Kigali City Peri-Urbanization and its Implications on Peri-Urban Land Use Dynamics: Cases of Muyumbu and Nyakaliro

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Abstract—Peri-urbanization is a form of urbanization that gradually incorporates peri-urban zones into the city. In Rwanda, Kigali City outward expansion is a major concern for future land use as it accelerates depletion of land for other uses. The purpose of this paper is to analyse Kigali City peri-urbanization and its implications on peri-urban land use. Peri-urban land use changes were detected by density analysis and map algebraic change detection techniques in ArcGIS10.2 Software. Base maps were orthophoto of 2008 and GIS online world imagery 2014, Kigali city evolution maps and Kigali City Master Plan maps 2007. The analysis revealed that an average of 1,200 hectares of peri-urban land around Kigali city is being built-up annually. The urban housing footprint was about 12,100 hectares in 2014 from 8,900 hectares in 2005. This study also examined social, economic and institutional factors that lead to the current rapid land use changes in peri-urban areas outside Kigali City. A field survey was carried out within 150 households from two peri-urban zones of Muyumbu and Nyakaliro. Findings show that out-migration from Kigali City is a major driver for peri-urban land use dynamics. Out migration was found to be fostered by various factors including the desire to own a house, bigger plots, affordable land and lower housing cost than in core urban areas of Kigali City. The implication is that there is informal subdivision of land; inconsiderable conversion of agricultural land into built-up environment. It also implies that there is a need to enforce land use plans in peri-urban areas to prevent outgrowth of new informal settlements. In response to the current pressure on peri-urban land, the study recommends the establishment of land development and subdivision control regulations to limit encroachment on agricultural land while adopting housing intensification measures.

Keywords: Kigali City, Peri-urbanization, Peri-urban areas, Land use dynamics

I. Introduction

The outward expansion of cities into peri-urban areas changes land use patterns in these areas (Owusu, 2008); and this process o is commonly referred to as peri-urbanization. Peri-urbanization is used to describe the process within the phenomenon of urban sprawl that has spatial consequences of threatened sustainable use of space (Danese et al., 2008, Etxebarria and Astorkiza, 2012, Galli et al., 2010, Mancebo, 2008, Trigal, 2010). The peri-urban is a zone of social and economic change and spatial restructuring in the context of older industrial or post-industrial countries, while in newer industrializing countries and most of the developing world, the peri-urban is often a zone of chaotic urbanization leading to sprawl (Ravetz et al., 2013). Peri-urban areas usually exist when urban residents buy up prime agricultural land outside the cities for residential or commercial purposes (Appiah et al., 2014, Mandere et al., 2010, Samat et al., 2011). According to a report by UNFPA (2007), the space taken up by urban localities is increasing faster than the urban population itself. The above report indicates that between 2000 and 2030 the world’s urban population is expected to increase by 72% while the built-up areas of cities could increase by 175%.

Particularly in Africa, the current pervasive peri-urbanization results from unprecedented informal urbanization of poverty (Kombe, 2005) by out migration of urban residents to escape from urban policies harassment (Lupala, 2002). Unlike the rest of the world, the World Bank statistics indicate that this form of urbanization in Africa leads mainly to horizontal growth of towns and encroachment upon farmland; while it is not always accompanied by tangible economic growth and buoyant secondary activities in substitute to agriculture (Spence et al., 2009). This form of urbanization consequently leads to land use changes whereby potential agricultural land in the periphery of cities is gradually converted into built up areas, and decline of rural employment (Adriana, 2003).

Rwanda being one of the smallest and densely populated countries in Africa, with a population density of 415 persons per km² (NISR, 2012), is susceptible to severe consequences of uncontrolled peri-urbanization. Since the adoption of the land policy in 2004, the Government of Rwanda has aimed at promoting planned urban development for optimal, rational and sustainable utilization of land. Specifically, the
government instituted a strong application of planning regulations to restrain urban footprint and encroachment on rural lands through urban sprawl. One of the strategies adopted by the government to optimize the use of land in rural areas is the development of grouped settlements, locally known as “Imidugudu”. In urban areas, the government has established land use master plans to optimally use land.

Despite initiatives to promote a controlled urbanization as a solution to ease pressure on land, peri-urbanization continues to contribute to further expansion of the built environment beyond the Kigali city’s boundaries. It is expected that Kigali City will encroach upon 5000 km² by 2050 (King, 2011), roughly 20% of total national land surface. This would mean a growth of 684%. Contrary, the urban population in Kigali City is expected to grow by 55.41% from 1.135428 million to 2.9 million people (Rwanda Natural Resources Authority, 2010). Peri-urbanization of Kigali City occurs amidst comprehensive and relatively successful land registration in Rwanda and established cadastral information system countrywide. These facts stress the need to investigate factors behind Kigali City’s faster spatial expansion and the implications on land use, especially in peri-urban areas.

The objective of this paper is to analyse the spatial-temporal dynamics of Kigali City peri-urbanization and implications on peri-urban land use.

Specific objectives

i. To analyse the urban housing footprint in Kigali City and peri-urban areas between 2005 and 2014;
ii. To examine the factors for Kigali City peri-urbanization;
iii. To indicate implications of Kigali city peri-urbanization on peri-urban land use.

II. Materials and Methods

Kigali city and neighbouring peri-urban Sectors (outside the administrative boundary of Kigali city) were selected for the analysis of spatial-temporal dynamics from 2008 to 2014.

Table 1: Purposive selection of peri-urban areas of Kigali city for field survey

<table>
<thead>
<tr>
<th>Names of the peri-urban areas</th>
<th>Housing pressure</th>
<th>Soil classification</th>
<th>Land classification</th>
<th>Overall Suitability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High pressure=4</td>
<td>High fertility=4</td>
<td>Urban land=*1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low pressure=1</td>
<td>Low fertility=1</td>
<td>Rural land=*(−1)</td>
<td></td>
</tr>
<tr>
<td>Bukure</td>
<td>2</td>
<td>2</td>
<td>*1</td>
<td>4</td>
</tr>
<tr>
<td>Fumbwe</td>
<td>3</td>
<td>3</td>
<td>*1</td>
<td>6</td>
</tr>
<tr>
<td>Muyumbu</td>
<td>3</td>
<td>4</td>
<td>*1</td>
<td>7</td>
</tr>
<tr>
<td>Mwogo</td>
<td>1</td>
<td>4</td>
<td>*1</td>
<td>5</td>
</tr>
<tr>
<td>Ntarama</td>
<td>2</td>
<td>3</td>
<td>*1</td>
<td>5</td>
</tr>
<tr>
<td>Nyakaliro</td>
<td>3</td>
<td>4</td>
<td>*1</td>
<td>7</td>
</tr>
<tr>
<td>Rugarika</td>
<td>1</td>
<td>2</td>
<td>*(-1)</td>
<td>-3</td>
</tr>
<tr>
<td>Runda</td>
<td>4</td>
<td>3</td>
<td>*(-1)</td>
<td>-7</td>
</tr>
<tr>
<td>Rutare</td>
<td>1</td>
<td>2</td>
<td>*(-1)</td>
<td>-3</td>
</tr>
<tr>
<td>Shyorongi</td>
<td>4</td>
<td>2</td>
<td>*(-1)</td>
<td>-6</td>
</tr>
</tbody>
</table>

Sources: Soil data from MINAGRI and urban boundaries data from NISR (2012).

Muyumbu and Nyakaliro were selected for field survey because of their high overall suitability. The aim of conducting a field survey in the selected per-urban areas was to identify factors leading to Kigali City peri-urbanization. Households in the two areas were purposively sampled for...
the survey. In total, 150 households were surveyed (75 households in Muyumbu and 75 in Nyakaliro). Data from sampled households was collected using a structured interview. In addition, discussions were held with key informants. The key informants were land managers in the selected peri-urban areas, urban planner from Rwanda Natural Resources Authority (RNRA), Director of urban planning in Rwanda Housing Authority (RHA), and urban planner from Kigali City One Stop Centre.

b. Data Collection and Analysis

Data collected included both primary and secondary data, as illustrated by the research design (Figure 1). Primary data were collected through face-to-face interviews by using a set of structured questions (both open- and close-ended questions).

Secondary data included government reports, books, journals and spatial data from Ministry of Agriculture, RNRA, Kigali City council, National Institute of Statistics of Rwanda, and Google earth 2014. The use of Google earth imagery allowed minimizing the cost of data acquisition, as it is cost-free. The imagery provided enough information to analyse land use changes and trends of Kigali City spatial expansion.

SPSS 20, ArcGIS 10.2 and MS excel 2013 softwares were used to analyse the data. Specifically, SPSS 20 software was used to compile and analyse data from household interviews. ArcGIS was used to map and analyse Kigali spatial-temporal dynamics and housing pressure on peri-urban areas. MS Excel sheets were used to present data in tabular and graphic formats.
III. Results and Discussion

Figure 2: Spatial evolution of Kigali city and selected peri-urban areas

Figure 3: (A)-(B) Land use Change Analysis

Figure 3 (A) was generated from the digitization of all buildings in Kigali City and its peri-urban areas. The digitized buildings vector map was rasterized, and the housing density was calculated using interpolation (point density analysis). The same procedure and technique were used to generate the housing density map of 2014 (Figure 3 B).

There is a general increase in housing density in peri-urban areas of Kigali City from 2008 to 2014. In 2008 (Figure 3 A), the highest housing density was 335 housing units per square kilometre, while in 2014 (Figure 3 B), the highest density was about 416 housing units per km². This indicates an increase of 24% in a period of six years. Figure 4 below particularly indicates urbanization pressure on the peri-urban areas considered as case study.

1907-1962: Kigali City occupied up to 300 hectares
1962-1984: Kigali experienced a rapid growth from 300 hectares to 2,300 hectares as a result of higher migrants due to loosening of colonial restrictions
1984-1999: Uneven growth from 2,300 hectares to 5,400 hectares due to high immigration after the Genocide of 1994
1999-2005: Sprawl to 8,900 hectares prompted by return of refugees of 1994 from DRC and rural–urban migration
2005-2014: Urban footprint on peri-urban land outside Kigali City where housing density is above 138 housing units (area considered as built up is 12100 hectares).

a. The urban expansion of Kigali City on peri-urban areas

The analysis of recent housing development trend in Kigali city, based on 2008 orthophoto and 2014 imagery, indicates inefficient use of available urban land and a faster encroachment on peri-urban land. Higher urban housing development was detected in Runda, Shyorongi, Nyakaliro, Muyumbu, Fumbwe and Mwogo (Figure 3 (A)-(B) below). These areas were initially used for agriculture.

Housing density analysis indicating housing pressure on peri-urban land as a result of Kigali City outgrowth
The map in Figure 4 above was generated by subtracting the housing density map of 2008 from that of 2014 using map algebra. It is evident that peri-urban land was significantly converted into urban housing. In this process, land that was predominantly used for agriculture is gradually being built-up. Even though the predominant mountainous landscape makes a significant part of Kigali City ill-suited for urban development, reviewed planning documents indicate that only 50% is buildable, the rest comprises steep slopes, wetlands and forests. The current built-up area occupies 17% of the whole city (city of Kigali, 2013).

Kigali City still has space for housing development. According to Kigali Master Plan, there were still 36,317.62 hectares of buildable land in 2007 (MININFRA, 2007). The 2012 research on housing needs revealed that the land required is 2,562 hectares to curb housing needs for the period 2012 to 2022 (PlanetConsortium, 2012). This is only 7.05% of the total available buildable land. In the following sections, we present empirical findings from the surveyed households in the sampled peri-urban areas of Muyumbu and Nyakaliro. Both Muyumbu and Nyakaliro are located on high fertile land, implying that the mushrooming housing development is engulfing land with high agricultural potential. If no measures taken, there would be no enough suitable land for agriculture in the future. In the section below, we sought to identify why, despite the existing buildable land in Kigali city, people prefer peri-urban areas for housing construction.

b. Factors for peri-urbanization of Muyumbu and Nyakaliro

Peri-urban expansion is influenced by different factors; social, institutional and economic (Haroldo, 2011). The factors for urbanization of Muyumbu and Nyakaliro were grouped into these three categories; social, economic and institutional factors.

i. Social factors: demographic changes and social heterogeneity

The demographic characteristics of Muyumbu and Nyakaliro have drastically changed over the last 10 years. The increase of population in Muyumbu and Nyakaliro results from people migrating from Kigali city. It was found that 93% and 83.8% of interviewed respondents in Muyumbu and Nyakaliro respectively came from Kigali City. This proportion of respondents gave various reasons for their migration to Muyumbu (Table 2).

<table>
<thead>
<tr>
<th>Reason that pushed the respondent to migrate to Muyumbu</th>
<th>Number of respondents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for owning a house</td>
<td>68</td>
</tr>
<tr>
<td>Desire for a bigger plot of land</td>
<td>58</td>
</tr>
<tr>
<td>Need of more land</td>
<td>8</td>
</tr>
<tr>
<td>Difficulties to pay urban taxes</td>
<td>8</td>
</tr>
<tr>
<td>Denied building permits in Kigali</td>
<td>4</td>
</tr>
<tr>
<td>Expropriation</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Household survey by authors, May 2014

A big number of migrations to Muyumbu and Nyakaliro started in 2008 (Figure 4). This was a year after the adoption of Kigali master plan. This means that construction permit requirements and building standards were highly enforced than ever before. In 2011, the rate of migration to Muyumbu started declining, perhaps due to the imposition of land lease taxes in this area (30 Rwandan francs (Rwf)/m²).
**Figure 5: Trends of migration to Muyumbu and Nyakaliro**

![Graph showing trends of migration to Muyumbu and Nyakaliro](image)

Source: Field survey by authors, May 2014

### ii. Economic factors: land and housing markets

Findings from surveyed households in Muyumbu indicate that about 93% of land parcels were obtained through purchase. The majority of plots were bought between 2008 and 2009. The land prices escalated during this period due to high demand. In 2008, the land price was estimated at 250,000 RwF per m², while in 2010 the estimate was about 788 RwF per m².

According to respondents, Muyumbu offered them more opportunities for housing at a lower cost. Unlike in Kigali City, building in Muyumbu does not necessarily require using burnt bricks, people can use adobe blocks. The cost of house construction in Muyumbu ranges from 4 million RwF to 25 million RwF. The average cost of house construction for the 75 surveyed households was 12,571,466 RwF. This cost of house construction is fairly cheaper compared to the cost in Kigali city.

It was also found that the cost of acquiring a building permit is lower compared to the cost in Kigali city. 78.6% of respondents obtained a construction permit at a cost less than 50,000 RwF. In average, the cost of acquiring a construction permit was 56,503 RwF.

In Nyakaliro, the flow of Kigali city out-migrants gradually increased concurrently with the rise of land prices till 2011. 80.43% of all land parcels owned in sample households was acquired through purchase. About 97% of surveyed households in Nyakaliro own bigger plots than 500m², the current upper limit of a standard plot size in Kigali city. The majority, 77.1% of out-migrant residents own plot size of 750 m². The average cost of housing in Nyakaliro for 73 respondent households was found to be FRW 11,847,945. Over 80% of interviewed households could afford a house costing between FRW 8,000,000 and FRW 16,000,000. Out-migrants reported that they benefited from lower cost of acquiring building permits and shorter waiting time. This is an important observation, which was also made in Muyumbu. It appears that lengthy processes especially high cost and conditions of processing building permits is among key factors compelling informal land transactions and acquisitions in peri-urban areas of Kigali City.

### iii. Institutional factors: Legal and institutional framework

Sector authorities administer most land in peri-urban areas, making the issuance of building permits faster and cheaper. The consequence is that people migrate from inner Kigali City to these peri-urban areas for housing construction. Sector authorities provide the regulations regarding construction, where the major requirement is the use of durable building materials. It was found that the average time taken to get a construction permit is 3 weeks. These factors attract people from Kigali City to buy land formerly used for agriculture for housing.

For instance, 89% of the Kigali City out-migrants in Nyakaliro asserted that they were encouraged by local officials to acquire land in the area by assuring them building permit.

   c. Implications of Kigali City peri-urbanization on land use

The fast and unprecedented urbanization of areas outside the boundaries of Kigali has the following implications:

1. **Decrease of land for agriculture**

   Areas outside the boundaries of Kigali City are mainly designated for agriculture and low-density housing. The migration of people from Kigali City to peri-urban areas seeking low cost land accompanied by cheaper building standards implies that more and more land initially potential for agriculture will be built up. As peri-urban areas have no physical boundaries that separate them from rural areas, this encroachment will continue on to the rural lands unless measures are taken to control urbanization.

2. **Development of new informal urban settlements**

   Some of the people that have migrated to Muyumbu and Nyakaliro came from Kigali City where they were living in informal settlements. As a result of Kigali City revitalization, these informal settlements are gradually redeveloped according to Kigali master plan where one of the strategies used is land exproporation. Landowners expropriated from these informal settlements in Kigali City find their way to peri-urban areas to acquire another land for housing. This situation means that if the trend continues without prior physical land use plans and provision of basic infrastructure, these areas will gradually develop into new urban informal settlements.

3. **Strong need to enforce land use plans**

   The haphazard urbanization of peri-urban areas is an indicator that land use plans are not strictly enforced by local authorities. The government of Rwanda established a national land use master plan, indicating how land in given areas should be used. However, people continue to erect houses even in areas zoned for agriculture or other uses outside Kigali city boundaries.

4. **Lack of inclusiveness and rigidity of land use plans**

   The rigidity of Kigali master plan and lack of flexibility thereof in its implementation implies that people who fail to comply with its requirements have no other option but to
migrate to peri-urban areas. This fact is supported by the existence of large undeveloped tracts of land in the boundaries of Kigali city (MININFRA, 2007). Despite these tracts of land that could be developed prior to encroaching on rural areas, people escape the city requirements for housing to where standards are cheaper, thereby misusing land.

5. **Irregular land subdivisions in peri-urban areas**
The out-migration of some people from Kigali City to peri-urban areas has created a dynamic land market, where landowners practicing agriculture have started to sell some plots on their land. Uncontrolled land subdivisions if unchecked will gradually change stipulated land uses outside Kigali City.

IV. **Conclusion and recommendations**

**Conclusion**
The aim of this paper was to analyse spatial-temporal dynamics of Kigali City peri-urbanization and their implications on peri-urban land use. Spatial analysis indicated that about 1,200 hectares of peri-urban land initially used for agriculture are being built-up annually, especially due to out-migration from Kigali City. The major reasons for out-migration were found to be pursuit of low cost land and cheaper housing requirements in peri-urban areas. Peri-urbanization threatens further land pressure as it contributes to excessive use of land for single detached housing on bigger plots, thereby displacing farming activities. It also leads to urban sprawl – the unplanned incremental urban development characterized by a low-density mix of land uses on the urban fringe.

The unplanned peri-urbanization of Kigali city implies gradual decrease of land for agriculture due to uncontrolled housing development, development of further new informal urban settlements, and weaknesses in enforcing land use plans in areas outside Kigali City, lack of inclusiveness and rigidity of land use plans in Kigali City, and irregular subdivisions of land in the peri-urban areas.

**Recommendations**

Drawing from the findings of the study, the following policy recommendations are suggested:

i. The authorities of Kigali city should allow incremental housing to limit out-migration to peri-urban areas;

ii. Regulations should be established and strictly enforced to control peri-urbanization;

iii. There is a need for effective coordination in issuance of building permits by local authorities in peri-urban areas;

iv. Regulating land subdivisions in peri-urban areas to prevent haphazard land use development.

**References**


