



## The Speed of Land Use Changes in The Region of Depok City

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### Article Info

History of Article  
Received April 2020  
Accepted June 2020  
Published August 2020

#### Keywords:

The Speed of Land Use Change, Core Region, Periphery Region, Spatial Analysis

### Abstract

This study aims to analyze the conditions of distribution location, the speed, the development direction and the influence of the accessibility, public facilities, land characteristics (topography), land value and population growth factors on the speed of land use change in the core and periphery regions of Depok City in 2013-2017. The methods used are spatial overlay analysis, the speed of land use change, gravity, scalogram and descriptive analysis. The results showed that the distribution locations of land use change in the core region were spread in the areas that close to the central government of Depok City and has stability with the South Jakarta City. Meanwhile, in the periphery region, it spread in areas that have a large proportion of agricultural land, correlated with the closest cities/ regencies and traversed by the good accessibilities. The speed of land use change in the periphery regions of Depok City occurs faster than the core region, with the direction of development towards the west of Depok City. In addition, there were also found that the factors influenced the speed of land use change in the core region is land value factor. Meanwhile, in the periphery region, it was influenced by different factors in each of the development area, with influential factors such as accessibility, public facilities, land value and population growth factors. Meanwhile, land characteristics factor (topography) does not affect to the speed of land use change in the core and periphery regions of Depok City in 2013-2017.

## INTRODUCTION

In general, the development of a city can't be avoided, both physical development and non-physical development. These conditions bring the potential causes for new growth activity centers that can affect to the land use. The more a city develops, it will increase the space or land requirements, so that also raises the problem of land use change. One of the physical development is like the development of urban spatial structure and the shifting of administrative boundaries from the previous city boundaries to form an area (Yunus, 1978).

JABODETABEK area is one example of the urban physical development that extends beyond the administrative boundaries of a city. JABODETABEK is included in the Kawasan Strategis Nasional (KSN) with DKI Jakarta Province as the "center" and the surrounding area as a buffer zone. The formation of this area has a role and function as the implementation of regional development related to water and soil conservation efforts, flood prevention, and economic development for the welfare of the community.

The dense condition of DKI Jakarta as Pusat Pertumbuhan Nasional (PKN) has caused population movements from the DKI Jakarta area to its closest area (buffer zone), one of them is Depok City. In its role and function in JABODETABEK, Depok City was directed as a buffer city for settlement and water catchment support area for DKI Jakarta Province. Based on its location, Depok City has a strategic location that located directly adjacent to DKI Jakarta and also has accessed by the road infrastructure like Jagorawi Toll Road and Desari Toll Road, as well as the availability of modes or public transportations like *Kereta Rel Listrik* (KRL) which were included in this region. Because of these conditions, Depok City has relatively a rapid development, it can be seen from the population growth of Depok City.

Based from Table 1 it know that the population growth in Depok City has relatively a rapid growth each year. According to Soegimo (2009) this is because the average population

growth of Depok City in above 2% per each year. Where this figure is included in the relatively fast growth of the population.

**Table 1.** Population Growth of Depok City in 2013-2017 (Soul)

Year	Population Growth		
	Total Population (Soul)	Population Growth (Soul)	Percentage (%)
2013	1.962.160	63.593	3,24
2014	2.033.508	71.348	3,50
2015	2.106.100	72.592	3,44
2016	2.157.349	51.249	2,37
2017	2.254.513	97.164	4,30

Source: BPS, Depok City in Figures 2013-2017

Recent changes in population growth according to Lambin et al (2003) said that the urban population has been growing more rapidly than the rural population worldwide, particularly in developing countries. In this case, Depok is "urban areas" in a developing country that has a rapidly increasing population.

In addition, the development of Depok City also can be seen from the economic growth or the rates of Gross Domestic Regional Product (GDRP) on Table 2 down bellow. The economic growth of the Depok City in 2013-2017 is higher than the economic growth of DKI Jakarta and at the JABODETABEK level, the economic growth rate of Depok City is included in the second largest economic growth rate after South Tangerang City i.e. 6,64 – 7,28% in 2013-2017 (Central Statistic Agency, 2018).

Meanwhile, in terms of the land use development, Depok City has decreased in "agricultural land" which tends "fast" categories in the buffer city of BODETABEK areas i.e. 359 Ha of agricultural land in 2013-2017 (Central Statistic Agency, 2018).

This rapid development condition of Depok City has a spatial consequence for lands demand that are increasing, so its resulting to the dynamics or speed of land use change. According to Yunus (2008) the speed or dynamics of land use change is the rate or

intensity of land use change, it is occurs from time to time.

Based on an interview with Mrs. Herni as Head of the Infrastructure and Development Section of the BAPPEDA in Depok City, said that land use changes in the Depok City it occurs unevenly in each development regions which called PPK and SPK regions. This condition has a led to the shift in land function, both in the core and periphery regions of Depok

City and it was called *Pusat Pelayanan Kegiatan* (PPK) or PPK Margonda for the core region. Meanwhile, *Subpusat Pelayanan Kegiatan* (SPK) for the periphery region. There have been 5 periphery regions of Depok City, as follows: SPK Cinere, SPK Sawangan, SPK Cipayung, SPK Tapos, and SPK Cimanggis. The land use change in the core and periphery regions of Depok City it have different speed or intensity of land use change between.

**Table 2.** Economic Growth of Depok City in JABODETABEK Level in 2013-2017

Cities/Regencies	Economic Growth				
	2013	2014	2015	2016	2017
South Jakarta	6.26	6.03	6.12	6.14	6.32
East Jakarta	5.89	6.14	5.5	5.87	6.21
Central Jakarta	6.08	5.83	6.67	6.36	6.02
West Jakarta	6.08	5.96	6.01	6.07	6.41
North Jakarta	6.66	5.79	5.59	4.62	6.36
Bogor Regency	6.14	6.01	6.09	6.1	5.96
Bogor City	6.04	6.01	6.14	6.73	6.12
Depok City	6.85	7.28	6.64	7.28	6.65
Tangerang Regency	6.41	5.39	5.09	5.1	5.21
Tangerang City	6.52	5.15	5.37	5.31	5.91
South Tangerang City	8.75	8.05	7.25	6.85	7.43
Bekasi Regency	6.23	5.88	4.47	4.99	5.78
Bekasi City	6.04	5.61	5.57	6.09	5.73

Source: BPS, Various Cities and Regencies in Figures 2013-2017

On the otherside, based on an interview with Mrs. Fani from *Dinas Ketahanan Pangan, Pertanian dan Perikanan* (DKPPP) of Depok City, said that some peripheral regions of Depok City still have a potential of agricultural land which also began to diminish due to pressure from the surrounding areas.

The more intensity or the speed of land use change increasing too fast, it will have an impact on the carrying capacity of the land function if these conditions are not controlled. According to Yunus (1999) the increasingly crowded conditions of the city, it will be a decline in the functions of the city structure that

can lead to urban environmental deterioration in the core region, Meanwhile in the periphery regions there will be the speed or dynamic of land use change with “quite high” category. This is due to the conversion of agricultural land into non- agricultural land which very high volume and frequency, so that the land use change will occur very quickly.

According to Lee (1979) there were several factors that influenced the speed of land use change, namely the accessibility, public facilities and land characteristics (topography) factors. Meanwhile, according to Chappin (1979) the factors that influence the speed of

land use change is topography, population, land value, accessibility, facilities and infrastructure factors. Summarizing, in this study used the accessibility, public facilities, land characteristic (topography), land value, and population growth factors.

Based on the conditions and background of the problem above, it makes the speed of land use change analysis is interesting and need to be observe. Because, the land has a dynamic nature and strategic resource. In addition, with this analyze also will know the intensities of land use change each year, so in the review of *Rencana Tata Ruang Wilayah* (RTRW) which is reviewed every 5 years. The areas that have a high speed of land use change can be controlled for development.

**RESEARCH METHODS**

This study used the primary data and secondary data. The primary data was obtained from interview and field observation techniques, where the interview is carried out with a keyperson from *Badan Perencanaan dan Pembangunan Daerah* (BAPPEDA) of Depok City and *Dinas Ketahanan Pangan, Pertanian dan Perikanan* (DKPPP) of Depok City. Meanwhile, the secondary data was obtained through documentation or literature study methods from *Badan Pusat Statistik* (BPS), *Dinas Pekerjaan Umum dan Penataan Ruang* (PUPR) and *Badan Keuangan Daerah* (BKD) of Depok City. While the analysis method used a spatial overlay analysis to determine the distribution location and direction of development, the speed of land use change analysis, gravity analysis to determine the accessibilities, scalogram analysis to determine the number of facilities that are available and descriptive analysis with value comparison to determine the factors that affect to the speed of land use change.

The steps used in spatial analysis in this study are using overlay techniques such as research from Yang et al (2017) where the basic idea is firstly to analyze changes in land use and land cover using remote sensing data and then classify the various land use change forms; secondly, to determine the driving factors

influencing changes in land use; thirdly, to undertake spatial overlay analysis between the various natural driving factor maps and land use change maps, respectively, and to calculate the probability of each land use in each grid; fourthly, to distribute the total area of each land use into the spatial grids based on the probability in each grid according to spatial allocation principles or approaches; finally, to calibrate the model results compared with base data, such as the administrative maps.

The speed of land use change measured by the formula of Rahmatullah and Idajati (2016), as follow:

$$V = L/t.....(1)$$

Source: Rahmatullah and Idajati (2016)

Where; V : The Speed of Land Use Change (Ha / year); L : Land Area Changes (Ha); T : Time Lapse (years).

The analysis output result, then grouped according to the its speed parameter, as follows:

**Table 3.** The Speed of Land Use Change Parameter

No	Explanation	Categories
1	$V_i > V_{average}$	Fast
2	$V_i = V_{average}$	Medium
3	$V_i < V_{average} > 0$	Slow
4	$V_i = 0$	Not Change

Source: Rahmatullah and Idajati (2016)

Meanwhile, the gravity analysis used a formula according to Tarigan (2005), as follow:

$$T_{ij} = \frac{P_i P_j}{d_{i,j}^b} (F_{zi}).....(2)$$

Source: Tarigan (2005)

Where;  $T_{ij}$ =Accessibility from i to j region;  $P_i$ =Total population in i region (analyzed region);  $P_j$ =Total population in j region (core region);  $D_{ij}$ =Distance from i to j region;  $B$ =Rank of b (b = 2);  $F(Z_i)$ =The attraction of i region, can also calculated as b.

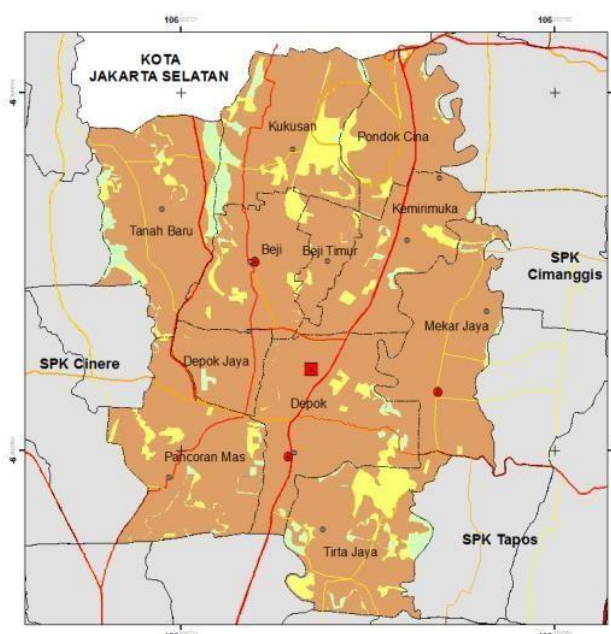
The distribution location of land use change variable in this study is the place of land use change, it from non-developed land into a built-in land measured with villanges for unit.

Meanwhile, the speed of land use change is measured of land use change intensities from non-developed land into built-up land that permanent Conditions (in Ha/year). Furthermore, the direction development of the speed of land use change variable is a spatial orientation with seeing the direction movement of the speed of land use change. It is measured based on the direction of the compass from the map. As well as influential variables which consist: (1) accessibility factors the ease of society in achieving a particular object from one area to the core area. It is measured by the value of gravity analyze; (2) public facilities factor which are many types of public services for the community included socio-economic facilities and measured by unit type; (3) land characteristic which is the slope of the land or topography based on meter above the sea level (mdpl); (4) land value factor measured on nominal prices for certain units of area. Land value in this study measured by *Nilai Jual Objek Pajak* (NJOP) in the regions of Depok City with IDR/m<sup>2</sup> for unit; (5) population growth factor is in the number of individuals or the population in a region certain period of time with soul for unit.

## RESULTS AND DISCUSSION

Based on the results of spatial overlay analysis, the condition of the distribution locations of land use change from non-developed land to built land (irreversible) in the core region (PPK Margonda), there were dominated occurs in: (1) Kukusan (2) Tirtajaya (3) Pondok Cina Villages. When viewed from its distribution, the location of the biggest land use change in core region occurs spread in the areas (villages) that closest to the Depok government center and has a stability with the South Jakarta City as *Pusat Kegiatan Nasional* (PKN).

This happens because the Kukusan and Pondok Cina villages are located directly adjacent to South Jakarta City and Tirtajaya village which closes to the central government of Depok City. The form of land use changes in the core region generally has dominated by permanent changes, with a form of change that used from agricultural land (mixed gardens, paddy fields or vacant land) that changes to become built in areas (for residential or commercial lands



**Figure 1.** Land Use Change in Core Region of Depok City 2013-2017

Source: Dinas PUPR Depok City, 2019

Where; Yellow= change permanently; Brown= fixed; Green= change not permanently

Meanwhile, in the periphery regions of Depok City these distribution location of changes occurs in villages, as follows:

**Table 4.** Distribution Location of Land Use Change in Periphery Regions of Depok City

No	SPK	Villages
1	SPK Cinere	Grogol, Rangkapan Jaya and Pangkalan Jati
2	SPK Sawangan	Bedahan, Pasir Putih and Pengasinan
3	SPK Cipayung	Cipayung Jaya, Cipayung and Bojong Pondok Terong
4	SPK Tapos	Cimpaean, Jati Mulya and Kalimulya
5	SPK Cimanggis	Cisalak, Tugu and Curug

In general, the distribution locations of land use change in this region were spread in each villages in the SPK region which still has a largest proportion of agricultural land, correlated with the closest cities/ regencies (interested in JABOTABEK) and traversed by the good accessibilities (the primary or secondary arterial roads and toll road as well). The result of spatial analysis can seen from the Figure 2 down bellow.

In Figure 2 the results of the spatial overlay analysis showed that the "yellow areas" in it maps were areas that experience permanent of land use changes; in "green areas" there were non-permanent or temporary changes, while in "brown areas" there areas were not changes.

The form of land use change in peripheral region dominate has changed from the agricultural land (mixed garden and vacant lands) that hasbeen converted into built-upland (settlement) or non-built land (paddy land/ agriculture into mixed garden or even vacant lands).

In terms of the conditions, land use change in core region is more critical in Depok City. Because the condition of PPK Margonda

was already dense with built up land which utilized as a central government, commercial, educational and residential areas. In addition, this region also has a proportion of agricultural land or vacant land smaller than the periphery region. Likewise, the form of land use change which is dominated by permanent change.

These conditions of the distribution locations of land use change in the core and periphery regions of Depok City is in line with the theory of Bintarto (1983) which revealed that land use changes will be distributed or spread to certain places or locations that have a potential land used and close to city center. In addition, when compared with research from Rachmatullah and Idajati (2016) the potential land use condition is also in line with the results of this study, where the location of the land use changes in the study also occurs spread around the land who has a good or potential land used.

Next, the speed of land use change variable in the Depok City. Based on the speed of land use change analysis showed that each development regions in Depok City has a different speed or intensity of land use change, with the speed of land use change in peripheral region has a faster than the core region. It can be seen from the Table 5 down bellow.

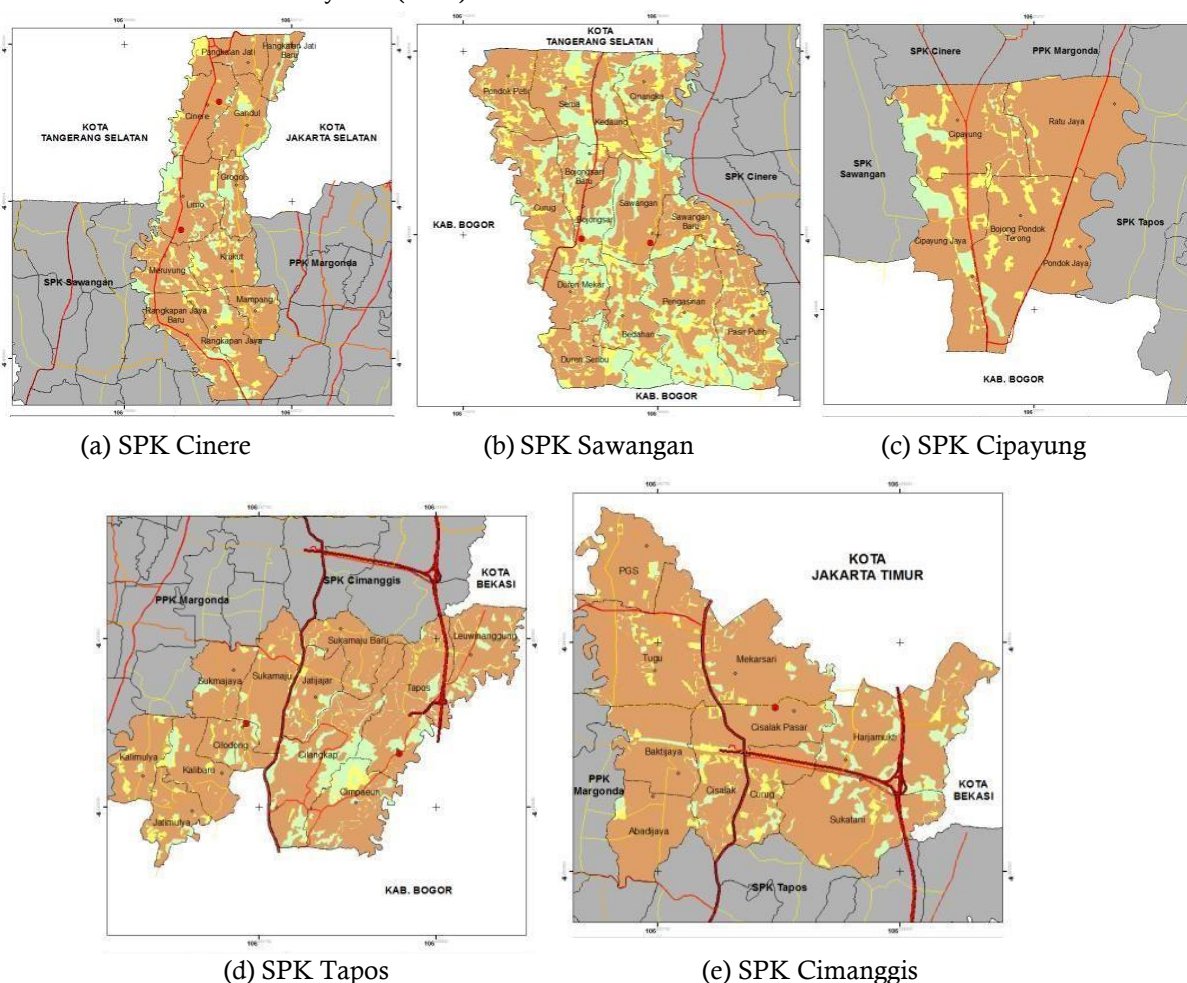
Based on this table it can be seen that 3 out of 5 peripheral regions in Depok city are categorized as fast land use changes rate. This is because the three regions, namely the SPK, Cinere, SPK Sawangan and SPK Tapos has an average rate of land use change above the average of land use change speed at the Depok city level.

When compared, these conditions in accordance with revealed theory by Yunus (2000) which reveals that the speed of land use change in peripheral regions tend to be faster than in the core region, because the periphery region is an area with a conversion phenomenon from rural land (agricultural/non-developed) becomes urban land (developed). In addition, when the core region is no longer able to provide the new residential land. Therefore, the potential land for settlements are agricultural land around the periphery regions, so that in

these peripheral regions the rate of speed of land conversion tend faster than the core region.

In addition, the results of this study in line with research from Hariyanto (2010) which

said that the intensity of land conversion occurs more rapidly in rural areas because these areas are targeted for urban development.



**Figure 2.** Land Use Changes in Pheriphery of Depok City 2013-2017

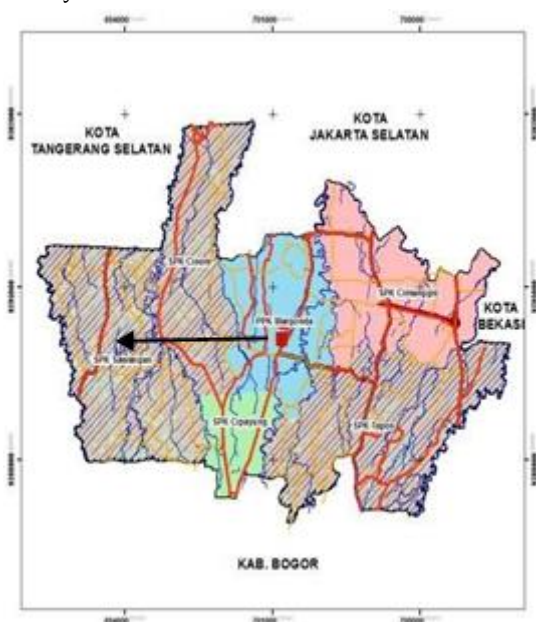
**Table 5.** The Speed Categories of Land Use Change in Core and Periphery Regions of Depok City

No	Regions	PPK/SPK	The Speed	Categories
1	Core Region	PPK Margonda	3,98 Ha/year	Slow
2	Pheriphery Regions	SPK Cinere	4,53 Ha/year	Fast
3	Pheriphery Regions	SPK Sawangan	8,23 Ha/year	Fast
4	Pheriphery Regions	SPK Cipayung	3,36 Ha/year	Slow
5	Pheriphery Regions	SPK Tapos	4,20 Ha/year	Fast
6	Pheriphery Regions	SPK Cimanggis	3,19 Ha/year	Slow

Next, the direction development of the speed of land use change in Depok City based on the spatial overlay analysis showed that the direction development was directed to the “west” of Depok City, with its moved out from

the core region towards the periphery region. This indicates that the direction of development dominated occurred in *Sub pusat Pelayanan Kegiatan* (SPK) which been located in the west of *Pusat Pelayanan Kegiatan* (PPK), including the

SPK Cinere and SPK Sawangan. This condition in accordance with the theory of Yunus (2000) which reveal that the direction development of land use changes in this region occurs due to the expansion of the core region to the nearest area or the surrounding area, which in the case means that the direction development of the speed of land use change is expanding from the downtown area/core region to the periphery, so the result of this study is in accordance with its theory.



**Figure 3.** Direction Development of the Speed of Land Use Change in Depok City in 2013-2017

Based on descriptive analysis method by comparing values between the variables, the results showed that the factors influenced to the speed of land use change in Depok City, that is the accessibility factor, it was influenced to the speed of land use change in one of the peripheral region, there was SPK Tapos, with the positive direction. This condition indicates that when the accessibility increases, it will raise to the speed of land use change. Due to the ease and advantage of mobilizing to the core region. This condition is in line with the theory of Yunus (2008) which states that an area or region that has high accessibility, it will have been an appeal stronger than an area that has low accessibility so that the dynamics of the speed of land use change will happen so fast.

The result of this study is supported by the research from Kusri et al (2011) which explains that accessibility factor can affect on the speed of land use change and has a positive correlation, and also supported from research from Munawir et al (2019) which reveals that the element of "distance" used in the accessibility factor has an influence on the dynamics / speed of land use change.

On the factor of public facilities, this factor also influenced the speed of land use change, with a positive direction in the periphery region of Depok City in 2013-2017 there were SPK Tapos and SPK Cimanggis. That means, the more complete the types of public facilities available in a region, it will increase the speed of land use change. This condition is in line with the theory by Yunus (2008) which reveals that the more types of facilities and infrastructure (public facilities) that concentrated in a region, it will increase the appeal to the population and urban functions.

In addition, the results of this study are in line with the research of Putra and Pradoto (2016) which reveals that the speed of land use changes was influenced by public facilities, these variables have a positive correlation between. And also supported by the results of Wibiseno's (2002) research who said that the factor of public facilities has a strong correlation with the speed of land use change.

On the land characteristic (topography) factor, this factor not influenced the speed of land use change, both in the core and periphery regions of Depok City in 2013-2017. That because Depok City is an urban region which has land characteristic (topography) not much different and belongs to average bumpy land and sloping topography category. This condition based on the theory of classification of land characteristics according to Dibyosaputro (1997) down below.

In addition, according to Sastra and Marlina (2005) which reveals that the land with similar characteristic will have the same development potential to serve as residential areas. This condition usually occurs in urban areas where the average of land characteristics



are relatively gentle with a small slope. The results of this study are different with research from Munawir et al (2019) which states that the topographic factor has an influenced the speed of land use change. This condition is different because the research was conducted in Gowa Regency which has a more varied topography and uses a lot of land with a “slightly steep slope” to agricultural activities with the main commodities in the form of tubers, carrots and potatoes. So in these areas, land characteristics (topographic) factors have influenced the speed of land use change.

**Table 6.** Classification of Land Characteristics / Topography in Depok City

PPK/SPK	Height Difference	Categories
PPK Margonda	13	Bumpy land with sloping topography
SPK Cinere	27	Bumpy land with sloping topography
SPK Sawangan	46	Bumpy land with sloping topography
SPK Cipayung	0	Flat Topography
SPK Tapos	21	Bumpy land with sloping topography
SPK Cimanggis	90	Bumpy hill land with medium sloping topography

Source: Dibyosaputro (1997)

Furthermore, the land value factor which based on the results of the study, it has influenced to the speed of land use change in the core region (PPK Margonda) and the periphery region (SPK Cinere and SPK Sawangan) in 2013-2017, with the positive direction. That means the more land value highly, raises the speed of land use change will be. This condition is in line with the theory of Chappin (1979) which revealed that land value factor affect to speed of land use changes. Because the more high the land value, it will stimulate land owners or stakeholder to sell their land. On land with high value, it will be able to shift business

activities that have low land values, so that can affects to the speed of land use change. In addition, according to the theory of Rustiadi et al (2009) which reveals that the correlation between land value and land use change is very closest because land use tends to change from activities with low value to activities with high values.

This is also in accordance with the research of Wibiseno (2002) which reveals that the land value is directly proportional to the speed of land use change. This means when land value increasing, it will increase the speed of land use change, and vice versa.

Finally, the population growth factor, where this factor influenced and has a positive direction on the speed of land use change in the periphery regions (SPK Cinere and SPK Cipayung). That means, the more increase the population growth who concentrated in aregion, the more raises the speed of land use change will be. This situation in line with the theory of Chappin (1979) which reveals that the population is one of the factors that influence the speed of land use change. The increasing population growth, it will increase the dynamics of land use change quickly.

In addition, this condition also supported by the results of research from Yusran (2006) which said that the factor of population growth has positively related to the speed of land use change. Population growth in an area will always be followed by an increase in demand for residential land in the area.

## CONCLUSION

The results of the study showed that the distribution locations of land use change in the core region of Depok City in 2013-2017 were spread in the areas which close to the central government of Depok City and had stability with South Jakarta City. Meanwhile, in the periphery regions, it spread in areas that have a large proportion of agricultural land, correlated with the closest cities/regencies and traversed by good accessibilities. The speed of land use change in the periphery region of Depok City occurs faster than the core region, with the

direction of development toward the west of Depok City. In addition, there were also found that the factors influenced the speed of land use change in the core region is land value. Meanwhile, in the periphery region was influenced by different factors in each development area, as follows: (1) SPK Cinere with influence factors are the land value and population growth factors, (2) SPK Sawangan with influence factor is land value factor, (3) SPK Cipayung with influence factor is the population growth factor, (4) SPK Tapos with influence factors are the accessibilities and public facilities factors, and (5) SPK Cimanggis with influence factor is public facilities factor. Meanwhile, land characteristics factor (topography) does not affect to the speed of land use change in the core and periphery regions of Depok City in 2013-2017.

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