Available online at www.asric.org
ASRIC Journal on Social Sciences and Humanities 1 (2022) 1-13

Effects of Urban Sprawl on Service Provision and Transport Accessibility in Peri - Urban Areas : the Case of Rwanda

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Received 19 July 2022; revised 31 July 2022; accepted 3 August 2022

Abstract

One of the most disturbing outcomes of rapid urbanization in least industrialized countries is the inability to manage land development in rapidly growing cities. Many of the present large cities in Africa for example, have sprawled beyond the limits of the city authorities to provide the basic infrastructure services such as piped water, electricity, sewerage and roads to a point where their efficacy is greatly reduced, but it also adds considerably to the costs of such services as education, health and transport. This study was therefore geared towards exploring the effects of urban sprawl on service provision and transport accessibility in peri-urban areas in developing countries. Through the case of Rwanda both Primary and Secondary data were used to stipulate current situation of urban sprawl in Rwanda without undermining environment and other factors included in sustainability elements. Literature review was done covering urban planning related documents, policies and legislations. Interviews with 90 residents in the city of Kigali were also conducted and these were selected randomly. Additionally, One (1) professional expert from the city of Kigali was interviewed to get his understanding while respecting ethical issue. The study has revealed that urban sprawl in the city of Kigali is controlled through building permits. The land developers in case they want to initiate their projects they need to seek for building permit which will allow them to execute projects. The land developers are monitored by the District officials to see whether what was approved on the plan comply with what is happening on the ground. In peri - urban areas important services are provided, a situation which makes community attracted in this area for development projects. This study highly recommend on consideration of smart city concept as cities are spatially expanding and due to the fact that this idea coming soon into action. Finally, the study recommends that public services provision including transport facilities be proved before settlement is developed.

Keywords: Level, Trend, Urban Sprawl, Developing World, Rwanda.

1.0 INTRODUCTION AND LITERATURE REVIEW

Urban sprawl is a difficult, poorly defined truth. It is an encroachments of City or town into forest cover, agriculture and others usually to create built up areas made by low income earners houses, as well as advanced adjustment of various elements like roads, houses and storerooms (Mancebo, 2009). With rapid urbanization and more than half of World's people live in cities and most of them face numerous challenges including environmental and socio-economic transformation (Wolff, Mdemu, & Lakes, 2021).

By 2030 city dwellers globally are expected to increase by 1.4 billion people, with city and towns population for 60% of globe's community. Thus by 2050 this numbers is anticipated to extent at 2.6 billion (Jones, Cummings, & Nixon, 2014). While the speed and pattern of urban development urbanization

changes daily and most of these changes will happen in Third World Countries. Therefore in an increasingly urbanized World, it is very important to make sure that public services provision in cities is reached even to poor people together with a wide population (Jones, Cummings, & Nixon, 2014). The amount, determinants, rate and spatial distribution of urbanization or urban development are major uncertainties for decision makers. Thus neighborhood accessibility and spatial policies are maintained the most powerful factors on present land use change (Kasraian, Maat, & Wee, 2019).

In Latin America and Caribbean countries between 1950 and 2000 they experienced rapid urbanization process and population living in urban areas increased from 42% up to 75%. According to United Nation projection population in region will be 82% in 2020. During 1980s most population growth was found in urban areas between 50,000 and 500 000 occupants. This quick urbanization has caused urban dynamics including poorly regulated land use, high crime level, scarce housing, lack of infrastructure as well as environmental deprivation (Torres, 2011). PLUREL Study carried out in Europe between 2007 and 2010 across 27 states said that peri-urban areas will increase four times as more as cities with an equivalent surface of built up land. Between 2040 and 2060 it is already confirmed that this movement will double the extension of current peri-urban areas (Torquati, Giacchè, & Tempesta, 2020). The existing growth of African cities exceed the capacity of different city managers to give proper, affordable housing to fill the gap of housing shortage. It is for this reason that many governments have opened up this sector for private investors and buyers so that they can get involved in providing houses and this added value in rapidly expansion of cities outside their boundaries. Additionally the rapid development of cities often results into uncontrolled urban sprawl or uncoordinated city expansion where all these quick cities sprawl leads to the encroachment of urban land uses on rural land as well as weakening spatial separation between urban and rural places (Yiran, Ablo, Asem, & Owusu, 2020).

Many of present large cities in Africa for example, have sprawled beyond the limits of the city authorities to provide the basic infrastructure services and community facilities. As more and more population move to the periphery of the cities where land is cheaper and can erect economical shelter, the result has been horizontal expansion of cities. This growth pattern not only attenuates major infrastructure elements such as piped water, electricity, sewerage and roads to a point where their efficacy is greatly reduced, but it also adds considerable to the costs of such services as education, health and transport. Although city sprawl a global phenomenon, its effects in poor countries are far more reaching than in the rich countries. In Mexico City, for example, as a consequence of sprawl, people are forced to commute sometimes 3 hours per day working. In Dar es Salaam city, poor households have been spending about 45% of their monthly income in transport costs from their homes to work places (Kombe, Kyessi, Lupala, & Mgonja, 2003).

Many developing countries including Lesotho are currently having problems connected with weakening infrastructure, environment deprivation and settlement deterioration (Mohapi, 1989).Various studies shows that the connection between land use and transportation is difficult since many factors like remarkable urban structure, amount and the size of cities are generally in effect in finding transportation demand, which in contrary will affect also the spatial structure, density and the size of urban places (Ustaoglu, Williams, & Petrov, 2017). Most worrying has not been only the declining capability of the most governments to provide basic infrastructure on the sprawling city, but the rapid urbanization that is driven by widespread poverty and stagnating poor economies. The consequences of this type of urbanization have been directly related to un-suitable urbanization characterized by the rapid growth of the informal sector and the proliferation of informal settlements. This environment has crippled effective urban management in most of these countries. As the intensity of urban sprawl increases new development tends to overspill into the peri-urban zones where buildable land is available at affordable price for the poor. Confronted with decreasing financial and administrative resources, and the fact that low-rise low-density housing development dominate in these areas, city sprawl and associated externalities are increasingly becoming more evident. This is manifested in increasing pressure on services in urbanized areas and absolute lack of such services in the peri-urban areas. This characterizes the concept of urbanization under poverty. This paper presents the experience of urban sprawl in the city of Kigali and discusses the impacts of urban sprawl on services provision and transport accessibility. It is argued that unless effective planning responses are made to guide

city growth, the on-going urbanization trend challenges the achievement of sustainable development. Rwanda government have set determined vision to change the country from an agrarian economy into knowledge based economy by the end of 2020 where these changes are taking place in the setting of Two import trend of 21st Century of rapid urban development and increased use of emerging technologies in all sectors which have positive benefits on public (Rich, Westerberg, & Torner, 2017).

2.0 METHODS, TECHNIQUES, STUDIED MATERIAL AND AREA DESCRIPTIONS

2.1 Overview of the study area

According to 2002 and 2012 National census, Rwanda has Six (6) secondary cities grew at average equals to 3.3 % which is below the national growth rate of 4.1 % and the ratio of Kigali city of 4.2. Both Musanze, Nyagatare and Rubavu are the most rapidly growing cities where Musanze and Rubavu corridor profits from various factors of (i) richness from agriculture production, (ii) Rubavu being at nearest market of Goma in DRC (World Bank Group, 2017). In Rwanda the 2011 National Land Use and Development Master Plans (NLUDMP) gives that Districts centers must be proven to meet community's opportunities on a life with quality. It suggests structures for a modern district center by the year 2020 concerning housing, education, population, health, administration, culture, sport, protected areas, recreation areas, Transportation, Sewage, Water, Solid Waste, Location and ICT (RLMUA, 2019). Peripheral cities or secondary cities are playing crucial role in serving country's peripheries as well as cross-borders both commercial activities and opportunities. The periphery broader cities are important and growth fast as outer growth poles of 300,000 to 650,000 population (Republic of Rwanda, 2020). Researchers considered Kabuga and Ruyenzi settlements in peri-urban areas in this study. Figure 1 shows the Country of Rwanda administrative map with all Provinces (Northern Province, Southern Province, Eastern Province and Western Province).

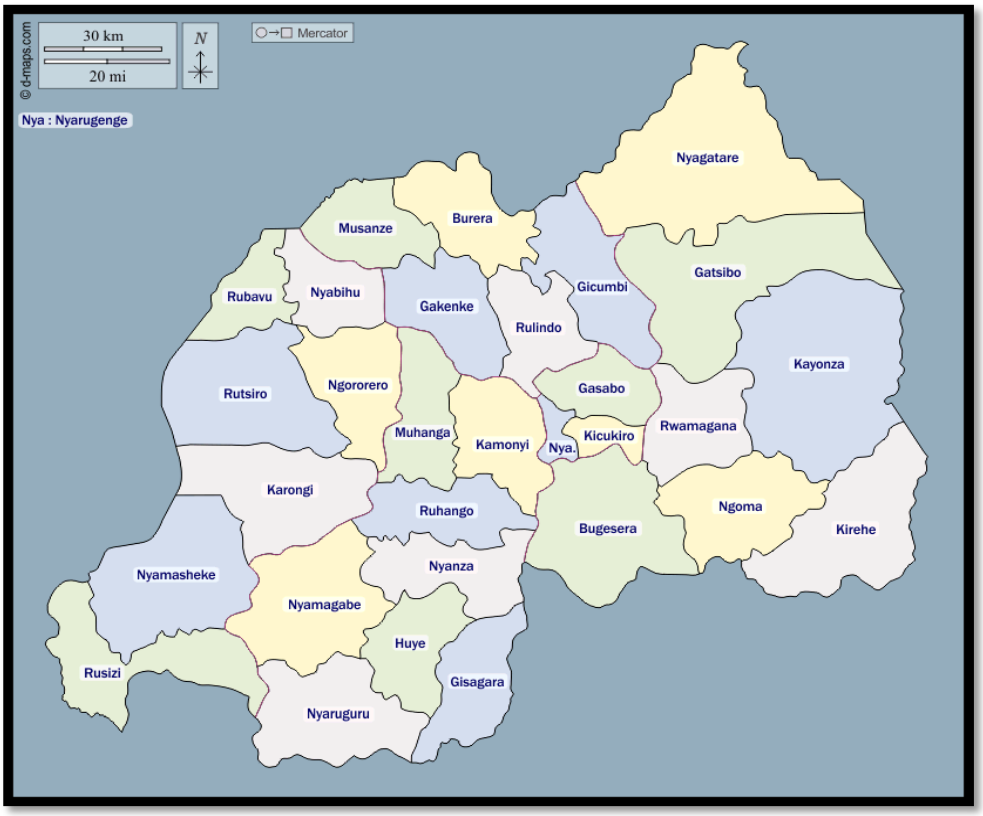


Figure 1: Country of Rwanda Administrative Map
Source: (d-maps.com, 2022)

2.2 Data Collection Procedures and analysis

According to Patton (1987) unity of analysis is based on the aforementioned decision on the major point of the study. Consequently unit of analysis can be individual persons, families, small group of persons, known organization, neighborhood, city or country when the case study is on international projects. From this definition above and the objective of this study, the unity of analysis for this study was people and peri-urban settlement in Kigali city. Thus in this study researchers considered Kabuga and Ruyenzi settlements in peri-urban areas. Both qualitative and quantitative research methodological approaches were adopted. In particular researchers conducted interviews with 90 residents to explore the characteristics and effects of urban sprawl on service provision and transport accessibility in peri - urban areas. In this case data collection procedures include primary and secondary data were collected through interviews and review of previous researches relating to this topic such as articles on urban sprawl conducted in other developed and developing countries, dissertation reports conducted by doctoral and master students from recognized universities. Also, observations completed when researchers had to go on the field and see how urban sprawl affects service provision and transport accessibility in Rwanda. Finally, data collected from residents of Kigali city and those from professional expert (Senior Engineer at City Engineering Division in the City of Kigali) were compiled together using Microsoft Word and Microsoft Excel was used for data analysis, including production of tables and figures.

3.0 RESULTS

3.1 Socio-demographic characteristics of the respondents

In this study to get data and information concerning effects of urban sprawl on service provision and transport accessibility in peri-urban areas and to attain on the results numerous people participated in giving their thoughts where 90 residents in Kigali City were selected randomly based on their presence and willing in giving responses on questions structured for us to capture the essential data for suitable output of this research. Table 1 clarifies everything concerning people who were involved in interviews. Both men and women were involved in where 39% were men and 61% were women. The rationale for interviewing more women than men is simple because during the interviews most women use to be at home by taking care of their children as well as carrying out household small jobs. On education perspective majority of the respondents 49% had attended university education, 31% had joined secondary education which assures that interactions with educated community can give valuable answer for reinforcement of this work. Based on the age 41% of the respondents were aged above 45 years. From their occupation big number were from Private sector with 56% compared to public sector of 44%. This is due to availability of people working on their own comparatively to those working in public sector. It was difficult to access household who were in most cases working in offices for interviews during fieldwork hours.

Table 1: Socio - Demographic Characteristics of the respondents
Source: Fieldwork, 2022

№	Respondent	Classifications	Frequency	%	Total
1	Gender	Female	55	61	90
		Male	35	39	
2	Age	Age 35-40,	24	27	
		Age 40-45	29	32	90
		Age above 45	37	41	
3	Level of Education	Primary Education,	18	20	
		Secondary Education	28	31	90
		Tertiary Education	44	49	
5	Activity Sector	Private Sector	50	56	
		Public Sector	40	44	90

3.2 Characteristics of urban sprawl in Rwanda

3.2.1 Scatted urban sprawl in Rwanda peri-urban areas

Physical site visit were done by researchers to observe current situation of peri-urban areas urban sprawl in Rwanda. It was noted that the city of Kigali is expanding toward rural areas, however, this development is controlled by District officials in charge of construction works who always supervise enforcement of regulation and rules that are to be adhered during construction of houses or roads especially in urban fringe just to avoid informal development which can take place in these areas as well as informal services provisions on country residents. According to residents 87% agreed that urban sprawl is managed in such a way that when land developers want to initiate their projects they need to seek for construction permit which will allow them to execute projects under the supervision of district officials to ensure that what agreed is happening on the ground as per the plan. In peri-urban areas important services including electricity and drinking water are provided which makes community attracted in these areas for development projects said by 76% of the respondents. Mentioned by Kigali city Engineer that it is difficult for government to provide services and transport due to distributed urban sprawl for the reason that it cost them too much money when connecting people to these services and many people nowadays are developing in peri-urban areas because of the availability of land on low cost for construction and construction materials compared to Kigali city. The figure 2 below explains the current situation of scattered urban sprawl in peri-urban areas in Rwanda.

Figure 2: Scatted urban sprawl in Rwanda peri-urban areas
Source: (Uwiringira, 2014)

3.2.2 Formal urban sprawl in Rwanda peri-urban areas

Here is another form of urban sprawl in Rwanda which is happening day by day where the development is formally developed and constructed to bring together people on small space. Said by 89% of the

respondents that development facilitated services provision in the settlement including potable water, electricity, connected roads, drainage systems and solid waste collection possibilities. Roofs and construction materials are good and strong to withstand climate conditions and for many years to come. The figure 3 shows housing developments stretches in peri urban area. This settlement can be accessed simply because the neighborhood internal roads linked to the major road from the Central Business District (CBD). Thus this helps community to move around in the settlement and outside of the settlement to visit friends and service seeking in various sections. Therefore city engineer explained that such development as they are developed here and there this always needs high cost during service provision. He suggested phase development as well as development following ring roads which can easy settlement accessibility and land use management.

Figure 3: Planned Neighborhood in Kabuga- Rwanda
Source: (Baffoe, Malonza, Manirakiza, & Mugabe, 2020)

3.3 Infrastructure and services provision in Rwanda

3.3.1 Schools provision in Rwanda peri-urban areas

In peri-urban areas also schools are provided so that people in urban areas and urban peripheral can go there and learn different skills either technical skills or sciences. It is for this reason that in Rwanda there are numerous technical schools which gives opportunities for young people and old people to learn technical subjects for their jobs, careers or their future employment seeking, this was said by 79% out of 90 respondents, schools accessibility is good where students are able to reach there on time and parents when students are too young for not going to school alone. Figure 4 shows schools in urban fringe which serve education to people neighboring these schools or people from urban areas. On the school sides you can see that there are roads which connect rural areas to urban areas also facilitate schools accessibility either by using bikes or cars. School roof covers are made with blue sheets while the roads are marram roads to avoid

road sliding during rain seasons. Schools are seen as potential effect of urban sprawl in peri-urban areas in Rwanda because help in connecting settlement community to education.

3.3.2 Rain water collection and storage in peri-urban areas

Rain water collection is another practice done in Rwanda to collect and store rain water in tanks and most of these tanks are made in metals, plastics, reinforced concrete, stones and bricks. They might be constructed either above the ground or underground depending on the elevation of the terrain and availability of local materials. The Figure 5 below demonstrate water collection and storage systems in urban and peri-urban areas in Rwanda. And these works are having positive impact on society not only in storing rain water for further activities but also they are used for example in gardening or cleaning pavements or washing cars but also in avoiding soil erosion while not going everywhere and cause erosion in some of the places and even where houses are constructed. 92% of the respondents said that they are able to capture the rain water from their rooftops and store them in the appropriate tanks or basins at their house hold, or direct them in soak pits in case they don't need them for future use.

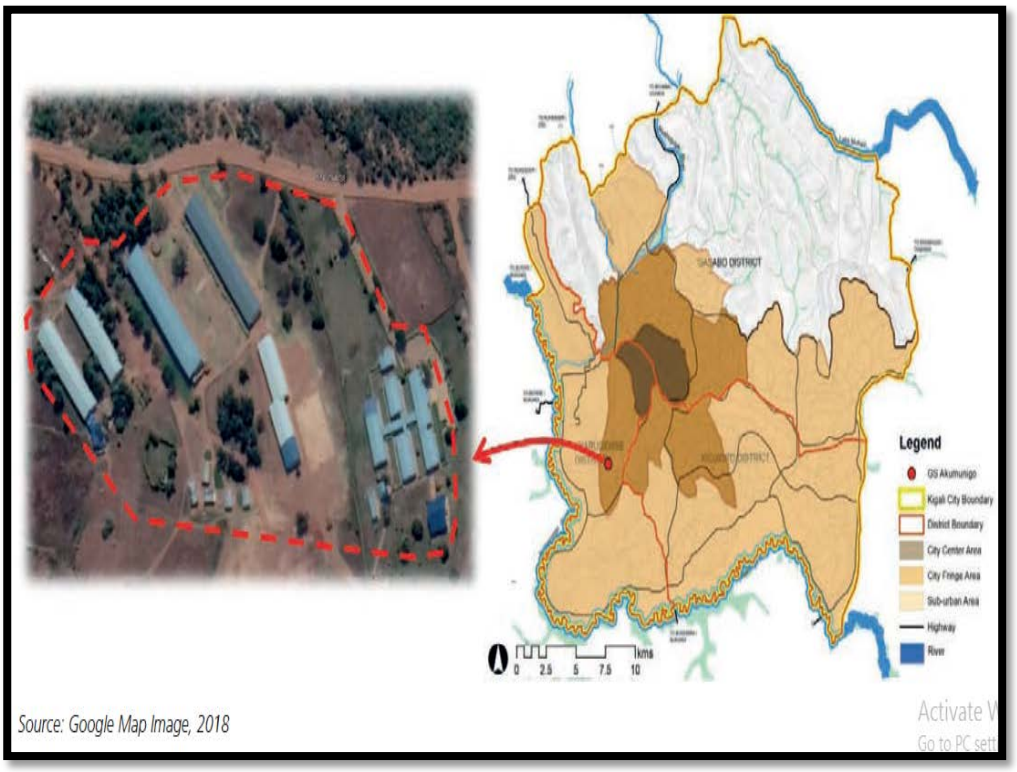


Figure 4: Infrastructure services provision in Rwanda
Source: (Matto & Jainer, 2019)

Indicated again by the respondents and city engineer that the major challenge met in provision of water in peri-urban areas is financial resources to implement rain water collection projects because most of these projects need construction materials for instance cements, stones, bricks, water, steel bars for reinforced concrete structures and fees for both Masons, Aid-masons, Plumbers and other technicians involved in the project for its completion.

3.3.3 Drainage System provision in Rwanda

Drainage system infrastructure provision was not forgotten in Rwanda in transporting unwanted water and rainwater in proper way without affecting neighboring community's properties and take away their

agricultural crops and farms or their gardens for their future food. Many of these drainage systems are made in stones together with concrete, some also are constructed in reinforced concrete as you can see in this figure 6 below where the walls are constructed in Stones and covers are made in reinforced concrete small slabs just to help for opening when they want to clean the drainage especially when the trees fallen down in drainage, other materials like stones or once the drainage is full of the sand. Regular drainage system cleaning is advised to avoid stuck of unwanted water in the drain and go out of drain to affect bordering houses and people. 78% out of 90 of the residents interviewed responded that there are sufficient drainage system provided to manage storm water and flooding in peri-urban areas.

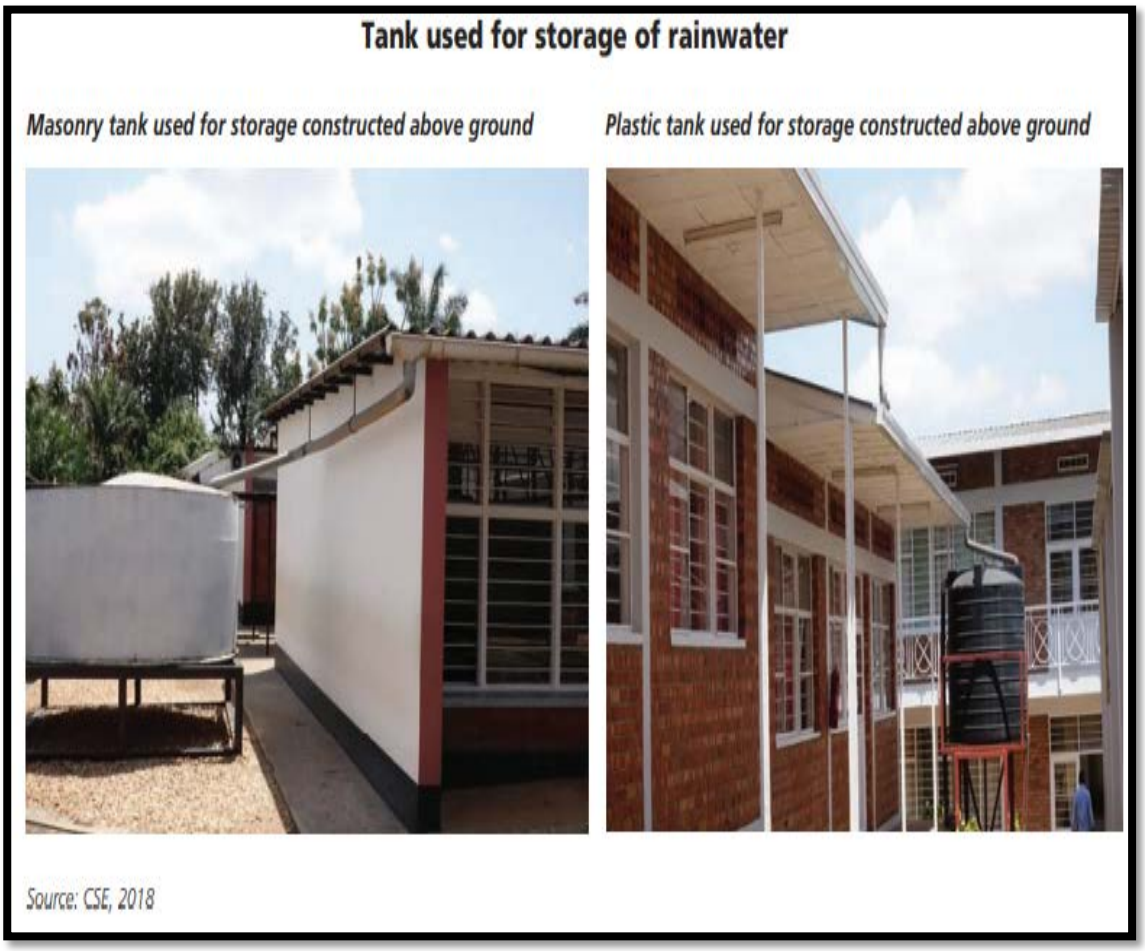


Figure 5: Thank used for storage of rainwater in Rwanda
Source: (Matto & Jainer, 2019)

3.4 Transportation accessibility in peri-urban areas

Highlighted by senior engineer at city engineering division in the city of Kigali that urban sprawl affected transport services in peri-urban areas in some ways including few number of buses to connect people and increase of transport cost in some places due to distributed land development in peri-urban areas. Distance and transportation cost from central business district (CBD) to peri-urban areas differ depending on where you are going, but in general most of peri-urban areas in Rwanda are not located far from CBD. Additionally people most of the time travel with public buses or their private cars from CBD to peri-urban areas. In Rwanda transportation provision and accessibility is possible in the city of Kigali and Rwanda Utilities Regulatory Authority (RURA) provided buses which transport people from their homes to the city center or to their destinations safely and on time depending on their distance to travel. Roads are

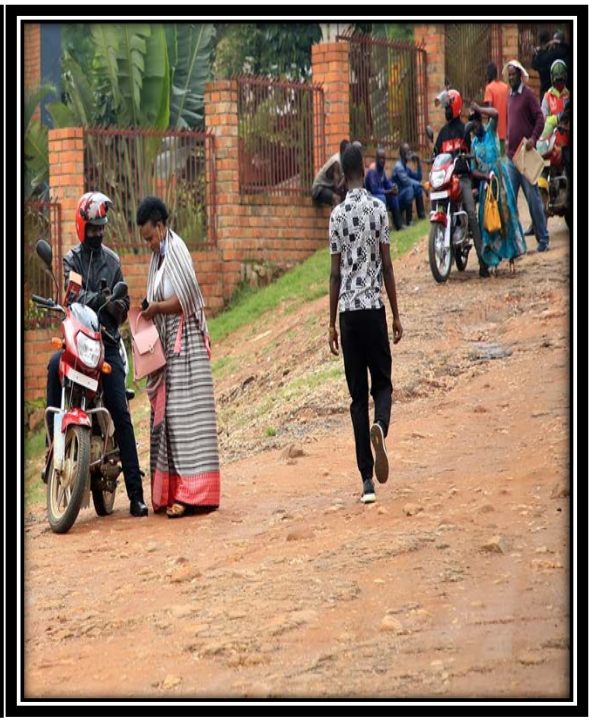
asphalts in Kigali city almost 80% of roads which constructed in Kigali is in bitumen surface, stone roads or paved roads to easy vehicles flow. This is also done in peri urban areas where main roads are asphalts while secondary and third roads are in marram to facilitate local people in peri-urban areas and countryside to connect other places easily. Thus in peri urban and local areas motorcycles are there to transport people from One place to the other. Cost of transport is moderate no more than 400 frw per person to Ruyenzi settlement in peri-urban when using public transport. For those who want to use motorcycles they are able to negotiate the cost per trip with drivers before using their motorbikes however currently there is machines mounted on bikes (named Mubazi in local language) which calculate the cost and distance traveled then pay as you move. Figure 7 below shows transportation facilities in Rwanda, on the left side it is an example of public buses used in transporting community from their living place to their destinations while on the right side there is an example of bikes adopted in transporting people in peri urban areas from main roads to secondary and tertiary roads a s well as in countryside.

Figure 6: Drainage System provision in Rwanda
Source: (RWANDA TODAY, 2018)

Urban sprawl in Rwanda affected transportation services in peri-urban areas positively in connecting peri-urban areas to Central Business District (CBD) and other villages in Rwanda though number of vehicle increase to solve the problem of transportation is the element to take into consideration these days. Furthermore, urban sprawl contributed in transportation while providing work especially for transportation companies to drive community to their destinations while on the other hand created transportation cost increase around 1500 frw because people need to pay many times to reach in the city center or to access other countryside due to expansion of cities into rural areas. According to the means of transport commonly used in peri-urban areas mostly are public buses as mentioned by 82 % respondents and shown in above figure 7 and motorbikes (electric and petrol motorcycles). Finally cycling is adopted there, some of the people engaged in this area to transport people on bikes and get paid after reaching required place. Many of

these persons are in cooperatives wearing jackets and having numbers from their respective cooperatives for identification in case they commit an offense or during conflicts with clients and misunderstanding occurrence for further problem solving. Moreover, the majority of the respondents 68% were of the opinion that the city of Kigali needs to provide more transportation buses as well as reduction of transportation cost on the other hand for enhanced transport services in peri-urban areas.

Source: (ABDUL, 2022)



Source: (Tasamba, 2021)

Figure 7: Transportation provision in Rwanda

3.5 The city of Kigali professional's opinion on urban sprawl and its effect on service provision and transport accessibility in peri-urban areas

According to Senior Engineer at City Engineering division in the City of Kigali city development is regulated by its Master Plan which allows community developing their land with respect to the master plan. For this reason some people seek to make construction projects contrary to the approved master plan concept and which among the cause of urban sprawl in peri-urban areas due to the availability of land on low cost, cheap construction materials as well as masons. He added that the land development in peri-urban areas is on one hand scattered, formally and informally developed. This situation creates a burden to the government in terms of services provision when trying to connect these scattered communities on services as well as related programs.

4.0 DISCUSSION

This paper as demonstrated the effects of urban sprawl on service provision and transport accessibility in peri-urban areas in the city of Kigali. The study has revealed that transportation accessibility in peri-urban areas is good except for far places located in rural areas where motorbikes connect communities which are far away from the city center and where public cars are not able to reach at each household. Cost in using motorbikes is fixed by electronic machine fixed on each bike known as Mubazi in local language. Also, it takes shorter time for residents living in peri-urban areas to arrive in their respective destinations without delay or waiting public transport. Services are also provided in many areas in the city of Kigali for example roads, electricity, drainage systems, potable water provision and optical fibers distribution in urban and rural areas. Authors see Rwanda on good rank in providing necessary urban, peri-urban and rural areas

services to community just to help them in living in the better life and achieve their desire in time. For instance electricity, in Rwanda both in urban and rural places people are able to access electricity regardless their financial capacity without forgetting roads during the night drivers can drive 24/7 due to lamps mounted on the road which facilitate and give light during the night where this offers much security to road users during the night and car drivers. Before installation of lamps people were not able to travel safely along the roads but now they are able to move from one place to the other safely from Morning to night and from Monday up to Sunday at any time.

Regarding drainage systems the study as revealed that once the road is constructed also drainage channels are also made at the road edge on both sides depending on the type of terrain because sometimes they can be provided where canals will be located due to the slope along the road. Road flooding is not common in Rwanda and its peri-urban areas simply because these water channels are provided during road design and implementation to drain away rain water from the road center to the appropriate end point. Rainwater harvesting when is not done it causes soil degradation and destruction of constructed houses, it is for this reason that most of houses constructed in peri-urban areas have tanks which store rainwater from the roof and people use them for many purposes. Therefore government and Non-governmental organizations provide tanks to poor communities for them to have water nearby and use them in case potable water is not around. Even when both private and public schools are constructed they make sure that water from the roof are collected at single point and transported into tanks either made of plastics or in other construction materials for example stones, bricks and reinforced concrete.

Land development in the city of Kigali is controlled through building permit from government authorities which allows land developers to continue with their construction projects. This process protects uncontrolled development and informal settlements as the city of Kigali is sprawling into peri-urban areas and rural areas. Though informal land developers on the other hand can't miss in case they want to develop their land without construction permit. The question arise if urban sprawl has connection with property formalization. But the answer is yes, because once land is not managed well in terms of land administration system or land development system this can cause informal urban sprawl development in various areas. Therefore urban sprawl and land formalization are two things related where fail of suitable land formalization can results in informal land development. It is for this reason urban developers need to think deeply on land registration systems which have positive impact in land management sector in order to avoid informal urban sprawl. Land information systems also must be updated and go with time as well as in the era of emerging technology and urban transformations taking place not only in Rwanda but also in both developed and developing countries.

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

In concluding results have shown that urban sprawl in Rwanda is controlled though building permit. Land developers must develop their land if and only they have secured construction permit from the government official which guide them how they will develop their parcels in accordance to their construction plans submitted during the time they seek for construction permit. In primary roads there are public buses and private cars which transport people to their homes or locations. Also, bikes transport people from major roads to secondary and tertiary roads specifically at the residence places. Drainage system have been provided to drain rain water and unwanted water away from their settlement to proper location where both farms and houses will not be affected. The study as revealed that both services provision and transport accessibility go with settlement development and housing construction in the city of Kigali including peri-urban areas.

5.2 Recommendation

Based on the analysis done regarding the effects of urban sprawl on service provision and transport accessibility in peri-urban areas in Rwanda the authors recommends the following:

1. Both Physical and social services and transport facilities in peri-urban areas be provided before settlement is developed. This means construction of roads should go hand in hand with provision of

community basic services such as potable water, electricity, drainage systems for better future of human lives in that neighborhood. Additionally both public and private sectors are the key role players in developing settlement before its occupation.

2. Compact city development and transit oriented development (TOD) are highly recommended. This will promote sustainable urban growth in developing countries as well as securing areas for open spaces and sustainable urban housing development as well as transportation system to urban residents. It can also be suitable answer especially for city sprawling for developing World cases. Where Government and private investors are important persons to execute this development.

6.0 ACKNOWLEDGEMENTS

We are grateful for the city of Kigali residents for their time and data provision for the success of this research. Finally we are thankful to the city of Kigali official at the city engineering division for his valuable contribution in this paper.

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