



ANALYSIS OF SPATIAL AND TEMPORAL VARIATION OF LAND PRICES IN URBAN AREAS OF RWANDA. Case Study Kigali City, Nyarugenge District.

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ABSTRACT

Land is one of the most important resources that humans need. The population' need for space has led to always want to open in space. With the increasing population in urban area, the demand for land increases while the land is fixed and the price of land varies respectively. Rwanda is experiencing land price variation in most urban areas since the emergence of master plan especially in Kigali city. Land prices have been varying over the years in Nyarugenge District and prices of land is constantly changing according to the way the land is closer to central business district (CBD)

With the process of urbanization in Kigali City, land value increased in Nyarugenge District and the native dwellers have been affected due to the limited capacity to comply with high price of land as well many dwellers

shift from the area unwillingly. In this research we analyse the trends of land price variation in different places as well as investigate the factors behind the variation of land prices in Nyarugenge district. After extraction by mask the slope of Nyarugenge District was calculated and later classified into three categories (Low slope, Medium slope and High slope). The analysis reveals that the steepness of the some areas are directly correlated with the variation of land prices. By using zoning and land use data in ArcGIS 10.6, we found that zoning and land use regulations in Nyarugenge district determine the quantity of land supply for a specific use. According to findings and analysis using GIS, we reveal that land price increased in all sectors of Nyarugenge district, however some sectors experienced high rate of increase than others. In general, the range of land price

increase fall between 4% to 94%. we found that the majors factors contributing to the variation of land prices in last ten years are concentration of economic activities, infrastructure provision such as transportation, electricity and water related infrastrure, zoning and land use regulation that limites the land released for specific use, facilities and accesssibility to econmic amenities such as bus stop, schools, and recreation areas. Government need to increase land released for residential use to accommodate all people according to their capacity therefore each categories of people can get land parcel that can afford themselves

Keywords: Land, Price variation, Land value, Zoning and Land Use and Land Supply

INTRODUCTION

Land is one of the most important resources that humans need. The population growth and need for more space has led to competition of lands and hence increasing land prices. The opening of new space tends to be intensive and in line with human population growth that continue to increase (Fakhruddin et al., 2020). With the increasing population in urban area, the demand for land increases while the land is fixed.

Land value is defined as a measure of how much a plot of land is worth. Land prices is

constantly changing according to the way the land is closer to central business district (CBD), facilities and accessibility to economic amenities such as school, bus stop, shopping and recreation(Goffette-Nagot et al., 2011). In addition, the land use change from one use to another is strongly related to land price variation. The process of urbanization and economic development increase the demand for land for residential and economic activities (Lepcha, 2018).With the instability of land price in urban areas most of dwellers with low income are forced to move out from the city due to the limited ability to comply with the increased land prices.

According to Walters (1983) defined land price as the value of ownership of stipulated right in perpetuity and is equal to estimated present value of the expected future appropriation of rents. Price in money, is the generally accepted expression to mark and compare land values in a functional market. Price variation is changing in the cost of items or property. When it comes to the concept of land use in urban, price variation concerned with changing in the cost land within a specific period of time and use of land (Jaloslav et al, 2018). The price of land is determined by its production potential, and by the present or future services it incorporates.

In the study analyzing land prices in Colombia. Sierra et al., (2013) found significant relationship between land prices and density and proximity to schools and other amenities. The general drivers for urban land prices are population density, level of development as well as several motivation drivers (Mostafa, 2018). The price of land is influenced by among other factors property, population, family relationship and social obligation, in addition land price is negotiable and varies greatly based on land size and its specific location (Twarabamenye and Nyandwi, 2012). According to Fernandez-Duran et al., (2011) the variation of land prices is dependent on the distance from the city center, employment opportunities in an area, area of the property and the accessibility to infrastructure such as road and transport facilities, schools, health and services, structure attribute such land size and built structure, environmental attribute (aesthetic features, air and water quality), security and crime.

The land price variation in Rwanda is observed in country wide in most areas of Kigali city and secondary cities. The price variation of land affects most of urban dweller through determination of land use and create a diverse barrier on government in setting policies related to land and allocation of

resources (RLMV 2014). Data on land prices and their determinants such as land prices, job access and demography are directly or indirectly affecting the spatial variation of land prices.

Rwanda is experiencing land price variation in most urban areas since the emergence of Kigali city master plan in 2013. According to Rwanda land report (2014) Rwanda's urban areas were characterized by uncoordinated and uncontrolled urbanization. Specifically, Kigali city had 6% of population growth rate per annum in 2006 and 9% per annum in 2008 (Republic of Rwanda, 2012). Spatialtemporal variation of land prices has been mostly influenced by the distance from CBD and accessibility to amenities and services since the emergence of Kigali city in (Lepcha, 2018) Taking an example of Nyarugenge CBD in Muhima and

Nyarugenge Sectors the mean land price per square meter is 64,460, rwf and 70,619.75 rwf from 2009 to 2017 respectively. When you go far away from the CBD, like Mageragere and Kanyinya Sectors, the mean land price in that sector is 2149 rwf and 2109 rwf from 2009 to 2017 respectively. The percentage increase in young people from native and migration of young people from rural areas

are correlated with the relocation of land they are the ones demand more land for from agriculture land to residential land as construction of their homes.

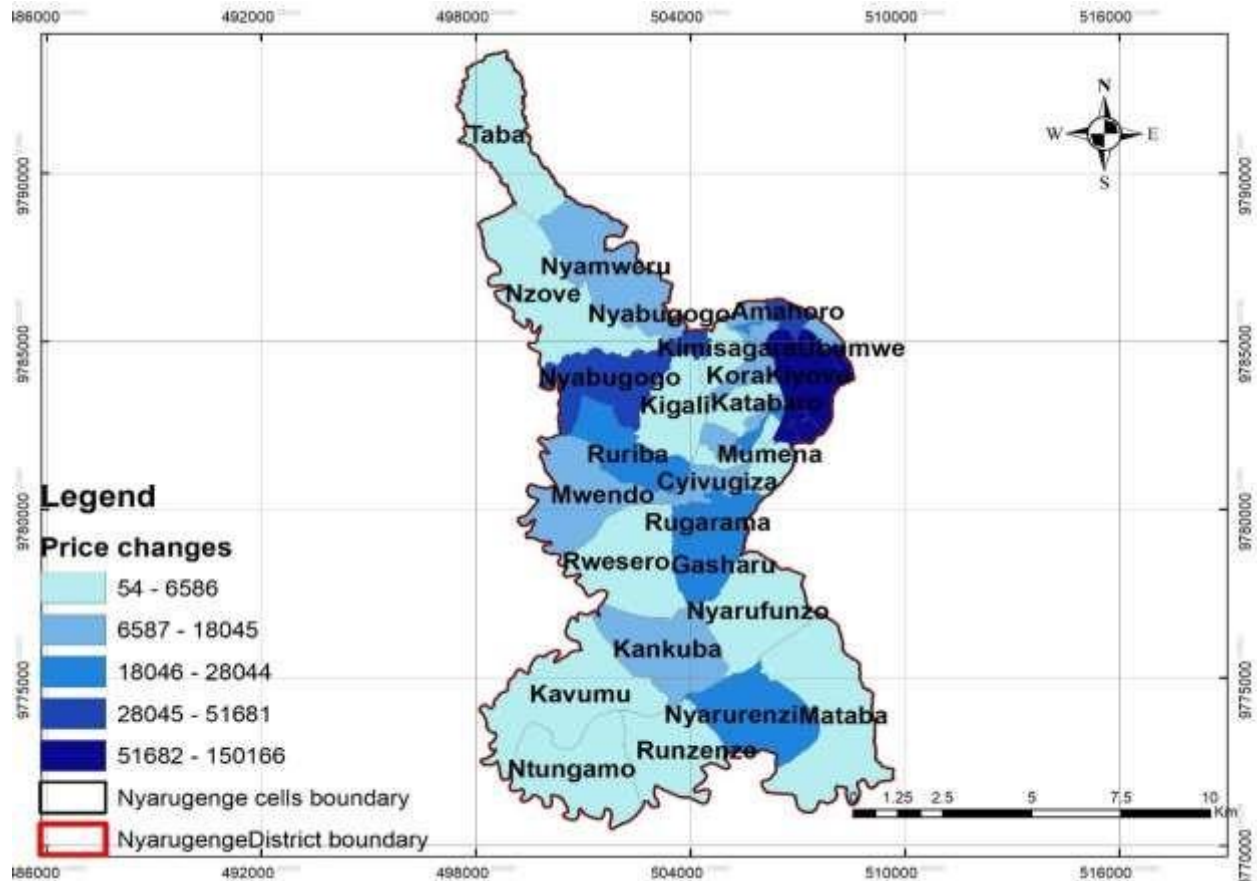


Figure1. Price variation in Nyarugenge Cells 2009-2018 (Data source CGIS/UR & IRPV, 2018)

According to Rwanda Land Management and Use Authority (2017) Rwanda is one of the countries in east Africa experiencing land scarcity and variation of its prices in most areas of Kigali city. The process of urbanization and economic development results into an increase of demand for land for residential and economic amenities. The demand for land and its limited availability make it a scarce resource. Variation of land prices in areas of the City of Kigali has affected most of low-income households and livelihood as they have no ability to comply with the increased land price. Today some areas of Kigali City are experiencing high increase of land prices and this creates many

challenges to urban dwellers with the limited increase of income (Nkurunziza, 2016). As defined by NISR (2014), the city of Kigali was divided into three strata, the first stratum is central Kigali, the second as per-urban and the third is rural Kigali. Land price has been increased to the higher extent in Nyarugenge district as a heart of Kigali city compared to the remaining areas.

According to Kigali City Development Plan (2013-2018) land prices has been varying

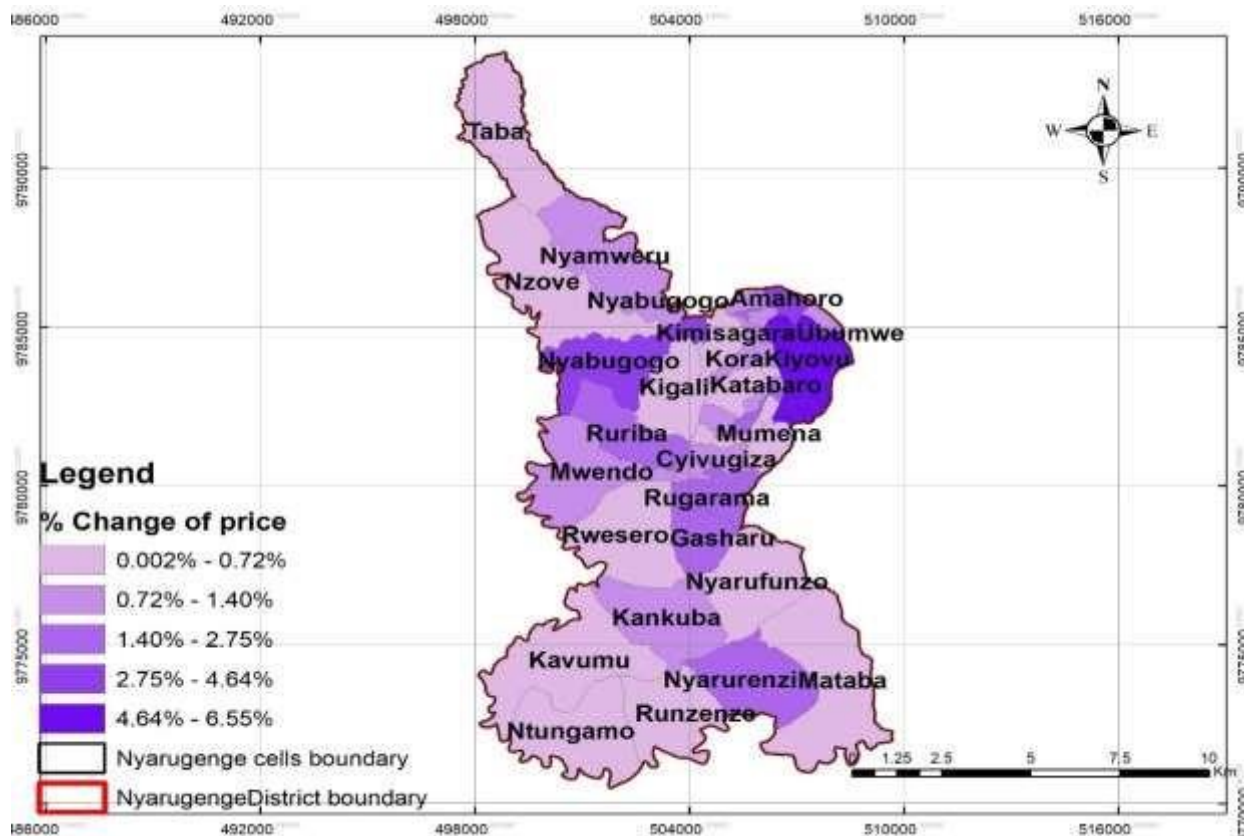


Figure2. Percentage change of land prices in Nyarugenge cells from 2009-2018 (Data source

over the years in Nyarugenge District. With the process of urbanization in Kigali City, land value increased in Nyarugenge District and the native dwellers have been affected due to the limited capacity to comply with high price of land as well many dwellers shift from the area unwillingly, as a proof the new buildings of high cost are being constructed in Nyarugenge District.

This research will analyze the spatial and temporal variation of land prices, the implications of land price variation to housing and infrastructures will be incorporated in this research as well as highlighting relationship between land value and other variable that are behind to the change of land prices in Nyarugenge District. Finally, the research will be a greater important to the decision makers in Nyarugenge District to adjust policies and different strategies as well as providing better solution for land price fluctuation and encourage inclusiveness of dwellers in Nyarugenge District. This will be achieved by using a spatial and temporal assessment approach supported by a Geographic Information System (GIS) which integrates the existing spatial data and information collected from land owners, local authorities' ideas, land brokers, existing documents and spatial analysis of study area.

II. MATERIAL AND METHODS

The study is based on primary and secondary data collected through intensively deep interview with sector land managers and land brokers, spatial data and statistical analysis where collected data are displayed into maps and charts using various software ArcGIS and Ms-Excel. Land sales data on real urban market in Nyarugenge District was captured by taking notes form published documents of land reference price. Discriptive statistical techeniques was used to organise, summarise and presente the information obtained from interview depending on how asked people respond. Data obtained compiled and tabulated into frequence distribution table, graphs and chats in order to analyse, interprete and present meangifull information.

Study area

Nyarugenge is one of the districts of Kigali city located in south-west of Kigali city, the area is made of 10 sectors namely Gitega, Kanyinya, Kigali, Kimisagara, Mageragere, Muhima, Nyakabanda, Nyamirambo, Nyarugenge and Rwezamenyo. Nyarugenge district boarder with Gasabo, Kicukiro, Rulindo, Kamonyi, and Bugesera district. Nyarugenge district contain most of city

business as it is the heart of Kigali city and located in west of the urban area. The total area of the district is about 134 Km² with the total population of 284,561 and 2100/Km² population density (National population census, 2012)

CGIS UR it was easy to create map showing the description of study area, analysis and visualization of spatial variation of land price. Data on land price variation was inserted into excel and later integrated into ArcGIS. By using statistical tools into Arc toolbox and

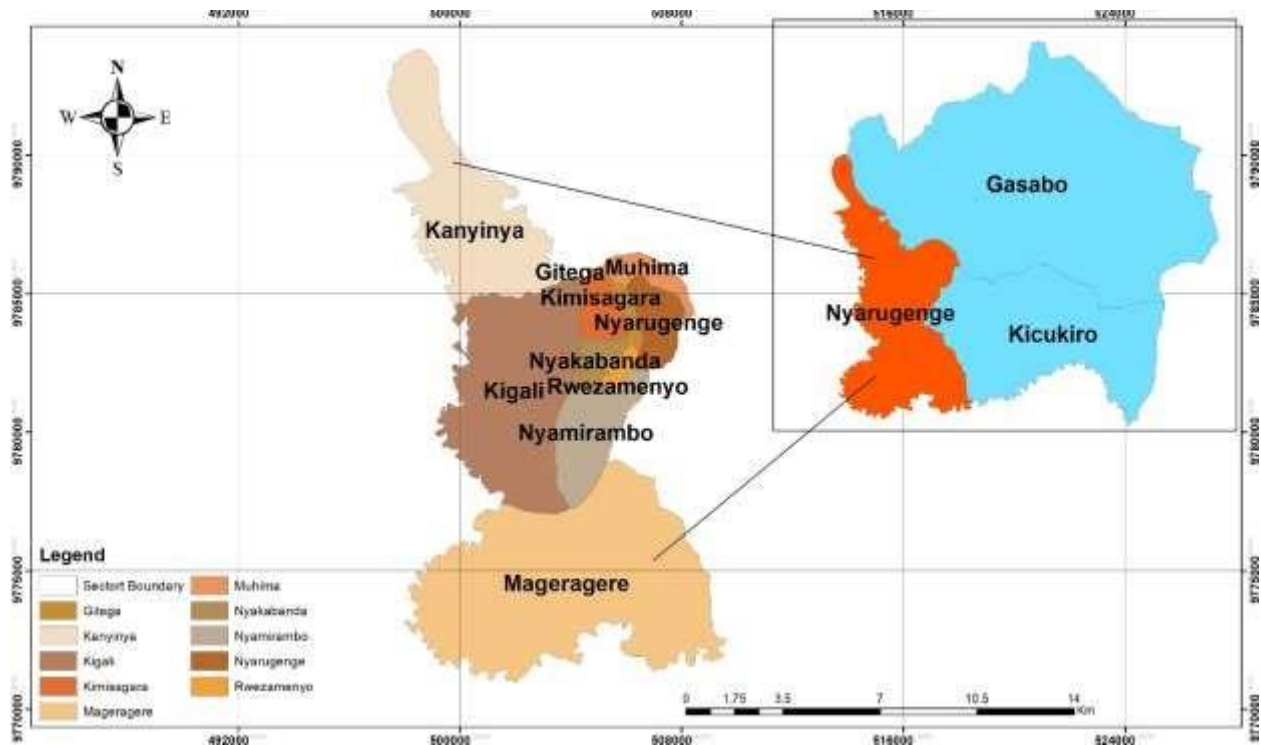


Figure3: Nyarugenge District administrative boundary (Data source CGIS/UR using GIS 10.6.)

Spatial data analysis

ArcGIS 10.6 software and its spatial analysis tools was essential in this research. Digital Elevation modal (DEM) inserted in ArcMap to analyse the topography of Nyarugenge district. after extraction by mask in Arc toolbox, the slope was calculated and classified into three categories (low slope, medium slope and high slope). By using the spatial data (administrative boundary) from

frequency analysis tool was used to create statistical representation on land price variation in different years

Sample size and Sampling techniques

Purposive sampling method was used in this research as it provided more information on spatial temporal variation of land prices. We used a total freedom in selecting of people to be a part of our research and all target people was eligible to be surveyed. Among the 10

sectors of Nyarugenge district three 4 sectors are selected such as Muhima and Nyarugenge closer to CBD and Kinyinya, Mageragere far from CBD, the sample size was chosen in household found in selected sectors. Depending on barriers of time and Covid-19 prevention strategies, 4 land officer was chosen in the selected sectors and 2 land brokers in each selected sectors.

III. RESULTS AND DISCUSSION

Factors behind the spatial and temporal variation land price

The topography of Nyarugenge district was analysed as the factor behind the variation of land prices in different places in the area. After extraction by mask the slope of Nyarugenge District was calculated and later classified into three categories (Low slope, Medium slope and High slope). The analysis reveals that the steepness of the some areas are directly correlated with the variation of land prices. The price of land increased depending to the slope of land, in the analysis we reveals that areas of low slope and medium slope has been affected by the increased land price compared to the areas of high slope due to the fact that most people are not willing to live in high risk zone and they prefer to settle in the comfortable areas which may not affect the life of their family but also that are highly

accepted by government law where regulation in building code state that , people must build their house in slope that are less than 18 degree of steepness . This lead to the increased the price of land in some sectors of Nyarugenge district with low and medium slope as the demand for land in those sectors increased. The analysis reveals that sector like Muhima, Nyarugenge, Kigali and Nyamirambo are the ones with low and medium slope that are effective to residential land and commercial use. This makes the land to be expensive and the price of land varies respectively whereas sectors like Mageragere, Kinyinya, Gitega and Kimisagara are medium and High slope. This do not attract residential and commercial use and the price changed at low rate in last ten years compared to other areas. However, the steepness of some sectors of Nyarugenge district has a direct impact on variation of land prices . for that context ,steepness has strong relationship with the demand of people to land and the demand is strongly related to the increase of land price, the lower the steepness the higher the demand for land vice-versa

The lower the slope of the area, the higher the demand for land of suitable and profitable uses like commercial activities and residential uses making the land to be expensive and the price varies respectively compared to the areas of high slope that prohibits the concentration development of attractive activities and unsuitable for residential land that are highly costive hence the price of land reduces, land price and slope are correlated in such manner”the higher the slope, the lower the price vise-versa”.

the price of land in the last ten years. By using zoning and land use data in ArcGIS 10.6, we found that zoning and land use regulations in Nyarugenge district determines the quantity of land supply for a specific use. The quantity of land released for residential purpose and commercial use directly affects the price of land. land use regulations recognized the local externalities, providing amenities that makes community more attractive and land pricing

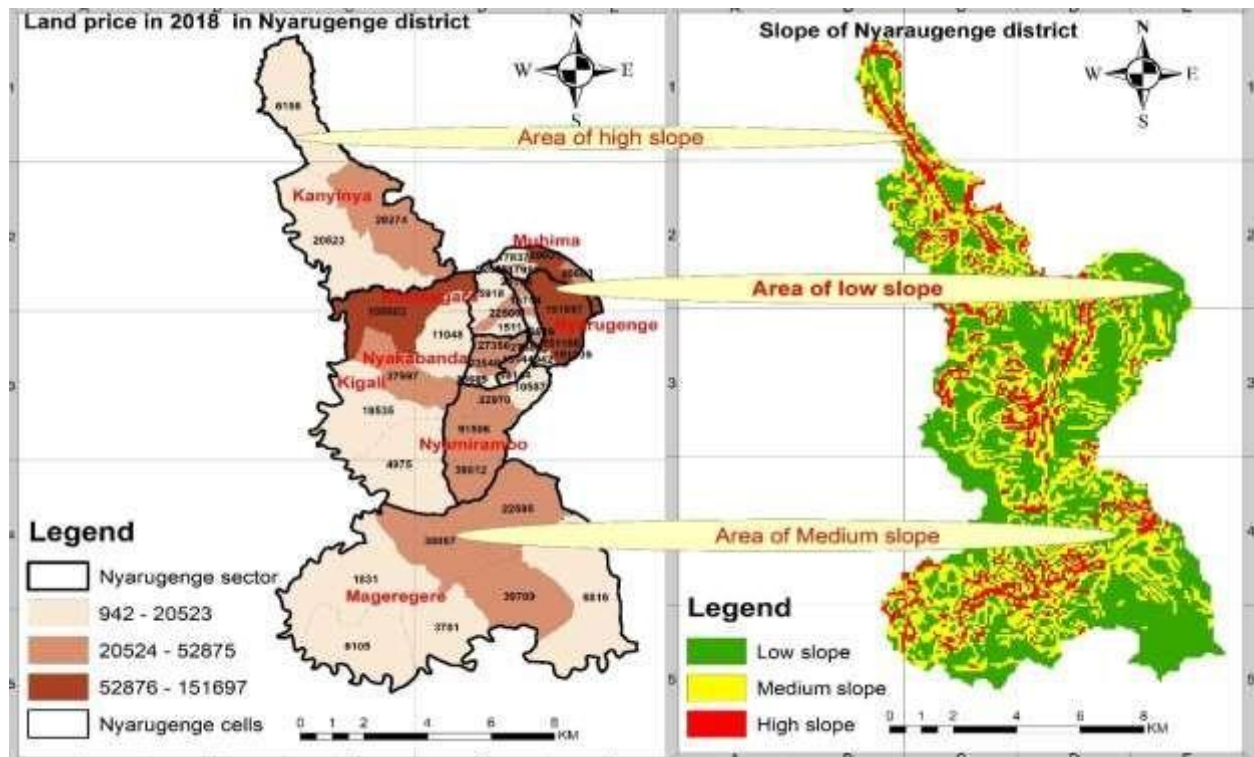


Figure4: Relationship between slope and land prices (Data source CGIS/UR) zoning and land use regulations has increased higher. Limiting land for a specific use in

some sectors of Nyarugenge District has increased land price as Land-use regulations increased land values through making land as scarcity resources, by increasing the scarcity of land available for a particular use in a particular location, the prices for those lands were increased in the market. For example, a limit on the land available for development in one location has increase the price of developed and developable lands. In this analysis we reveal that some areas in Nyarugenge District were zoned for residential and commercial use which have attracted more communities and make land pricing higher as well as housing price affected. Land price increased at high rate in sectors like Muhima, Nyarugenge and Nyamirambo where those areas zoned for residential and commercial zone. Although others sectors were zoned for residential and commercial use but they are at low rate

compared to the mentioned above areas. This make the price of land to increase in the last ten years at low rate. However, zoning and land use regulations makes land price change in Nyarugenge District by limiting land released for specific use in some sector and increase also land released for specific in other areas. Areas zoned for commercial and residential use are more valuable compared to the areas zoned for agriculture and wetlands in Nyarugenge District.

Commercial and residential zone increase the demand for land in that areas making the appreciation of land in some sectors of Nyarugenge district. Taking example of Nyarugenge, Muhima, Kigali and Nyamirambo sector there was appreciation of land compared to sectors like Mageragere and Kanyinya where the most areas of these sectors zoned for agriculture.

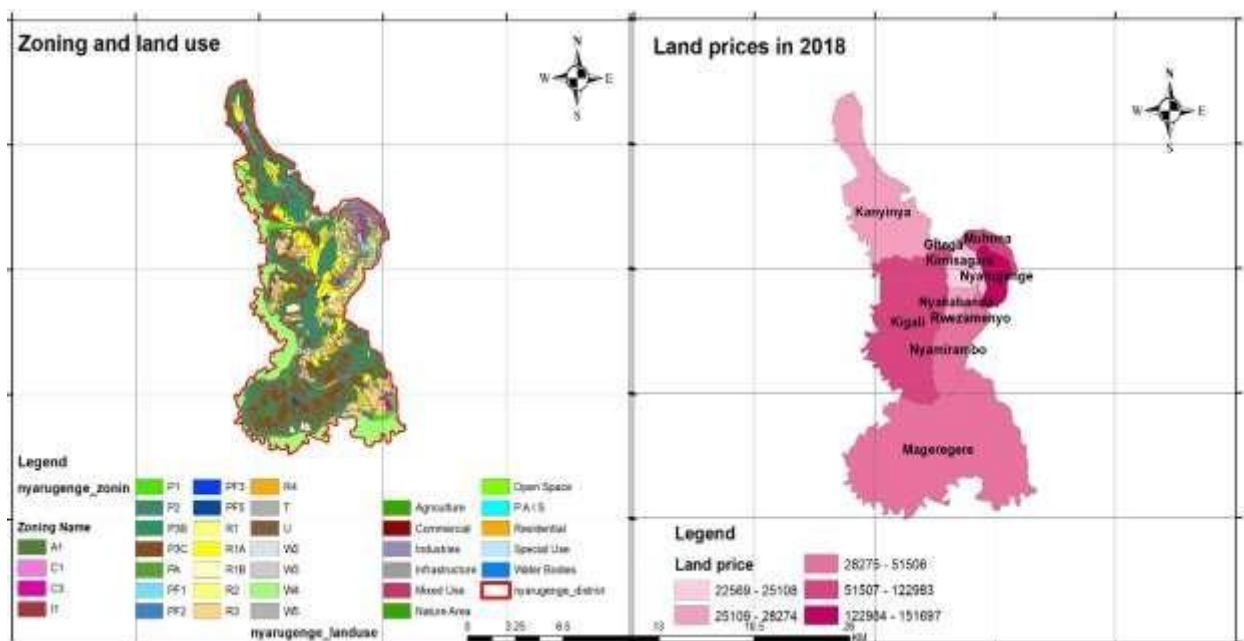


Figure5. Relationship between land price and zoning and land use in Nyarugenge District (Data source CGIS/UR).

Facilities and accessibility level to economic amenities such as school, bus stop, shopping and recreation, health facilities and infrastructure such as transport and education. Area which has most of those amenities like Nyarugenge and Muhima sector experiencing rapid increase of land price due to the factor that areas are highly demanded by people and investor that would like to use land for profitable task as declared by land brokers of Nyarugenge and Muhima sector. In addition, the cost of land parcel in Nyarugenge was 612,400 rwf in 2009 and the price increased to 45,600,000 rwf in 2018 and 53,000,000 rwf in 2021. Land brokers in Nyarugenge sector states that the major factor that contributed to increased land price was the growing trends of economic activities and the most factor contribute to the price variation is the zoning and land use regulation. According to Mageragere sector land officer, the plot size was 25/30 in 2009 before the introduction of Kigali master plan, after the introduction of Kigali master plan the plots size reduced from 25/30 to 20/20 in 2013 and also changed to 15/20 in 2050 master plan. The price of land parcel depends on their location but in Mageragere sector, two sites were taken as examples (Nyarufunzo and Mataba). The cost of land parcel in the above mentioned sites was

300,000 rwf in 2009 and the price increased to 2000000 rwf in 2018 and 6000000 rwf in 2021. In 2009 the price of land parcel per meter squared was 400 rwf whereas in 2018 increased to 5000 rwf per meter square and 20000 rwf per meter square in 2021 and the percentage rate of price increase from 2009 to 2021 is 5%. The sector land officer argued that the factors behind the variation of land price in this sector are information on land demand. The famous of the site selected for residential use determine the level demand for land in that site meaning that if the site is not known the price of land parcel is low but when the site is known the demand for land parcel in that site increase as well as the price of land parcel increase, introduction of master plan, fees for getting permission for construction in the site, low land released for residential use needed by many people.

The current plot size in Kigali sector is 15/20, and price of land parcels depends on their location from the main road. Meaning that parcels that are closer to the main roads has high prices compared to the parcel that are far from the roads as declared by Kigali sector land officer. The cost of land parcel that is near to the main road is between 15 Million and 20 Million but in 2009 the cost land parcel was between 900000 rwf and 1500000 rwf. The rate of land price from 2009 to 2021

was 7.5%. referring to the conversation we had with sector land officer and land brokers, the factors behind the increased land price in this sector are physical plan, integrated infrastructure such roads, water, and electricity. The market orientation by government to the investors contributes to the variation of land price variation in a way that government occupy land in order to attract more investors to use that land hence increase the land price.

In the analysis using ArcGIS 10.6, land price in diferent sectors of Nyarugenge district was

usefull in elaboration of statistical graph of land prices in each year and their variation using graphs in ArcGIS The analysis reveals that land price varies in most areas of Nyarugenge district The areas experienced the increased land price are those sectors that are in low and medium slope, closer to CBD and access to ammenities compared to other sector We revealed that the lowest cost of land parcel was 230 rwf per square meter and found in Kanyinya and Mageragere sector in 2009 and the highest cost of land parcel was 1,286 rwf and 1,531 rwf and found Muhima

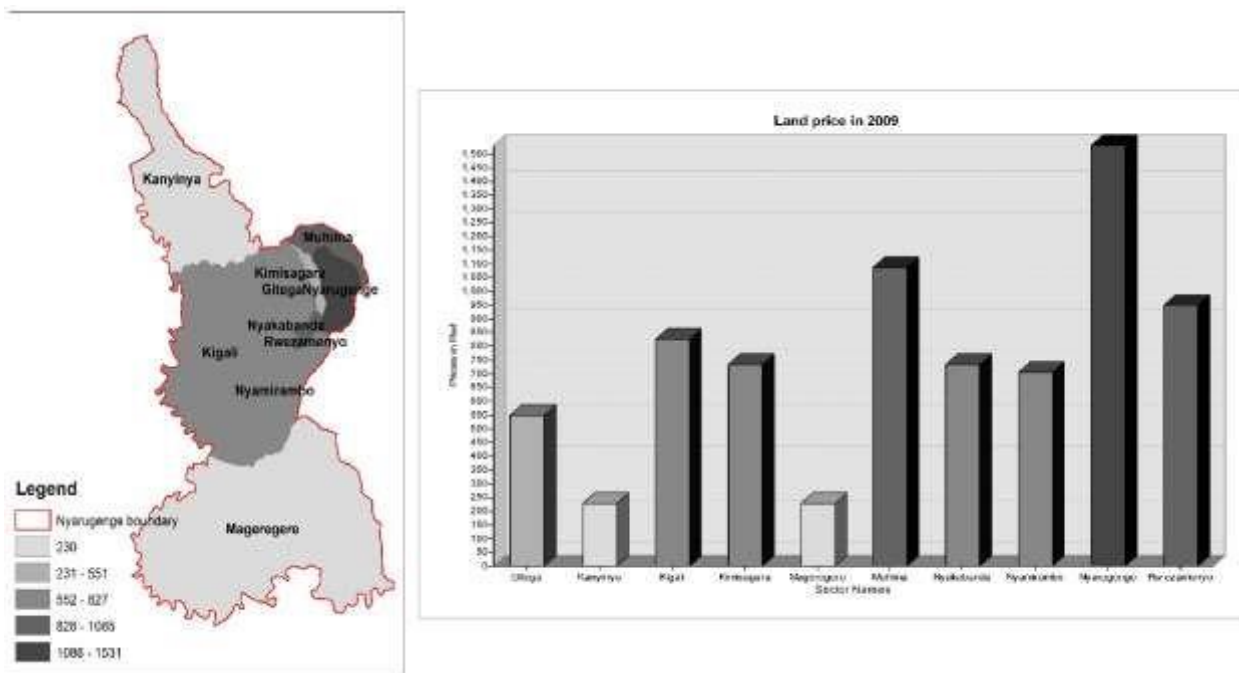


Figure 6. land price in 2009 in Nyarugenge District in Rwf (Data source CGIS/UR) analysed. Land price in 2009 and 2018 inserted into excell and later integrated in ArcGIS and the frequence analysis tool in Arc toolbox was used to create a table which was

and Nyarugenge sector respectively (figure 6).

The land price continue to increse in the next ten years from 2009, land price increased in all

sectors of nyarugenge district but some sectors experienced high variation of land price. The cost of land parcel in Kanyinya and Mageragere increased from 230 rwf per square meter in 2009 to 28,274 rwf and 39,789 rwf per square meter respectively (figure 7). The percentage change in kaninya

and mageragere sector was 4% and 13% respectively (figure 8) . In 2018, the highest cost of land parcel was 151,697 rwf per square meter and was found in Nyarugenge sectors. The percentage change of land price in Nyarugenge sector was 94% (figure 8).

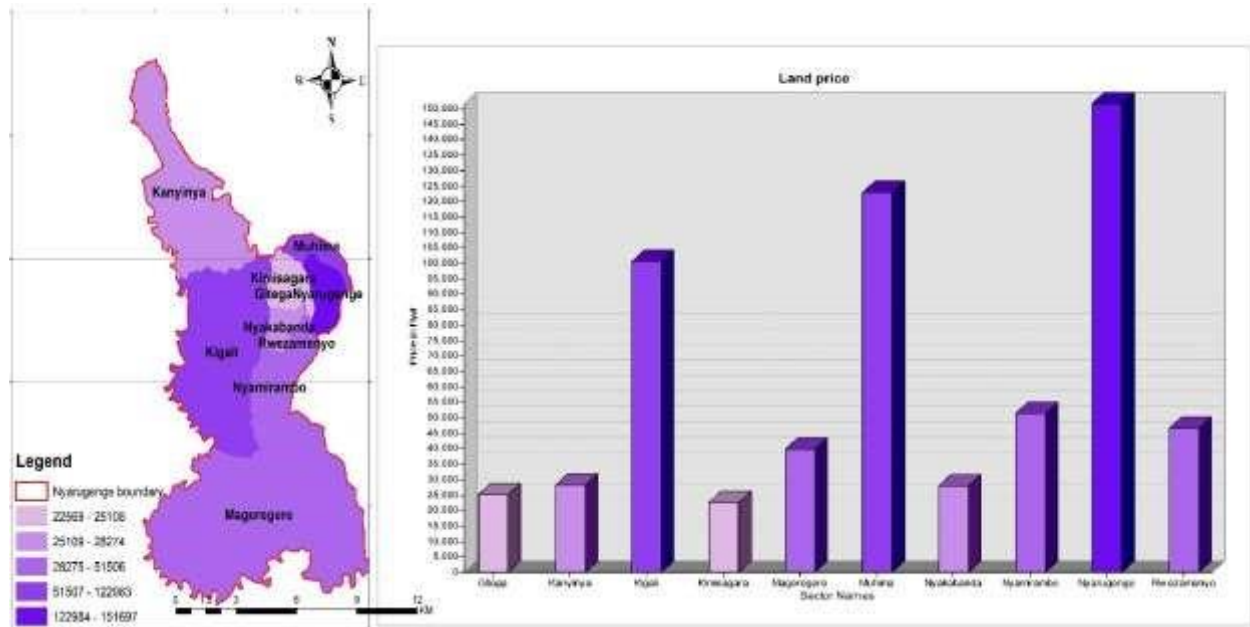


Figure 7. land price in 2018 in Nyarugenge District in Rwf (Data source CGIS/UR & IRPV, 2018)

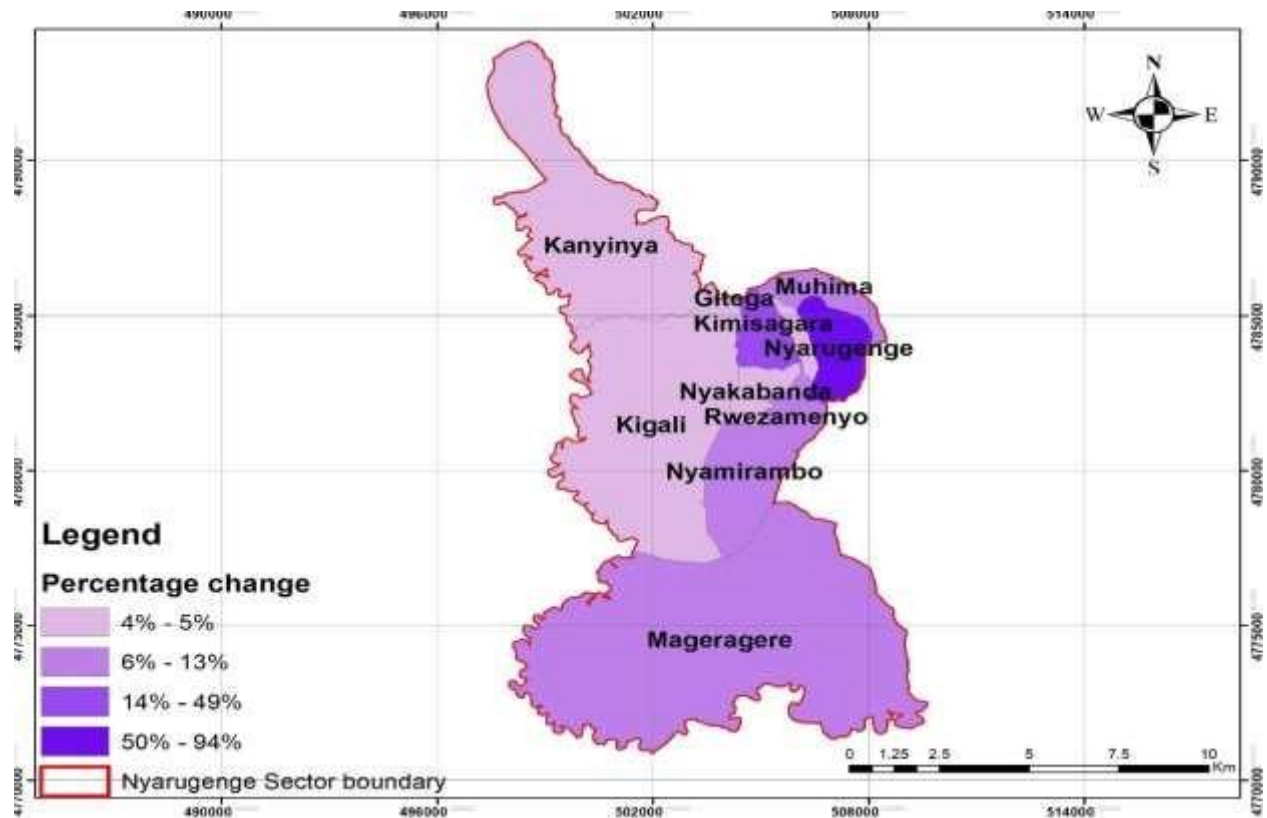


Figure 8. percentage change of land price between 2009 and 2018. (Data source CGIS/UR &IRPV, 2018)

According to findings and analysis, we reveals that land price increased in all sector of Nyarugenge district, however some sectors experienced high rate of increase than others. In general, the range of land price increase fall

between 4% to 94% (figure 8). Referring to the interview with land brokers and land officers in some sector, we found that the majors factors contributing to the variation of land prices in last ten years are concentration of economic activities, infrastructure provision such as transportation, electricity

and water related infrastructure, zoning and land use regulation that limits the land released for specific use, facilities and accessibility to economic amenities such as bus stop, schools, and recreation areas.

The implications of increased land price on housing provision

Land prices are the primary driver of housing prices, and their impacts on housing prices vary over different administrative levels. Increased land price lead to high housing prices through a direct impact on costs and a reduction in the price elasticity of supply. According to Mageragere sector land officer, the increased land price creates a diverse impact to low income people especially youth with limited capacity to buy land parcel and build houses that comply the master plan at the same time. as a results youth tends to buy the land parcel at high price and wait for the long time to get the financial required to build houses. The primitive people with limited financial to build houses that meets housing standard decide to sale their land hence reduce the provision of houses as declared by Kigali sector land officer. Due to the increasing land values, people with low income are tempted to build housing in restricted areas such as flood zones, and drainage channels. In addition, the increased

land price affects the implementation of master plan if the people buy land parcel at high cost and fail to comply with the physical plan and delaying the implementation of master plan.

The implications of increased land price on infrastructure provision

The infrastructure includes services such as sewerage and drains, roads, and public transport, as well as social infrastructure such as health care facilities, education facilities and other community services (Romkaew, 2001). Referring to Mageragere sector land officer, Increased land price lead to the increase of land tax and the collected taxes are used as a sources of funds for infrastructure provision. In addition to that Kigali sector put in place the policy that encourage people who buy parcel in that sector to contribute in infrastructure provision by paying an amount about 385000rwf that will be used to increase efficiency of infrastructure in that sector. However, the increased land price affects government negatively in the process of compensation for land of high prices leading to more expenses and sometimes delays the implementation of infrastructure provision.

Policies put in place to insure there is provision of sufficient land in the right place for right use.

The revised new master plan incorporated the inclusiveness of all people with different capacity. All housing types are integrated in the selected sites; mud blocks have been approved by the city master plan to allow people to build their house meeting their capacity. According to Mageragere sector land officer, citizens, investors, planners and land surveyors and GIS are advised to unite themselves in collaboration with their local leaders to plan the suitable site and present to the government to be implemented in order to provide sufficient land in the right place for the right use. The extension of master plan that increase the land released for residential and other use and reduce the competition for one site as well as increase inclusiveness hence reduce the variation of land prices.

Implementation of policies to regulate land price variation

Policies to regulate land price variation are implemented through the cooperation of leaders and their citizens. As declared by Mageragere sector land officer, mobilization is used by explaining the benefits collaboration among themselves and integration of master plan and the associated infrastructure to their lifestyle. this reduce the demand competition on existing site and increase the land released for the specific use

as result cost of on land parcel are maintained as demanded people spread in other new planned site and land price became effective regulated. According to Kigali sector land officer, they mobilize people to sale part of their land and get the financial required to build the remaining land but if they have limited capacity to comply with the housing type designed in the planned site, they are advised to sale their land and shift to the areas that meet their ability. Furthermore, people with financial instability are advised to negotiate with investors to construct mixed use on their land and give them the upper part of house and lower part can be used by the investors.

Assistant provided to the households affected by the increased land price.

Increased land price lead to high housing prices through a direct impact on costs and a reduction in the price elasticity of supply, poor people are forced to move out the city due to the limited ability to afford land of high price, in the interview with different sector land officers some assistance are provided to the household affected by increased land price. People from category one (direct support) are accommodated in IDP modal village. In addition, other people with limited capacity are advised to unite themselves,

combine their forces and buy land parcel as well as construct one house of different room that can accommodate them.

V. CONCLUSION AND RECOMMENDATION

Conclusion

In fact, land price has been increased in Kigali city in most sectors that are experiencing most trend of economic activity and boasting of infrastructure provision, rapidly increase in land price has its low associative effect on infrastructure and housing provision and on the dweller of the city, most of the sign of that land price increase started to be observed at the time of introduction to masterplan which induce land use and zoning regulation that determined the quantity of land released for specific use, increase demand for land due to continuous urbanization of Kigali city. The most increase has been observed in some area of our case study depending on different factor that are behind the variation of land price like topography, infrastructure provision, accessibility and facilities to dairy need of the people, based on the finding of the study, we have been observed that Nyarugenge, Muhima, Kigali sector experience more rapid land price compared to the remaining sector of Nyarugenge district. in literature review of existing situation of

land price in 2009 and 2018 reveal that land price in 2009 was on steady level but as the time goes on with introduction of masterplan and continuous urbanization lead to massive rapid demand of land for specific use which is interrelated to land price increase In general, the range of land price increase fall between 4% to 94%, if nothing done currently the rate of land price will be much higher as possible and will create a great barrier to people and economic development.

Recommendations

From the finding of this study, the following recommendation are made concerning different situation that have been identified in different sector of Nyarugenge district, the analysis of the slope, zoning and land use regulation, facilities and accessibility in Nyarugenge district. the institution that are in charge of land as a scarce resource and the effect associated regarding to poor people, some efforts are needed to improve the situation and control the land price variation and make land an inclusive resource in upcoming century

Government must put in place different policy that favor good working condition of institute of real property valuer for making land reference price and record it for better land market operation.

Government must increase land released for residential use to accommodate all people according to their capacity therefore each categories of people can get land parcel that can afford themselves

Government have to put in place strategies for regulation of urban land market, penalties for informal land purchase for better regulation and control of urban land price.

There is need for integration of affordable houses while making the physical plan in the

selected sites in order to provide more accommodation to the households that cannot afford their own houses due to the increased land price so that they can be accommodated at low rent and stay in the city instead of shifting unwillingly.

There is need for land re-adjustment while providing infrastructure to the citizen and this will reduce the amount of money during the period of compensation.

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