



Spatial And Temporal Variation of Land Price in Gasabo District

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ABSTRACT

Land resources are fixed while land users are usually dynamic. Thus, the demand on land is higher than the supply of land resources leads to the increase of land prices and value. Land is too expensive in core urban areas than peri-urban areas due to high plot accessibility to infrastructures and economic activities. Indeed, land is not sold and compensated at equal price, even if land parcels have equal size and same location. Therefore, the variation of land prices is a critical issue that needs to be assessed in order to know the driving factors to the spatial and temporal variation of land prices. In this regard, we conducted the study of assessing the spatial and temporal variation of land prices in Gasabo District.

In this research, we have analyzed the spatial and temporal patterns of land prices in last ten years from 2009 up to 2018, the rate of land prices increase from 2009 to 2018, current cost of average land parcel for residential houses in developable sectors, the driving factors of spatial and temporal variation of land prices, the impact of variation of land prices on housing and infrastructure provision and its impact on community living condition. Finally, the research proposes the alternative measures that should be taken into account to control land prices variation in Gasabo District. The research objectives have been achieved by using various methods and techniques such as online research that help us to understand the concepts of the research topic, interview with sector land officers and land brokers where the interview guides were used in data collection, and spatial data analysis using ArcGIS software. Spatial and non-spatial data collected from the field were manipulated as a charts and scatterplot by using Microsoft excels and Statistical Package for the Social Sciences (SPSS).

We found that the land prices in Gasabo District have been increased from 2009 up to 2018 and also, the variation of land price in time and space is due to the high land accessibility to roads, markets, electricity lines and electrical facilities, water utilities and water facilities, population growth, access to health and education facilities, topographic nature of plot, distance from CBD, distribution of public facilities, approved local development plans and also, land use and zoning regulations and categories are the most driving factors to spatial and temporal variation of land prices in Gasabo District. This research found that high price of land leads to high cost of housing construction and the low income earners are discomfited to be neighbors of those with high income. It is not easy to compensate for new planned infrastructures and it is costly to relocate people for infrastructure provision in an area with high land prices.

In order to control the variation of land prices in Gasabo District, Institutes of Real Property Valuers (IRPV) should updates reference land prices at most every two years from provincial to village level in order to guide land sellers and buyers. Land brokers and housing construction related business have to be managed by Gasabo District in order to avoid inappropriate way of pricing land. Rwanda Transport and Development Agency (RTDA) in collaboration with Ministry of Infrastructure (MININFRA) should balance the establishment of infrastructure and other urban amenities to equalize the development of all sectors.

Keywords: Land, Spatial and Temporal variation, Land market, Land price and Land value.

1.1 Introduction

Land is the key factor of production on which economic well-being, social ability of individuals, families and nations are based on. Land is defined as a terrestrial bio-productive system that comprises soil, vegetation and other biota, the ecological and hydrological processes that operates with the system (Helen 2019). The land resources are fixed while land users are increasing.

This is the case of Rwanda, that faces an acute land pressure. According to National Institute of Statistics of Rwanda (NISR), Rwanda is among the most populated countries in the world with its fixed surface area of 26,338 km² with a national population density of 415 people per km² (NISR, 2012). The demand for land exceeds the resources supplied by the land since the land is a finite and fixed resource. The concentration of people in certain region leads to the high price of land. Mostly, the price of land decreases from urban areas to rural areas. Moreover, the land price is determined by the market expectations of its future developments or present policy instruments (Wang, Liu & Zha; 2011).

The rapid population growth in the urban areas resulted from the movement of people from rural to urban leads to urban land scarcity where land price is higher compared to land in rural areas. Such an increase in

value of land is influenced by different factors such as the availability of infrastructure, population changes, location, social economics, government regulations, and desirability for residents as a place to live, vicinity to school and park, road accessibility, distance of retail establishments and also the surrounding improvements made by the community (Nkurunziza 2016). The value of urban land is very high closely to Central Business District (CBD) where people are attracted by infrastructures, civic services and other economic developments then high value. The existence of High demands and populations put the pressure on supplied land within an area.

According to the law Zhan No. 17/2010 of 12/05/2010, land values and land reference prices for property development in Rwanda are provided by the Institute of Real Property Valuers (IRPV). The land reference price indicates the price of land per square meter in various regions. The IRPV takes into considerations of all factors of uniqueness of properties in the country during determination of land price (IRPV, 2018). Nevertheless, negotiation is popular methods in determining price of a land in Rwanda between land seller and buyer, where the seller begins with high price than the buyer. Sometime, the friends and land brokers mediate them to an agreed price.

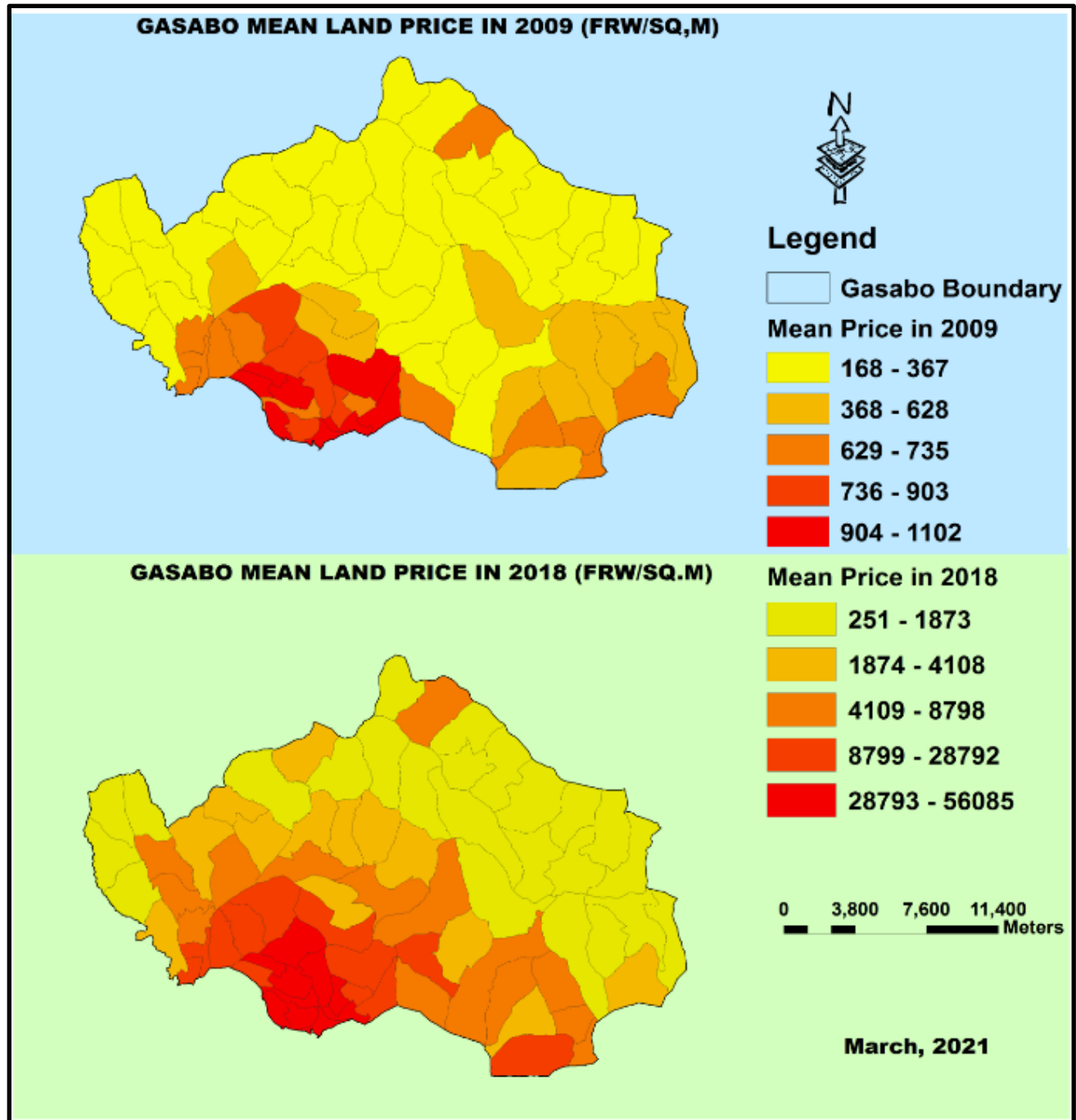


Figure 1 Map showing Gasabo mean land price in 2009 and 2018

(Source: Ministerial order No 001/16.00 of 23/11/2009 and IRPV, 2018 reference land price and interpreted by the authors)

Like other places in Rwanda, land prices in Gasabo district vary from one place to another even parcel to parcel with respect to

time, this simply indicate the spatial and temporal variation of land price. The spatial and temporal variation refers to the variability with respect to space and time. In this regard, there is a need to assess the driving factors of spatial temporal variation of land price in Gasabo District.

In Rwanda, the people are converging towards the city of Kigali leading to high demand for lands for housing. While huge migration of people in City has agglomeration advantages, influence the economic growth and development, when not planned, it also leads to uncontrolled expansion and soaring land prices. In 2001, Kigali covers 314 Km² with 605000 inhabitants. Its surface area enlarged to 731km² in 2006 with inhabitants of 1 million, Kigali's surface area remains constant from 2006 but urbanization is still taking place as the population is migrating from rural-Kigali city.

In 2012 and 2020, population increases up to 1.2 million and 1.6 million respectively. Once migration continues, the population will increase up to 3.8 million in 2050 (Surbana, 2020; NISR, 2012). Though, the land resources support day-to-day people's life, the land is immobile and it can be neither moved nor produced but land is fixed in supply (Burian, 2018). Furthermore, the inability to move land or to produce more of it makes land a scarce resource which is very expensive.

Moreover, land is very expensive especially in urban areas; because of land is subdivided

into smaller parcels due to population pressure in order to increase supply and financial returns and also, the land is too expensive in core urban areas than peri-urban areas due to high plot accessibility to infrastructures and economic activities (Locke & Henley, 2016). Land is not sold and compensated at equal price, even if land parcels have equal size and same location. In Kenya, land price growth accelerated marginally in the city of Nairobi and slowing down in the city's satellite areas. The same trend of land was also observed in Dar-es Salam where prices variation depends on proximity to locational advantages, communicational networks, land quality and present land law (Valley, 2019; Kironde, 1995).

Based on the reference land prices during 2015-2018, the land price per square meter are not equal for all places in Gasabo District and other areas in general. Whereby, the mean land price in Kacyiru and Rutunga sector in Gasabo District is 35098 frw/m² and 2094 frw/m² respectively. And also, the land price in Kimihurura is higher than land price in Gikomero Sector where Kimihurura has reference price of 48150 frw/m² and the price in Gikomero is 1287 frw/m² (IRPV, 2018).

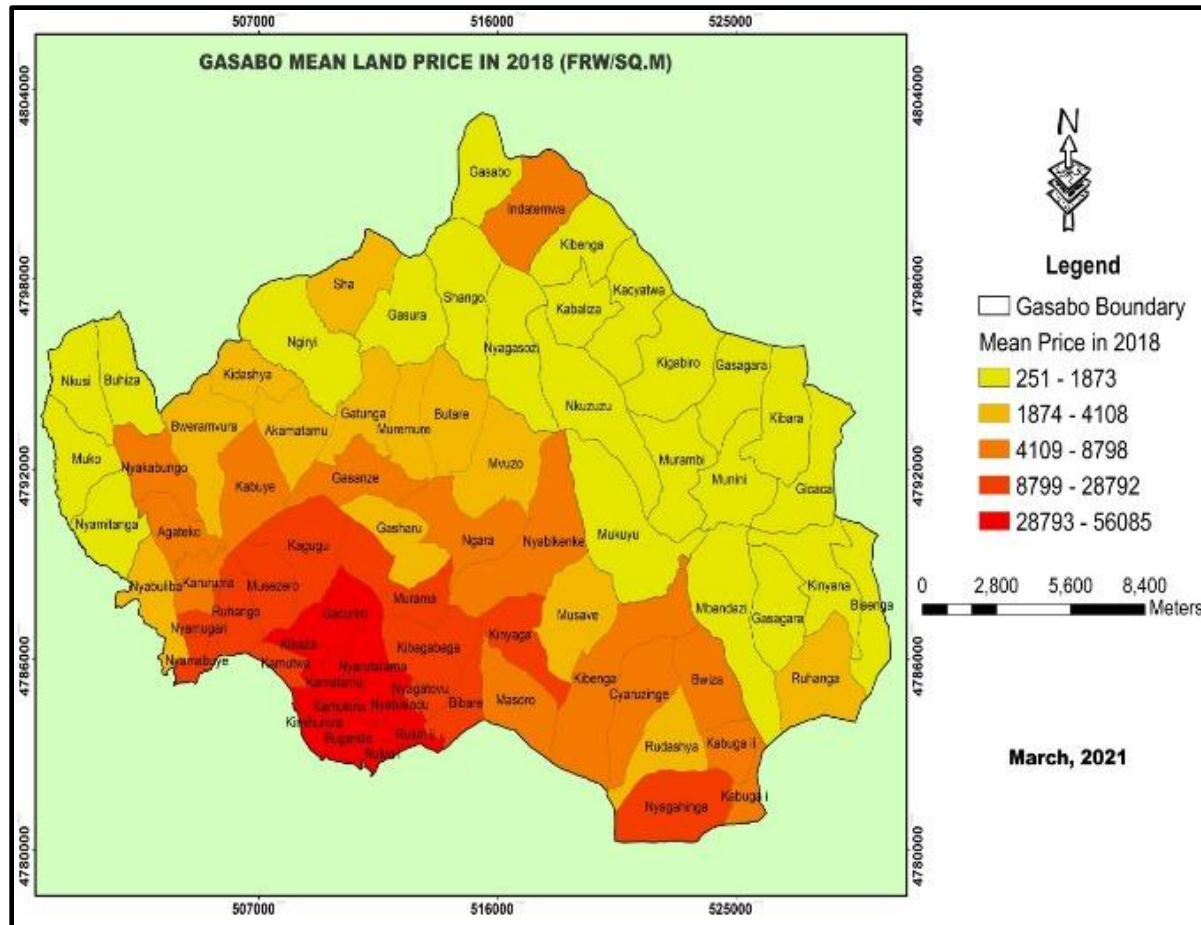


Figure 2 Map showing Gasabo District mean land price in 2018
(Source: IRPV, 2018 and interpreted by the authors)

In reality, a few studies have been carried out to assess the factors influencing the land prices and land values in Kigali City, especially in Gasabo District. From literature, these factors may include for example land location, employment opportunities, accessibility to amenities and services, infrastructures and other facilities (Keima, 2014). The effects of urban land market dynamics and land prices variation on livelihoods, on housing condition and infrastructures provision have been conducted by various researchers in other countries (UN- HABITANT, 2010). However, there has no study done in urban

areas of Rwanda for assessing the factors influencing the land price variation in space and time in Rwanda and in Gasabo District. This research is therefore aiming at assessing the driving factors of spatial and temporal variation of land price in Gasabo district. This has been achieved by using a spatial and temporal assessment approach supported by a Geographic Information System (GIS) which integrates existing spatial data and information collected from, local authorities' ideas, land brokers, existing documents and spatial analysis of study area.

factors of land price and value change (Topçu, 2009).

So far, few studies trending of land market values, land prices and policies on people's livelihoods have been conducted in Rwanda done on through discovering the driving

factors that are causing the diversity of land price and land market value together with the implementation of the land policies and regulations (Keima, 2014). This research is aiming therefore to assess the driving factors of spatial temporal variation of land price in Rwandan urban areas especially in Gasabo District.

CHAPTER 3. DATA AND METHODS

This chapter involves investigation of methods for collecting and organizing data and conducting rigorous research and also, it shows the overall strategies to achieve research objectives. It begins by description and delimitation of study area and ends with data collection methods.

3.1. Description and Delimitation of study area

Kigali is a capital city of Rwanda with three Districts including Gasabo, Nyarugenge and Kicukiro. Gasabo District cover 429.2km² and it is the most populated district with 529,561 residents, which represent 46.8% of the total population of Kigali city. Whereby, 274,546 are males while females are 255,015

with sex ratio of 107 male per 100 women. It also has population density of 1234 per sq.km and 5.2 percent as its population growth rate. Gasabo has 15 sectors that are; Bumbogo, Gatsata, Gikomero, Gisozi, Jabana, Jali, Kacyiru, Kimihurura, Kimironko, Kinyinya, Ndera, Nduba, Remera, Rusororo and Rutunga. Kinyinya and Kimironko are the most populated sectors with 57,846 and 57,430 respectively. Nevertheless, Gikomero and Rutunga are less populated sectors in Gasabo District, where Gikomero has 16,625 inhabitants and Rutunga has 17,906 inhabitants (NISR, 2012). Gasabo has 73 cells and 501 villages (imidugudu), it is bordered by Kicukiro District in the south, Rulindo and Gicumbi Districts in the North, Rwamagana District in the East and Nyarugenge District in the West. Being located in the urban area is an opportunity for business and population development where the biggest share of the district's population lives from off-farm activities like small businesses, handcraft and others (Gasabo District, 2013). Furthermore, the study area is described from national to district and sector level.

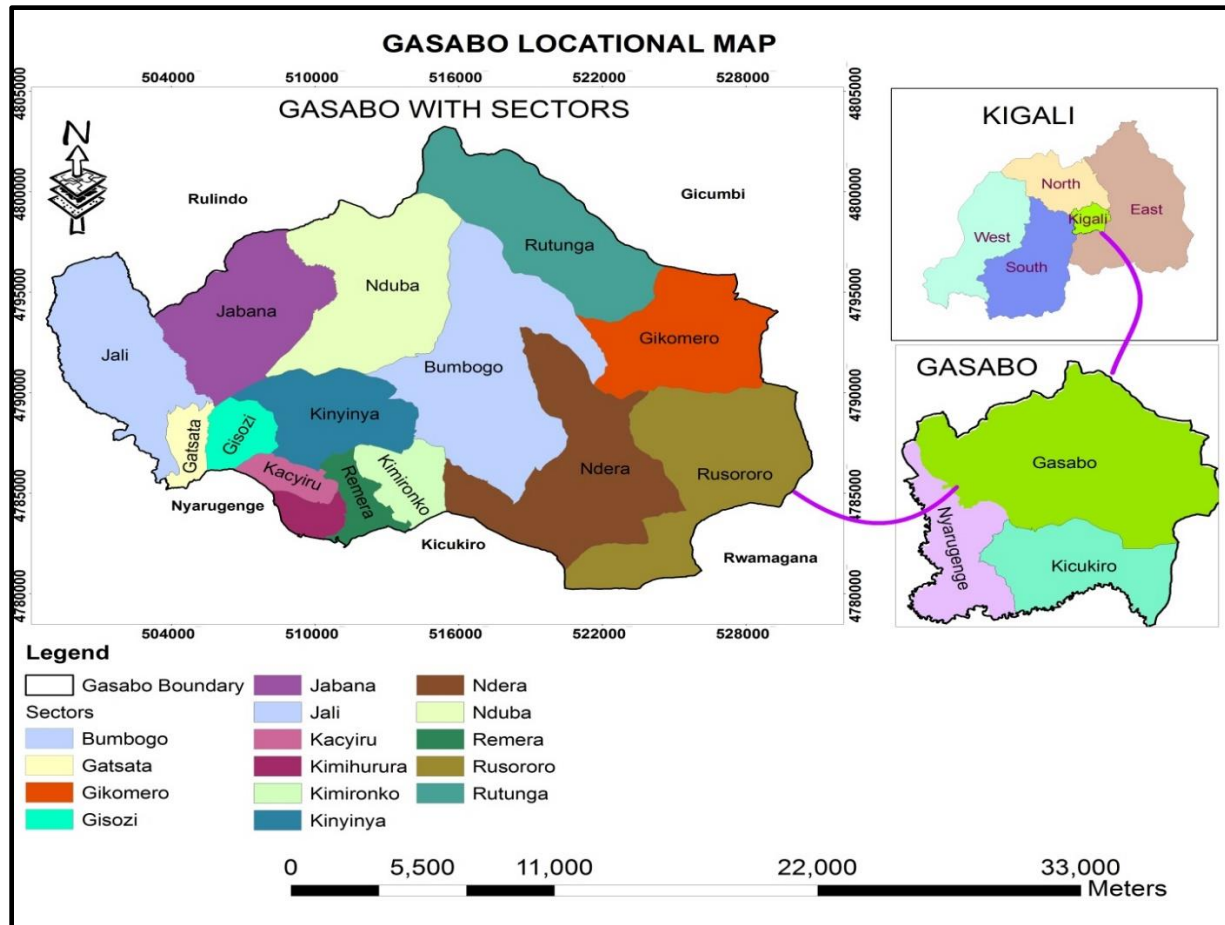


Figure 3 Map showing location of Gasabo District

3.2. Data collection methods

Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer state research question and evaluate outcomes. In facts, the goal for all data collection is to capture quality evidence to answer question that have been posed. Data collection is one of the most important stages in conducting research. You can have the best research design in the world but if you cannot collect the required data, you will not be able to complete your project. (Muhammad & Kabir, 2018). This section summarizes both primary and secondary data collection that has been used in this research. Whereby, the data gathered were also based

on types of data collection methods and techniques that have been chosen and applied.

3.2.1. Primary data collection

Primary data is the one, which is collected for the first time by the researcher with aim of getting solution to the problem at hand. Primary data sources are as follow; surveys, observations, experiments, questionnaire and personal interview (Vector, 2017). Truly, the key point is that the data you collect is unique to you and your research where no one has access to it until you publish it. In this research, interview method has been used in collecting the data for land price.

3.2.1.1. Interview

An interview is an appropriate method when there is a need to collect in-depth information on people’s opinions thoughts, experiences

and feelings. This research has been conducted in Gasabo District, the cluster and purposive sampling has been applied as sampling strategies in order to get an interviewee. Indeed, the total population was grouped in sectors with its land prices as clusters. And the researchers selected the households to be interviewed based on the purpose and objectives of the research. The interviewees have been chosen on the basis of various parameters including the desired degree of precisions, timing and the budget. Due to limited time, effect and measures of Covid-19 and budget, fifteen interviewees were chosen from sectors which have high land prices including Kimironko, Kinyinya, Gisozi, Gatsata, Kacyiru, Kimihurura and Remera sector. Whereby, seven interviewees were the land officers and other seven were land brokers from above mentioned sectors and one land officer from district level. Unfortunately, ten people were interviewed including seven sector land officers and three land brokers from Kimihurura, Gisozi and Kimironko sector.

Normally, the quality of data collected in an interview depends on both interview design and on the skills of the interviewer, we used semi-structured interview where interview guide was used as a most tool during interview session. It was consisted of a list of high-level questions that you want to be answered by interviewees. The interview technics helped us in gathering information by talking to land officers and land brokers in order to know the most driving factors of spatial and temporal variation of land prices, impact of land price variation on both housing and infrastructure provision and also to propose the alternative measures that should be taken into account to control land price variation in Gasabo District.

3.2.2. Secondary data collection

According to Victor, defines Secondary data as the data that have already been collected

from primary sources and made them readily available for researchers to use for their own research, data which are collected by someone else earlier and made it available to be used by another researcher. Furthermore, the secondary data collection sources are government publications, websites, books, journal articles and internal reports (Vector, 2017). In this research, we used online research and spatial data analysis to review and analyze data for spatial temporal variation of land prices from different scholars. Furthermore, the spatial data that has been collected and integrated into GIS, these data include quantitative data of land prices at cell level, infrastructures like roads, markets, electricity lines and electrical facilities, water utilities and water facilities, location of CBD, educational and health facilities, government institutions, building footprints, zoning categories, public facilities, approved Consolidated Local Development Plans and topographical data (slope).

3.2.2.1. Online research

Online research is the straight forward, assessing introduction to social research online. In this research various published materials from internet were used including articles, websites, online books, and journals to define and understand different concepts related to land and land price variation. Whereby, reference land price established by Institute of Real Property Valuers, ministerial order No.001/16.00 of 23/11/2009 and other readings were highly used to obtain the required data.

3.2.2.2. Spatial data analysis

According Xiaoyi and Tao defines spatial data analysis as set of techniques to describe and visualizes spatial distributions, discover patterns of spatial association, identify atypical observations and suggest different spatial regimes or other forms of spatial heterogeneity (Xiaoyi & Tao, 2012).

Geographic information systems are considered to perform basic functions on spatial data analysis such as; capture, input, store, analysis and output (Chatterjee, 2010). The land price data used in this study were obtained from published materials, the Ministerial order No.001/16.00 of 23/11/2009 determining the reference land prices in city of Kigali and the official Gazette No. special of 08/11/2018 prepared by Institute of Real Property Valuers (IRPV) which determined the reference land prices in 2018. Both 2009 and 2018 reference land prices are in pdf format and the prices are expressed in Rwandan francs per square meter (frw/m²). These land prices were used to produce the mean land prices maps of Gasabo District in 2009 and 2018 in stating the problem. Indeed, the mean land prices for designed chart are deliverables to indicate the rate of increase of land prices in various sectors. The spatial data including infrastructures like roads, markets, electricity lines and electrical facilities, water utilities and water facilities, location of CBD, educational and health facilities, government institutions, building footprints, zoning categories, public facilities, approved Consolidated Local Development Plans and topographical data (slope) were analyzed together with spatial patterns of land prices to examine the most driving factors of land price variation in Gasabo District.

3.3 Data processing and analysis

In this research, we have collected both spatial and non-spatial data where softwares including ArcGIS, Statistical Package for the Social Sciences (SPSS) and Microsoft Excel were used to integrate all collected data. These softwares have been used to convert data into maps and chart, this make it easy to

the driving factors of spatio-temporal variation of land prices in Gasabo District.

both years have been entered in ArcMap by editing the attribute table of cells of Gasabo District and their quantities were processed and drawn using color to show values into five classes. The spatial data set from City of Kigali including administrative boundaries of national, province, district and sectors were used in describing the study area by using ArcGIS 10.4 software. The mean land prices for both 2009 and 2018 have been integrated in ArcGIS 10.4 to achieve the spatial patterns of land price variation in last 10 years in Gasabo District through delivering a well-designed map using reclassify tool as a GIS tool. Also, the change in price between 2009 and 2018 helped us to compute the rate of land price increase in sectors of Gasabo District, this has been computed using field calculator in attribute table where a well-gather the necessary and useful information. Some data were collected through online research by using the reference land prices established in 2009 and 2018 by Ministerial order No 001/16.00 of 23/11/2009 and IRPV respectively. Furthermore, the current cost of land parcel for residential were collected using interview guide tool. The land prices were entered and mapped in ArcGIS by editing attribute table using editor tool and also non-spatial data were presented in forms of tables and charts. SPSS was used to determine the most driving factors by computing the spearman's coefficient correlation between driving factors as independent variables and mean land price in 2018 as dependent variable.

3.4 Research Design

The conceptual framework describes the methods and techniques used assess the methods and techniques used to assess the spatial patterns of land prices and to assess

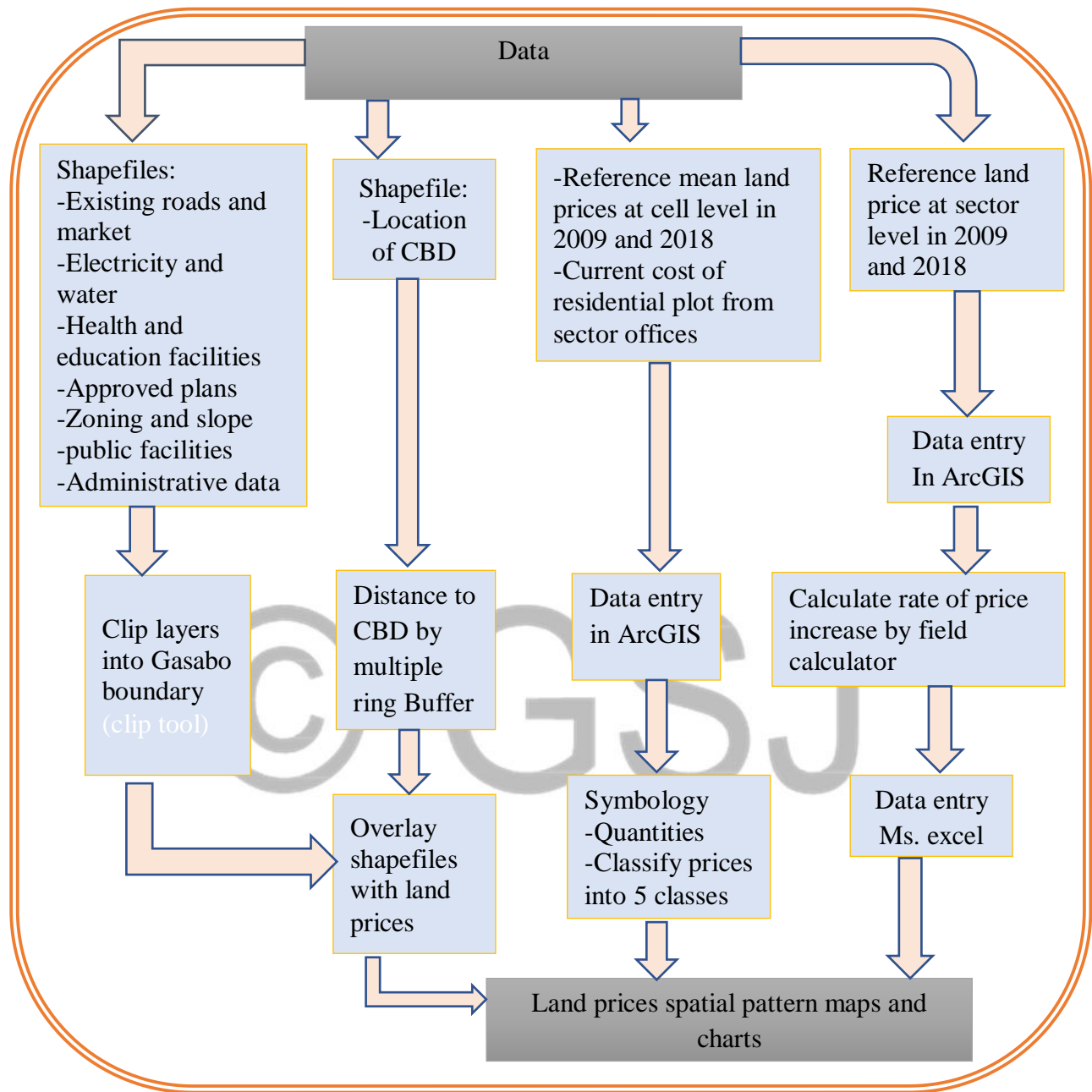


Figure 4 A follow charts showing a research design

CHAPTER 4. RESULT AND DISCUSSIONS

4.1 Spatial and temporal patterns of land prices in last ten years in Gasabo District

4.1.1 Spatial and temporal patterns of land prices in 2009

In 2009, the land price in Gasabo District was inexpensive contrast to the 2018 land prices due to the development that have taken place which have led to the increase of the land value and price of land. By that reason, the expropriation and compensation become different as the values and prices of land are unlike. The land price variation in Gasabo District has become an issue to its residents where it leads to the displacement of people who are not able to accommodate those increasing of land prices.

The land prices vary from one place to another due to different driving factors, whereby, it depends to the nature of locations and how those locations are well serviced. this imply that, the values to the locations which has development with presence of infrastructures and good level of standard of living conditions compared to the locations which are not developed and this lead them to low costs of land prices on land market.

With the help of Ministerial order No. 001/16.00 of 23/11/2009 determining the reference land prices in the City of Kigali and ArcGIS tools to classify and analyze Gasabo District mean land price in 2009 at cell level. We found that there are some cells that have high prices compared to others according to their levels of land values in that time where varied from one place to another with respect to time. For instance, Kibagabaga, Rukiri I & Rukiri II, Kibaza Kimihurura, Kamatamu, Kamutwa and Nyarutarama cell are classified in high classes of Mean Price (Frw/Sq.m) in

the range of 904 frw/m²-1,102 frw/m² and there are other cells that were expensive compared to other cells which were very poor in that time, Kagugu, Rugando and Gacuriro cell with the cost of 736 frw/m² – 903 frw/m² and Musezero, Ruhango, Masoro, Kabuga I & II, Kibenga and Rudashya and Ruhanga cells were classified in the range of cost of 629 frw/m² - 735 frw/m². Whereby, the cells of less developed regions like Bibare, Kabuye, Murama, Mukuyu, Bwiza, Cyaruzinge, Nyagahinga Bisenga and Kinyana, Gasharu and Mbandazi cell were in the range of 368 frw/m² -628 frw/m². Therefore, cells of rural areas were undeveloped, such that Ngiryi, Gasabo, Sha, Mvuzo, Munini, Butare, Kibenga, Nkuzuzu, Shango cells were classified in range of 168 frw/m² – 367 frw/m² that had low cost compared to other cells of Gasabo District.

In 2009, the land prices in Kibenga cell, Rutunga sector were in range of 736 to 903 frw/m² which was expensive prices compared to other cells like Indatemwa, Shango, Gasabo and others, this is because Kibenga cell has high connectivity of roads than nearest cells. Nevertheless, land prices in Kibenga became too cheap in 2018 compared to neighboring cells with in the range of 251 to 1873 frw/m². It was mainly caused by the change in land use where in 2009 Kibenga was predominantly residential use but in 2018 Kibenga Land was mostly zoned as A1, P3B and P3C which are not attracting land buyer then low market value. Even in Indatemwa cells, land price were not expensive in 2009 but it becomes very expensive in 2018 because change in land use to Residential, mixed use zone(C1) and P1 and also many approved Consolidated Local Development Plans and other improvements in Kibenga lead to the increases land price in 2018.

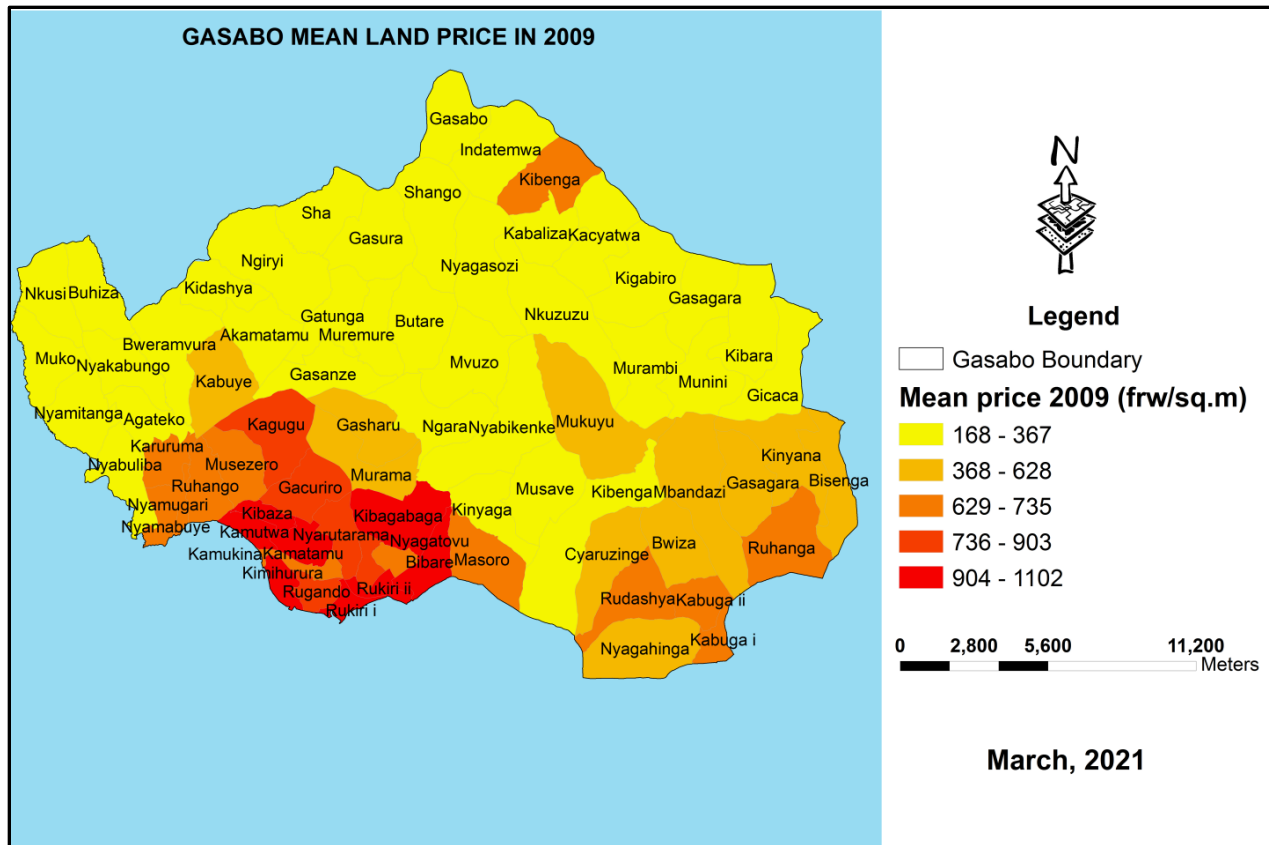


Figure 5 Map showing spatial and temporal patterns of land price in 2009. (Source: Ministerial order No. 001/16.00 of 23/11/2009 interpreted in ArcGIS software by the authors)

4.1.2 Spatial and temporal patterns of land prices in 2018

During 2018, the land price variation has increased due to the development that was taking place in Gasabo District which increase development of land as whole where it was tremendously difficulty for some residents to accommodate housing in some areas because it was expensive, this increase of land price variation has imposed the residents to migrate from one place to another so that they can get places which fits their living condition. It is regarded that there are regions which have continued to be developed and other regions which is

developing compared to the previous years that where development was very low.

Using land reference prices established by IRPV in 2018 and ArcGIS software tools to spatially classify and display Gasabo District Mean land price, we found that the cells that are expensive with their Mean Price (Frw/sq.m) are Gacuriro, Nyarutarama, Rugando, Rukiri I & II, Kimihurura, Kamatamu, Kibaza, Kamukina and Kibagabaga these cells were ranged in 28,793 frw/m²-56,085frw/m². These cells are expensive as development continues taking place where their land values have also increased. For instance, Musezero, Ruhango, Nyamabuye, Nyanmugari, Kagugu, Murama, Bibare, Kinyaga, Nyagahinga where these cells were classified in the range of 8,799 frw/m²-28,792 frw/m².

The other cells that are becoming developed which lead to the increase of the land values

and prices of these locations, for instance those cells that were ranged in 4,109 frw/m² – 8,798 frw/m² are Nyakabungo, Agateko, Karumuna, Kabuye, Gasanze, Ngara, Nyabikenke, Masoro, Kibenga, Cyaruzinge, Bwiza, Indatemwa and Kabuga I &II. As years passes by, land have become expensive where the areas that were substandard, have developed and their land values and prices increases, for instance people are moving to live there and this has increased its population density and level of housing which leads to the increases of land values.

We found that, cells such as Bweramvura, Gatunga, Sha, Butare, Musave, Gasharu,

Rudashya, Ruhanga, Mvuzo, Akamatamu, Kidashya, Nyabuliba, Muremure cells which are ranged in 1,874 frw/m² – 4,108 frw/m². There are also areas in Gasabo District which are less developed where their land prices and values are still low compared to others areas and are classified in the range of 251 frw/m² – 1,873 frw/m². Those cells are; Shango, Ngiryi, Nyagasozi, Nkuzuzu, Mbandazi, Kigabiro, Gasabo, Kabariza, Kacyatwa, Kibara, Bisenga, Munini, Kibenga, Kacyatwa and Kabaliza, etc. The mean reference price of 2018 is expressed in Rwandan francs per square meter (frw/m²).

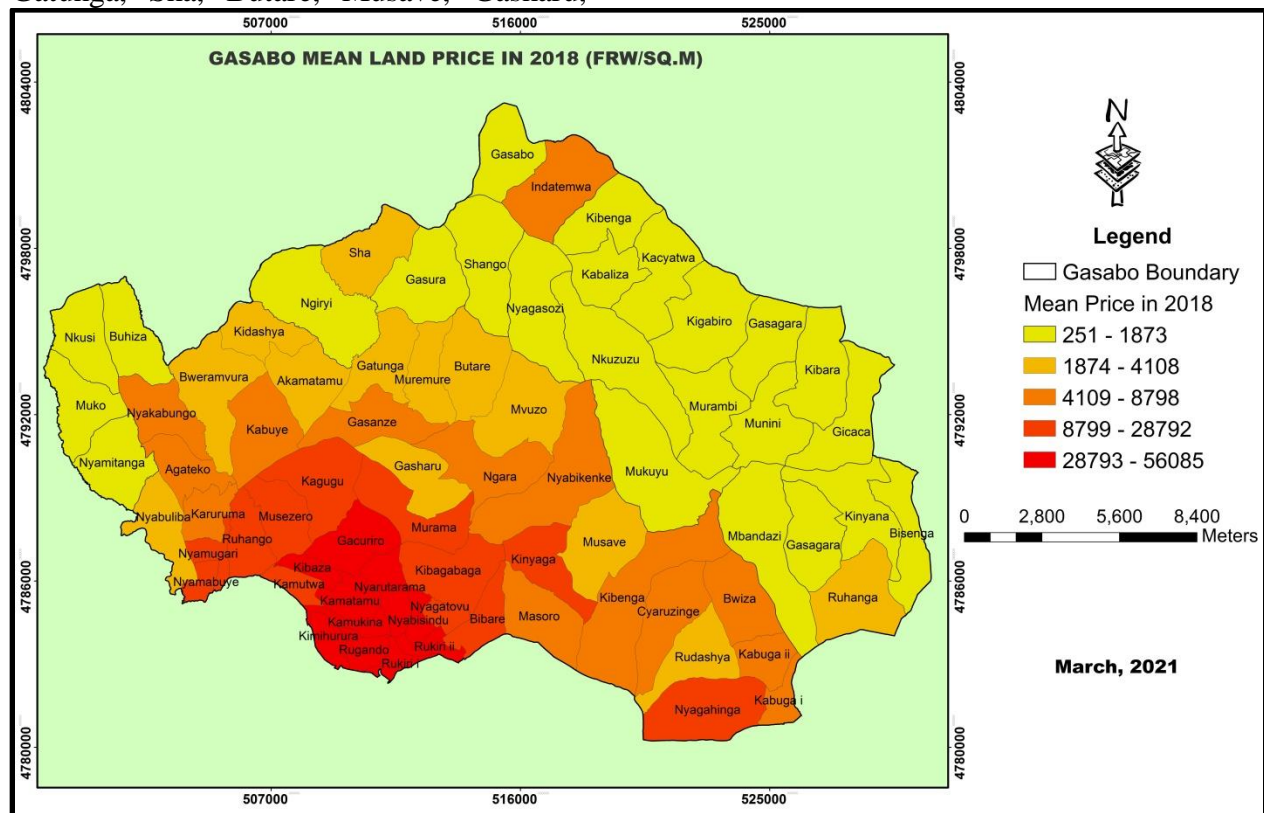


Figure 6 Map showing spatial and temporal patterns of land price in 2018 (Source: secondary data from IRPV, 2018 and interpreted in ArcGIS software by the Authors)

4.1.3 The cost of land parcel for residential housing in 2021 in developable sectors

In selected developable sectors such as Kacyiru, Kimihurura, Remera, Kimironko, Kinyinya, Gatsata and Gisozi, some residential land parcels are below or above

100m² but the Kabbalist average size of the residential plot has 15m/20m which is approximately 300m². In 2021, the current cost to buy a land parcel for residential housing in above surveyed sectors is spatially varying according to location and plot improvements. For instance, Kibagabaga, Bibare and Nyagatovu cells in Kimironko sector, the plot with 300m² cost 15 million, 90 million and 9 million respectively (Assistant sector land officer said). Furthermore, Kamukina, Kimihurura and Rugando cells in Kimihurura sector land parcel cost 30 million, 109 million and 55 million respectively. Remera sector land

officer said that Nyarutarama and Nyabisindu cells have the most expensive plots with 36 million and 31.5 million respectively and also, Rukiri II and I cells have cheap land parcel compared to Nyarutarama and Nyabisindu cells where the land parcel for residential housing cost 27 million in Rukiri II and 13 million in Rukiri I. In this regards, the current cost to buy the average size (300m²) of land parcel for residential housing in selected developable sectors were surveyed from their sector offices under land management unit, the cost per meter square were calculated by dividing the cost of whole plot over the average size of land parcel.

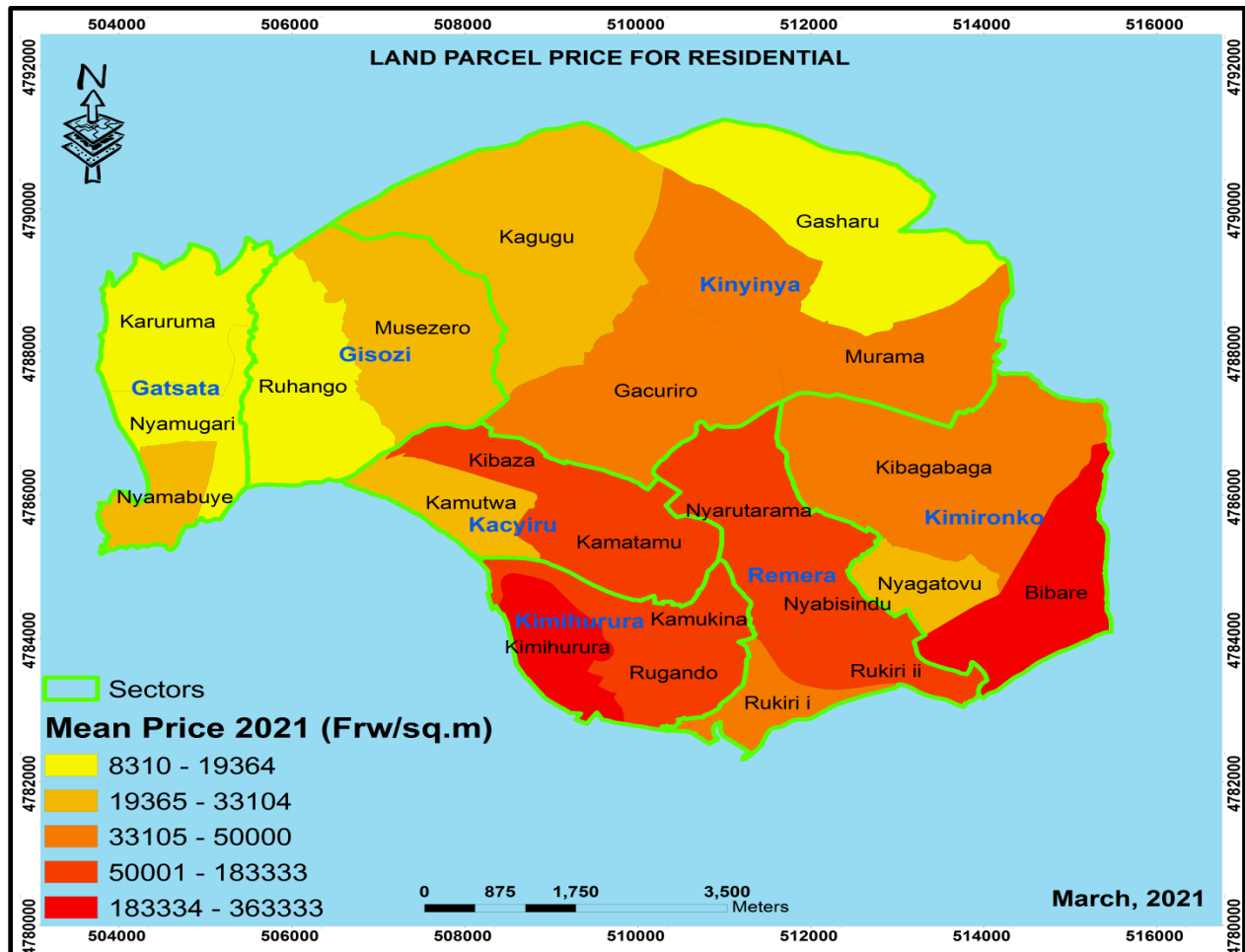


Figure 7 Map showing the cost of land parcel for residential housing in 2021. (Source: Primary data, 2021 and interpreted by the authors)

4.2 Brief status on how land prices vary at different cells in selected developable sectors.

In 2009, the cost average size of land parcel for residential housing was too low compared to its current cost. The value and prices of land in Kamukina, Kimihurura and Rugando cells of Kimihurura sector are raising compared to the recent years. Generally, land does not lose value and its prices are rising as

the years are coming (Kimihurura sector land and infrastructure officer said). The land officers from seven selected sectors (Kimihurura, Kacyiru, Remera, Kimironko, Gisozi, Kinyinya and Gatsata) ranked their cells according to the level of land parcel expensiveness with respect to land transaction done in 2021. The table below shows the level of expensiveness of land parcels for residential housing in various cells of selected developable sectors.

SECTORS	KACYIRU	REMERA	KIMIRONKO	GISOZI	GATSATA	KINYINYA	KIMIHURURA	LEVEL
CELLS	Kamatamu	Nyarutarama	Bibare	Musezero	Nyamabuye	Gacuriro	Kimihurura	1
	Kamutwa	Nyabisindu	Kibagabaga	Ruhango	Nyamugari	Murama	Rugando	2
	Kibaza	Rukiri II	Nyagatovu		Karuruma	Kagugu	Kamukina	3
		Rukiri I				Gasharu		4
LEVEL								
1	Very expensive							
2	Expensive							
3	Moderate							
4	Cheap							

Table 1 The level of expensiveness of land parcel for residential houses in selected sectors

(Source: primary data, 2021 and compiled by the Authors)

4.3 The rate of land price increase in sectors of Gasabo District

With reference to the reference land prices established in the Ministerial order No. 001/16.00 of 23/11/2009 and the reference

land prices established by Institute of Real Property Valuers (IRPV) in 2018. We calculated the changes in land prices (C_{LP}) between two different years (2009 and 2018) in all sectors of Gasabo District. After that, we calculated the ratio (R) of C_{LP} to an old land prices in 2009.

$$C_{LP} = (\text{Land price in 2018}) - (\text{Land price in 2009})$$

Where; C_{LP} is the change of land prices in two years (2009 and 2018)

$$R = C_{LP} / \text{land price in 2009}$$

- Where, R is the ratio and C_{LP} is change of land prices in 2009 and 2018

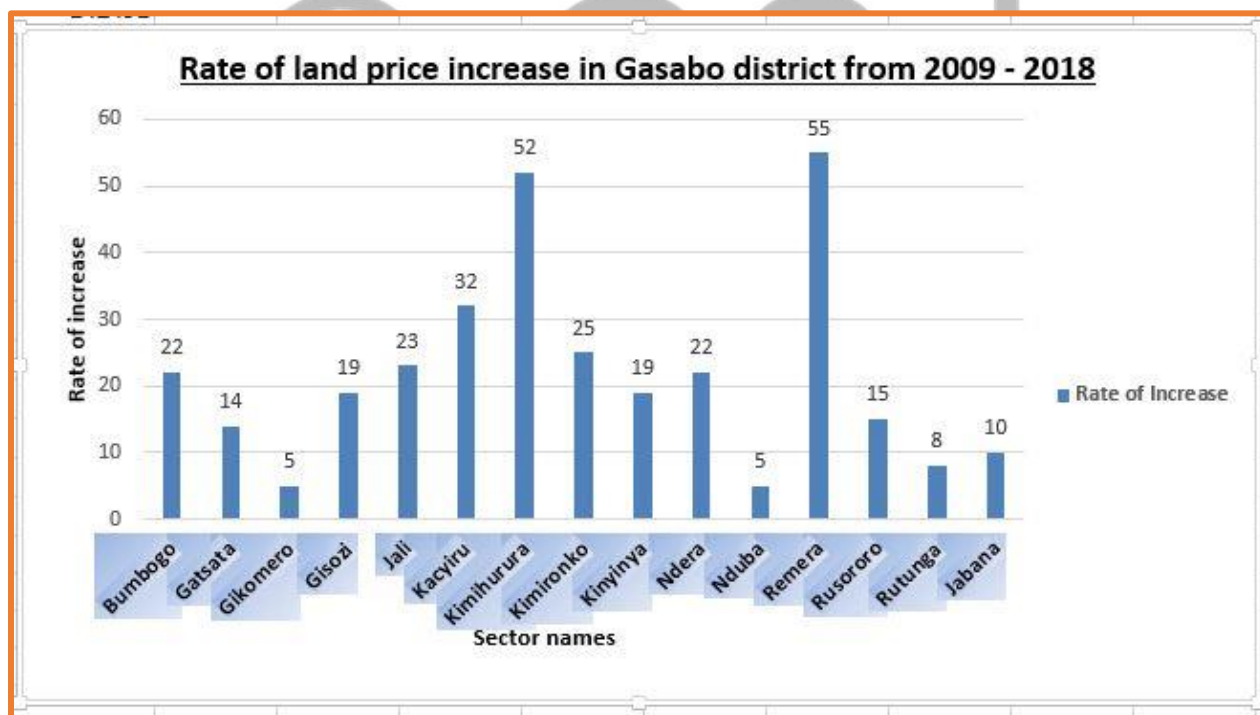


Figure 8 Chart of the rate of land price increase in Gasabo District from 2009-2018 (Source: computed and compiled by the authors)

All calculations were computed using ArcGIS field calculator in attribute table of land price at sector level and bar chart was designed in Microsoft Excel. As a result, we found that the land prices have been increased at high rate especially in Remera, Kimihurura, Kacyiru and Kimironko sectors with the rate of increase of 55, 52, 32 and 25 times respectively. Whilst, Nduba, Gikomero and Rutunga have the lowest rate of land prices increase in Gasabo district. Whereby, in Nduba, Gikomero and Rutunga the land prices were multiplied up to 5, 5 and 8 times from 2009 up to 2018.

4.4 Driving factors of land prices variation in Gasabo District

In Gasabo district, there are a large number of foreign investors reside in that region which result the increase of prices of land in that region, local business is rising up the value of land in Remera, Kacyiru and Kimironko sectors where most population wish to reside in that area due to the attractiveness of those business involved by more foreign investors. The more provision of commercial centers in Gasabo district the more price variation increase and also, the price on land vary according to plot accessibility to roads networks, electricity, water utilities, schools, health centers and the nature of an area are the most factors for raising the cost of land. For instance, well-connected roads, public facilities like market, existence of schools including St-Ignace, the uniqueness of a region and how its name is popular in community in Kimironko sector leads to expensiveness of land (Kimironko sector assistant land officer said).

In addition, the predominant activities within the cell also contribute to the changes in land prices. Kimihurura cell is very expensive

because it is dominated by residential use while Rugando is the cell of Investment which makes it expensive and Kamukina is dominated by unplanned area with low land prices (Kimihurura sector land and infrastructure officer said). Therefore, roads and market accessibility, electricity and water utilities, health and education facilities, slope and approved plans, zoning are the most driving factors for land prices variation in Gasabo District.

4.4.1 Roads density

Asadi (2016) explains that the provisions and changes in transportation infrastructures like good road connections leads to the changes in land prices, where the prices of land are mostly predicted with respect to transportation accessibility. The ArcGIS tool was used to clip and created road density with in Gasabo District. Road density map and 2018 mean land prices map were used to analyse the trends between the two variables. We found that the areas with high road density which are well connected have also high land prices compared to the areas with poor distribution of roads. For instance, the road networks are densely distributed in Kacyiru, Kimihurura, Remera, Kinyinya, Kimironko, Gisozi and Bumbogo sector. Nevertheless, Rutunga, Gikomero, Nduba, Ndera, Jabana, western part of Jali and eastern part Rusororo sector have low land prices ranging from 251 frw/m² to 1,873 frw/m². Therefore, good road connection is a central to the high land price while the poor distribution of road networks have the perfect correlation of falling of land prices in sectors of Rutunga, Gikomero, Ndera, Jabana, western part of Jali and also in the eastern part of Rusororo sector. The density of roads is expressed in km/km² in ArcMap.

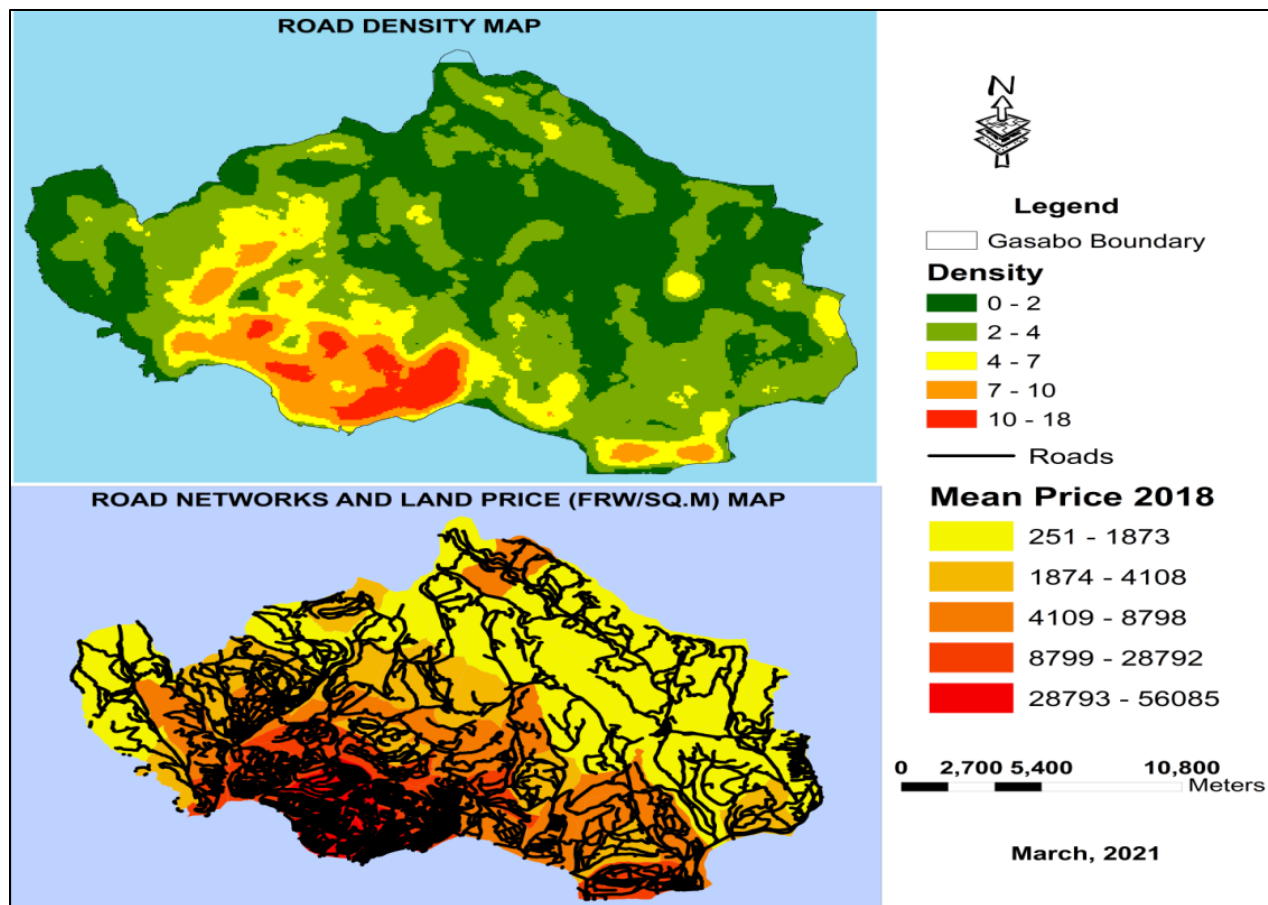


Figure 9 Map showing road density in Gasabo District (Source: CoK/ OSC)

4.4.2 Electricity lines and electrical facilities

Land prices variation depends on proximity to locational advantages including communicational facilities, electrical facilities, land quality and other amenities (Valley, 2019). Using the data set of water utilities and water facilities of Gasabo District, we found that the areas with high

distribution of electrical power plants, electrical substations, electrical transformers, medium voltage lines, low voltage line and high voltage lines have high land prices compared to the eastern part of Gasabo District especially in sectors of Rutunga, Gikomero, Nduba and Rusororo. This simply means that, the existence of electrical utilities and electrical facilities increases the prices of land in Gasabo District. The mean land price in 2018 is expressed in frw/m².

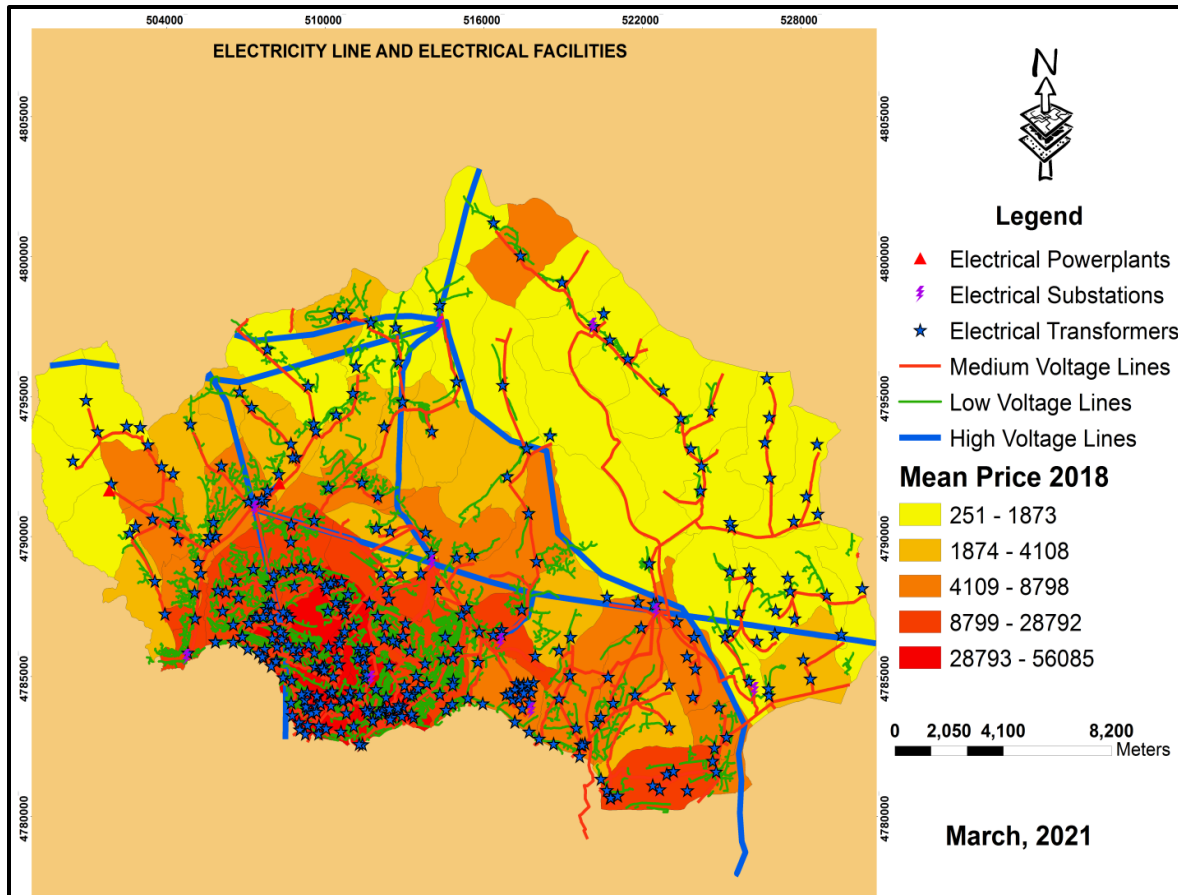


Figure 10 Map showing electricity lines and electrical facilities Gasabo District
 (Source: CoK/ OSC)

4.4.3 Water utilities and water facilities

Hammer (2000) argued that the provision of good and adequate infrastructure is a central to property value and also, the areas with basic facilities like public water supply, good drainage, roads and electricity attract high land value and prices. Therefore, falling and rising of land prices in Gasabo District have strong relationship to the distribution of

water utilities and water facilities. We overlaid the 2018 mean land prices with the layers of water facilities and we found that the availability and a well-distributed water pipelines, sources, Kiosk and water treatment plants attract high land prices in Kacyiru, Kimihurura, Remera, Kimironko, Kinyinya, Gisozi, Bumbogo, Jabana and western part of Rusororo sector and led to the rising of land prices with the range of 4,109 frw/m² to 28,792 frw/m². Nevertheless, sectors with poor provision of water utilities tend to have low land prices especially in Gikomero, Nduba, Jali and Rutunga sector. Mean land price is expressed in frw/m².

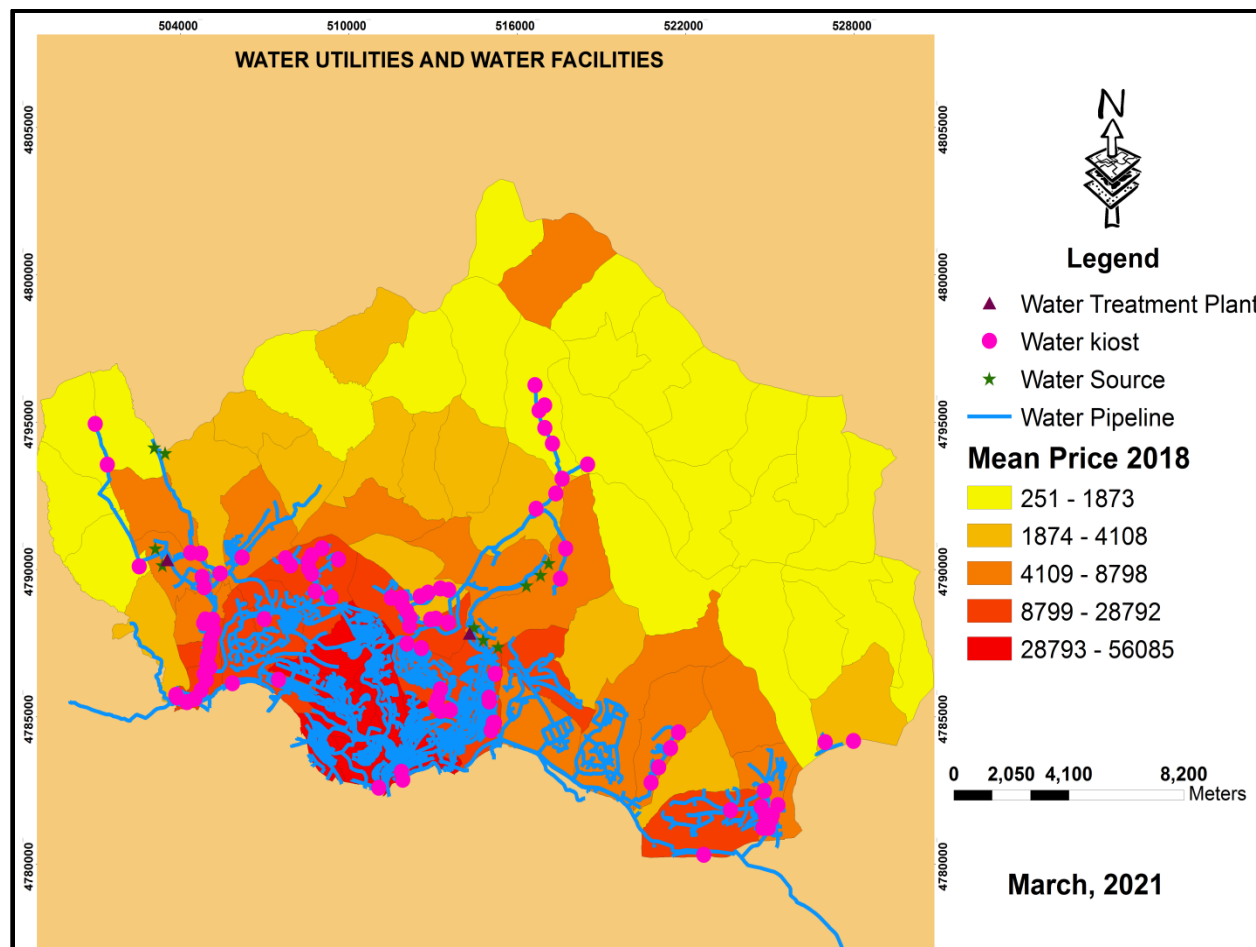


Figure 11 Map showing water utilities and water facilities of Gasabo District
 (Source: CoK/ OSC)

4.4.4 Health facilities and Education facilities

The ArcGIS overlay and clip tools were applied to indicate and visualize the trends between spatial distribution of health centers, hospital, secondary and primary schools, and spatial patterns of land prices variation in Gasabo District. As a result, the high

concentration of both health and education facilities such as health centers, hospital, primary and secondary schools in Kimihurura, Kacyiru, Gatsata, Kinyinya, northern part of Jali, Jabana, Gisozi, Remera, Kimironko, northern part of Ndera and Western Part of Rusororo sector increases the prices of land. Evidently, Rutunga, northern part of Nduba, Gikomero, eastern part of Bumbogo sector have low land price ranging from 251frw/m²- 1873frw/m², as a result of inadequate schools and health facilities.

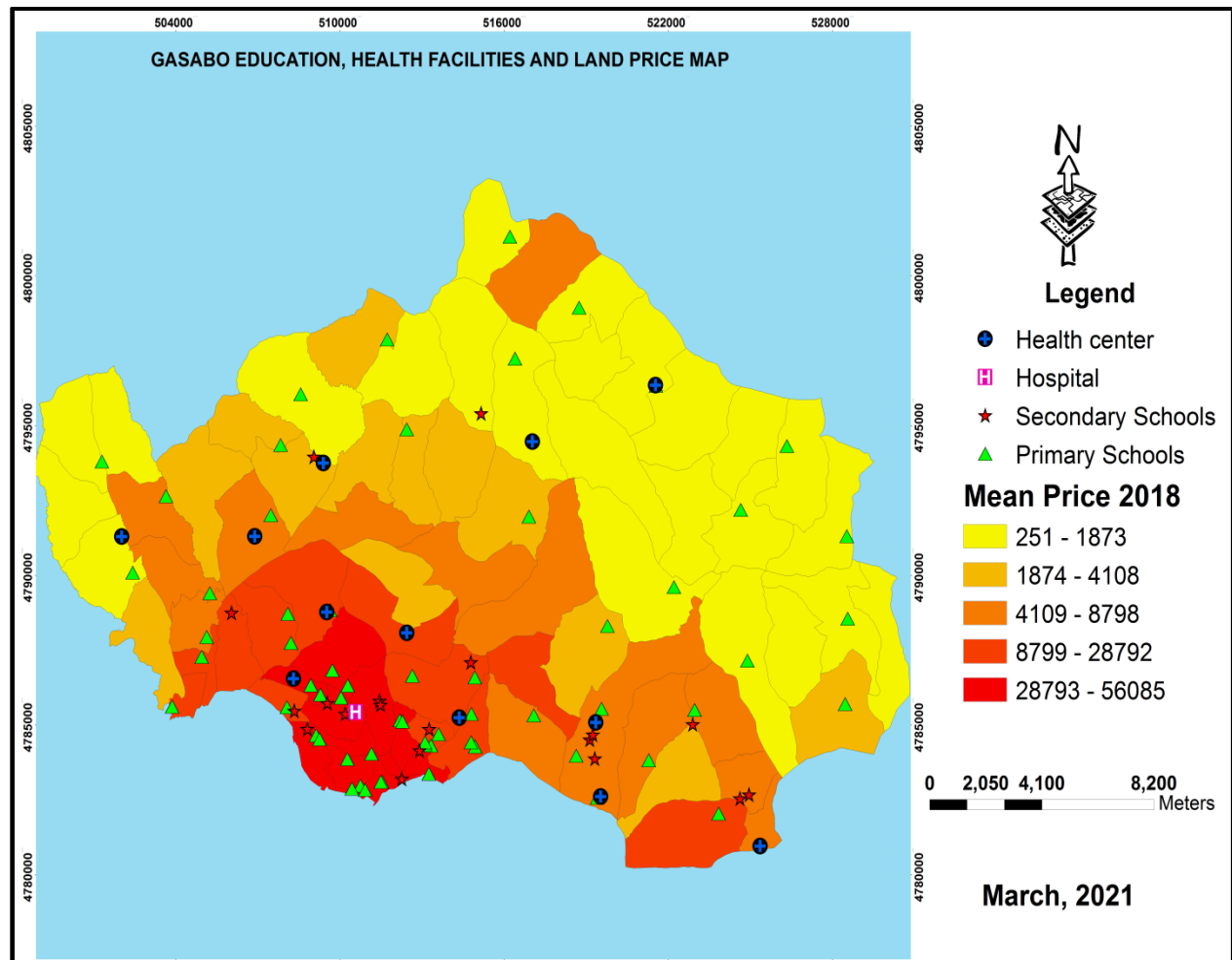


Figure 12 Education and Health facilities of Gasabo District
(Source: CoK/ OSC)

4.4.5 Distance from CBD

Purnomo (2014) stated that the location of land by considering distance to CBD is among the driving factors affecting land prices variation. The land prices decrease as the distance from or to CBD increases. by applying multiple ring buffer tool from CBD toward rural areas with the distance ranging from 2 to 20 km to the CBD, indicates that the nearest sectors (Kacyiru, Kimihurura, Gisozi, Remera, Gatsata, Kinyinya and

Kimironko) to the CBD with the distance of 2km, 4km, 6km and 8km have the highest mean land prices ranging from 8,799 frw/m² to 56,085 frw/m² and also, sectors like Bumbogo, Ndera, Jabana and Nduba are ranging from 8km to 14km have moderate mean land price ranging from 1874 frw/m² to 8,799frw/m². However, the land prices are very low in the sectors far away from CBD especially in Rutunga, Jali and Gikomero sectors with 14km, 20km and above. The map below shows the distance from CBD and land price which are expressed in Kilometer (km) and frw/m² respectively.

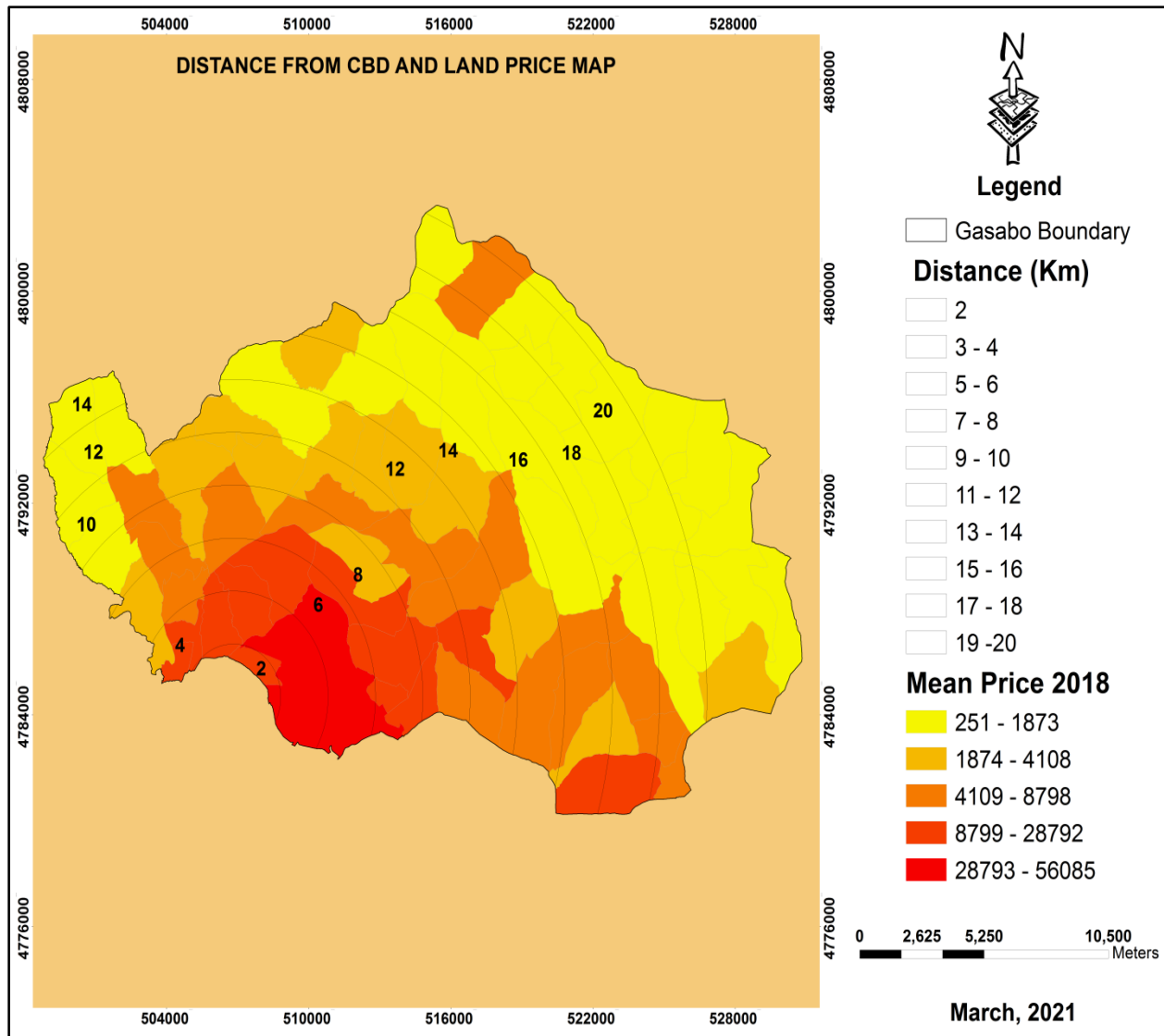


Figure 13 Distance from CBD and mean land price in 2018 map of Gasabo District. (Source: IRPV, 2018 and Distance calculated by the authors using ArcGIS software)

4.4.6 Population growth

According to NISR (2012), Gasabo District is the most populated district in Kigali city and has 46.8% of the total population of Kigali city with 529,561 residents, and Kimironko and Kinyinya are the most populated sectors, while Gikomero and

Rutunga are the less populated sectors in Gasabo District. By using a building footprints of the most populated sectors such as Kimihurura, Kinyinya, Remera, Kacyiru, Gatsata, Gisozi, Kimironko, Gikomero and some cells of Ndera and Jali sectors. We found that the high concentration of population has a positive relationship to the increase of land prices in Gasabo District. Whereas, low land prices are for less populated sectors including Rutunga, Gikomero, Nduba, Rusororo, Jabana and some cells of Ndera and Jali sectors. In the map shown below, the mean land prices have frw/m² as its unit.

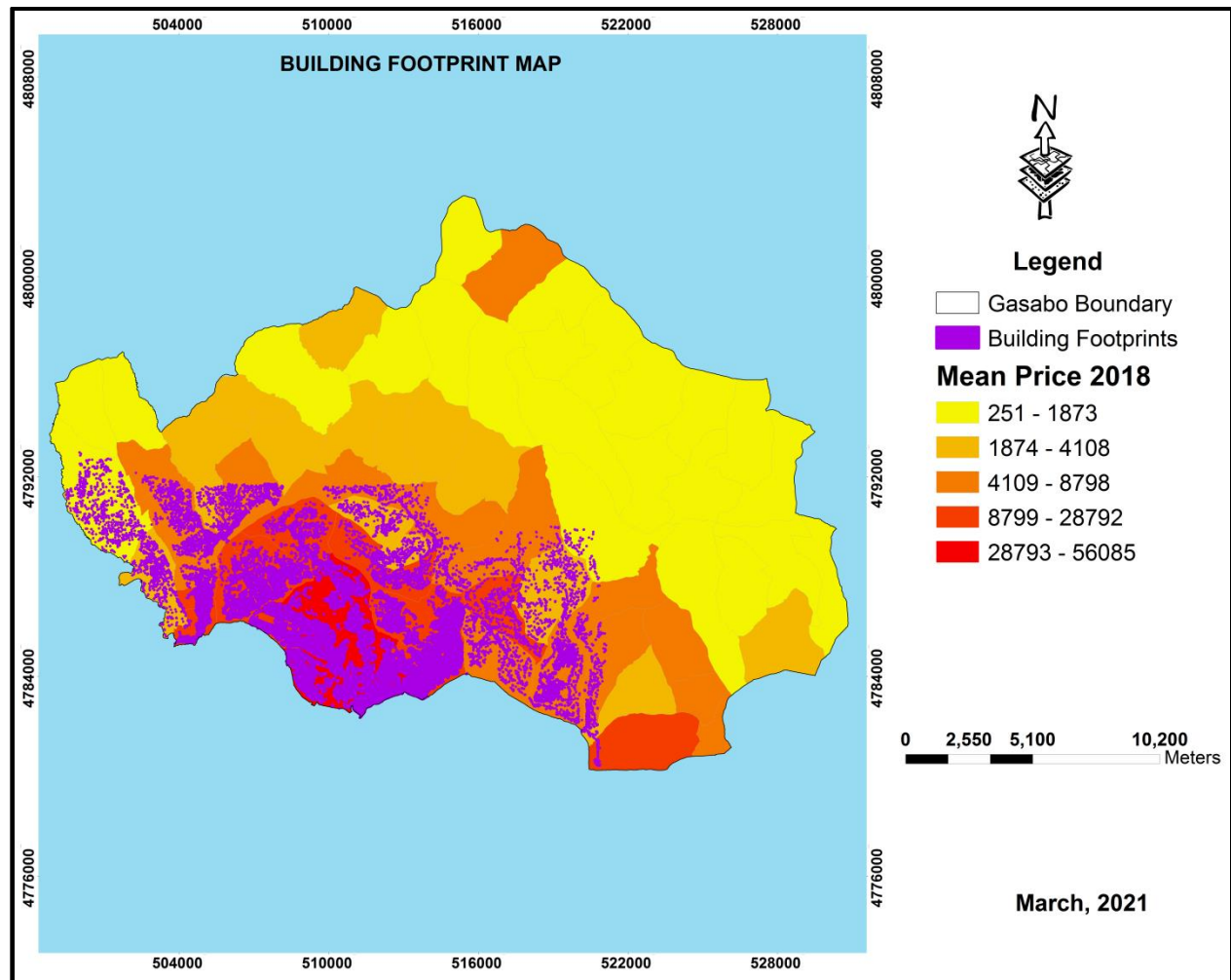


Figure 14 the building footprints map of sectors with high land prices in Gasabo District.

(Source: Gasabo District/OSC)

4.4.7 Topography/slope

Gasabo District comprises a range of mountains including Mt Jali which is located in Jali Sector. According to the figure 4.3.5, the slope of Gasabo are classified into six classes and expressed in percentage, the classes of 0-10 percent and 10-20 percent have low elevation, the classes of 20-30 percent has moderate altitude while 30-40 percent and, 40 and above percent are gentle

slope and steep slope respectively. The areas with 0-10 percent are mostly wetlands and also highly affected by floods and the areas with slope above 40% tend to be affected by landslides even if the majority of this areas are covered by forest. Therefore, the first and the last class are known as a high risk zones. Using the slope of Gasabo and the variation of land prices in Gasabo District, we found that those sectors within high land prices have also the slope which is below 30 percent. Indeed, land prices in Gasabo vary according the slope of an area where the increase of slope leads to decrease of land prices and the decrease of slope tends to increase of land prices in Gasabo District.

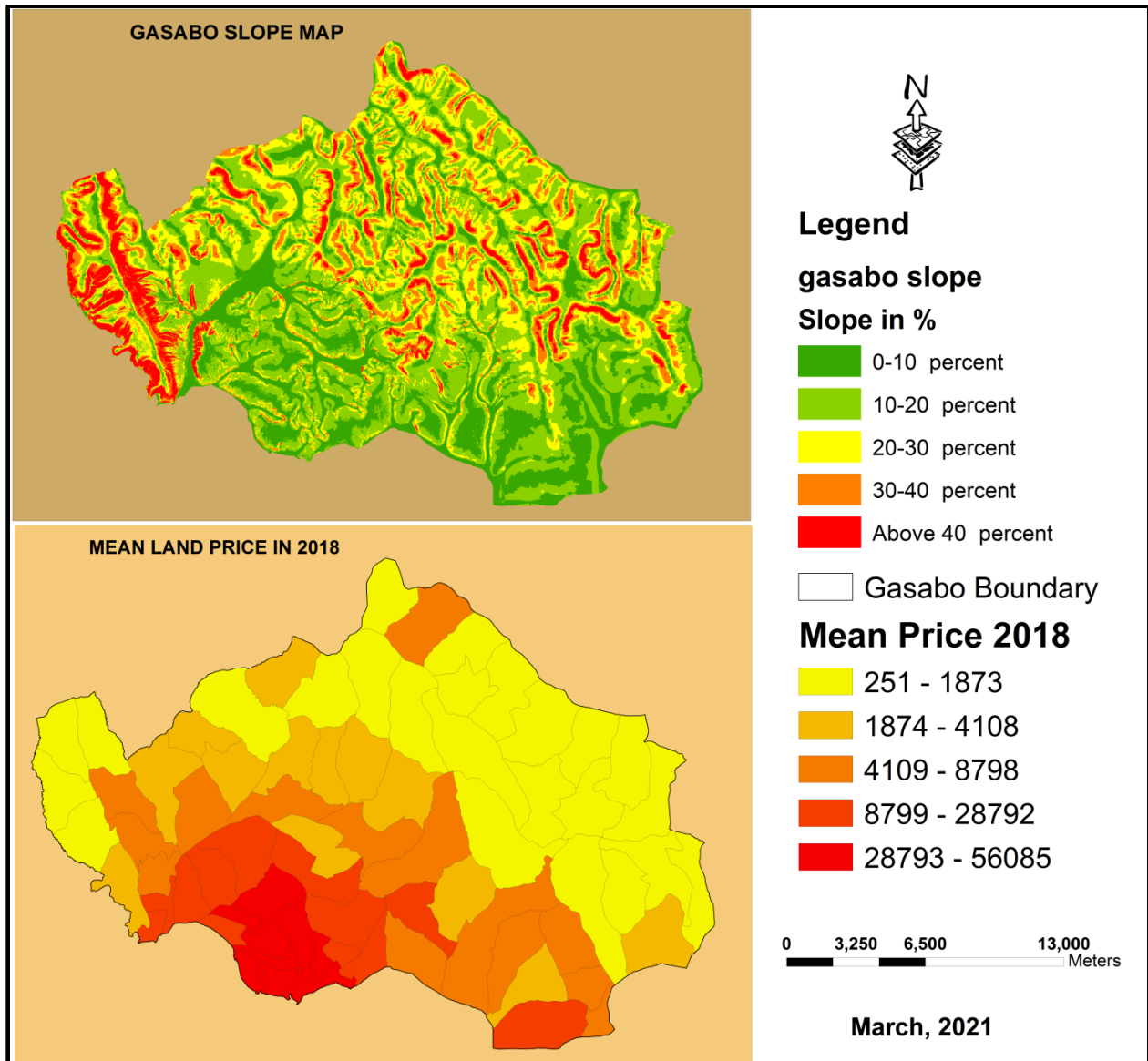


Figure 15 Map showing slope of Gasabo District and mean land price in 2018 (Source: CoK/OSC)

4.4.8 Public facilities and Approved Consolidated local development plans

Land is very expensive especially in urban areas, because of land is subdivided into smaller parcels to increase the high plot accessibility to infrastructures and economic activities (Locke & Henley, 2016). We used shapefile of approved consolidated local Development Plans (CLDP) from CoK and

we found that the areas with approved plans have high land prices. Mostly, CLDP are in form of Grids where each plot has accessibility to the road network and plots within the plans have high market value since the limitations of building a residential house is reduced as well as the building permits are easily obtained from local governments. The people are willing to buy the land parcels because they have a hope that the site will develop as soon as possible. Furthermore, the high distribution of public facilities in sectors of Kimihurura, Kacyiru, Kinyinya, Gisozi,

Rusororo, Kimironko, Remera sector and Indatemwa cell in Rutunga Sector increase the land market value hence high land prices. However, areas of Gikomero, Nduba, Jali, Jabana, Eastern part of Rusororo and other cells of Rutunga sector have less distribution

of public facilities has also low land prices. Therefore, the concentration of public facilities and approving CLDP increase the land prices in Gasabo District. The mean land price of Gasabo District is expressed in frw/m²

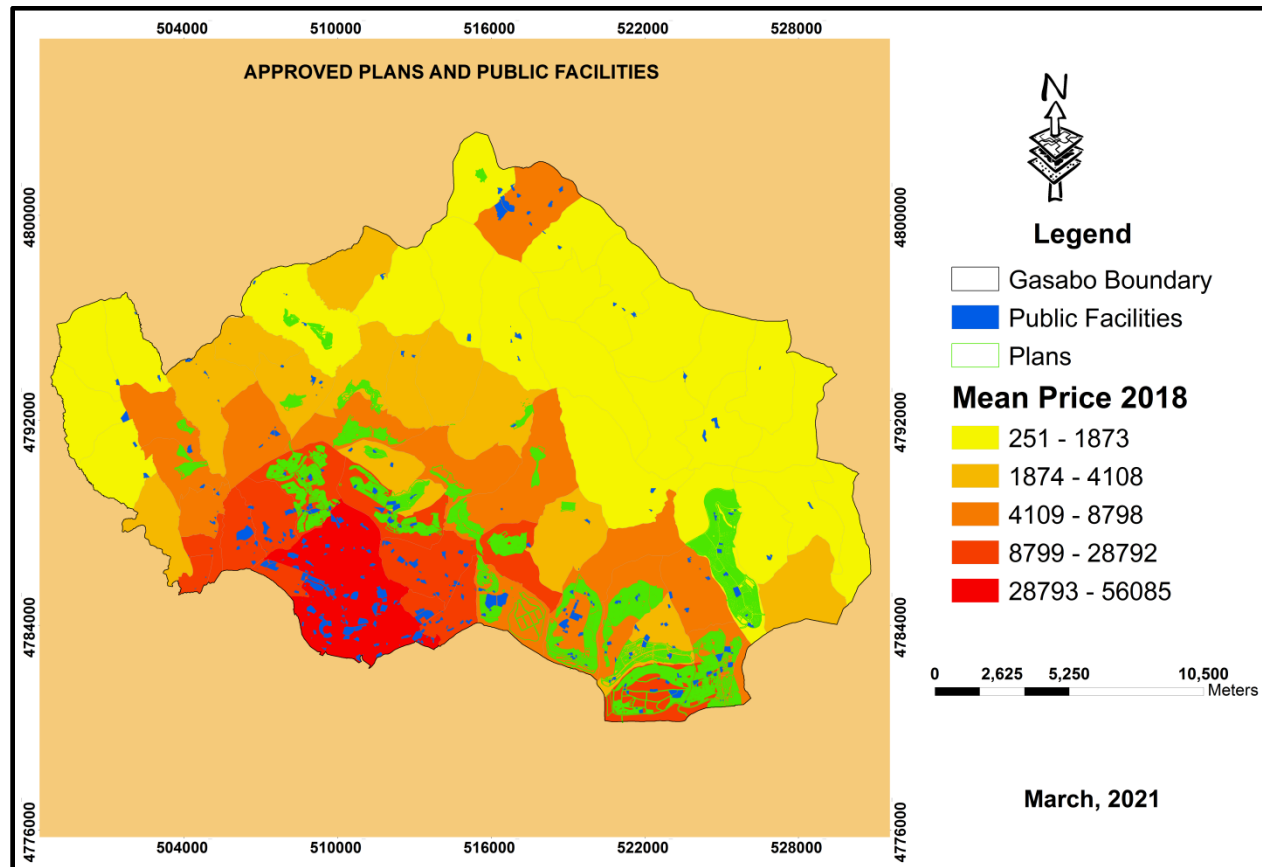


Figure 16 Map showing Public facilities and approved consolidated local development plans
(Source: CoK/OSC)

4.4.9 Land use Regulations and Zoning categories

Quigley (2014) stated that the geographical locations, land use regulations and zoning changes are strongly correlated with land and housing prices variation. Where prices vary quite substantially in response to natural constraints and localized regulation of land

use. We used spatial data set containing shapefile of KCMP 2050; these data were obtained from CoK. The data of land use and Zoning was used to determine how land use and zoning categories are interrelated to the variation of land prices in Gasabo District. We found that zoning categorized as residential (R1, R2, R3, R4, R1A, R1B) , commercial zones and mixed use zone (C3, C1) and industrial zones (I1, I2, I3) are within the range of high land price between 4,109 frw/m² to 56,086 frw/m² compared to the other zoning categories including wetlands

(W2, W3, W4, W5), water body (WB), Agriculture (A1) and forest and open space (P1, P2, P3B, P3C), these zonings have low land prices below 4,109 frw/m². As a result,

type of land use, regulations and zoning categories influences the changes of land price in Gasabo District. The mean land price of Gasabo District is expressed in frw/m².

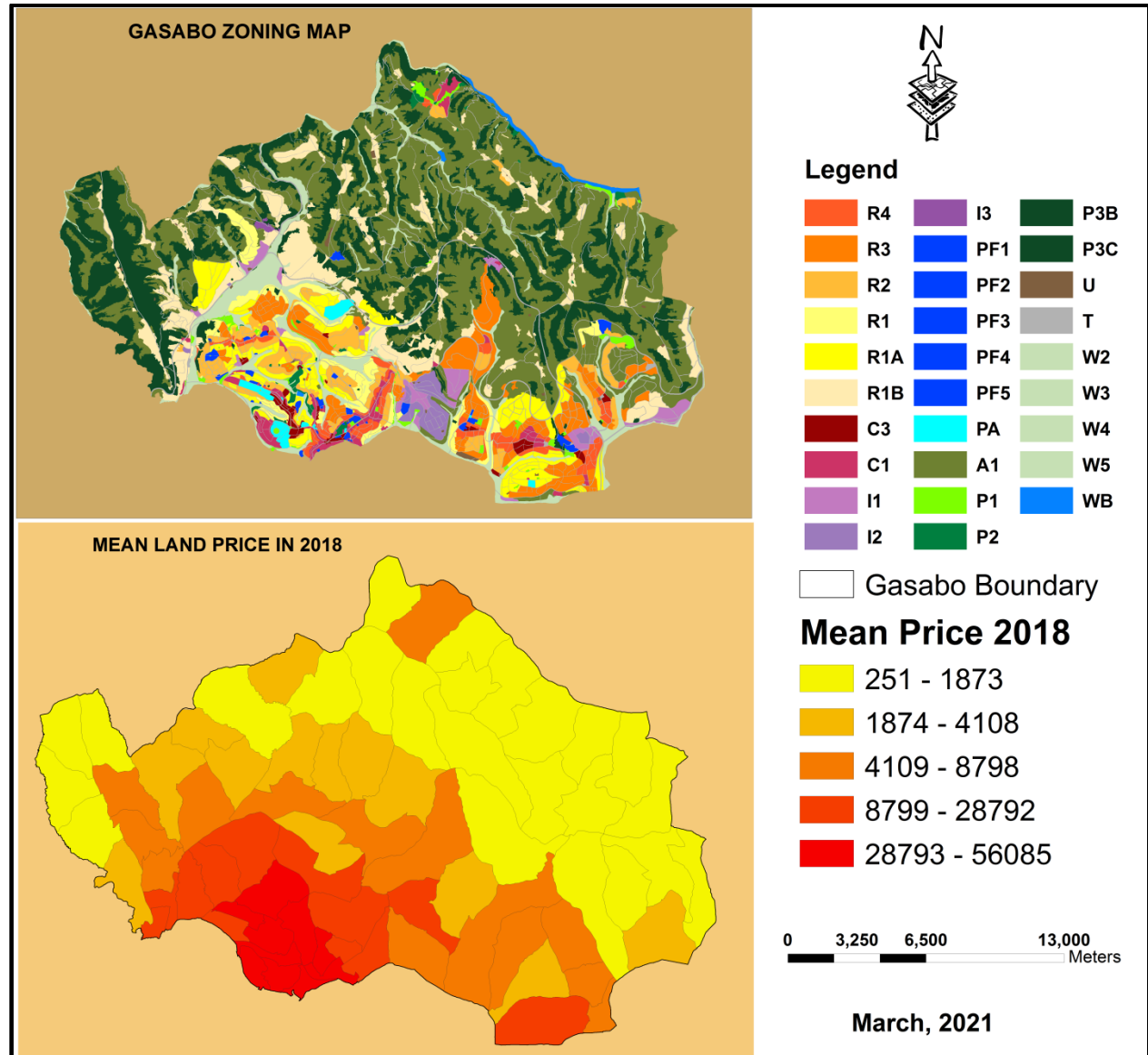


Figure 17 Map showing Gasabo zoning categories and mean land price in 2018 (Source: CoK/OSC)

4.4.10 Market Distribution and Government institutions

Government institutions are densely distributed in three sectors including

Kacyiru, Kimihurura and Remera and also, they have high land prices. These trends indicate that the presence of these institutions plays a big role in raising the value and land prices in Kacyiru, Kimihurura and Remera sectors. We also found that, the majority of Markets in Gasabo District are spatially distributed in the sectors with high land prices and it proves that the nearest land to

the market tend to have high prices. Whereby, most land buyers are attracted by the services and goods provided by both

market and government institutions then high land market value.

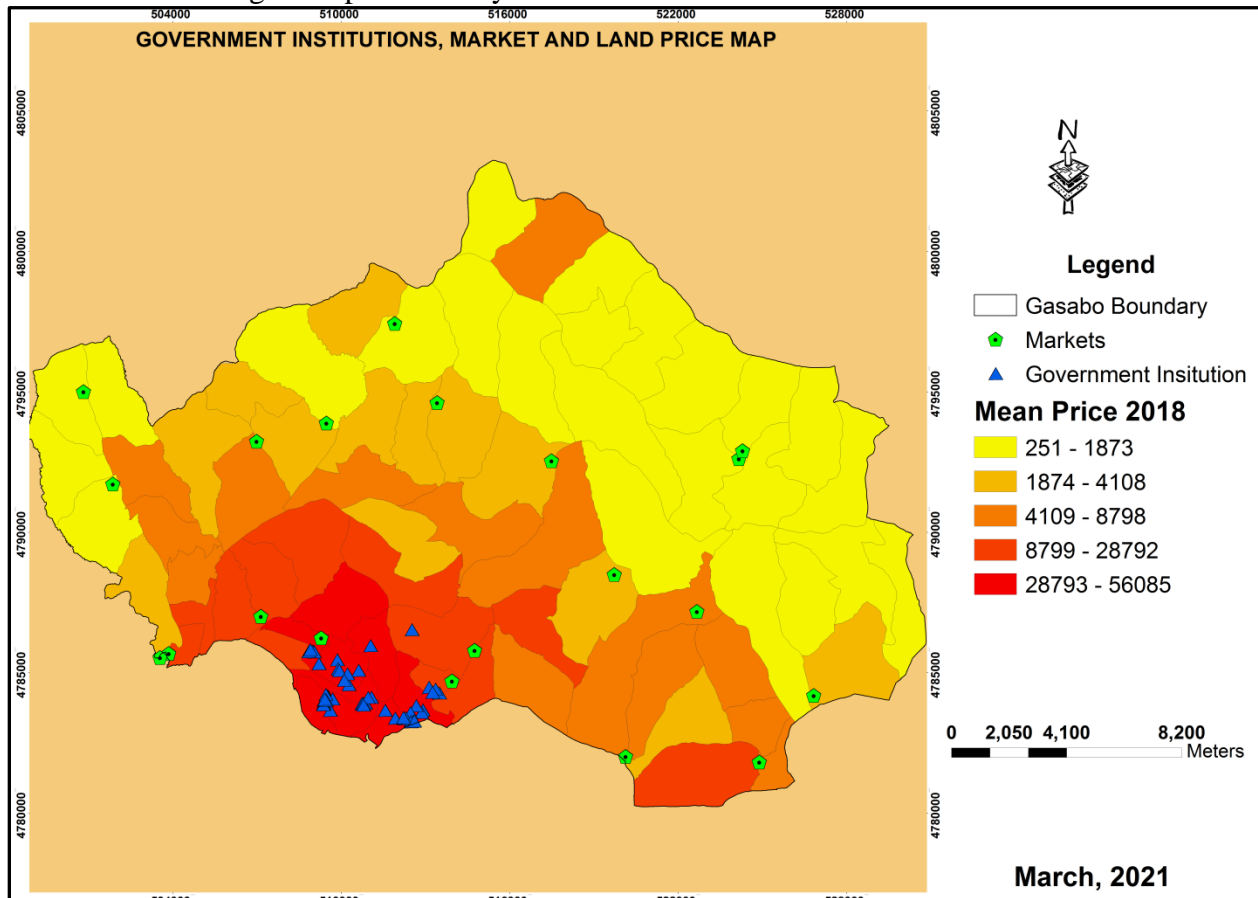


Figure 18 Map showing government institutions, markets and mean land price in 2018

(Source: CoK/OSC)

4.5. The most driving factors of land price variation in Gasabo District.

From all above driving factors of land price variation in Gasabo district such as road density, electricity line and electrical facilities, water utilities and water facilities, distance from CBD, market and government institutions, approved plans and public facilities, population growth indicated by building footprints, slope and zoning categories with a help of IBM- SPSS

statistics software. We found that the driving factors which have the positive spearman's correlation coefficient approaching to one with Mean land prices in 2018 of Gasabo District are the most influencing factors to land price variation.

The driving factors were taken as independent variables while Mean land price in 2018 was taken as a dependent variable. This means that land price varies depending on the driving factors. The correlation coefficient is normally in range -1 up to +1 where a negative coefficient indicates the weak correlation between variables and positive coefficient indicates that the variables have strong correlation. A coefficient which is equal to 1 means that the

two variables have perfect correlation and the positive coefficient indicates the strong correlation between two variables. Therefore, road networks, electricity lines and facilities, distance from CBD, schools and zoning categories are the most driving factors of

spatial and temporal variation of land price in Gasabo District. The table below shows the spearman's correlation of coefficient of the most independent variable with positive correlation with land prices in Gasabo District.

No	Independent variable	Dependent variable	Spearman's Coefficient of correlation
1	Road network	Mean land price 2018	0.701
2	Electricity lines and facilities		0.587
3	Distance from CBD		0.406
4	Schools		0.181
5	Public facilities		0.177
6	Zoning categories		0.149
7	Slope		0.109
8	Water utilities and facilities		0.096
9	Approved plans		0.096
10	Markets		0.005
11	Building footprints		-0.214
12	Government institutions		-0.301
13	Health facilities		-0.07

Table 2 Spearman's coefficient of correlation between variables

(Source: Computed and compiled by the authors)

4.6 The impact of land prices variation on housing and infrastructures provision.

Gasabo district is one of three districts found in Kigali city for that reason there are variety

of infrastructures, such as paved roads, electricity, water supply, stadium, hospitals and health centers. Furthermore, Gasabo has more developed sectors such as Remera, Kacyiru, Gisozi, Kimihurura, Kinyinya, Gatsata and Kimironko where there are more infrastructures and public facilities. The selected developable sectors were taken as a sample and sector land officers and land

brokers were interviewed to examine the impacts of land prices variation on both housing and infrastructure provision.

4.6.1 The impact of land prices variation on housing provision.

Through provisions of housing in Gasabo district, it is costly for individuals to build their own house especially low income earners, because the price of land is high which lead to high cost of housing construction. And also, the capacities of residents which are living in developed sectors are economically different. Whereby, low-income earners are discomfited to be neighbors of those of high-income, because their buildings are completely different and to reconstruct the building as same as those with high income earners are difficult (Kimironko sector assistant land officer said). And some investors purchase land on highly cost with aims to invest in purchasing complete building are facing the problem of lack clients for their houses because they bought land at high cost, housing cost and building materials are high as well. The residential zones are mostly expensive than other zonings which limit the efficient and affordable housing provision.

4.6.2 The impact of land prices variation on Infrastructure provision.

Infrastructures are the main indicators of urban areas, in Gasabo district infrastructures are well served to the residents where land from developed sectors are very expensive as building are near to the street roads, water and healthy facilities and electricity is also well served. However, those facilities are not distributed in whole part of District. As the residents are already settled, it is not easy to compensate people during expropriation for a new planned infrastructures and it is costly to relocate people. Assistant land officer of Kimironko sector said that, the Ministry of health was willing to construct health post in Kimironko but they lack money to

compensate people for the suitable site and it is constructed in wrong site where their budget fit with the site land prices. The confiscation is at high rate compared to the capacity of district this leads to delaying or not providing those planned infrastructures. In addition, developed sectors are lived by rich people where it is not easy to negotiate with them during the implementation of some infrastructures such as fibre optics, water pipes and other underground infrastructures.

4.7 Impacts of land price variation to the communities' living condition

Kimironko assistant land officer argued that in some areas of Gasabo District, the communities seem not to be included to live in that area due it is very expensive and they always have misunderstanding by complaining on their compensation result like why others have been expropriated at high price. The land price variation changes the living condition of communities due to while in expropriation process they got enough money depending on their land values though, it regarded that the poor residents who live in the expensive place sometimes they have guilty due to they are living and surrounded by rich people because mostly they have lived in that place before development has occurred and these changes leads them to leave that place.

4.8 Alternative measures that should be taken into account to control land price variation

A land and infrastructure officer in Kimihurura explained that there are no standard measures to control the variation of land prices. However, government should implement the standard range of land price at certain region where this can control high increase of land price in some areas and this will be as guidance for people who need to buy and sell land. In Gasabo District, people who want to buy land are normally

approaching land brokers and mediate him/her to the seller.

Mostly, the price is negotiable between the buyer and seller as well as brokers acts as a mediator. Though, negotiable price is interchangeably with respect to the attitude, problems and experience of seller, buyer and land broker, there is a need to manage land brokers. Where some of them have a business of buying land and after it is being sold at high price by considering on how it is needed by many people and this let them increase the price so that they can get much benefit in short time. Therefore, government have to manage them by minimizing those businesses of buying and selling land and also dealer for land must be controlled due they increase the land value in order to benefit from it and they reduce the land value which leads to the land depreciation. In addition, the variation of land price has to be controlled by balancing the distribution and establishment of infrastructures in all regions.

Act of using and controlling land banking should be the measures of land price variation and also use of financial tool known as land value capture to charge land fees and tax should be the measure of the land price variation (Kacyiru sector land officer said). Gatsata land officer said that land readjustment should be the measure to control land price variation by increasing the value of land while engaging and involving the original residents and landowners as stakeholders.

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

This chapter deals with the conclusions of the study and recommendations regarding to the results and solutions delivered from our research questions.

5.1 Conclusion

This research has discovered how land price had varied by comparing the land price of previous years to the current land price which was conducted in Gasabo District, in the City of Kigali. In conducting this research, the primary data have been used where semi-structured interviews were held with the land officers and land brokers of some sectors in Gasabo District, also secondary data have been used by analyzing spatial data, this was made to have deep insight about this topic of spatial temporal variation of land price in Gasabo District. The main purpose of this research were to identify the spatial and temporal variation of land price in Gasabo District, assessing various driving factors of land price variation, the most influencing factors of land price variation, impacts of land price variation on surrounding environment. afterward, possible solutions about this issue of land price variation were suggested.

From the interview results, we found that both housing, infrastructure provision and community at large are being affected and this have resulted from the interviews made with land officers and land brokers in some sectors of Gasabo District. It is regarded that people moves away when they are not fitting with that living condition and it is difficult for them to live in areas with high price, this leads to displacement of people to find the place which meets their earning income. Actually, People are being expropriated and compensated unequally, where some residents agree and others claims for those actions of being expropriated and compensated for their properties. On the other hand, this issue of spatial temporal variation of land price has shown by explaining how it impacts by decelerating both provision of housing and infrastructures development. Therefore, this research project is fruitful to community by letting them to know better about how the land prices vary

according to their respective places and comprehend the determinants of land price variation in Gasabo District.

5.2 Recommendations

With regards to the results from data collected by using different research techniques and methods including; interview, online research and GIS technology in spatial data analysis. The following recommendations were formulated.

- Institute of Real Property Valuers (IRPV) should update reference land prices at most every two years from provincial to village level in order to know the accurate variation of land prices without any missing villages.
- Gasabo District should manage and control private land brokers in order to avoid inappropriate way of pricing land and properties.
- Gasabo District should manage and collaborate with construction business owners who buy land, build houses and sell them for profit in order to control land price speculation in sectors of Gasabo District.
- Rwanda Transport Development Agency (RTDA) in collaboration with Ministry of Infrastructure (MININFRA) should balance the establishment of infrastructures such as roads in all sectors of Gasabo District.
- Lastly, government of Rwanda should effectively use land readjustment strategy in taking and buying land from landowners. It should also use and control land banking for those who are investing in land. Government also should use land value capture as a financing tool to charge land or other property fees and taxes.

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