each suburban area. The region's characteristics can be seen based on demographic conditions and socioeconomic conditions. The data associated with this is the average land price, the number of people with livelihoods as labor for industry and construction, and the amount of car ownership. The data used to analyze the effects of area characteristics on land prices. Also, descriptive analysis is used to present data in the form of graphs, diagrams, and tables that are then analyzed and explained according to the data obtained.

## 4 Result and Discussion

The study results (Tables 1 & 2) show that the price of land in suburban areas is not only influenced by the distance of the location to the center of the city, but other variables influence it. There are even suburban areas where land prices are not affected by the city center. Table 1 shows the mileage effect on the specified variables in each of Semarang's Suburbs areas. Table 2 gives the regression analysis results from using SPSS. The results form the regression models, Table 3.

**Table 1:** Variables that influence land prices in Semarang City.

Independent Variable (km)	East of Semarang	South of Semarang	West of Semarang
The distance of City Center	A	NA	A
The distance of Shelter BRT	NA	NA	NA
The distance of Health Facility	NA	NA	A
The distance of Education Facility	A	A	NA
The distance of Recreation Facility	NA	NA	NA
The distance of Trading Facility	NA	NA	NA

Note: A = Available = Affects land prices  
NA = Not Available = No effect on land prices

Based on the multiple linear regression model, land prices in each suburb area are influenced by different independent variables. The price of land in the East Semarang Suburbs area is influenced by distance to the city center and educational facilities. While the price of land in the Suburbs area of West Semarang is influenced by the distance of the city center and health facilities, these two suburb areas are a residential function and have activities that are still dependent on the

city center, so that the city center still has a large influence on the development of this suburban area including the land price. The coefficient on the distance between the location of the location with the city center in the two suburb areas is smaller than the coefficient of distance to the education or health facilities, and this shows that land prices are influenced by spatial conditions.

**Table 2:** Regression results for each part of Semarang City.  
East of Semarang

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	16,261	1,270		12,803	,000
City Center	-,658	,128	-,559	-5,128	,000
2 (Constant)	18,713	1,658		11,286	,000
City Center	-,780	,136	-,663	-5,735	,000
Education Facility	-1,814	,823	-,255	-2,205	,032

a. Dependent Variable: Land Prices

#### South of Semarang

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	15,504	1,634		9,487	,000
Education Facility	-5,050	1,986	-,324	-2,543	,014

a. Dependent Variable: Land Prices

#### West of Semarang

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	1,399	3,893		,359	,721
City Center	6,112	2,146	,429	2,848	,007
2 (Constant)	8,120	4,575		1,775	,085
City Center	7,248	2,066	,508	3,509	,001
Healthy Facility	-9,580	3,931	-,353	-2,437	,020

a. Dependent Variable: Land Price

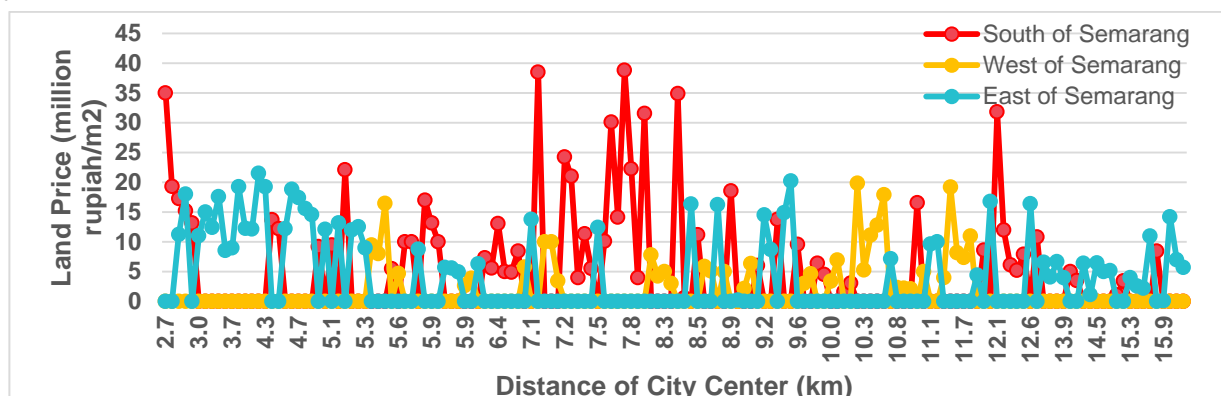
**Table 3:** Regression Equations

Suburbs	Regression Equations
East of Semarang	$Y = 18.713 - 780 X_1 - 1.814 X_4$
South of Semarang	$Y = 15.504 - 5.050 X_4$
West of Semarang	$Y = 8.120 + 7.248 X_1 - 9.580 X_3$

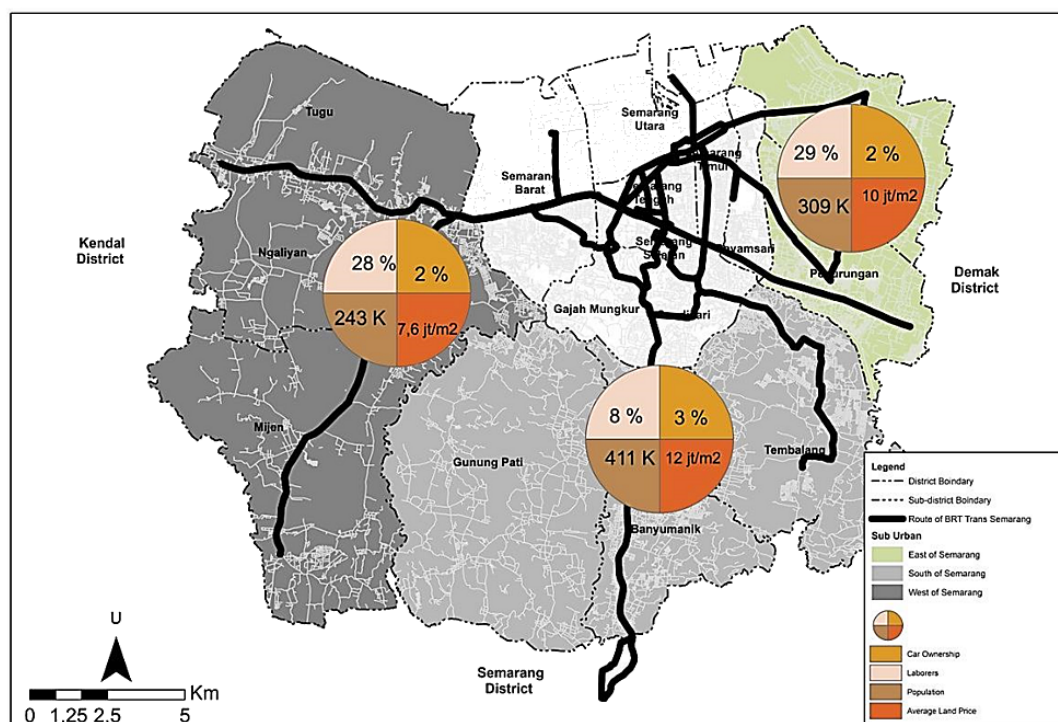
Land prices (Figure 3) in the suburbs of South Semarang are influenced by distance to educational facilities. The distance to the city center does not have a significant effect because, in this region, there are regions that have a national-scale educational function that can attract large activities in the region. So that educational facilities in the region have a significant influence on the development of areas including land use and land prices. The price of land, which is no longer affected by the distance from the city center, shows that the city of Semarang has a polycentric spatial pattern. Polycentric patterns are also seen in land prices in all suburb areas, which are very volatile to the sub-urban center, as in Figure 1d.



Land prices at locations away from the city center do not necessarily decrease, but tend to fluctuate at some points. The results of this study are not in line with Von Thunen's theory that the closer the land point is to the city center, the higher the land price. In line with what was stated by Guangzhong and Quijie (2016) that the formation of urban areas is exogenous and based on CBD when viewed in the gradient of land rent allowing the descending pattern of the CBD but there can also be a maximum upward pattern in sub-center centers even further outside the CBD or downtown. Suburb characteristics also support the growth and development of the area, including demographic data. Including changes in land and land prices in sub-urban areas in Semarang City are also influenced by these characteristics. In this study, the data analyzed were population data, employment data, and private vehicle ownership data.



**Figure 3:** Graphic Relationship between Land Prices and City Center Distance



**Figure 4:** Map of Characteristics of Sub-Urban Areas (the statistical data was from Semarang Central Statistics Agency (2019), and the shapefile from Bappeda Semarang City (2011)).

Based on statistical data (Semarang Central Statistics Agency, 2019) in Figure 4, the percentage of total car ownership in the East Semarang sub-urban area is 2%, in the South Semarang sub-urban area is 3%, and in the West Semarang sub-urban area is 2 %. This shows that

the sub-urban area of South Semarang has the highest percentage compared to other sub-city areas. In Figure 1, the percentage of population-based livelihoods as industrial and construction laborers in the East Semarang sub-urban area is 29%, the South Semarang sub-urban area is 8%, and the West Semarang sub-urban area is 28%. The result shows that the sub-urban area of South Semarang has the lowest percentage compared to other suburban areas. These two data can show that economic conditions in the Suburbs area of South Semarang have higher economic conditions compared to the other two sub-urban areas. This economic level can represent a high quality of life, so people want to buy land at a higher price by choosing land in a better environment. Land prices in the South Semarang Suburbs area also have the highest average land prices compared to other suburb areas. This shows the socio-economic characteristics affect the land selection and, subsequently, the overall price of land area. So it could be that the price of land in a suburban area can be the same or even higher than the price of land in the city center.

## 5 Conclusion

Based on the results of the analysis, it can be noted that land prices are not only influenced by the distance to the city center but more by the location of the spatial land and local factors from the suburbs. Some characteristics can be activities that have high attractiveness. This characteristic is in the form of the socioeconomic population in the area concerned. Also, some facilities have great appeal so that they can affect the price of land at a location, so it does not only depend on the distance from the city center. Besides, the sub-urban center can also influence the price of land, as evidenced by the price of land that tends to rise close to sub-urban even though it is far from the city center.

This is in line with research attraction of a region (Amarin et al., 2019) that can come from various characteristics of urban configurations or urban spatial arrangements (Xiao et al., 2015) that have specific and different attraction forces in each suburbs area. Indonesia, the power of characteristics area, can vary due to the uniqueness of urbanization and complex social-economic activities in developing countries. Therefore, a strong influence on the city center is more easily applied to cities that have concentric structures. However, the results showed that in Semarang, the city structure had shifted from monocentric to polycentric so that the city center did not have a significant influence on changes in land prices and land use in all areas of the city. As with changes in the spatial structure of major Chinese cities (Daquan et al., 2017) from monocentric to polycentric because of increased activity and development of suburban infrastructure.

## 6 Availability of Data and Material

Data can be made available by contacting the corresponding author.

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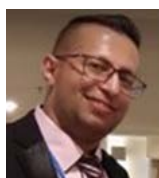
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