

Final report

The dynamics of unplanned settlements in the City of Kigali

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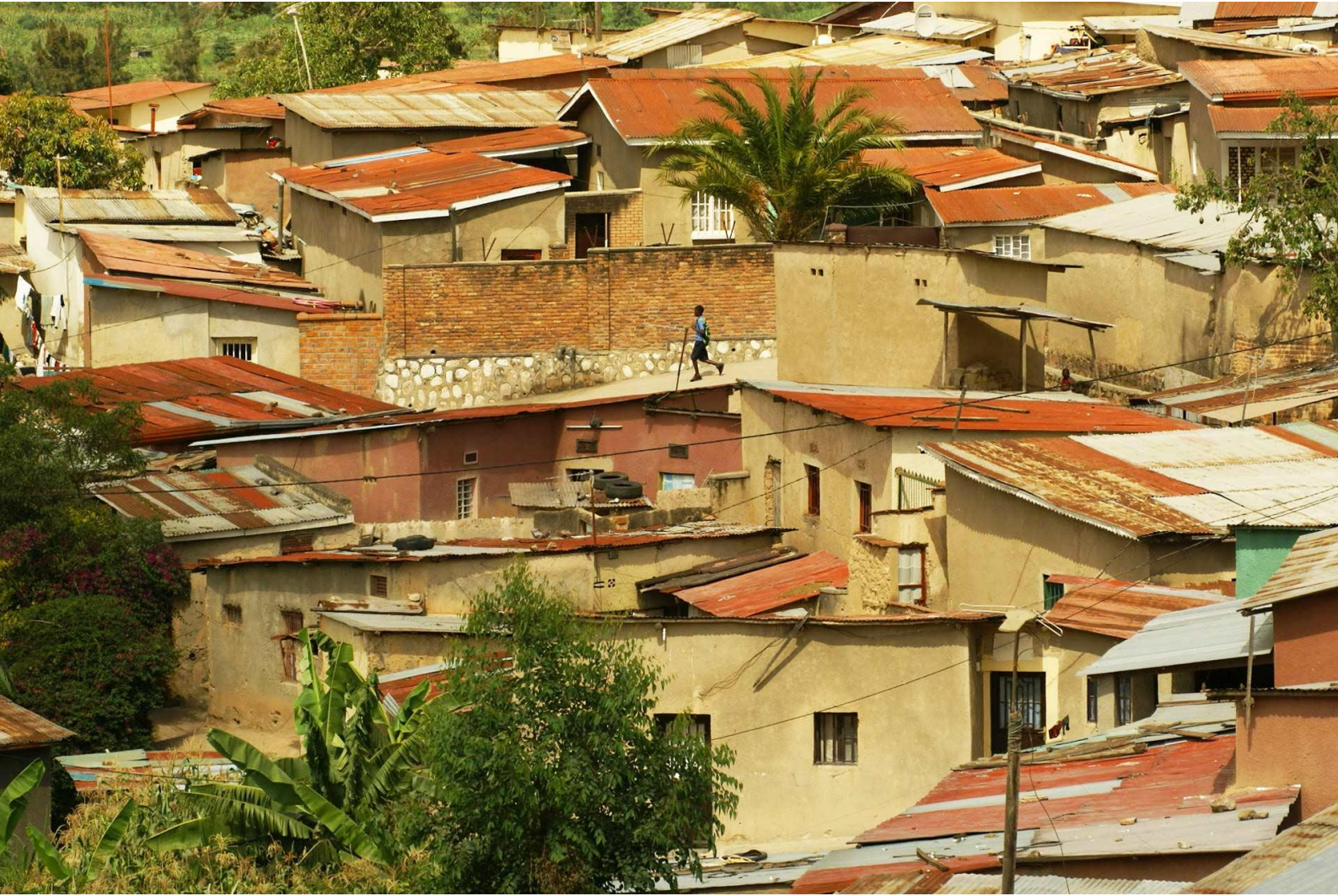


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Abbreviations

BRT	Bus Rapid Transit
CBD	Central Business District (used interchangeably with City Centre)
CoK	City of Kigali
DED	Deutscher Entwicklungsdienst
EICV	Integrated Household Living Conditions Survey
FAR	Floor Area Ratio
IGC	International Growth Centre
JMP/WHO	Joint Monitoring Program/World Health Organization
KBS	Kigali Bus Service
MINIFRA	Ministry of Infrastructure
NISR	National Institute of Statistics Rwanda
OPM	Oxford Policy management
PPP	Public-Private Partnership
RISD	Rwanda Institute for Sustainable Development
REG	Rwanda Electricity Group
RFTC	Rwanda Federation of Transport Cooperatives
RHA	Rwanda Housing Authority
SMS	Short Message Service
WB	World Bank

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Executive Summary

Kigali is Rwanda's main urban centre and accommodates about half the urban population. Rapid urban growth in Kigali has led to the development of unplanned settlements. Unplanned areas, characterized by inferior living conditions such as limited access to infrastructure, limited plot accessibility, and rudimentary housing construction-materials, pose a long-term risk to the quality of life for city residents. Official estimates put the population living in Kigali's unplanned settlements at 79%.

It is against this backdrop that Laterite, with support and funding from the International Growth Centre (IGC) and in close collaboration with the City of Kigali, undertook this study. This project is a multi-dimensional effort to understand the socioeconomic profile of residents in unplanned areas and to assess the physical infrastructure in these settlements. Key focus areas of interest include: (i) migration, (ii) employment, (iii) housing, (iv) mobility and (v) access to basic services. This study was designed to overcome the gap in information on the socio-economic situation of residents in unplanned settlements. An explicit objective of this study was also to pilot a methodology to: (i) create a representative sample of residents living in unplanned areas of the city; and (ii) to test the use of SMS surveying as a tool for the city to gather high-frequency data on residents in unplanned settlements.

The data presented in this report is based on a sample of 1,594 households living in unplanned settlements. Households were randomly selected in identified unplanned areas of the city; eligibility criteria included owning a mobile phone and having used this phone in the past two weeks. SMS surveys were conducted over a 3 month period and yielded unusually high response rates of over 50%. We believe that this is due to a mix of training, reminders, incentives and the deployment of an initial face-to-face survey.

Key insights

Migration

Kigali is a city of migrants; unplanned areas are home to more migrants than other urban areas. We estimate that about 65% of adult residents in unplanned settlements – aged 18 or above – in 2018 were born outside of the Kigali Province. Urban migration into Kigali is a product of two factors: geopolitical events and, more recently, economic migration. Migration is primarily an internal phenomenon with an estimated 74% of migrants born in a different province. Over half of migrants were born in the Southern Province; a quarter in the Western Province; with only 8% of migrants coming from the Eastern Province, and another 8% from the Northern Province. Migration patterns have been more geographically balanced recently, with an increase in arrivals from the Eastern Province. Migrants from the North continue to be under-represented.

Recent migrants – arriving over the past five years - are young and have moved mainly for economic purposes. An estimated 85% of recent migrant adults are aged 18 to 35. This young population moved

to Kigali looking for work opportunities. An estimated 63% of recent migrants identified seeking business opportunities or paid employment as one of the main reasons they moved to Kigali. A high proportion of recent adult migrants are female (61%). Male migrants state economic and educational purposes as the main motive for moving to Kigali; female migrants emphasize social motivations.

Migrants are residentially mobile and tend to move residences frequently; the longer they stay in Kigali, the more their living situations stabilize. Migrants reported having moved houses 2.5 times on average, compared to just 1.5 times for Kigali natives. 70% of migrants that were in their second year in Kigali had already moved once, about 40% had already moved twice.

There is a very large gap in home ownership rates between migrant and non-migrant households. On average, an estimated 89% of native households own the house they live in, compared to 54% of migrant households. Migrant families live in slightly smaller housing on average. They tend to have fewer rooms (about 0.3 fewer rooms) and tend to live in accommodation with more people per room (about 0.2 more people per room). This is not a reflection of their job status or socio-economic status, but rather a reflection of the fact that they are much more likely to be renting their home and looking to minimize the rent they pay.

Employment

Unemployment rates in unplanned areas are approximately 18% and remained stable during the 3 month period of the study; stability at the aggregate level was not reflected at the individual level, where we observed a high level of transition in and out of employment. Based on panel data from the SMS surveys, we find that at the individual level there was a lot of movement in and out of the job-market. Very few heads-of-household remained unemployed throughout the survey period; however about one-quarter of households transited in or out of jobs, highlighting vulnerability with respect to their job situation.

Unemployment in unplanned areas is heavily determined by factors such as age, gender, migration status, and the distance residents live from the CBD. Unemployment is the highest for young heads-of-household (in the 18 to 24 age-group), female heads of household, and household-heads born in Kigali. Proximity to the city-centre also matters. Unemployment levels were about 10 percentage points lower for household-heads living within 2kms of the CBD, compared to household-heads living more than 2kms from the CBD

We estimate that about one out of three working heads-of-household (36%) in unplanned settlements were underemployed (worked less than 35 hours per week); underemployment is heavily determined by gender, migration status and type of occupation. Female heads of household and household-heads born in Kigali were about 9 percentage points more likely to be underemployed, while internal migrants are less likely to be underemployed compared to Kigali natives. Casual wage labourers across all sectors were an estimated 42 percentage points more likely to be underemployed compared to salaried employees

The most common economic activities for heads-of-household in unplanned areas are “Wholesale and retail trade” (29%), “Transport and storage” (12%), and “Construction,” (11%). An estimated

40% of heads-of-household work in the informal sector. There is a strong link between where people live and the sector of activity in which they work, suggesting that different parts of the city specialize in different types of economic activities. This is particularly true for traders, who are more likely to live and work close to the city centre.

There are commercial and residential areas in Kigali, but jobs for unplanned settlers are relatively well distributed across the city. There are several Sectors in Kigali that are clearly commercial and attract more unplanned settlers for work than they do for residential purposes. These Sectors include Nyarugenge, Kicukiro, Kimironko and Gikondo. The most commercial area is the city centre itself. Populated residential areas, that also attract a relatively large proportion of jobs, include Remera, Kacyiru, Nyamirambo and Muhima.

Wages are strongly associated with education and gender; there are high returns to education for workers living in Kigali's unplanned settlements; female-headed households are associated with a large drop in income. Median incomes from employment are approximately RWF 80,000 in unplanned areas. Each additional step in the education system increases the earning potential of residents substantially. The median monthly income for working household-heads with no education was about RWF40,000 per month. Household-heads with primary-level education earned a median income of RWF70,000; those with secondary-level education RWF100,000; and finally, those with tertiary-level education RWF224,000. About 31% of households were female-headed. The median female head-of-household living in unplanned areas earns RWF40,000 per month from employment, compared to RWF100,000 for men. This is a difference of more than 2:1.

Mobility

People in Kigali's unplanned settlements live close to where they work. Over 70% of household heads live within 2kms from their work place (straight-line distance). An estimated 44% of working heads-of-household work in the sector in which they live; the remaining workers transit to nearby Sectors. Unplanned settlers choose to work in the commercial centres that are nearest to where they live. A large proportion of households that relocate do so locally. About 60% of relocations - from one home to the next - occur within the same geographic Sector

While travel on foot is the most common mode of transport, the preferred means of transport is tied to the distance to work. For half of working heads-of-household in Kigali's unplanned settlements commute by foot; the other half use a mix of bus, moto or private means of transport to get from home to work. Public transport – buses - are used by about 16% of commuters; moto taxis by about 13%; private means of transport by about 10% of commuters; while the remaining 10% of commuters use a mix of transportation means or other forms of transport. Three-quarters of heads-of-household that live within 1km of their workplace walk to work, but the proportion of people that walk quickly drops as the distance to work increases. Moto taxis are preferred to buses for short trips, but buses are preferred for longer trips. This is most probably because buses are the cheapest form of motorized transport. We estimate the median cost of a bus trip to be about RWF250 per trip (origin-destination) compared to RWF500 for moto taxis

Evidence suggests that the cost of public transport is a binding constraint for low income households that currently commute to work on foot; the cost of transport effectively constrains these households to live in close proximity of their workplace. High transportation costs constrain the mobility of the labour force. These cost barriers explain why the choice of transportation mode is very closely tied to income levels. Heads-of-household that take the bus or commute to work using their own motorbike earn a median monthly wage of RWF35,000 more than heads-of-households that commute on foot; those that take moto taxis earn RWF81,000 more; finally, those that commute by car, earn RWF440,000 more.

The commute time for unplanned residents is hampered by poor infrastructure. Bus waiting times are especially problematic in areas that are located farther away from the city core, and for those residents located far away from major roads. Access to main roads is a problem for isolated settlements, which lack internal arteries and rely on small paths and alleyways.

Housing

The quality of housing in unplanned areas is variable, with low quality walling materials but high quality roofs and floors. Our estimates suggest that “Mud Bricks” constitute the main walling material for nearly 69% of dwelling units. Only 11% of dwelling units have “Burnt Bricks” or “Cement Blocks” as their main walling materials. A high proportion of households report the use of high-quality flooring: approximately 79% of households report having cement floors while another 15% have tiled floors. Almost all households report the use of iron sheets for roofing.

Compound living is the most common form of housing arrangement in unplanned settlements. We estimate that 68% of dwellings are enclosed in compounds; 98% of compounds range between 2 to 8 dwelling units.

Overall, tenancy and owner-occupied housing is almost evenly split across unplanned areas. Based on this survey data we find that approximately 44% of households reported tenancy arrangements while 51% reported owner occupancy.

Tenants are more likely to face the burden of poor quality, unaffordable accommodation and rental insecurity. Overcrowding in unplanned settlements is more prevalent amongst tenants (17 percentage points higher). Tenants are also more likely to live in smaller dwelling units. Most tenants live in compounds (84%). At a median level of RWF27,000 per month, rent affordability in unplanned areas is a concern for low income households. Rental insecurity is also a concern with a high proportion of tenants not having a rental contract or experiencing increases in rent levels.

Access to housing finance appears to be a major constraint for homeowners or prospective homeowners. Savings (not credit) are the most common sources of finance for all forms of housing acquisition including greenfield developments, housing purchases and incremental improvements. The mix of financial sources for the construction of a dwelling appear to be associated with the quality of that dwelling. Home owners-occupants who built their houses using “Burnt Brick”/ “Cement Blocks” were more likely to have accessed credit compared to those using other housing material.

Housing supply trends indicate a gradual outward expansion (sprawl) of Kigali – although these trends might have stalled in recent times. Homeowners that purchased land on which to build a house are more likely to have done so in areas that are located farther away from main roads. Those who have purchased empty land at the time of acquiring their house have consistently done so further away from a car-accessible road compared to those who have purchased existing homes. While owner-occupants that purchased their property a long time ago are more likely to have bought undeveloped land and built their own dwelling on it, more recent owner-occupants are likely to have purchased the land with a finished or unfinished dwelling on it.

Access to basic services

We estimate that access to key basic services in unplanned settlements is high. Approximately 87% of households have access to access to improved water, 97% of households have access to improved sanitation, 89% of households have access to waste collection services, and 96% of households have access to electricity. This indicates that most households in unplanned areas have access to key services.

Access to improved water sources appears to be the least common service. Although we estimate that 87% of households in unplanned settlements have access to improved water sources, only 56% reported access to a piped water connection either in their house or in their compound. Households with access to improved water varies according to the distance that residents live from major roads, suggesting that ease of access to major transport infrastructure plays a role in the availability of water across households. Piped water connections do not necessarily result in better access, as households face frequent water cuts. Households without access to a water connection in their house or compound tend to rely on public standpipes or private water sources for both drinking and other purposes. 30% of residents in unplanned areas reported using standpipes or public springs, while 11-12% report using private water. Respondents who purchase water and transport it using jerry-cans face some price fluctuations. From SMS surveys we found that the prices vary between RWF 47 and close to RWF 100 per jerry-can. Water prices increase steadily – on average RWF 15 – 20 – increase from the city centre, with those living 6km away from the city centre paying the highest

Access to improved sanitation is near universal, which is remarkable given the lack of traditional sanitation infrastructure. Most households – nearly 65% - use pit latrines as a means of waste disposal. The use of pit latrines is closely tied to the socio-economic situation of households, with more affluent households more likely to select septic tanks over pit latrines. Sharing is a key aspect of toilet usage in Kigali: nearly 60% of households share toilets. While sanitation facilities are satisfactory, they are not environmentally sustainable in the long-term due to the lack of onsite or offsite waste treatment.

Waste collection is ubiquitous with 89% of households reporting access. 83% of households report that waste collection is provided privately by either a cooperative, private company or contractor while 5% report that the City Council (MVK) oversees their waste collection. 76% of households report that their waste is collected every week. Households without access to waste collection services generally dispose of their waste by burying it (6%) or burning it (2%), both of which have negative environmental consequences

A high proportion of households report having access to some form of electricity in their dwelling.

96% of households report having access to electricity in their dwelling, while 89% report paying for electricity monthly, indicating a potential gap that could be explained by off-grid electricity solutions. SMS surveys revealed that the quality of service is variable: 43-56% of households reported between 1-7 electricity cuts over the course of a typical week, while between 42-52% reported no cuts. About 54% of households that reported that any cuts indicated that they lasted less than one hour, on average, implying that intermittent electricity does not cause major disruptions.

Kigali's unplanned settlements are generally perceived to be safe places. Perceptions of safety – measured by asking residents how many times respondents thought about or worried about petty crime, such as minor theft, within the previous four weeks – indicated that 68% of households reported that they never thought of petty crime in their neighborhood. However, residents living closer from the CBD are more likely to worry about petty crime compared to those living further away from CBD.

Access to amenities and public infrastructure does not yet meet the standards set out by the MININFRA. Water points are the most accessible basic service, while health services are the least accessible service when compared against ministerial targets. Proximity to a main road is a key predictor of access to amenities and public infrastructure.

Residents prioritize roads and affordable housing above all other infrastructure, and are willing to contribute their time and labour in order to improve it. 27% of respondents listed “Access to roads for cars” as their top infrastructure upgrading priority, followed by 15% who indicated that they wished to “Upgrade housing quality.” Homeowners are significantly more likely to request improvements to road infrastructure compared to tenants. Respondents overwhelmingly report that they would most be able to provide their time either to support community mobilization efforts or their labour. Approximately 48% of respondents reported being willing to contribute their “Participation in community mobilization” as a means of ensuring better services in their neighborhood, followed by 38% of whom reported being willing to provide labour.

Policy Discussions

The report concludes with a discussion on policy options that the City of Kigali can pursue to address some of the key challenges identified in this study. We group discussion points based on the following themes:

1. **Improving data-driven policy making in the city.** This section includes ideas on how to leverage home grown solutions, such as *umuganda*, or existing data sources collected by other government agencies (such as NISR, RRA, RURA, REG, WASAC, IREMBO) to benefit city planning.
2. **Securing high-quality and affordable housing options for less affluent residents.** Short-term options that are discussed include the impact of regulations and their implementation on

investments in home upgrading and construction; how the mapping of existing vacant government lands can provide a backbone for concrete investments in affordable housing; and the importance of finding innovative ways to bring down the cost of mortgages. Key challenges the city will face in the long term are also highlighted, including:

- How to ensure affordable housing is constructed close to the city centre and not in the periphery?
- How to promote higher density housing and slow down the outwards expansion?
- How to innovate and promote locally sourced high-quality building materials and simple and cost-efficient housing design?
- How to deploy financial strategies – such as land value capture – so that the City of Kigali can sustain investments into the continuous upgrading of the city?
- How to encourage the participation of private investors in the construction of affordable housing?

3. **Street/lane upgrading.** Upgrading roads is a major focus for City authorities; in this section we discuss how community-led initiatives can contribute to shifting more of the responsibility of these upgrades to home owners and local residents.
4. **Improving sanitation.** The lack of systematic on-site or off-site waste treatment means that households construct individual pit-latrines or septic tanks to deal with waste. This is not an environmentally optimal and sustainable solution for the city. We discuss a short-term alternative for the city, consisting in the delivery of sanitation using community-level septic tanks or biogas digesters.
5. **Improvements in public transport and pedestrian infrastructure.** We discuss the importance of finding ways to reduce the cost of the commute for city-dwellers, including potential changes to the fare structure for bus transportation – shifting from a flat pricing model per kilometer, to more progressive pricing mechanisms that reduce costs for low income households. We also discuss how the introduction of smaller mini-buses in peri-urban areas could have a significant impact given that waiting times are longer in the periphery and fewer roads are paved.
6. **Skills development.** High returns to education suggest that it is important for the city to develop a city-specific vision for skills upgrading. We discuss examples from other cities and the importance of focusing efforts on female-headed households, who are the most vulnerable sub-group in the city.



1. Introduction

Rwanda’s urban population has grown rapidly over the last decade. Official statistics indicate that the country’s urbanization rate currently stands at 17.3% (EICV 2013/2014), a rate similar to the 16.5% urbanization rate estimated in the 2012 Census. More recent studies conducted by the World Bank, however, suggest that these numbers underestimate the country’s urban population due to changes in the definition of “urban areas,” and that rates of urbanization have increased from 15.8% in 2002 to 26.5% in 2015. Between official estimates - Census 2012 – and World Bank calculations, Rwanda’s current annual growth rates stand between 4.1% and 6.7%.¹

Rwanda’s urban population will likely see further growth, with urbanization being an explicit objective of the Rwandan government as part of its goal to increase economic development and reach middle income status. Rwanda’s Vision 2020 aims to increase the urban population percentage to 35% by the end of the decade, while the country’s Economic Development and Poverty Reduction Strategy II (EDPRS), 2013-2018, outlines the need for urbanization as one of the driving factors for economic growth.² In similar vein, the Ministry of Infrastructure’s National Urbanization Strategy, 2017-2024, lists economic growth as a key pillar, with “well-coordinated urbanization... [that] provides the basis for socio-economic opportunities” being a main contributor to this goal.³

Kigali is the main urban centre in Rwanda and accommodates about half the urban population, or 859,332 residents (1,132,686 residents in total, including rural areas) as per the Census 2012; it is expected that Kigali will continue to remain driver of urbanization despite mandates to promote alternative “growth poles” in secondary cities and other urban areas. Kigali’s official annual rate of population growth is 4.2%, driven in part by higher urban fertility rates – compared to rural areas -, lower infant mortality rates, and high levels of rural-urban migration.⁴ According to EICV 2013/2014, the districts of Kigali have been the main destination for internal migrants making up for 29% of all recent migrants (those who arrived in the previous 5 years).⁵

Rapid urban growth has led to the development of unplanned settlements as migrants, unable to access formal land and housing markets, have arrived in search of economic opportunities.⁶ Unplanned areas, characterized by inferior living conditions such as limited access to infrastructure, limited plot accessibility, and rudimentary housing construction materials, pose a long-term risk to the

¹ World Bank, *Rwanda Economic Update - Rethinking Urbanization in Rwanda: from Demographic Transition to Economic Transformation*, 2017, pp 19-24; Census estimates calculate annual urbanization rates from 2002-2012, while World Bank estimates calculations are from 2002-2015. Current annual growth rates in the urban population exceeds worldwide averages of 1.8%, see Republic of Rwanda, *Urbanization and Rural Settlement Sector Strategic Plan 2012/13-17/18*,

² See Republic of Rwanda, *Vision 2020*, 2012, pp 13 and Republic of Rwanda, Ministry of Finance & Economic Planning, *EDPRS II*, 2013, pp 21

³ Republic of Rwanda, Ministry of Infrastructure, *National Urbanization Strategy*, 2015, pp 36

⁴ World Bank, *Reshaping Urbanization in Rwanda – Economic and Spatial Trends and Proposals*, 2017, pp 4

⁵ See Republic of Rwanda, National Institute of Statistics, *Fourth Population and Housing Census of Rwanda 2013/2014*, 2014, pp viii

⁶ Vincent Marnirakiza, “Promoting Inclusive Approaches to address Urbanization challenges in Kigali”, *African Review of Economics and Finance*, Vol 6, No. 1, June 2014, pp 162

quality of life for city residents. Moreover, lack of access to key services has the long-term potential to reduce the economic productivity in urban areas and limit economic growth.⁷

Unplanned settlements have grown over the years. While EICV3 (2011) and Census 2012 estimates put the population living in unplanned settlements between 63%-66%, respectively, EICV4 (2013/2014) indicate that 79% of residents in Kigali province live in “unplanned urban housing.”⁸ Unplanned settlements are unevenly divided across Kigali’s three districts, with Nyarugenge district being home to most unplanned dwellings followed by Kicukiro and Gasabo.

Pro-active urban management is critical to sustainable urban growth and to ensuring that urbanization pressures are sufficiently managed. At the national level, these goals have been articulated through various policies, including the National Informal Settlement Upgrading strategy (2015), the National Urbanization Policy (2015), and the National Housing Policy (2015) among others. Notably, the National Informal Settlement Upgrading Strategy provides an overarching framework on improving the informal housing stock and incorporating it into the formal housing stock. The strategy largely advocates for this through the use of a “support” model, whereby the provision of basic infrastructure is facilitated by creating an enabling environment that would allow residents to improve their living conditions through a combination of in-situ upgrading, core housing provisions, basic sites and services, and incremental housing improvements.⁹ The key pillars of this model include: (i) public participation in community upgrading, (ii) setting infrastructure servicing standards, (iii) prioritizing public investment in settlement upgrading, (iv) increasing efficiency in land use allocation, and (v) targeting groups that do not qualify for mortgage financing with home improvement schemes.¹⁰ The Kigali Conceptual Master Plan (KCMP) of 2007 and Kigali Master Plan of 2013 are additional “support” mechanisms, but specifically directed at guiding urban development in the city, both in terms of improving existing settlements and future developments.¹¹

In Kigali, various stakeholders including the city government, Rwanda Housing Authority and Ministry of infrastructure have focused on providing upgraded urban infrastructure and new housing for informal settlement residents directly. Major efforts at upgrading have included improvements to roads and stormwater drainage, as well as comprehensive upgrading efforts such as the Agatare upgrading project (2016), which was conducted with support from the World Bank. In addition, seven affordable housing projects have been undertaken since 2016 with five currently in the planning phase.¹² While expropriation and relocation were used as strategies for informal settlement upgrading until 2010, it is presently only considered as a last resort in areas that are considered dangerous (for example situated on a very steep slope).

⁷ World Bank, *Reshaping Urbanization in Rwanda – Economic and Spatial Trends and Proposals*, December 2017, pp 34

⁸ Republic of Rwanda, Ministry of Infrastructure, *National Informal Settlement Upgrading Strategy*, 2015, pp 7

⁹ Republic of Rwanda, Rwanda Housing Authority, *Profiling and Providing Indication of the Status Quo and Trends in Informal Settlements and Propose Mechanisms for their Upgrading in Kigali City*, 2014, pp 110

¹⁰ Republic of Rwanda, Ministry of Infrastructure, *National informal settlement upgrading strategy*, pp 18

¹¹ Manirakiza Vincent, “Promoting inclusive approaches to address urbanization challenges in Kigali”, pp 169

¹² Republic of Rwanda, Ministry of Infrastructure, *Sector Strategic Plan for National Strategy for Transformation*, 2017, pp 18

For future policymaking, the appropriate mix of direct public infrastructure provision and an enabling environment – such policies, financing schemes and collaborations with the private sector – at both the city and community scale, are best addressed using a data-driven policy approach. Government interventions in city-wide public infrastructure – such as transport, access to business services and opportunities, and access to basic services and safety – as well as efforts in building an enabling environment for settlement upgrading and community development can be better crafted with data highlighting the socioeconomic characteristics of residents in unplanned areas as well as their living conditions.

However, the ability of the government to determine appropriate policies is currently hampered by data constraints, including a lack of data on residents in unplanned areas. Only two major studies have been undertaken focusing on residents in unplanned areas – one in 2008 by DED, City of Kigali and RISD, and the other in 2014 by RHA – both of which focused on providing snapshots of housing quality and current levels of infrastructure provision rather than dynamic changes in socioeconomic profiles or living conditions of residents. A third study, conducted by UN habitat in 2017, focused more on topological and spatial issues.

Considering these trends and key priorities, Laterite, with support and funding from the International Growth Centre (IGC), undertook a study “Understanding the Dynamics of Unplanned Settlements in the City of Kigali.” This study, conducted between 2017-2018, collected data from a representative sample of unplanned settlements using face-to-face interviews and SMS surveys. The project was a multidimensional effort to understand the socioeconomic profile of residents in unplanned areas and assess the physical infrastructure in these spaces, to highlight key areas for interventions such as (i) migration, (ii) employment, (iii) housing, (iv) mobility and (v) access to basic services. Key to this study was the experimental nature of the data collection methodology, which captured baseline data and changes over time. The report focuses on a number of key research questions including:

- **The role of migration** in the creation of unplanned settlements, the residential preferences of migrants in Kigali, and in-migration patterns to the city over time;
- **The socioeconomic profile** of residents in unplanned settlements and variations to their employment conditions, such as unemployment and underemployment;
- **Mobility and work commuting patterns** of residents in unplanned areas across the city, including commuting times, work destinations and modes of transport;
- **Housing conditions** in unplanned areas including housing adequacy/quality, housing financing and housing supply over time; and,
- **Access to basic services** in unplanned areas, including access to water, sanitation, electricity and waste collection, and how that varies across different population segments.

While our study is primarily descriptive, we offer key insights into several of these areas to paint of cohesive picture of major living conditions and patterns in unplanned areas. A secondary aim of this study is to test the viability of SMS based surveys for research purposes, an analysis of which is included in Annex I.

1.1 Structure of the report

The report consists of the following sections:

- **Chapter two** will briefly outline the study design, including the sampling strategy, face-to-face survey implementation and SMS survey implementation
- **Chapter three** will explore migration patterns, links between Kigali residents and rural areas and rent migrants
- **Chapter four** will highlight trends in employment and mobility. Topics include issues related to the socioeconomic situation of residents in unplanned areas, the trade-off between house location and job location, and patterns in transportation usage
- **Chapter five** will discuss aspects related to housing quality, housing adequacy and housing affordability
- **Chapter six** will focus on access to basic services, safety and access to public amenities and infrastructure
- **Chapter seven** will draw out key trends and insights from the previous chapters and offer policy recommendations.



2. Methodology

Three major studies focusing exclusively on unplanned settlements in Kigali have been conducted in the last decade. The first was conducted by the City of Kigali, Rwanda Institute for Sustainable Development (RISD) and Deutscher Entwicklungsdienst (DED) in 2007/2008. Results and conclusions from the study were included in the National Informal Settlements Upgrading Strategy published in 2016 by the Ministry of Infrastructure (MININFRA). The study surveyed 1,049 individuals from all 35 sectors in Kigali, and included questions on access to services, housing and employment.

The more recent study of unplanned areas in Kigali was conducted by Calculus and Infohub and commissioned by the Rwanda Housing Authority 2014 (RHA). The study, which used a mixed methodological approach, included a quantitative survey, key informant interviews, focus group discussions, aerial maps, and transect walks. The quantitative portion of the survey was conducted with 900 households equally divided across Kigali's three districts. The study covered all major themes including issues related to socio-economic conditions and access to basic services, with the aim of categorizing settlements according to how much infrastructure they lack.

Finally, an additional study highlighting the benefits of a city-wide approach to unplanned settlement upgrading was conducted in 2017 by UN Habitat.¹³ This initiative, however, was intended to categorize unplanned settlements into different typologies using spatial analysis in order to inform the city of potential policy interventions. It was less focused on understanding broader issues around how residents in unplanned areas live, especially along the themes outlined in this study.

As such, this study is unique in terms of (i) the means of data collection, (ii) the sample, and (iii) the scope of the study, which included questions related to mobility and employment, as well as housing quality and access to services. This chapter will explain the study methodology including the sampling frame, survey questions and survey methods.

2.1 Surveys

The Dynamics of Unplanned Settlements study consisted of two data collection phases: phase 1 involved face-to-face surveys of field prepped respondents using enumerators and tablets with pre-loaded surveys, and phase 2 involved collecting data from the initial face-to-face survey respondents using a series of weekly SMS surveys.

The face-to-face survey with 1,594 households took place in December 2017 and occurred in all unplanned villages chosen as part of the study. Respondents who were asked to take part in the face-to-face survey were visited prior to data collection for sampling purposes and to obtain consent. Either household heads or the spouses of heads of household were interviewed as part of the study, but household heads were required to have a working mobile phone and to have sent an SMS or

¹³ Mathias Spaliviero., "Upgrading and preventing unplanned and underserviced settlements in Kigali City, Rwanda: Towards the definition of a citywide strategy"., UN Habitat., Nov 2017

WhatsApp message in the last two weeks to qualify for the study. This means that this study is only representative of households living in unplanned areas with household heads that own and use a mobile phone.

All major research themes were covered during the face-to-face survey. Questions related to migration were asked of everyone in the household; questions related to housing and access to basic services were asked to either household heads or spouses (who responded on behalf of their household); and questions related to employment and mobility were asked to household heads - or to spouses who were asked to respond on behalf of the household head.

The SMS data collection phase began after the conclusion of the face-to-face survey and spanned three months beginning in January 2018. This phase consisted of three SMS surveys covering a combination of the five primary research themes. The three surveys were each repeated three times over this three-month period. Respondents who did not complete the survey within three days were sent a reminder message. Table 1 highlights the schedule of SMS surveys, and their areas of focus. These high frequency surveys enabled us to construct panel data to track various indicators of interest over time.

Table 1: SMS Survey Schedule

Topic	January	February	March
Employment/ Migration	January 10 January 14 - <i>reminder</i>	February 6 February 9 - <i>reminder</i>	March 3 March 6 – <i>reminder</i>
Services/ Residential mobility	January 18 January 21 - <i>reminder</i>	February 14 February 17 - <i>reminder</i>	March 11 March 14 - <i>reminder</i>
Mobility/ Employment	January 26 January 29 - <i>reminder</i>	February 23 February 26 – <i>reminder</i>	March 19 March 22 – <i>reminder</i>

A pilot study with the same structure was completed in March 2017 before the final data collection took place. The pilot study offered helpful guidance all of which was shared with the City of Kigali and IGC in May 2017 and incorporated into the design of the final study.

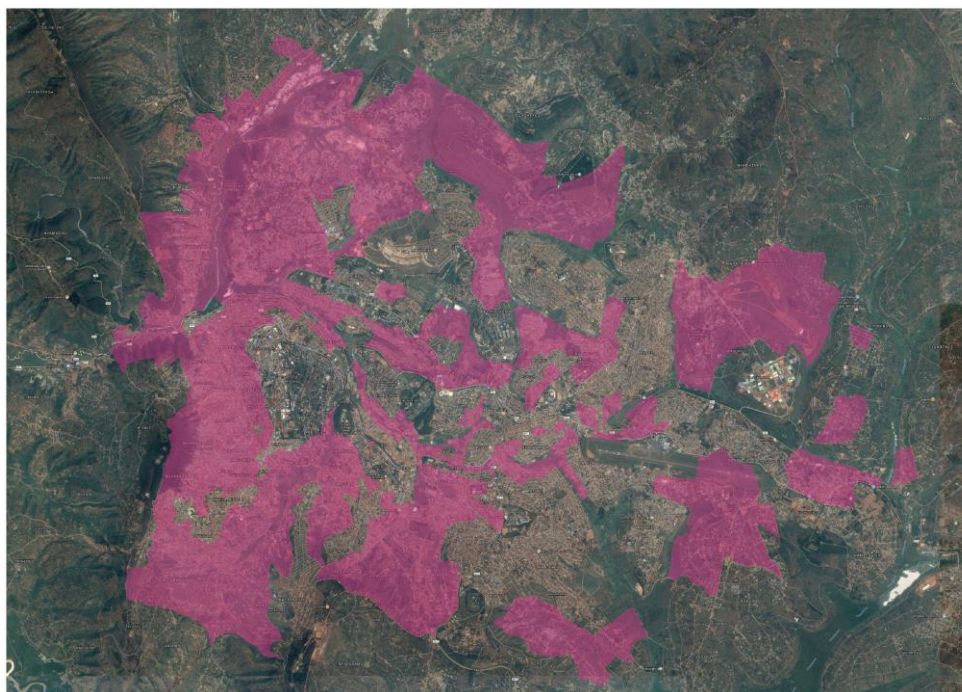
2.2 Sampling

Laterite employed a unique sampling frame to identify a representative survey of unplanned settlements in Kigali. Given the rapidly changing dynamics of urban Kigali, especially the rapid rate of growth, we chose not to use existing classifications of planned and unplanned areas – as per RHA 2014 study – but instead to use data from satellite imagery analysis conducted by researchers at the University of Tübingen Department of Geography and the International Growth Centre (IGC).¹⁴

¹⁴ Felix Bachofer, Sally Murray, *Remote Sensing for Measuring Housing Supply in Kigali – C-38418-RWA-1*, University of Tübingen, IGC, 2018

The team at the University of Tübingen used remote sensing data from the Pleiades stereoscopic satellite images taken in 2015 to classify buildings according to various parameters including roof color, building height, and neighborhood density amongst others. By their estimation, approximately seven primary building categories exist in Kigali. These include: rudimentary (residential), local type (commercial), bungalow (residential), villa (residential), local apartment (residential/commercial), modern apartment (residential/commercial) and hall (commercial). The rudimentary building type – which makes up approximately 80% of buildings in Kigali – correspond most closely to unplanned settlements and match the classification for unplanned dwellings in the Census approximately 90% of the time. Figure 1 highlights the unplanned villages that were identified.

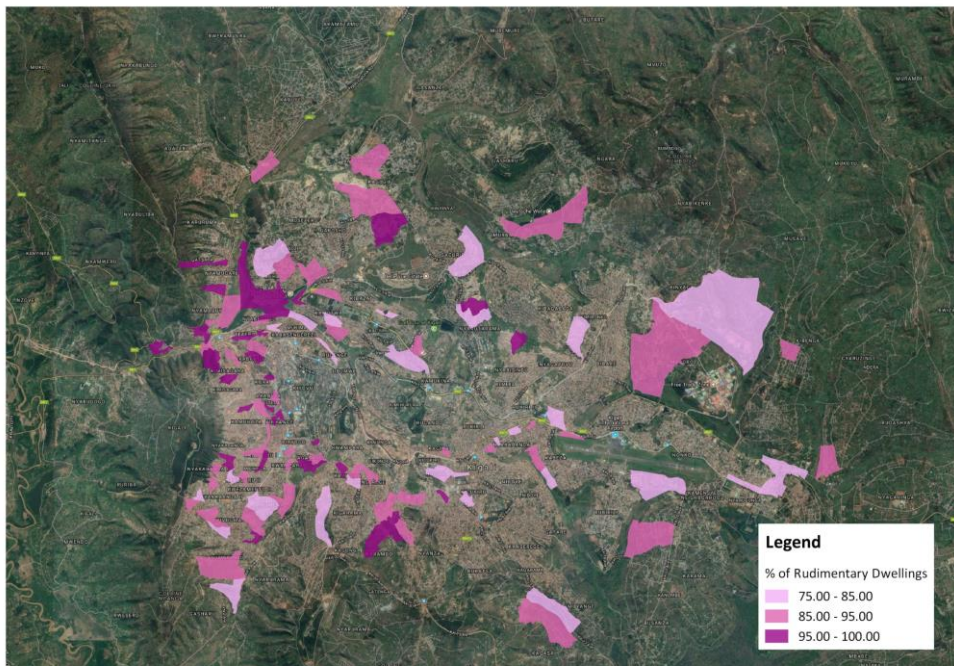
Figure 1: Villages with a share of rudimentary houses >75% in urban Kigali



A stratified random sampling technique was used to select villages from the list of villages with a high proportion of rudimentary dwellings. Approximately 444 villages in urban Kigali met the criteria of having 75% or more of its total housing stock being classified as “rudimentary.”¹⁵ Out of these, 120 villages were randomly selected to be included in the study, proportionally stratified by the three districts of Kigali. Overall, 45% of the unplanned villages we sampled were in Nyarugenge, 26% were in Kicukiro and 29% were in Gasabo. Households were sampled after collecting comprehensive lists from village leaders (*umudugudu* leaders) in all sampled villages. Village leaders were asked to specifically prepare a complete list of households in the entire village regardless of housing tenancy and the contact details of household heads were recorded.

¹⁵ Rural parts of Kigali Province were ignored for the purposes of this study as the housing stock in these parts did not correspond to the “rudimentary” housing classification. Moreover, rural parts of Kigali were not of primary interest in this study.

Figure 2: Sampled villages highlighted by share of rudimentary housing



Sampling at the village level was structured in two phases. First, 30 households were randomly drawn from village lists using a systematic random sampling technique. A random number between 1-5 was drawn for each village list and every 5th household was selected until a list of 35 households was obtained for each village.¹⁶ Second, enumerators field-prepped 20 households from the list of 35 shortlisted houses by obtaining their consent to participate in the full study and asking basic demographic questions. Field preparation took place with the help of village leaders who explained the purpose of the study to participants. Enumerators were instructed to field prep households starting with the top of the list and continuing until they reached the bottom. The eligibility criteria for the study included:

- Households where the head of the household or spouse was over the age of 18
- Households where the head of the household had a phone (feature phone or smart phone) that was working and able to receive SMSs
- Households where the head of the household had sent a message via SMS or WhatsApp in the last two weeks
- Respondent agreed – either on behalf of themselves or their spouse – to participate in 9 additional SMS surveys over 3 months beginning in January and ending in March 2018. Respondents were informed that the SMS survey recipient would receive RWF 100 in compensation for each SMS survey they consented to and completed.

¹⁶ If enumerators reached the end of household lists and 30 households were not drawn, enumerators were asked to continue drawing every 5th household from the beginning of the list

2.3 Survey implementation

We aimed to collect data from 15 of the 20 households that were field prepped. Given the difficulty in finding households in urban Kigali, enumerators were given the flexibility to collect data from any of the 15 of the 20 field prepped households in any order. Overall, 1,594 of the desired 1,800 households were interviewed. Table 2 summarizes the villages and households sampled across Kigali's three districts, and the average number of households interviewed per village.

Table 2: Villages sampled, and households interviewed

District	Total estimated unplanned villages	Villages sampled	Households sampled	Avg. households per village
Nyarugenge	202	54	752	14
Gasabo	129	35	434	12.4
Kicukiro	113	31	408	13.2

Face-to-face data collection took place with all 1,594 eligible households, using tablets and trained enumerators. Respondents were asked at the beginning of the face-to-face survey if they agreed to be a part of the study and if they agreed to participate in all subsequent SMS surveys. At the end of the face-to-face data collection respondents were asked if they agreed to be a part of a panel. Respondents were told that being part of the panel involved receiving (i) regular SMS surveys on other topics and (ii) submitting their contact details to NISR for any additional SMS survey. Finally, respondents were trained on how to answer SMS surveys and were given incentives for completing a training survey. They were also given handouts with an explanation of how to complete the SMS survey for reference.

Given evidence of response bias, responses to each SMS survey were re-weighted. Weights were calculated using an inverse propensity score methodology. The likelihood of responding to a survey was calculated based on respondent demographic characteristics captured during the face-to-face survey. Answers to questions from respondents with characteristics that were less likely to answer SMS surveys were weighted higher.

2.4 Study Limitations

The following limitations are important to keep in mind:

- **The sample is limited to households in which the head of the household has a working mobile phone.** Our sample is therefore not representative of the entire population of households in unplanned settlements and is likely to under-represent households that are too poor to either own or use a mobile phone. Nevertheless, mobile phone penetration in Kigali is very high: EICV4 (2013/2014) estimates that 90% of households in Kigali province own at least one mobile phone.¹⁷ Moreover, our estimates from field preparation indicate that over 99% of respondents with a mobile phone had used it within the past two weeks.

¹⁷ Republic of Rwanda, NISR, *EICV 2013/2014*, 2014, pp 81

- **The analysis of migration data patterns is limited to the stock of current migrants living in the City.** The nature of our cross-sectional survey means that despite collecting information on previous areas of residence, our data on migrants is limited to those who were living in Kigali during the survey period. Our study misses cyclical migrants who might arrived in Kigali and returned to their place of origin prior to the completion of the study.
- **The sampling strategy was unique in that satellite imagery was used to determine which parts of the city were planned and unplanned.** While this strategy was most comprehensive given the lack of official demarcations and relevant up to-date information on areas with a high prevalence of households in unplanned areas, the strategy is unlikely to be perfect because unplanned settlements were classified based on housing structures, and roofs. In addition, our justification for choosing villages with a housing stock > 75% rudimentary meant that in many cases villages that were sampled also included housing that was of higher quality. Moreover, our sampling frame was limited to urban parts of Kigali province and did not include rural areas, which, according to EICV 4 (2013/2014) is home to approximately 25% of the province's population.¹⁸
- **Finally, questions on employment and mobility were only asked with reference to heads-of-household, and not all adults within the household.** This was necessary to ensure we could complete the survey within the target time limit. Data on employment and mobility can therefore not be extrapolated to the entire population of adults living in unplanned areas.

¹⁸ Ibid. pp 4



3. Migration and Urban-Rural linkages

The emergence of unplanned settlements is often tied to inwards migration that takes place as a result of the urbanization process. Here we study the migration status of residents in Kigali's unplanned settlements. This section uses cross-sectional data of the current stock of migrants in Kigali to illustrate patterns of in-migration. Given that such data masks the important phenomena of circular and return migration, the extent of our analysis limited.

3.1 Migration patterns in space and time

Migration: is defined as the movement of people across a specified boundary to establish a new residence.

Kigali is a city of migrants; the proportion of migrants is highest in unplanned areas. We show this using sample data from the 2012 Population and Housing Census, which is representative of the entire city of Kigali. According to the 2012 Population and Housing Census, an estimated 69% of adult residents (aged 18 or above) were born outside of the Kigali Province: 54% of residents were born in a different Province; 15% in a different country.¹⁹ Migration patterns have shaped the economic geography of the city. There are geographic Sectors where the proportion of migrants is high; others where it is low. Census data reveals that in the Sectors selected for this study – where the proportion of unplanned settlements is the highest – about 75% of adults were migrants in 2012, compared to 45% in the Sectors not selected for this study. The fact that there is a strong link between living in an unplanned area and migration is also confirmed by Census data: an estimated 84% of adults living in “spontaneous/squatter” housing in Kigali in 2012 were migrants, compared to 35% of adults living in dispersed and more isolated housing.

This study, which is representative of unplanned settlements in Kigali in 2018 (as defined in the methodology section), confirms that the proportion of migrants in unplanned settlements is high. We estimate that about 65% of adult residents in unplanned settlements – aged 18 or above - in 2018 were born outside of the Kigali Province.²⁰

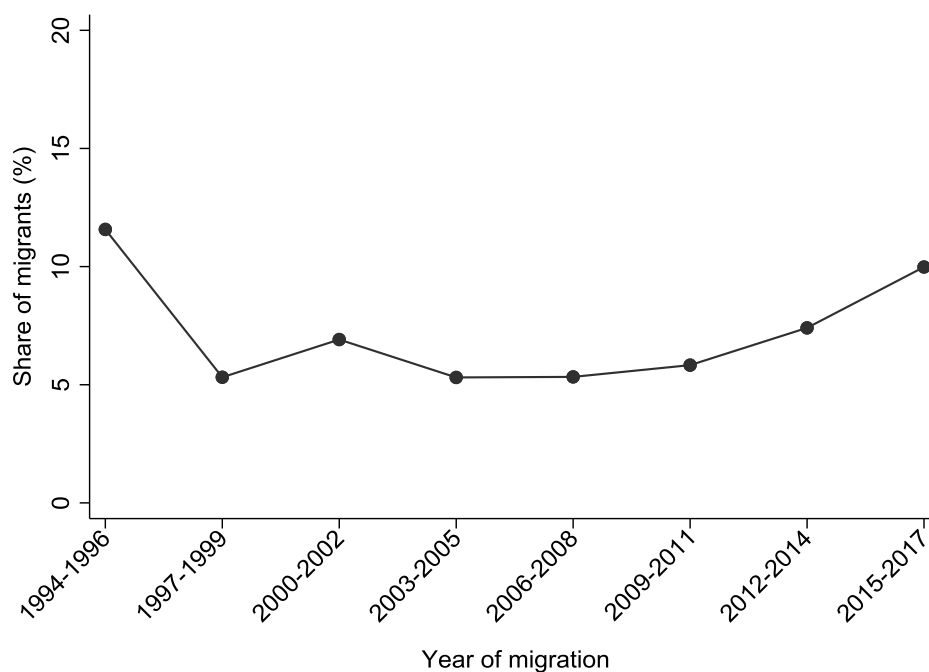
Migrants in unplanned settlements arrived because of two dynamics: geopolitical events in the aftermath of 1994 and the process of urbanization. Out of the population of adult migrants in Kigali's unplanned settlements today, about one-quarter migrated to Kigali in the immediate aftermath of the

¹⁹ All calculations conducted by Laterite, using the sample 2012 Population and Housing Census, provided online by the National Institute of Statistics of Rwanda

²⁰ This is lower than the estimate of the Census for the Sectors covered in this study because of the passing of time. There are a greater proportion of children born in Kigali and living in unplanned settlements turning 18, than there are new migrants arriving. As a point of comparison, we estimate that 73.3% of adults living in unplanned settlements and aged 24 or above in 2018 (who were aged 18 or above in 2012) are migrants, an estimate that is statistically indistinguishable from the Census figure of 74.5%.

genocide between 1994 and 1999. An estimated 74% of these migrants were born in a different province, the remaining 26% in a different country (mainly neighboring DRC, Burundi, Uganda and Tanzania). Most internal migrants during that period – and that are still living in Kigali today – came from the South of the country (56%), about a quarter from a West (27%), 8% from the East and another 8% from the North. The province of origin of recent migrants is more balanced. Out of migrants that have arrived since 2012 – and that were born in Rwanda and still live in Kigali’s unplanned settlements today – about 39% arrived from the Southern Province, 30% from the Western Province, 22% from the Eastern Province and just 9% from the Northern Province. The oldest migrants in terms of their time of arrival are migrants from the South; the youngest, migrants from the Eastern Province. Migrants from the Northern Province remain under-represented in Kigali’s unplanned settlements, with migration patterns showing a flat profile over time.

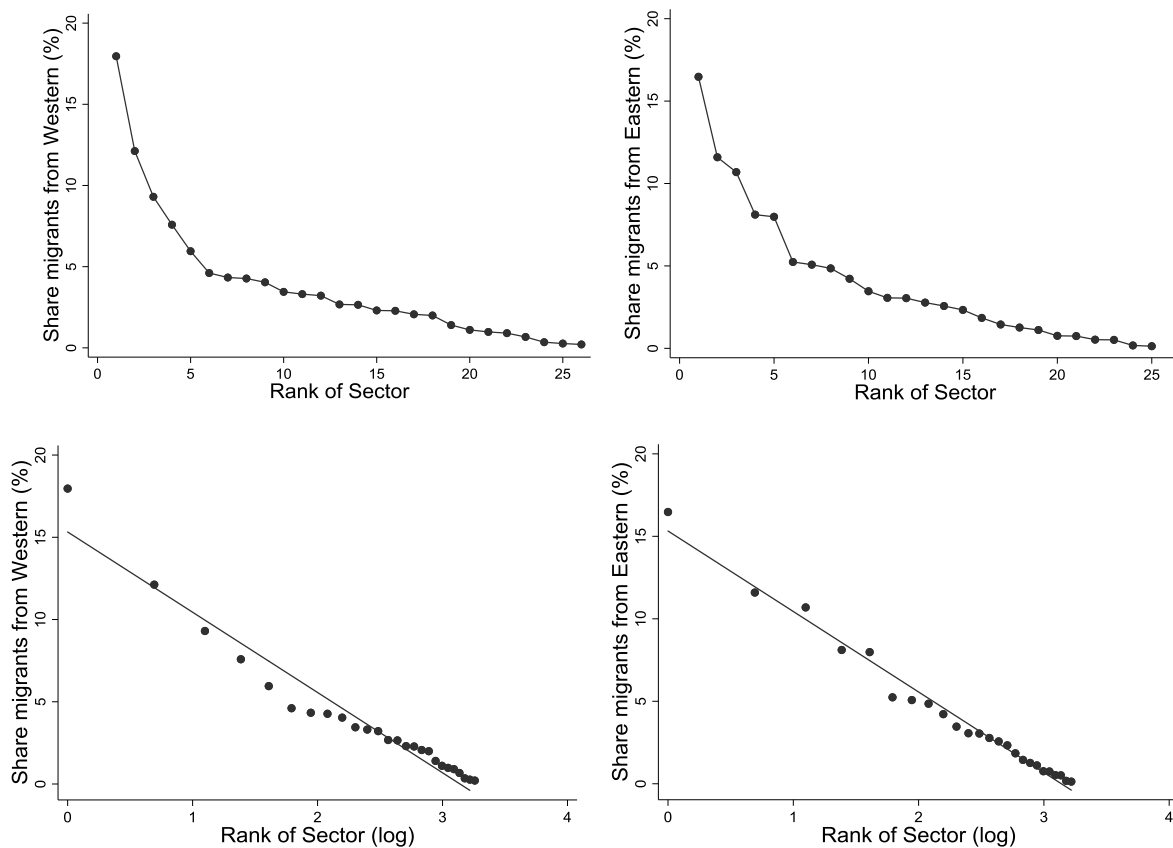
Figure 3: Year of arrival of current migrants in unplanned settlements in Kigali



Geographic clustering within unplanned settlements is highest for migrants arriving from the West and the East of the country, though it is important to note the unplanned areas are well integrated in terms of the place of origin of internal migrants. Migrants born in the Western and Eastern Provinces of the country are more likely to re-locate to areas where there is a greater concentration of migrants from the same Province. This can be seen in Figure 4, which shows that the distribution of migrants from the Western and Eastern Provinces by Sector follows a power law. This means that there are a handful of Sectors where there is a very high concentration of migrants from the West or East. For example, out of the 26 sectors in this study, we find that 3 sectors alone – Gisozi, Remera and Kinyinya – account for almost 40% of migrants for the Western province, compared to 21% of Kigali natives, 20% of migrants from the Southern Province and 16% of migrants from the Northern Province. These same sectors also account for close to 40% of arrivals from the Eastern Province (albeit in a different order). Power-laws arise when there is preferential attachment within networks – i.e.

when people are more likely to connect to people with which they have the greatest proximity. We do not find a similar pattern for migrants from the Southern or Northern Provinces.

Figure 4: Proportion of migrants from Western (left) and Eastern (right) living in Sectors, ordered by rank of importance

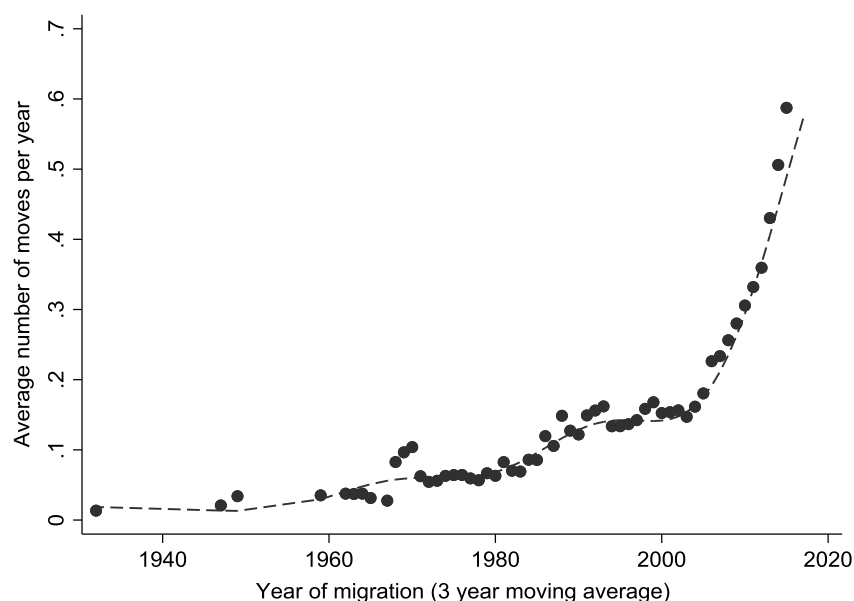


It is important to keep in mind that migrants are more mobile and move more frequently than their native peers; the longer adults have lived in Kigali, the more stable their housing situation becomes.

Focusing on the population of household-heads living in unplanned settlements, we find that migrants reported having moved houses 2.5 times, compared to just 1.5 time for Kigali natives (a very large and statistically significant difference). Migrants are exponentially more vulnerable to have to move in their very first year of arrival in Kigali than in any subsequent year (see

Figure 5: Average number of changes of house per year (3 year moving average)). With each passing year, their situation becomes more stable on average. Although sample sizes are too small to offer precise estimates by year of arrival, we find for example that about 70% of migrants that were in their second year in Kigali had already moved once, about 40% twice; about 77% of migrants that arrived three years ago had moved once, almost 60% of them twice. The number of moves starts to stabilize after about 8 to 10 years spent in Kigali. This is clearly a reflection of the fact that the housing situation of new migrants is much more unstable than that of migrants that have lived in Kigali for a longer period.

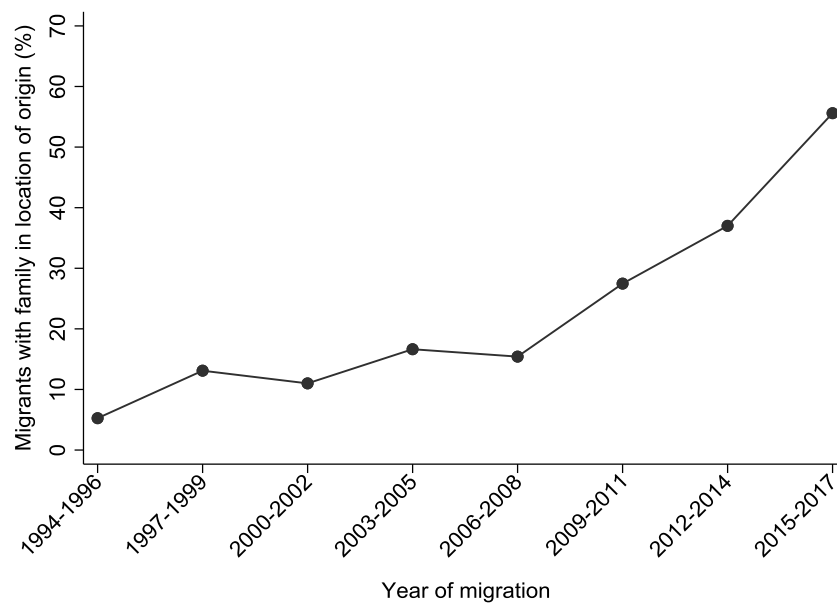
Figure 5: Average number of changes of house per year (3 year moving average)



People tend to move houses within the same sector, in particular when they are looking for cheaper or better-quality housing. An estimated 60% of the moves happened within the same sector. People were significantly more likely to move within the same sector when they were looking for better quality housing (75% of the time) or for cheaper rental options (about 70% of the time). One interpretation of this is that the longer people live in a certain location, the more likely they are to identify and act upon good housing opportunities locally. People are comparatively more likely to move to a new Sector when purchasing a house (about 50% of the time).

As migrants settle in Kigali, their social ties with their places of origin weaken. The longer adult migrants stay in Kigali, the greater the chance that their families will also have moved to Kigali or with time have passed away. This dynamic is depicted in Figure 5, which shows that the percentage of migrants maintaining close relatives (from their household) in their places of origin decreases over time. An estimated 60% of adult migrants that arrived between 2015 and 2017 had close family ties in their places of origin; this number decreases to about 20% of adults who migrated slightly more than 10 years ago, between 2006 and 2008.

Figure 6: Percentage of adult migrants maintaining household memberships in place-of-origin



Though their ties with their places or origin become looser, migrants continue to maintain economic ties with their places of origin. Migrants are much more likely than Kigali natives to own property outside of Kigali Province. An estimated 9% of migrant heads-of-household in unplanned settlements own a house in a different Province, compared to 1% of Kigali natives; about 26% of migrant heads-of-household own undeveloped land outside of Kigali Province, compared to 6% for Kigali natives. They are also much more likely to remit funds outside of Kigali. An estimated 13% of migrant heads-of-household sent money to a different province in the past year, compared to 5% of heads-of-household born in Kigali. These patterns suggest that migration strengthens the social and economic connectivity of the country.

3.2. Recent migrants in unplanned settlements

Recent migrants: Recent migrants are individuals/households that moved to Kigali between 2013 and early 2018 (over the past five years).

Recent migrants account for about 15% of the adult population of unplanned settlements. They are a minority population in the unplanned areas of Kigali. We estimate that there are about 60,000 recent migrants living in unplanned settlements today.

About 50% of recent migrants (adults) live in unplanned areas in 6 of the 23 sectors covered by this study, namely Gisozi, Kacyiru, Kinyinya, Muhima, Kanombe and Nyamirambo. While there are some sectors that attract a greater proportion of recent migrants, new migrants are generally well distributed across unplanned areas of Kigali. For new migrants arriving from the West, South and North we do not observe a very strong clustering effect by place of origin; recent internal migrants do not necessarily move to areas where there are other migrants or other new migrants from the same

province. We do observe a higher level of clustering for recent migrants arriving from the Eastern Province. Almost 25% of recent migrants arriving from the Eastern Province move to Gisozi, the next highest Sector being Remera with 11%.

Recent migrants are young and moved to Kigali to find employment opportunities. The median age of recent migrant adults is 25 years old; the median age at which they arrived in Kigali is 19 years of age. An estimated 85% of recent migrant adults are aged 18 to 35. This young population moved to Kigali looking for work opportunities. An estimated 63% of recent migrants identified seeking business opportunities or paid employment as one of the main reasons they moved to Kigali; 11% mentioned living with family or friends as one of the main reasons they moved; 11% to seek educational opportunities, and 9% moved to Kigali following a wedding or divorce.

A striking feature of recent internal migrants is that they are much more likely to be female. An estimated 61% of recent adult migrants are female (a strongly statistically significant difference compared to males). This is not the case for long term migrants, where the proportion of males/females is balanced. There are very large differences in the reasons for moving to Kigali by gender. In general terms we find that male migration is more driven by “economic” motivations; whereas female migration is driven by both “economic” and “social” motivations. Recent male migrants essentially moved for work (75%) and to seek educational opportunities (15%); only about 4% of recent male migrants identified family and friends as one of the main reasons they moved, and only 1% identified marriage or divorce. Female migrants moved to Kigali for a greater variety of reasons. An estimated 55% identified seeking work opportunities as one of the main reasons; 16% moving in with family and friends; 15% marriage or divorce; and 7% to seek educational opportunities. We are not able to conclude on the main reason why females account for over 60% of recent migrants. Table 3 highlights the gender split of adults by province of origin for recent migrants living in unplanned settlements.

Table 3: Proportion of recent adult migrants by gender

Province of Origin	Male (%)	Female (%)
Northern Province	41	59
Southern Province	35	65
Eastern Province	37	63
Western Province	41	59

3.3 Comparative socio-economic analysis of migrant and native households

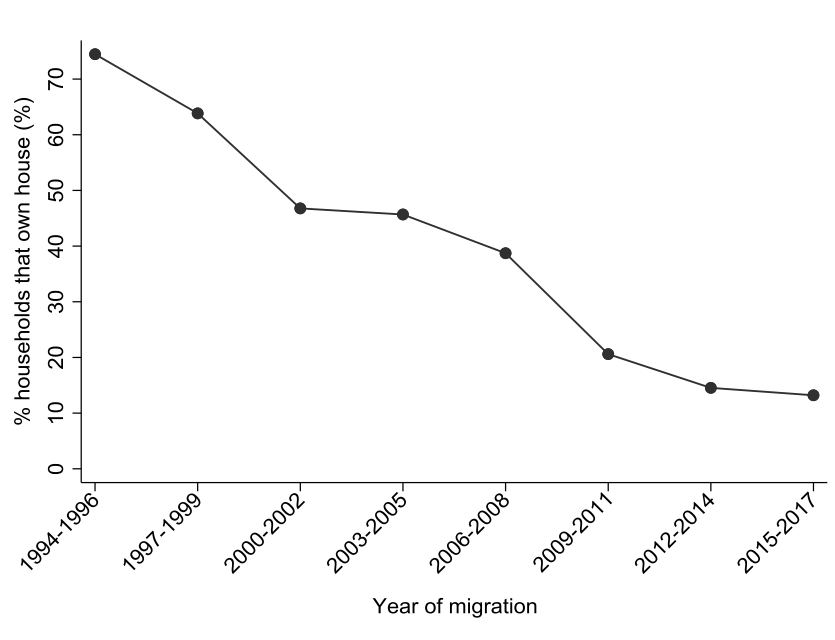
Migrant Households: Migrant households are those in which the head-of-household was born outside of Kigali Province.

3.3.1 Housing and living conditions

There is a very large gap in home ownership rates between migrant and non-migrant households living in unplanned areas. Migrants are on average 35 percentage points less likely to own the house they live in, controlling for their age, gender and the District they live in. On average an estimated 89% of native households own the house they live in, compared to 54% of migrant households. The average

home ownership rate of recent migrants that have arrived in the past five years is 16%. As can be seen in Figure 7 it takes migrant families living in unplanned settlements many years to purchase a house. For example, less than half of migrants that arrived during the 2000-2013 period (15 to 18 years ago) own the house in which they live. These patterns are reflected in the frequency with which migrant families re-locate when arriving in Kigali (see discussion above).

Figure 7: Home ownership rate, by year of migration



Migrant families live in slightly smaller housing on average. They tend to have fewer rooms (about 0.3 fewer rooms) and tend to be more people per room (about 0.2 more people per room) compared to non-migrants who live in dwellings with 2.5 rooms and 2.4 people per room. This is not a reflection of their job status or socio-economic status, but rather a reflection of the fact that they are much more likely to be renting their home and looking to minimize the rent they pay. The difference between migrants and non-migrants on number of rooms and room occupancy rates are statistically significant controlling for age, age squared, gender and location dummies, but disappears when we control for tenancy.

While migrant households do not own the houses they live in and tend to live in smaller housing on average, not observe any other differences between migrant and non-migrant households in terms of their living condition metrics. They have similar levels of access to utilities, including electricity, water and garbage collection services and live at a comparable distance from the main road. They have similar levels of affluence, when measured in terms of asset ownership or their *ubudehe* category. Their education levels are comparable on average and they are equally likely to be in a job.

3.3.2 Access to work

Employment rates and underemployment rates vary based on the migration status of heads-of-household. Migrant household-heads are on average 15 percentage points less likely to be

underemployed relative to household-heads born in Kigali; they are also about 7 percentage points less likely to be unemployed.²¹ An estimated 49% of native Kigali household-heads are underemployed, compared to just 33% of migrant household-heads. These differences hold controlling for age, gender, education status, location of origin and the current District where households live.

Household-heads born in Kigali are also much more likely to be working in the informal sector.

Having been born in Kigali is associated with a 10-percentage point increase in informality, in so far jobs are concerned (a statistically significant result, that holds controlling for age, age squared, gender and location dummies). On average, an estimated 48% of non-migrant household-heads that declared having a job were employed in the informal sector, compared to about 38% of migrant heads-of-household.

Migrants and non-migrants tend to work in similar sectors, but with some key differences.

Household-heads born in Kigali are more likely to work in the construction business (+6 percentage points) or in non-professional services (+11 percent); migrant households are significantly more likely to work in the public administration (+5 percentage points).²²

²¹ This relationship holds at the 5% level controlling for a head of household's gender, age, age square, level of education and location dummies.

²² All differences are statistically significant at the 10% level, controlling for age, age squared and gender

3.4 Box 1: Key Insights on Migration

Kigali is a city of migrants and unplanned areas are home to more migrants than other urban areas

- According to the 2012 Population and Housing Census, an estimated 69% of adult residents (aged 18 or above) were born outside of the Kigali Province: 54% of residents were born in a different Province; 15% in a different country
- Census data reveals that in the Sectors selected for this study – where the proportion of unplanned settlements is the highest – about 75% of adults were migrants in 2012, compared to 45% in the Sectors not selected for this study.
- In our study, we estimate that about 65% of adult residents in unplanned settlements – aged 18 or above - in 2018 were born outside of the Kigali Province.

Urban migration into Kigali is likely a product of two factors: geopolitical events and, more recently, the prospect of employment opportunities

- Out of the population of adult migrants in Kigali's unplanned settlements today, about one-quarter migrated to Kigali in the immediate aftermath of the genocide between 1994 and 1999. An estimated 74% of these migrants were born in a different province; most came from the South of the country (56%), about a quarter from a West (27%), 8% from the East and another 8% from the North
- The province of origin of recent migrants is more balanced. Out of migrants that have arrived since 2012 – and that were born in Rwanda and still live in Kigali's unplanned settlements today - about 39% arrived from the Southern Province, 30% from the Western Province, 22% from the Eastern Province and just 9% from the Northern Province.
- An estimated 85% of recent migrant adults are aged 18 to 35. This young population moved to Kigali looking for work opportunities. An estimated 63% of recent migrants identified seeking business opportunities or paid employment as one of the main reasons they moved to Kigali.
- Migrant household-heads are on average 15 percentage points less likely to be underemployed relative to household-heads born in Kigali; they are also about 7 percentage points less likely to be unemployed
- A high proportion of recent adult migrants are female (61%). This is not the case for long term migrants, where the proportion of males/females is balanced

Residential patterns of migrants in Kigali are clustered

- Migrants born in the Western and Eastern Provinces of the country are more likely to re-locate to areas where there is a greater concentration of migrants from the same Province. There are a handful of Sectors where there is a very high concentration of migrants from the West or East. Out of the 26 sectors in this study, we find that 3 sectors alone – Gisozi, Remera and Kinyinya – account for almost 40% of migrants for the Western province
- About 50% of recent migrants (adults) live in unplanned areas in 6 of the 23 sectors covered by this study: Gisozi, Kacyiru, Kinyinya, Muhima, Kanombe and Nyamirambo. While there are some sectors that attract a greater proportion of recent migrants, new migrants are generally well distributed across unplanned areas of Kigali and there is no evidence of clustering by province of origin, apart from those from Eastern province.

Migrants are residentially mobile and tend to move homes frequently compared to those born in Kigali; the longer they stay in Kigali, however, the more their living conditions stabilize

- Focusing on the population of household-heads living in unplanned settlements, we find that migrants reported having moved houses 2.5 times, compared to just 1.5 time for Kigali natives (a very large and statistically significant difference).
- 70% of migrants that were in their second year in Kigali had already moved once, about 40% twice; about 77% of migrants that arrived three years ago had moved once, almost 60% of them twice.
- However, an estimated 60% of the moves happened within the same sector. People were significantly more likely to move within the same sector when they were looking for better quality housing (75% of the time) or for cheaper rental options (about 70% of the time)
- There is a very large gap in home ownership rates between migrant and non-migrant households. Migrants are on average 35 percentage points less likely to own the house they live in. On average, an estimated 89% of native households own the house they live in, compared to 54% of migrant households
- Migrant families live in slightly smaller housing on average. They tend to have fewer rooms (about 0.3 fewer rooms) and tend to be more people per room (about 0.2 more people per room). This is not a reflection of their job status or socio-economic status, but rather a reflection of the fact that they are much more likely to be renting their home and looking to minimize the rent they pay

Migrant ties with their places of origin loosen over time, although their ties with areas outside Kigali are stronger than those of Kigali natives

- The longer adult migrants stay in Kigali, the greater the chance that their families will also have moved to Kigali or with time have passed away. An estimated 60% of adult migrants that

arrived between 2015 and 2017 had close family ties in their places of origin; this number decreases to about 20% of adults who migrated slightly more than 10 years ago.

- Migrants are much more likely than Kigali natives to own property outside of Kigali Province. An estimated 9% of migrant heads-of-household in unplanned settlements own a house in a different Province, compared to 1% of Kigali natives; about 26% of migrant heads-of-household own undeveloped land outside of Kigali Province, compared to 6% for Kigali natives.
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4. Employment and Mobility

4.1 Employment

We study employment patterns for household-heads living in unplanned settlements using two datasets: the face-to-face surveys, conducted in late 2017, and SMS-based follow-up surveys, conducted in early 2018. All household-heads are aged 18 or above.

Note that this data is not directly comparable to statistics from the latest Labour Force Survey published by the National Institute of Statistics in 2017/2018, because: (i) we are focusing only on household-heads and not all members of the household aged 16 or above; (ii) our sample only consists of people aged 18 or above (and not 16 or above, as per the Labour force survey); (iii) the definition of employment does not include the latest changes with respect to subsistence foodstuff producers; (iv) the definition of unemployment does not include availability criteria and the provision for future starters, which leads us to slightly over-state the level of unemployment compared to official statistics.

Nevertheless, the statistics presented below provide a useful overview of labour dynamics in unplanned settlements in Kigali.

4.1.1 Employment patterns in unplanned settlements

Employment: we consider a person as employed if he/she worked for at least one hour in the past week or if he/she is employed, but was temporarily absent from work due to illness or other factors;

Unemployment: a household-head is unemployed if he/she is not employed, but carried out activities to seek a job during the past four weeks;

Unemployment rate: number of unemployed heads of household, divided by the total number of employed and unemployed heads of household;

Underemployed: a household-head is unemployed if he/she is in employment but works less than 35 hours in a week.

Based on the face-to-face survey, we estimate that about 18% of household-heads living in unplanned settlements are unemployed. The strongest determinants of employment/unemployment patterns in this sample include:

- **Age.** Unemployment is the highest for young heads-of-household (in the 18 to 24 age-group) and for heads-of-household in their late 50s. An estimated 27% of household-heads aged 18 to 24 are unemployed, compared to about 15% of heads-of-household between the ages of 35 to 55. Unemployment increases to about 22% for household heads aged 55 to 65.

- **Gender.** Unemployment is highest for female heads of household living in unplanned settlements, who are about 20 percentage points more likely to be unemployed compared to their male peers (controlling for age and education levels).
- **Migration status.** Unemployment is about 8 percentage points higher for household-heads born in Kigali. Internal migrants are more likely to be employed. This is consistent with findings from the Labour Force Survey (NISR, 2017-2018), which finds that internal migrants were more likely to be in the labour force and less likely to be unemployed.
- **Proximity to city centre.** Unemployment levels were about 10 percentage points lower for household-heads living within 2kms of the City Centre, compared to household-heads living more than 2kms from the City Centre. Possible explanations include: (i) the fact that housing costs are significantly higher in the centre of the city, making it less accessible to unemployed household-heads; or (ii) the fact that living in the city centre, increases the likelihood that people will find a job.

During the survey period aggregate unemployment rates were relatively stable over time in unplanned areas; however, at the individual level, there was a lot of movement in and out of employment. Being able to observe movements in and out of employment is one of the key advantages of using high-frequency SMS surveys. As part of this study, we managed to gather panel data on employment patterns for 431 household-heads at 4 time periods: (i) during the face-to-face survey, (ii) during an SMS survey (4 weeks later), (iii) during an SMS survey (7 weeks later); and (iv) during an SMS survey (10 weeks later). Out of this sub-sample of household heads, we find that only 5% were out of a job throughout the survey period; about 70% were in a job throughout the survey period; and the remaining 25% were in and out of a job. Unemployment is not a permanent status for most household-heads. At the same time employment is not a permanent status for about one-quarter of household-heads during the survey period. On average there were a similar number of people transiting in and out of jobs during each round of surveying.

We estimate that about one out of three working heads-of-household in unplanned settlements were underemployed at the time of the face-to-face survey; this sub-group were also the most vulnerable to shifting in and out of employment. About 36% of household heads that were employed at the time of the face-to-face survey worked 35 hours per week or less. These household heads were about three times more likely to be out of a job after four weeks, compared to those that worked more than 35 hours a week. Unemployment and underemployment have similar determinants, but there are also some key differences:

- **Age is not a significant predictor of underemployment, but gender and the migration status are.** Female heads of household and household-heads born in Kigali (natives of Kigali) were about 9 percentage points more likely to be underemployed.
- **The type of job matters a lot.** Casual wage labourers across all sectors were an estimated 42 percentage points more likely to be underemployed compared to salaries employees; self-employed professionals were also about 15 percentage points more likely to be underemployed.

The employment status of heads of household affects the stability of their housing situation.

Unemployed tenants were about 12 percentage points more likely to have moved homes in the previous year compared to employed tenants. Out of household heads who reported having moved in the previous year, those who were unemployed were also about 18 percentage points more likely to have moved because the rent in their previous place of residence was too high. Similar patterns are observed for underemployed heads of household.

4.1.2 Types of jobs and sectors of activity

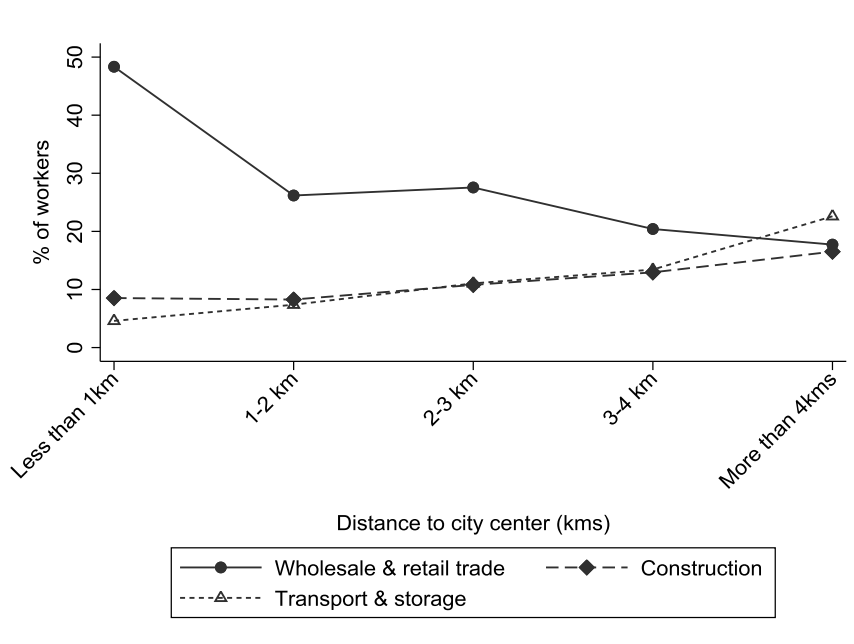
The most common economic activities for heads-of-household in unplanned areas are “Wholesale and retail trade” (29%), “Transport and storage” (12%), and “Construction,” (11%). Table 4 summarizes the top five sectors of activity, accounting for about 66% of all workers. One noticeable activity missing from the mix is manufacturing sector jobs, confirming that from a jobs perspective Kigali is a city of trade and services, not manufacturing. This is also reflected in the Labour Force Survey (NISR, 2017), which shows that 5.8% of workers in urban areas of the country worked in manufacturing.

Table 4: Top 5 sectors of activity for employed heads-of-household

Sector	% of employed household-heads
Wholesale and retail trade	29%
Transportation & storage	12%
Construction	11%
Public Administration & defense	7%
Administrative services	7%

There is a strong link between where people live and the sector of activity they work in, suggesting that different parts of the city specialize in different types of economic activities. Almost half of household-heads living within 1kms of the centre of Kigali are traders (see Figure 8). The further we move away from the city centre, the lower the proportion of traders. Fewer than 20% of household-heads living more than 3kms away from the city centre work as traders. Opposite dynamics are observed for household-heads working in the construction or transportation sectors. The further away from the city centre people live, the more likely they are to work in construction and/or transportation. These patterns hold controlling for individual characteristics such as age, gender, education and migration status.

Figure 8: Distribution of sectors of activity of heads-of-household, by distance of home to city centre



The sector of economic activity is also closely associated with the job situation of workers. Most household-heads working in wholesale and trade were “self-employed” (79%); the majority in the construction sector were “casual labourers” (91%); those working in “Public Administration and Defense” were predominantly “Salaried employees” (94%). Industries such as “Transport & storage” included workers with a mix of employment statuses.

Working households-heads in unplanned areas are almost equally split between casual labourers (33%), self-employed workers (32%, employers excluded) and salaried employees (28%).

Informality is highest for those working in the construction sector and/or as casual labourers²³. The construction sector is the most informal out of the main sectors of economic activity. An estimated 77% of household-heads working in the construction sector reported being employed by an informal organization/person. Informality only affects about one-third of household-heads working as traders or in the transport & storage sector. Sectors with a high proportion of salaried employees – such as the public administration sector - experience the lowest level of informality. More than 90% of household-heads working as salaried employees worked for a formally registered employer.

About 40% of employed heads of household in unplanned areas work for informal employers.

Income from employment is highest for those working in the formal sector or employed as salaried employees. However, the biggest driver of differences in income is not the employment status of workers or the sector they work in, but rather their level of education.

²³ We define as informal any private business enterprise or employer that is not registered with the Rwanda Revenue Authority (does not have a TIN number) and did not keep written records of accounts

4.1.3 Income from employment

There are high returns to education for workers living in Kigali's unplanned settlements. While median incomes are approximately RWF 80,000, each additional step in the education system increases the earning potential of residents substantially. The median monthly income for working household-heads with no education was about RWF40,000 per month. Household-heads with primary-level education earned a median income of RWF70,000; those with secondary-level education RWF100,000; and finally, those with tertiary-level education RWF224,000 (differences in median income between education levels are statistically significant at the 1% level controlling for age, gender and type of job in a quantile regression). For individuals of a similar age and gender, the median income from employment was 5 times higher for people with a university degree compared to people without; and about 2.5 times higher for individuals with a university degree, compared to those having completed secondary education. The very high returns to university-level education point to a shortage of university graduates in Kigali, with employers willing to pay a very high premium for skills. Table 5 highlights education levels for household heads living in unplanned settlements, indicating that, on average, household heads in Kigali's unplanned settlements have obtained higher levels of education compared to the national average – 78% of the labour force has only achieved a primary education or below. However, a smaller proportion of household heads report completing tertiary education (11%) compared to the national average in urban areas (14.9%).²⁴

Table 5: Highest completed level of education amongst household head

Highest Level of Education	% of Household heads
No Formal education	6.5
Primary education	43.5
Lower secondary education	14
Upper secondary education	25
Tertiary education	11

Being a female head of household – in particular, being divorced or widowed – is associated with a very large drop in income. About 31% of households were female-headed. The median female head-of-household living in unplanned areas earns RWF40,000 per month from employment, compared to RWF100,000 for men. This is a difference of more than 2:1. Female-headed households tend to be households where the male has either died or left the home. An estimated 53% of female household-heads had either been through a divorce or lost their partners, compared to just 3% of male households. Their situation is particularly vulnerable. They are less likely to be employed, more likely to be underemployed and when employed earn significantly less.

²⁴ See Labour Force Survey August 2017, pp 14 and pp 115

4.2 Mobility

4.2.1 Location of employment

Household heads in unplanned settlements in Kigali tend to live close to where they work. Over 70% of household heads live within 2kms from their work place (straight-line distance). This is particularly true for female heads-of-household, who on average work almost 500m closer to home than men do (about 35% closer to home). The choice of where to live is a balancing act, a difficult-to-solve equation that involves maximizing housing quality and proximity to important social networks, while minimizing the cost of housing and the cost (in time and money) of the commute to work.

Table 6: Distance to work

Distance to work (straight-line)	% of employed household-heads
Less than 1km	45%
1-2 kms	26%
2-3 kms	12%
More than 3 kms	17%

When asked about why they had relocated in the past (from one place of residence in Kigali to another), households responded that they were more concerned about housing requirements than proximity to the workplace. Only 4% of households responded that they had relocated to move closer to their workplace; this compares to about 40% that moved because they had purchased or completed the building of a dwelling and about 30% that moved to seek better housing quality or because rent in their previous place of residence was too expensive. One way to interpret this data would be to conclude that distance to work, or the cost of the commute, is not a major concern for households. We believe that this interpretation is incorrect and that, on the contrary, it is because most people live relatively close to their workplace that proximity to the workplace does not emerge as a strong concern.

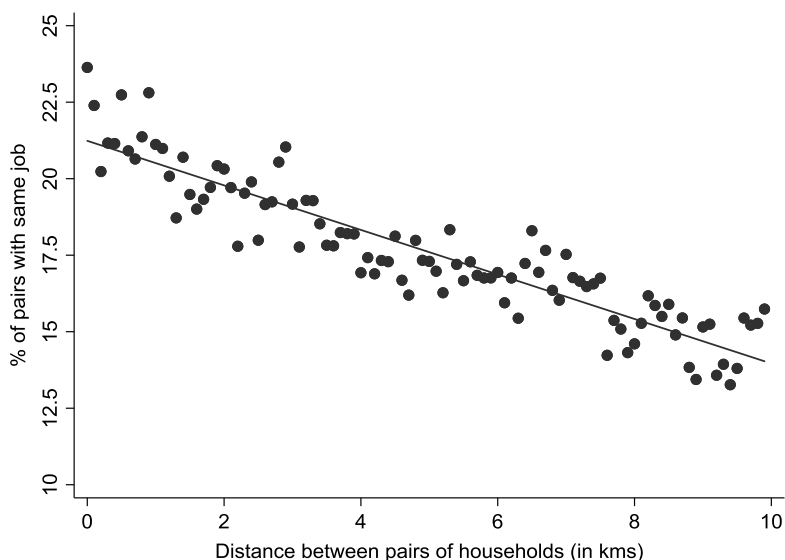
A large proportion of households relocate locally, within the vicinity of their old place of residence and workplace. About 60% of relocations - from one home to the next - occur within the very same geographic Sector. This could be because people are aware of better “housing opportunities” within the vicinity of where they live or because they want to continue to maintain their social relationships in that area; but the data also suggests that while their housing situation might be top of mind, households are not likely to consider relocating far away from their workplace.

There is evidence of geographic clustering based on people’s profession, implying that the selection of where to live could also be tied to their professional occupation. The closer households live to each other, the more likely it is that their members work in the same profession. The association between distance and the similarity in the profession of household heads is linear and provides a clear signal

(Figure 9). One might argue that this clustering happens naturally due to the economic situation of households, and that that less/more affluent households tend to both live in the same unplanned settlements and work in the same kind of jobs. This does not seem to be the main driver of the results we observe however. If that hypothesis were true, we would expect to observe a similarly strong signal

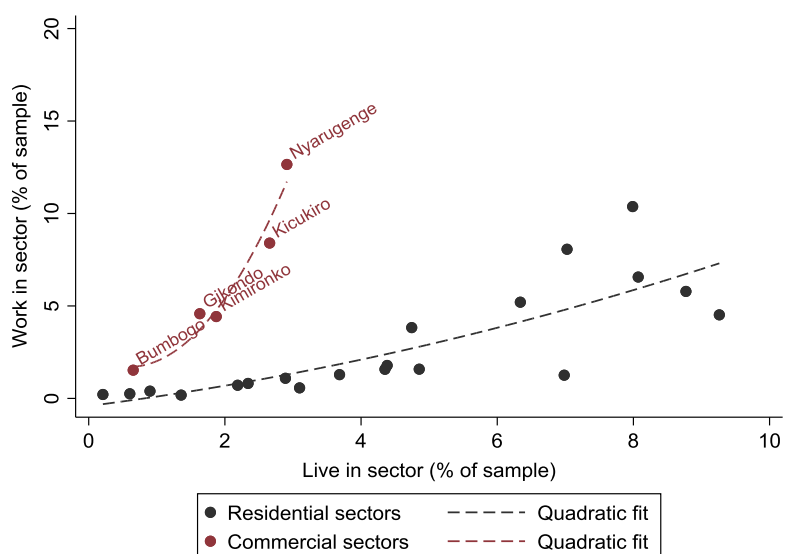
when looking at the similarity of the job status of pairs of households (whether they are in a job or not, and what kind of contract they have). The signal we obtain is at best weak.

Figure 9: Similarity in the professions of household-head pairs based on geographic distance between them



There are commercial and residential areas in Kigali, but jobs for unplanned settlers are relatively well distributed across the city. There are several Sectors in Kigali that are clearly commercial and attract more unplanned settlers for work than they do for residential purposes (see Figure 10). These Sectors include Nyarugenge (the city centre), Kicukiro, Kimironko and Gikondo. The most commercial area is the city centre itself. An estimated 13% of heads-of-household that live in Kigali’s unplanned settlements work in Nyarugenge / the city centre, compared to just about 3% of heads-of-household that live there. Populated residential areas, that also attract a relatively large proportion of jobs, include Remera, Kacyiru, Nyamirambo and Muhima. An estimated 44% of working heads-of-household work in the sector they live in; the remaining workers transit to nearby Sectors.

Figure 10: Distribution of working heads-of-household, by location of residence and by location of work



Residents in unplanned areas choose to work in the commercial centres that are nearest to where they live. We show this using Table 7, which looks at the proportion of heads-of-household that work near the city centre, based on how far their home is from the city centre. We find that about three-quarters of heads-of-household that live within 1km of the city centre, also work in the city centre. This number quickly drops as we move away from the city centre. As the diagonal that is highlighted in Table 7 shows, households-heads in unplanned settlements tend to live and work at a similar distance from the city centre.

Table 7: Proximity of job location to the city centre for heads-of-household in unplanned settlements, based on the distance of their home to city centre

Distance: job location to city centre (straight-line)	Distance: home to city centre (straight-line)				
	0-1 km	1-2 km	2-3 km	3-4 km	4+ kms
0-1 km	74%	32%	20%	6%	14%
1-2 km	16%	40%	23%	9%	3%
2-3 km	4%	12%	39%	19%	5%
3-4 km	2%	9%	9%	38%	10%
4+ kms	4%	7%	8%	28%	67%
Totals	100%	100%	100%	100%	100%

These patterns point to a situation where the commute to work in the city is localized, people live near to where they work. Kigali is not a city that experiences the big commute to work from the periphery to the centre or vice versa; long commutes currently only concern a small proportion of workers. One of the reasons this might be the case is the cost and availability of urban transport.

4.2.2 The cost of commuting to work

For half of working heads-of-household in Kigali's unplanned settlements, the commute happens on foot; the other half use a mix of bus, moto or private means of transport to get from home to work. About 51% of working unplanned settlers experience the city of Kigali on foot (see Table 8). This is especially true for female heads-of-household, who are about 15 percentage points more likely to walk to work than their male counterparts (controlling for distance to work, age and wage). Public transport – buses – are used by about 16% of commuters; moto taxis by about 13%; private means of transport by about 10% of commuters; while the remaining 10% of commuters use a mix of transportation means or other forms of transport. One statistic that stands out is the low proportion of heads-of-household that use a privately-owned bicycle to get to work. This statistic is corroborated by low rates of bicycle ownership amongst households in unplanned settlements, which we estimate at about 6.5% of households.

Table 8: Mode of transport from home to work and time it takes to get to work

Mode	Share of employed heads-of-household	Median commute time
Walking	50.8%	30 mins
Bus	15.5%	60 mins
Moto taxi	12.9%	30 mins
Privately owned Bicycle	0.6%	30 mins
Privately owned moto	4.0%	30 mins
Privately owned cars	5.7%	30 mins
Shared transport	0.1%	30 mins
Other	3.9%	30 mins
Total	100%	30 mins

The sheer number of people that walk to work underlines the importance of having a “pedestrian” vision for the city, and to not overlook the importance walking plays.

The preferred means of transport is closely tied to the distance to work; the closer the workplace, the more likely people are to walk; the further away, the more likely people are to take the bus. Three-quarters of heads-of-household that live within 1km of their workplace walk to work (see Table 9). The proportion of people that walk quickly drops as the distance to work increases. Public transport, in the form of buses, become increasingly popular on the other hand. Whereas only 6% of people that live within 1km of their workplace reported taking the bus to work, this proportion increases to about 44% for working heads-of-household living 3kms or further from their job. Motos are preferred to buses for short trips, but buses are preferred for longer trips. This is most probably because buses are the cheapest form of motorized transport. Based on the SMS surveys, we estimate the median cost of a bus trip to be about RWF250 per trip (origin-destination) compared to RWF500 for moto taxis. Note that bus trips are on average significantly longer than moto rides. Based on official guidelines from the Rwanda Utilities Regulatory Authority (RURA), the cost per km for bus rides in the city of Kigali is RWF22 since April 2018; moto service providers in Kigali (such as Safe Motos) estimate the cost of a moto ride at RWF100 per km, about five times the price of a bus ride.

Table 9: Mode of transport from home to work, by distance to work

Mode	Distance from home to work (kms, straight-line distance)			
	0-1km	1-2km	2-3kms	3+ kms
Walking	75.5%	43.5%	38.8%	11.9%
Bus	5.8%	23.8%	28.6%	44.2%
Moto taxi	10.7%	17.8%	15.7%	22.1%
Privately owned Bicycle	0.0%	0.3%	2.0%	1.9%
Privately owned moto	4.5%	4.8%	3.3%	3.2%
Privately owned cars	1.4%	8.3%	7.9%	6.2%
Shared transport	2.3%	1.5%	3.6%	10.5%
Total	100.0%	100.0%	100.0%	100.0%

The cost of public transport is practically prohibitive for heads-of-household that currently walk to work; we believe that this is the main reason that heads-of-household choose to work near their workplace. We show this with some simple back-of-the-envelope calculations. The median monthly income of heads-of-household in unplanned settlements that walk to work is about RWF50,000. The median cost of a bus ride for unplanned settlers in Kigali is about RWF250. To go and come back to work this would amount to RWF500 per day or an estimated RWF11,000 per month (assuming 22 working days per month). This adds up to about 22% of the median wage. The median head-of-household that walks to work and is in a tenancy situation pays a rent of about RWF25,000 (or 50% of their wage). Combined, just rent and transport at RWF36,000 would consume over 70% of the monthly wages of a median tenant that walks to work, leaving that person and their household in a vulnerable situation. There is a very real tradeoff for households between rent and the cost of transport. A household would only choose to move to further away location if the new location offered better housing options, at a rate that more than offsets the additional cost of transport a household would be incurring.

The current pricing strategy by RURA for bus transportation in Kigali provides a simple benchmark with which policy makers can measure the price by which rent levels would have to drop, for a household to consider moving to a given location. RURA currently prices bus rides based on the number of kilometers people travel. The current cost per kilometer is RWF22. For example, a household that would move 10kms away from their workplace (in terms of actual distance by road), would face a commute cost by bus of about RWF440 per day (RWF22x10x2). Per month, this would amount to a cost of about RWF9,680. To convince a household to move 10kms away from their job would require improved housing conditions with a reduction in rental costs of at least a similar amount.

These cost barriers explain why the choice of transportation mode is very closely tied to income levels. Heads-of-household that take the bus or commute to work using their own motorbike earn a median monthly wage of RWF35,000 more than heads-of-households that commute on foot; those that take motorbikes earn RWF81,000 more; finally, those that commute by car, earn RWF440,000 more. Combined, these patterns paint a clear picture, which is that transportation costs appear to be a binding constraint for the movement of labour in Kigali. The cost of transportation is also what likely geographically constrains households to look for housing opportunities within the vicinity of their jobs (or vice versa).

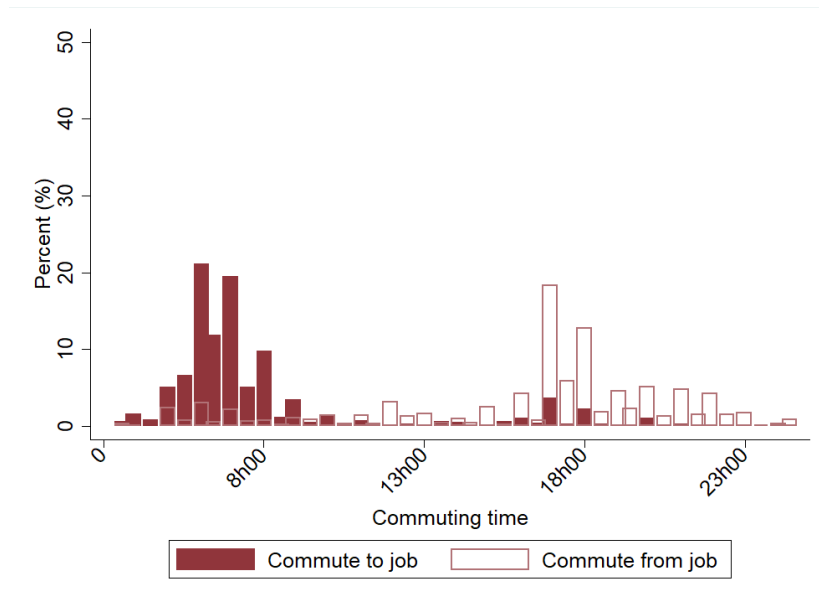
Currently, Kigali's labour pool is geographically constrained by transportation costs and accessibility issues. Alternative policies for the pricing of public transport, that providing more favorable rates for riders with long commutes (for example zoning policies), might free up opportunities for labour to move more efficiently across the city. The cost of transport for households, and the effect it has on their ability to find a job or continue in their job, is a very important consideration to consider when designing unplanned settlement upgrading policies.

4.2.3 The commute

Commute times for unplanned residents follow a traditional work schedule: respondents leave for work in the morning and return in the evening, suggesting a traditional daytime commuting pattern

rather than one more night-work focused. As Figure 11 highlights, the most frequent commuting times are in the morning between 06h00 and 09h00 (53%) and in the evening between 15h00 and 18h00 (43%).

Figure 11: Histogram of commuting times



The roads used most frequently for morning and evening commutes, regardless of mode, are similar, suggesting that residents in unplanned areas are highly dependent on several key roads and arterials. We estimated the roads which are more commonly used using origin geocoordinates, destination geocoordinates, Google Maps API and map directions produced by Google. Table 10 highlights the roads most frequently travelled by residents in unplanned settlements, split by mode of transport and time of day. Roads used for morning and evening commutes are quite similar regardless of mode of transport. Most of the key roads used by unplanned residents to travel to work are in the Nyarugenge District, which is expected given that most of our sample resides in Nyarugenge district. Note that these roads are estimates based on Google routes and may not reflect the actual roads taken.

Table 10: Most frequented roads, by travel mode and time of day

	Motorized transport (Moto, Car, Bus)	Pedestrian
Morning (6h00-9h00)	KN 2 Ave	KG 14 Ave
	KN 8 Ave	KN 8 Ave
	KG 14 Ave	KN 2 Ave
	KN 5 Ave	KN 1 Road
	KN 3 Road	KN 20 Ave
Evening (15h00-18h00)	KN 2 Ave	KG 14 Ave
	KG 14 ave	KN 5 Road
	KN 8 Ave	KN 2 Ave
	KN 5 Road	KG 9 Ave
	KG 9 Ave/KN 3 rd	KN 8 Ave

Despite the preference for bus transport, residents in unplanned areas face issues related to their bus commutes such as long commutes and waiting times. First, we estimate that bus commute times – both to work and from work – are significantly longer than commute times for other modes of transport, controlling for distance to work. Second, we estimate that bus stop waiting times – as reported by households across all unplanned settlements – is around 18 minutes. Third, we hypothesize that the longer commutes for those traveling by bus are higher due to longer bus waiting times. Using average bus stop waiting times – and comparing it to morning and evening commute times – we find that waiting for a bus makes up between 33-39% of overall commute times for those traveling by bus.

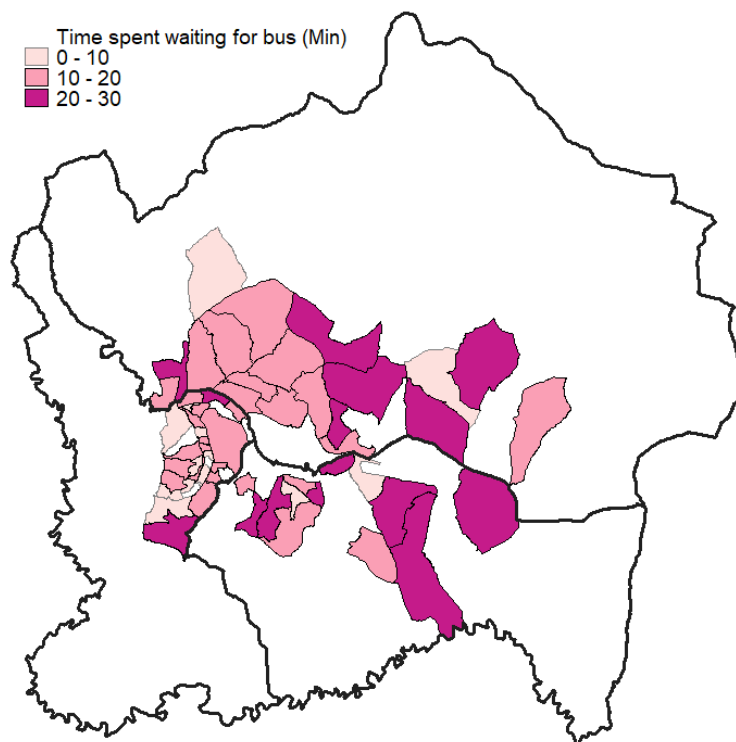
Bus waiting times are especially problematic in areas that are located farther away from the city centre, and for those residents located far away from major roads. Both trends highlight the same phenomenon which is that mobility is limited further away from the city centre due to a lack of adequate transportation infrastructure such as roads or frequent bus services. The higher bus waiting times by sector are highlighted in

While **proximity to a bus stop is high, we estimate that the majority of households in unplanned settlements are reliant on a few stops.** Using bus stop data obtained from the City of Kigali and measuring straightline distances to the closest stops, we find that households living in unplanned areas are likely to access only 113 bus stops (50%) out of a total of 223 bus stops; further, approximately 7 bus stops are likely to receive almost 24% of households, the most busy being the “Nyamirambo-Ryanyuma” stop followed by the “APAPE Gikondo (Alimentation),” and the “Nyamirambo-Tappis” stop. Nevertheless, the average distance households need to travel to the bus stop is relatively short: we estimate that most households live close to a bus stop (510-690 meters, straightline distance), which is in accordance with guidelines set out by MINIFRA. Moreover, those living closer the city center (<2km) are significantly closer to the nearest bus stop, with an average distance of 285 m, compared to those further away from the city centre (>8km), who are, on average, over a kilometer away from a bus stop.

Figure 12, which shows that, for those living in areas east of the city bus stop waiting times average 24-30 minutes compared to areas close to the CBD where they average 6-12 minutes.

While proximity to a bus stop is high, we estimate that the majority of households in unplanned settlements are reliant on a few stops. Using bus stop data obtained from the City of Kigali and measuring straightline distances to the closest stops, we find that households living in unplanned areas are likely to access only 113 bus stops (50%) out of a total of 223 bus stops; further, approximately 7 bus stops are likely to receive almost 24% of households, the most busy being the “Nyamirambo-Ryanyuma” stop followed by the “APAPE Gikondo (Alimentation),” and the “Nyamirambo-Tappis” stop. Nevertheless, the average distance households need to travel to the bus stop is relatively short: we estimate that most households live close to a bus stop (510-690 meters, straightline distance), which is in accordance with guidelines set out by MINIFRA. Moreover, those living closer the city center (<2km) are significantly closer to the nearest bus stop, with an average distance of 285 m, compared to those further away from the city centre (>8km), who are, on average, over a kilometer away from a bus stop.

Figure 12: Average bus stop waiting times, by cell



Finally, we estimate that, on average, 22-23% of a household head's overall commute time is taken up walking to a main road – a clear indication that paths and lanes located within unplanned settlements ought to be a focus for future upgrades. Heads-of-household that live the furthest from an accessible road are those who walk to work.

4.3 Box 2: Key Insights on Employment and Mobility

Unemployment rates in unplanned areas are approximately 18% and this relatively stable over time; however, individuals experience movements in and out of the labour force

- During the survey period, aggregate unemployment rates were relatively stable over time in unplanned areas
- However, based on our panel SMS survey and our sub-sample of household heads, we find that 25% were in and out of a job over the course of the 3-month survey

Unemployment in unplanned areas is heavily determined by factors such as age, gender, migration status, and the distance residents live from the CBD

- Unemployment is the highest for young heads-of-household (in the 18 to 24 age-group): an estimated 27% of household-heads aged 18 to 24 are unemployed, compared to about 15% of heads-of-household between the ages of 35 to 55

- Unemployment is highest for female heads of household living in unplanned settlements, who are about 20 percentage points more likely to be unemployed compared to their male peers
- Unemployment is about 8 percentage points higher for household-heads born in Kigali. Internal migrants are more likely to be employed
- Unemployment levels were about 10 percentage points lower for household-heads living within 2kms of the CBD, compared to household-heads living more than 2kms from the CBD

We estimate that about one out of three working heads-of-household (36%) in unplanned settlements were underemployed (worked 35 hours per week or less); underemployment is heavily determined by education levels, gender, migration status and type of occupation

- The higher the level of formal education, the lower the level of underemployment. An estimated 66% of heads of household without any formal education were underemployed, compared to about 37% of household heads with either primary or secondary education, and 18% of heads of household with a university degree
- Female heads of household and household-heads born in Kigali were about 9 percentage points more likely to be underemployed, while internal migrants are less likely to be underemployed compared to Kigali natives
- Casual wage labourers across all sectors were an estimated 42 percentage points more likely to be underemployed compared to salaries employees

Jobs and employment exhibit a strong spatial pattern

- The most common economic activities for heads-of-household in unplanned areas are “Wholesale and retail trade,” “Transport and storage,” and “Construction,” which account for about 66% of all workers
- Different parts of the city specialize in different types of economic activities, with almost half of all household-heads living within 1km of the centre of Kigali being traders and fewer than 20% of household-heads living more than 3kms away from the CBD working as traders. Opposite dynamics are observed for household-heads working in the construction or transportation sectors
- There is evidence of geographic clustering in where people live based on their profession: the closer households live to each other, the more likely it is that their members work in the same profession.
- There are several Sectors in Kigali that are clearly commercial and attract more unplanned settlers for work. These Sectors include Nyarugenge (CBD), Kicukiro, Kimironko and Gikondo.

- An estimated 13% of heads-of-household that live in Kigali's unplanned settlements work in Nyarugenge (CBD). Populated residential areas, that attract a relatively large proportion of jobs, include Remera, Kacyiru, Nyamirambo and Muhima.

About 40% of employed heads of household in unplanned areas work for informal employers.

- An estimated 77% of household-heads working in the construction sector reported being employed by an informal organization/person. Informality only affects about one-third of household-heads working as traders or in the transport & storage sector.
- More than 90% of household-heads working as salaried employees worked for a formally registered employer.

While there are high returns to education for workers living in Kigali's unplanned settlements, female-headed households are associated with a large drop in income

- While median incomes are approximately RWF 80,000, each additional step in the education system increases the earning potential of residents substantially. The median monthly income for working household-heads with no education was about RWF40,000 per month. Household-heads with primary-level education earned a median income of RWF70,000; those with secondary-level education RWF100,000; and finally, those with tertiary-level education RWF224,000.
- About 31% of households were female-headed. The median female head-of-household living in unplanned areas earns RWF40,000 per month from employment, compared to RWF100,000 for men. This is a difference of more than 2:1.

Commutes in Kigali are localized: people live close to where they work

- Over 70% of household heads live within 2kms from their work place (straight-line distance)
- An estimated 44% of working heads-of-household work in the sector they live in; the remaining workers transit to nearby Sectors. Unplanned settlers choose to work in the commercial centres that are nearest to where they live
- A large proportion of households that relocate do so locally. About 60% of relocations - from one home to the next - occur within the same geographic Sector

While travel on foot is the most common mode of transport, the preferred means of transport is tied to the distance to work

- For half of working heads-of-household in Kigali's unplanned settlements commute by foot; the other half use a mix of bus, moto or private means of transport to get from home to work. Public transport – buses - are used by about 16% of commuters; moto taxis by about 13%;

private means of transport by about 10% of commuters; while the remaining 10% of commuters use a mix of transportation means or other forms of transport.

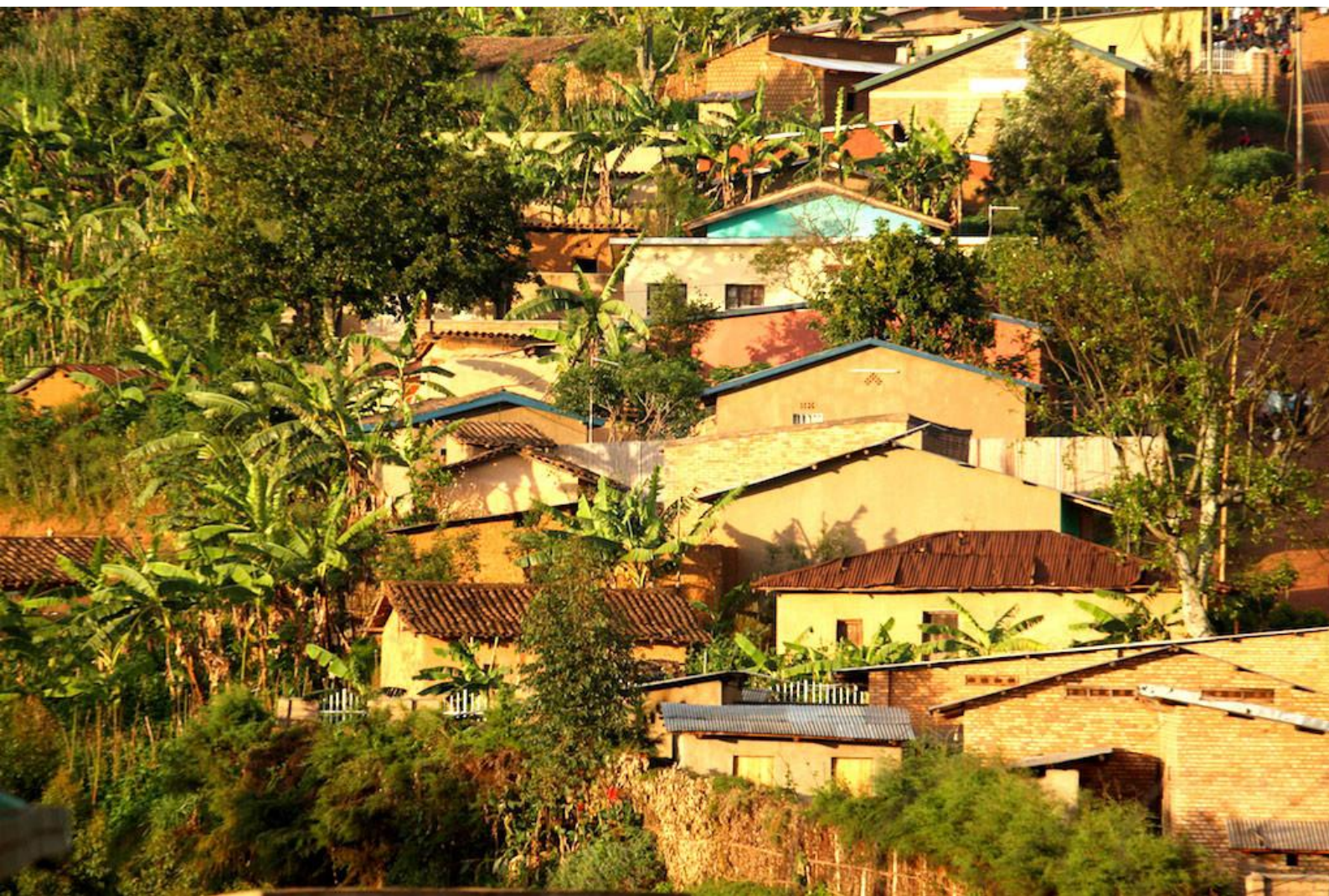
- Three-quarters of heads-of-household that live within 1km of their workplace walk to work. The proportion of people that walk quickly drops as the distance to work increases
- Motos are preferred to buses for short trips, but buses are preferred for longer trips. This is most probably because buses are the cheapest form of motorized transport. We estimate the median cost of a bus trip to be about RWF250 per trip (origin-destination) compared to RWF500 for moto taxis

The choice to live close to the workplace is likely driven by cost of public transport, which is practically prohibitive

- Based on official guidelines from the Rwanda Utilities Regulatory Authority (RURA) and a private moto company (Safe Motos), the cost per km for bus rides is about five times less than the price of a moto ride
- Using these benchmarks, we estimate that transportation costs add up to approximately 22% of a household's median earnings
- Moreover, choice of transportation modes is highly correlated with median monthly wages, with median monthly wages of RWF35,000 being reported for heads-of-households that commute on foot; RWF81,000 for those that take motorbikes; and RWF 440,000 for those that commute by car

Commute times for unplanned residents are hampered by poor infrastructure

- Residents in unplanned areas are highly dependent on several key roads and arterials
- Despite the preference for bus transport, residents in unplanned areas face issues related to their bus commutes such as long commutes and waiting times. We find that waiting for a bus makes up between 33-39% of overall commute times for those traveling by bus.
- Bus waiting times are especially problematic in areas that are located farther away from the city centre, and for those residents located far away from major roads
- We estimate that, on average, 22-23% of a household head's overall commute time is taken up walking to a main road – a clear indication that paths and lanes located within unplanned settlements ought to be a focus for future upgrades



5. Housing

In this Chapter, we present key findings from our survey on housing adequacy, housing affordability, housing finance and housing supply.

5.1 Housing

5.1.1 Housing structure

The most common walling material used by dwellings in unplanned areas is “Mud Bricks,” although dwellings located closer to the CBD are more likely to be constructed out of “Rammed Earth.” Our estimates suggest that “Mud Bricks” constitute the main walling material for nearly 69% of dwelling units. Only 11% of dwelling units have “Burnt Bricks” or “Cement Blocks” as their main walling materials. Overall, dwellings constructed out of “Rammed Earth” walls are more prevalent closer to the CBD (<4km).²⁵ District differences in walling material, indicate a higher estimated proportion of rudimentary (“Rammed Earth”) walls (40%) in Nyarugenge District and an equally distributed housing constructed out of “Burnt Brick”/ “Cement Blocks” across the three districts.

Houses built using rudimentary walling materials tend to be smaller in size compared to houses built out of improved materials. Most dwelling units (77%) in unplanned settlements have between 0 to 3 sleeping rooms. Houses constructed out of poor-quality walling materials - such as “Rammed Earth” or “Mud Brick” - have on average, 2.3 rooms. This compares to 3.4 rooms on average for houses constructed out of “Burnt Bricks” or “Cement.” This is consistent with the previous finding that houses constructed out of rudimentary walling materials – and “rammed earth” in particular – are more likely to be found in higher density unplanned settlements.

A high proportion of households report the use of high-quality flooring and roofing materials. With respect to floors, approximately 79% of household report having cement floors while another 15% have tiled floors. Only 5% of households report having “compacted earth floors.” In terms of roofing, approximately 99% of households report the use of iron sheets.

Compounds – enclosed/attached dwelling units – constitute the most common form of housing arrangements in unplanned settlements. We estimate that 32% of households in unplanned settlements live in standalone dwelling units; the remaining 68% of dwellings are enclosed in compounds. Compound size ranges between 2 to 8 dwelling units (98%). Dwellings units located in compounds are likely to be smaller with an average number of rooms being between 1-2 bedrooms – compared to standalone units which tend to have 3-4 bedrooms. Another difference is that households living in compounds are more likely to be renting their dwelling unit compared to those

²⁵ This relationship holds at the 5% level controlling for the density of unplanned settlements, homeownership status and household income.

living in standalone housing (see below).²⁶ This suggests that houses located in compounds are subdivided by landlords into smaller units which are then rented out.

5.1.2 Housing adequacy

Overcrowding: We use the UK Housing Act of 1983 to calculate overcrowding. This measured overcrowding based on “person units” that regularly sleep in a house, compared to the total number of rooms in dwelling unit (excluding kitchens, bathrooms and toilets). A person unit equals 1 if the person is over 10 years old, 0.5 if the person is 1-10 years old, and 0 if the person is less than 1 year old.²⁷

Overcrowding in unplanned settlements is generally low and is more prevalent amongst tenants and large households. Our study finds that, overall, only 14% of dwelling units in unplanned areas are overcrowded. The most exposed to living in over-crowded housing are tenants. When controlling for age, gender, household size and location, we find that tenants are about 17 percentage points more likely to live in over-crowded housing. Overcrowding also increases with household size. An estimated 8% of households with five or fewer members live in over-crowded housing, compared to about 22% of households with more than 5 members.

5.1.3 Housing tenure

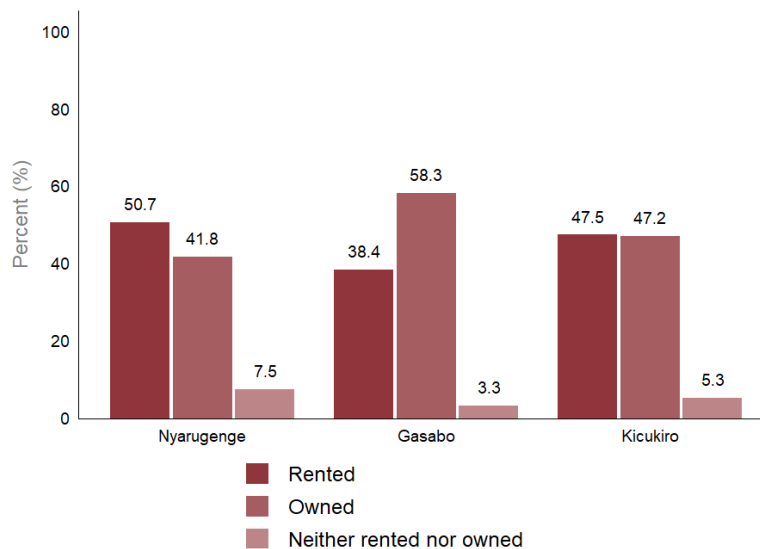
Overall, tenancy and owner-occupied housing is almost evenly split across unplanned areas. Based on this survey data we find that approximately 44% of households reported tenancy arrangements while 51% reported owner occupancy. Approximately 5% of households report neither being homeowners nor tenants, indicating alternative arrangements such as living in dwellings owned by other family members or living in housing provided by employers.

Comparing across surveys, we see that tenancy arrangements are more prevalent in unplanned areas located closer to the CBD as well as in more dense unplanned settlements. Figure 13 highlights district-level differences in housing tenure arrangements, with unplanned settlements in Gasabo District having the lowest tenancy rates (38%). The predominance of tenancy arrangements in inner parts of the city could be a result of higher demand for rental housing (due to the proximity of economic activities – see above), which increases the opportunity cost of owner-occupancy, while the higher proportion of owner-occupied housing in Gasabo is possibly a result of spatial expansion (see below).

²⁶ This relationship holds at the 1% level controlling for the density of unplanned areas, distance to the CBD, and the quality of the dwelling’s walling material.

²⁷ The act considers the following scenarios overcrowded: a 1-room dwelling unit with more than 2-person units, a 2-room dwelling unit with more than 3-person units, a 3-room dwelling unit with more than 5-person units, a 4-room dwelling unit with more than 7.5-person units, or a 5 or more room dwelling unit with more than 2 person units per room. See <https://www.legislation.gov.uk/ukpga/1985/68/part/X/crossheading/definition-of-overcrowding> for more information

Figure 13: Distribution of housing tenure by district



Tenants are also more likely to live in smaller dwelling units compared to homeowners. The prevalence of tenancy arrangements falls from 83% among 1-bedroom units to 25% among 3-bedroom units. The drastic decrease in the rate of tenancy is accompanied by an increase in owner-occupancy rates as dwelling sizes increase. While most tenants live in compounds (84%), which tend to have smaller dwelling units on average (see above), tenants that live outside of compounds are also likely to live in smaller units compared to homeowners, lending further evidence to the idea of landlords subdividing dwelling units when renting them out.²⁸

Most owner-occupants report having purchased their current dwelling. When households were asked about the means of housing acquisition approximately 80% reported purchasing the property compared to 12% of those who reported inheriting it; another small proportion of household reported receiving housing as a gift/ donation or as compensation from the city as a result of resettlement (8%).

5.1.4 Housing insecurity and affordability

Rental Rates

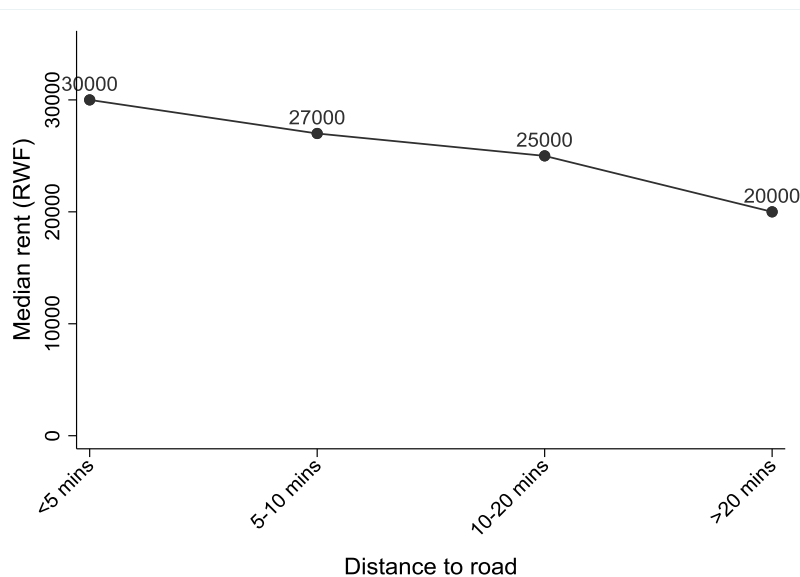
At a median level of RWF27,000 per month, rent affordability in unplanned areas is a concern for low income households. Estimated median rent levels are similar to those measured in Rwanda's Integrated Household Living Conditions survey from EICV4 (2013-2014). Using EICV 4 data, we estimate that the median rent was about RWF20,000 per month in 2013/2014 for households in urban areas of the Kigali province.

²⁸ We interacted compound living with housing size to see if tenants were more likely to live in smaller dwelling units depending on whether the unit was in a compound or not. Main effects and interactions were significant at the 5% level controlling for distance of the house from the CBD, the density of unplanned settlements and the walling material that was used in the house

Rental rates in unplanned settlements vary across the city, with lower prices in areas with a higher share of rudimentary housing. The level of rent is closely tied to the level of informality of the area. The median rent is about RWF7,000 lower in areas with more than 85% of rudimentary housing, compared to areas which have between 75-85% rudimentary housing.²⁹ However, controlling for housing quality, house size, and access to infrastructure and services there are no significant variations in rental rates based on the distance households live from the city centre – barring those living more than 8km from the CBD who are likely to be pay RWF 6700 less per month than those living 0-2km from the city centre.

Rental prices are higher for dwellings located in areas with better access to public infrastructure, in particular roads. Better access to public amenities such as health services, markets, primary schools, administrative services are determinants of higher rents (see below of fuller discussion of accessibility).³⁰ Access to roads is especially important with significantly higher prices being reported for houses located close to a road, which can accommodate four wheeled cars. We estimate that for every additional one minute of travel time to a main road, monthly rents reduce by approximately RWF 300 (see Figure 14). Both these findings have an important consequence, namely that any infrastructure upgrade – and especially the construction of new roads in hard to reach areas – are likely to result in higher rental prices. Median monthly rents are also dependent on dwelling size with rent increasing by about RWF 16,000 per month for each additional sleeping room in the house.

Figure 14: Median monthly rentals (RWF) by walking distance to the nearest car-accessible road



Rental insecurity

Amongst those who rent their dwelling, rental insecurity is common. One aspect of rental insecurity – the lack of a rental contract – is common amongst residents in unplanned areas. Estimates from survey data indicate that one-third of tenants have no rental contract. Households with lower rents,

²⁹ This result holds controlling for individual and location factors of interest

³⁰ These were significant at the 5% level controlling for the quality of the house and distance to the workplace.

or living in smaller dwellings, are at a greater risk of not having a rental contract. This lack of rental agreement is also more prevalent in areas farther away from the CBD (>4km) and in areas with a higher proportion of rudimentary housing.

Another aspect of rental security – rental increases – is also common amongst tenants with 66% of households reporting at least one rent increase since they moved into their dwelling. While most tenants report only one increase (52%), an estimated 11% report 2-3 increases. However, there appears to be no spatial pattern in where rent increases are more common.

Access to Housing Finance

As part of this survey, we asked respondents what sources of finance they used to fund land purchases, house purchases/ house construction and incremental housing upgrades, depending on how they acquired their homes.

Savings (not credit) are the most common sources of finance for all forms of housing acquisition including greenfield developments, housing purchases and incremental improvements, suggesting major constraints in terms of housing finance. Table 11, which highlights the major self-reported sources of finance, suggests that in addition to personal savings, “savings placed in formal banks or MFIs” are also a major source of housing finance. Formal bank loans make up a very small proportion of the total financing that respondents receive for land/ housing purchases, suggesting major credit constraints. However, formal banks do appear more willing to loan money for the construction of additional rooms/ upgrades compared to housing purchases or new housing construction.

Table 11: Method of housing purchase by source of finance³¹

Source of Finance	Purchase Land Parcel	House (Constructed)	House (Purchased as is)	Additional increments
Savings at home	54%	54%	39%	36%
Savings (formal bank, MFI)	24%	20%	24%	28%
Sold other property	13%	13%	21%	8%
Savings (informal bank, MFI)	11%	8%	7%	6%
Loan (formal bank, MFI)	5%	10%	14%	20%

The mix of finance sources for the construction of a dwelling appear to be associated with the quality of that dwelling, proxied for here using the walling material that was used for the construction. Owners-occupants who built their houses using burnt brick/ cement blocks were more likely to have accessed credit compared to those using other housing materials (see Table 12). Potential explanations include that: (i) home-owners that were able to afford higher quality housing materials were also more likely to get bank loans; (ii) the loans made it possible for owners to use better quality material in the construction of their homes. Sources of finance are also

³¹ These values do not add up to 100% as respondents often used multiple sources of finance

Table 12: Dwelling walling material by source of finance

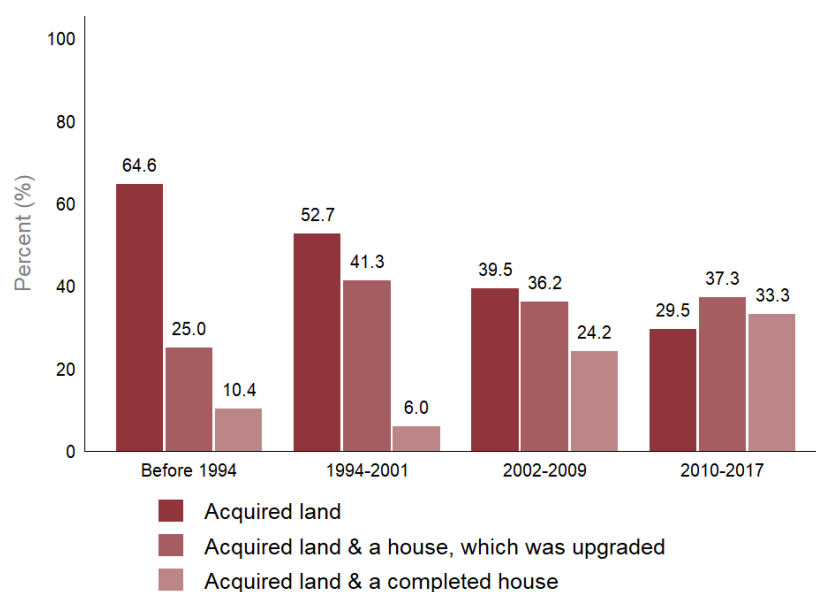
Source of Finance	Rammed Earth	Mud Brick	Burnt/ Cement Brick
Savings at home	34%	42%	34%
Savings (formal bank, MFI)	48%	19%	23%
Sold other property	13%	22%	18%
Savings (informal bank, MFI)	0%	8%	9%
Loan (formal bank, MFI)	4%	13%	26%

5.1.5 Housing supply

The analysis in this section is based on cross-sectional data from a subset of residents in unplanned settlements. We use only a subset of house owners, those that currently stay in their houses (herein referred to as owner-occupants).

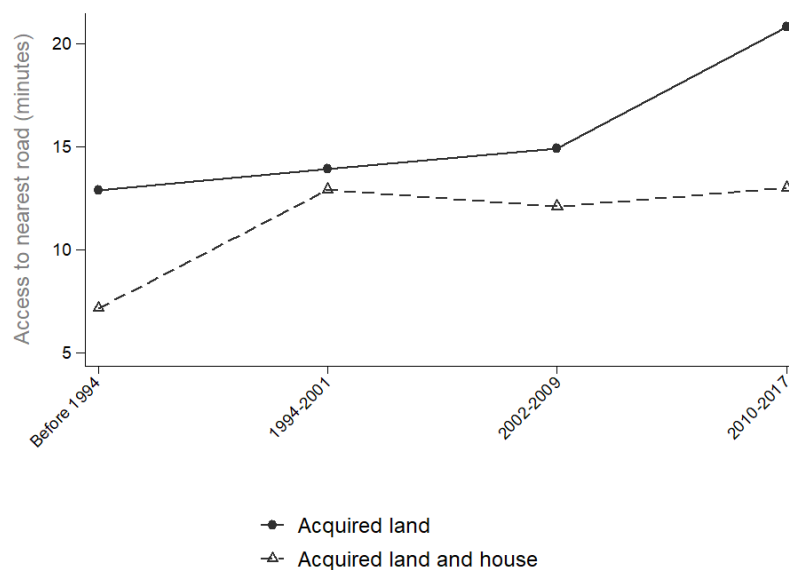
Owner-occupants that purchased their property a long time ago are more likely to have bought undeveloped land and built their own dwelling on it; more recent owner-occupants are likely to have purchased the land with a finished or unfinished dwelling on it. Figure 15 shows that 65% of current homeowners who acquired their property before 1994, constructed their dwellings on undeveloped lands. This figure decreases to about 30% of owner-occupants who purchased their properties between 2010 and 2017. An estimated 70% of owner-occupants who purchased their property between 2010 and 2017 bought the plot with a finished or unfinished dwelling on it. The lower proportion of current homeowners purchasing undeveloped land is likely driven by two major factors: (i) the increasing scarcity of lands for new developments and (ii) the effective implementation of master planning codes by the City of Kigali.

Figure 15: Method of house acquisition by year of acquisition



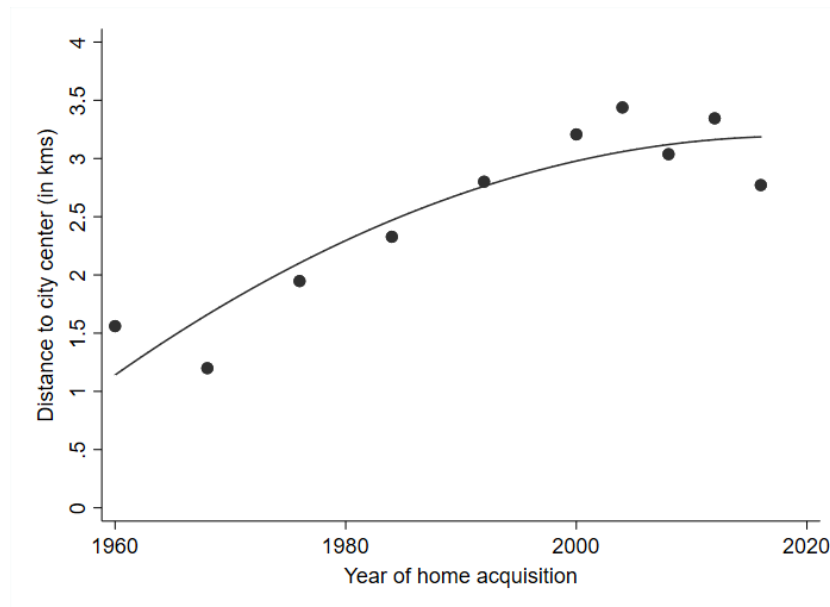
Homeowners that purchased land on which to build a house are more likely to have done so in areas that are located farther away from main roads. Figure 16 highlights the time that residents currently must travel to reach a road that can hold cars. It highlights that those who purchased empty land at the time of acquiring their house have consistently done so further away from a car-accessible road compared to those who have purchased existing homes. The relationship highlights two important trends: first that it is possible that new road construction has made settlements which were built in the past more accessible, and second that those who have purchased housing now are likely to do so in places farther away from the city hinting at city's expansion and offering some evidence of sprawl.

Figure 16: Proportion of homeowners by time to nearest car road, method of house acquisition and year of house acquisition



We also estimate that new housing construction over the years has largely taken place in areas further away from the CBD, highlighting Kigali's urban expansion. As highlighted in Figure 17, new construction has been pushed to the city's periphery either due to a lack of land or high land prices closer to the CBD. However, Figure 17 also indicates that pace of outer-expansion has somewhat slowed at least in so far as distance from the centre is concerned. This might show a tendency towards greater densification of existing unplanned settlements.

Figure 17: Year of home acquisition by distance from the CBD (km)



Incremental housing improvements – instances where homeowners report building additional rooms in their house after acquiring it – in unplanned settlements is more likely to take place in Gasabo district compared to any other district. The proportion of houses that report adding at least one additional room to their dwelling is significantly higher in Gasabo district (36%) compared to Kicukiro (29%) and Nyarugenge (19%) although the average number of rooms they increment is similar across districts (2-2.3 additional rooms).³²

³² These differences hold at the 5% level controlling for household wealth, the share of unplanned settlement, access to roads and distance to the centre of the city.

5.2 Box 3: Key Insights on Housing

The quality of housing in unplanned areas is variable, with low quality walling materials but high quality roofs and floors

- Our estimates suggest that “Mud Bricks” constitute the main walling material for nearly 69% of dwelling units. Only 11% of dwelling units have “Burnt Bricks” or “Cement Blocks” as their main walling materials.
- A high proportion of households report the use of high-quality flooring and roofing materials. With respect to floors, approximately 79% of household report having cement floors while another 15% have tiled floors. In terms of roofing, approximately 99% of households report the use of iron sheets
- Houses constructed out of poor-quality walling materials - such as “Rammed Earth” or “Mud Brick” - have on average, 2.3 rooms. This compares to 3.4 rooms on average for houses constructed out of “Burnt Bricks” or “Cement”

Compound living is the most common form of housing arrangement in unplanned settlements

- We estimate that 68% of dwellings are enclosed in compounds. 98% of compounds range between 2 to 8 dwelling units
- Dwellings units located in compounds are smaller on average with the number of rooms ranging between 1-2 bedrooms

Overall, tenancy and owner-occupied housing is almost evenly split across unplanned areas

- Based on this survey data we find that approximately 44% of households reported tenancy arrangements while 51% reported owner occupancy
- Comparing across surveys, we see that tenancy arrangements are more prevalent in unplanned areas located closer to the CBD as well as settlements with a higher proportion of rudimentary housing.

Tenants are likely to face the burden of poor quality, unaffordable accommodation and rental insecurity

- Overcrowding in unplanned settlements is more prevalent amongst tenants: we find that tenants are about 17 percentage points more likely to live in over-crowded housing compared to home-owners

- Tenants are also more likely to live in smaller dwelling units compared to homeowners. Tenancy arrangements fall from 83% among 1-bedroom units to 25% among 3-bedroom units. Most tenants live in compounds (84%), which also tend to have smaller dwelling units on average
- At a median level of RWF27,000 per month, rent affordability in unplanned areas is a concern for low income households
- However, rental rates in unplanned settlements vary across the city, with lower prices in areas with a higher share of rudimentary housing: median rent is about RWF7,000 lower in areas with more than 85% of rudimentary housing, compared to areas which have between 75-85% rudimentary housing
- Rental prices also vary based on the level of public infrastructure, in particular roads. Better access to public amenities such as health services, markets, primary schools, administrative services are determinants of higher rents (see below of fuller discussion of accessibility).
- One aspect of rental insecurity – the lack of a rental contract – is common amongst residents in unplanned areas. Estimates from survey data indicate that one-third of tenants have no rental contract. Households with lower rents, or living in smaller dwellings, are at a greater risk of not having a rental contract
- Rental increases are also common amongst tenants with 66% of households reporting at least one rent increase since they moved into their dwelling. While most tenants report only one increase (52%), an estimated 11% report 2-3 increases

Access to housing finance appears to be a major constraint for homeowners

- Savings (not credit) are the most common sources of finance for all forms of housing acquisition including greenfield developments, housing purchases and incremental improvements
- The mix of financial sources for the construction of a dwelling appear to be associated with the quality of that dwelling. Home owners-occupants who built their houses using “Burnt Brick”/ “Cement Blocks” are more likely to have accessed credit compared to those using other housing material.

Housing supply trends indicate a gradual outward expansion (sprawl) of Kigali – although these trends might have stalled in recent times

- Homeowners that purchased land on which to build a house are more likely to have done so in areas that are located farther away from main roads. Those who have purchased empty land at the time of acquiring their house have consistently done so further away from a car-accessible road compared to those who have purchased existing homes.

- While owner-occupants that purchased their property a long time ago are more likely to have bought undeveloped land and built their own dwelling on it, more recent owner-occupants are likely to have purchased the land with a finished or unfinished dwelling on it. 65% of current homeowners who acquired their property before 1994, constructed their dwellings on undeveloped lands; this decreases to about 30% of owner-occupants who purchased their properties between 2010 and 2017.
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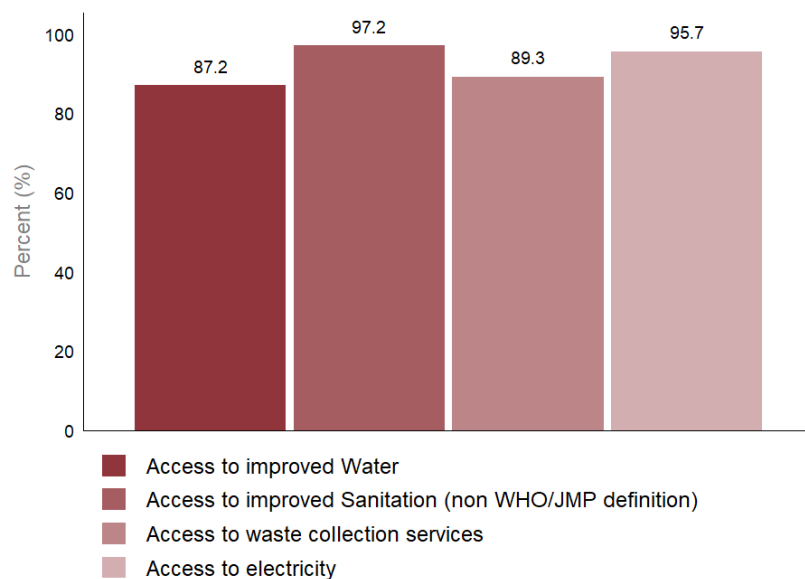
6. Access to Basic Services

The following chapter will examine key statistics related to infrastructure and access to services. This chapter will offer insights on access to four basic services – water, sanitation, waste collection and electricity –, in addition to accessibility to public amenities, and safety. All data was captured as part of our household and SMS data, and compared to national level datasets where possible.

6.1 Overview

From our survey, we estimate that access to key basic services in unplanned settlements is high. We measured access to four key basic services: (i) access to improved water, (ii) access to improved sanitation, (iii) access to waste collection services and (iv) access to electricity. Our data suggest that households in unplanned areas have a high level of access to key services. Figure 18 indicates the overall proportion of households with access to each of the services. Access to improved water is the least common, while access to electricity is nearly universal. Approximately 74% of households in unplanned areas have access to all four services, while close to 0% of households have access to no services.³³

Figure 18: Percentage of unplanned households with access to four key basic services



³³ We excluded any reference to “slabs” while measuring access to Improved Sanitation as it was unclear whether this information was correctly coded; we measured access to electricity based on the number of respondents who reported having some form of electricity (potentially grid power or alternate sources of power) in their main living room.

Access to basic services amongst households in unplanned settlements is similar to province-wide EICV estimates apart from access to waste collection services and electricity, which are much higher than previously reported. Table 13 compares the access to key basic services in unplanned areas found in this study to city-wide estimates from EICV4 (2013/2014), and highlights that a higher percentage of households in unplanned areas report access to basic services compared to overall percentage of households across Kigali – including urban and rural areas - in previous years. Changes are especially dramatic in the proportion of households reporting access to waste collection services and electricity.

Table 13: Access to Basic services over time

	Current study 2017 (Kigali unplanned)	EICV 4 (2013/2014)
Improved Water access	87%	83%
Improved Sanitation access	97%	92%
Access to waste collection services	89%	47%
Access to Electricity	96%	73%

6.1.1 Access to improved water

Improved Water (Safely Managed/ Basic): Improved sources are those that have the potential to deliver safe water by nature of their design and construction. These include piped supplies (such as households with tap water in their dwelling, yard or plot; or public stand posts) and non-piped supplies (such as boreholes, protected wells and springs, rainwater and packaged or delivered water).³⁴

Limited Improved Water: Drinking water from an improved source for which collection time exceeds 30 minutes for a round trip, including queuing

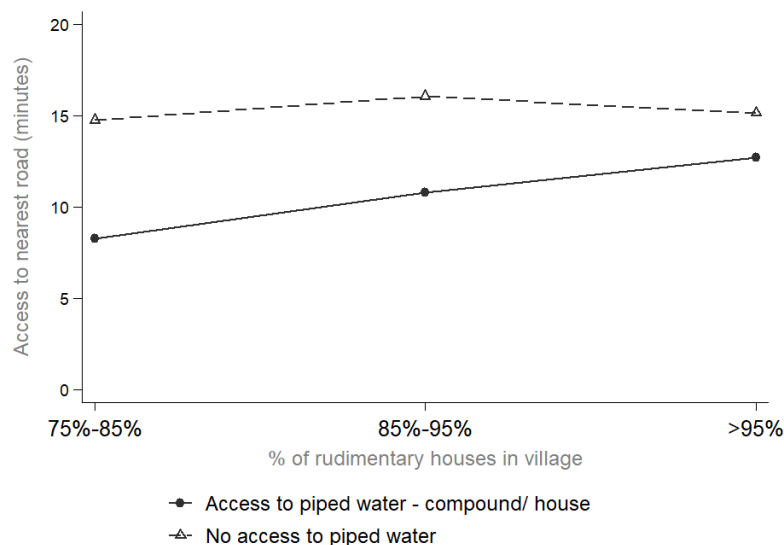
As per JMP/WHO definitions, access to improved water sources appears to be the least common service that households in unplanned areas have access to, despite major improvements over time. On average, we estimate that 87% of unplanned settlers have access to improved water sources, although only 56% reported access to a piped water connection either in their house or in their compound. This suggests that while the piped water provision in unplanned areas has increased over time, a large proportion of households still rely on alternative sources of water such as public standpipes.

The proportion of households with access to water in their house or compound varies according to (i) the share of rudimentary housing and (ii) the distance that residents live from major roads, suggesting that ease of access to major transport infrastructure plays a role in the availability of

³⁴ WHO/ UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, *Progress on Drinking Water, Sanitation and Hygiene*, 2017, pp 12

water across households. Comparing between unplanned settlements, a higher proportion of households who live in areas with a higher share of rudimentary housing (>95%) report no access to piped water on their compound compared to those with a lower share of rudimentary housing (70-85%). Additionally, access to on-site water varies depending on how far households report living from major roads, with those living closer to major roads being more likely to report access to piped water services (see Figure 19).³⁵ Overall, household access to piped connections have improved with EICV4 (2013/2014) estimates of province-wide access to on-site water being 37%.

Figure 19: Distance of respondents from road, by piped water access and % of rudimentary houses per village



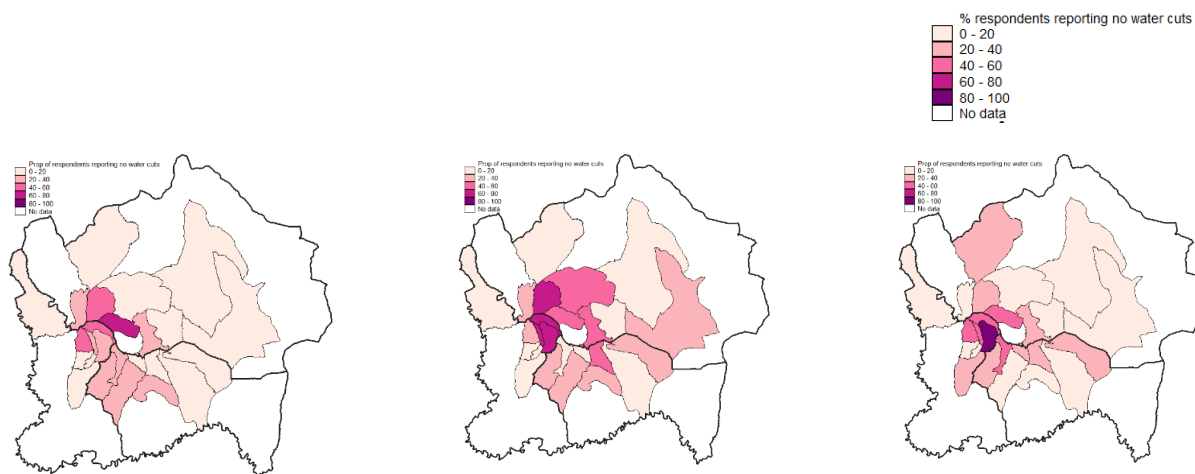
On-site water access within unplanned settlements also varies between wealth categories, with wealthier households being significantly more likely to report access to water within the house or compound. Comparing the proportion of households with access to water across wealth categories, we see that with each quintile, the likelihood of having on-site water increases significantly, suggesting that those with more resources are able to live in houses that are better serviced and can pay for water to be piped to their area of residence, regardless of where they live.³⁶

Piped water connections do not necessarily result in better access, as households face frequent water cuts. For each survey, about one-third of respondents reported between 1-3 cuts in their water supply in the 7 days preceding the SMS survey. Conversely, about one-third of respondents never reported experiencing a water cut in any survey. Respondents living in areas closer to the city centre are less likely to experience water cuts compared to others – although the exact areas where this takes place varies over time. Figure 20 highlights the different parts of the city where respondents were more likely to report never experiencing a water cut over the previous week, indicating a clear spatial pattern.

³⁵ This relationship holds controlling for household income and homeownership status.

³⁶ The relationship of on-site water access to wealth category holds at the 1% level controlling for distance to roads, the density of unplanned settlements and home ownership status.

Figure 20: Percentage of households with piped water access reporting no water cuts in the previous 7 days, by SMS survey and sector



Households without access to a water connection in their house or compound tend to rely on public standpipes or private water sources for both for drinking and other purposes. 30% of households in unplanned areas reported using standpipes or public springs, while 11-12% report using private water, as highlighted in Table 14. Despite the need to fetch water from outside the compound, 92% of those who access water sources outside the compound report a travel time of 30 minutes or less, highlighting that most respondents have access to “Limited water services” as defined by JMP/WHO.³⁷

Table 14: Alternative sources of water

		Potable water (%)	Water for other uses (%)	EICV4 2013/2014 (%)
Improved	Public standpipe/spring	30	30	36
	Protected well	0	1	1
	Rainwater	2	1	0
	Bottled water	1	0	
Unimproved	Surface water	1	1	1
	Private water services	12	11	11

Households that purchase water and transport it using jerry-cans face some price fluctuations varying by locality. From SMS surveys we found that the prices vary between RWF 47 and close to RWF 100 (see Table 15). In comparison, the cost of 20 liters of water from WASAC is approximately RWF 6.3, which means that some respondents had to pay a 10-fold premium. While we did not find any significant variations in the price of water over time, the water prices increase steadily – on

³⁷ J WHO/ UNICEF Join Monitoring Programme for Water Supply, Sanitation and Hygiene, *Progress on Drinking Water, Sanitation and Hygiene*, 2017, pp 8

average RWF 15 – 20 increase from the city centre, with those living 6km away from the city centre paying the highest prices.³⁸

Table 15 Average price of water per 20 Liter jerry-can (RWF), by survey and distance from city centre

	Less than 2km	2-4 km	4-6 km	More than 6 km
Survey 2	74	94	88	94
Survey 5	76	82	80	97
Survey 8	61	89	82	81

6.1.2 Access to improved sanitation

Improved Sanitation (Safely Managed/ Basic): As defined by the JMP/WHO, improved sanitation facilities are those designed to hygienically separate excreta from human contact. These include wet sanitation technologies (flush and pour flush toilets connecting to sewers, septic tanks or pit latrines) and dry sanitation technologies (ventilated improved pit latrines; pit latrines with slabs; or composting toilets).³⁹

Limited Sanitation: Use of improved sanitation facilities shared between two or more households

As part of our survey, we asked households about three aspects of their toilet: (i) whether they had a toilet or not, (ii) the method of waste disposal for the toilet and (iii) whether the toilet was shared by other households. Using these variables, we classified levels of access to sanitation across the city.⁴⁰

Overall, households in unplanned settlements in Kigali have near universal access to an improved latrine (97%). This is a remarkably high proportion, given the lack of traditional sanitation infrastructure and the lack of any major outreach efforts to improve hygiene practices and increase access to toilet infrastructure.

Most households – nearly 65% - use pit latrines as a means of waste disposal. The use of pit latrines is closely tied to the socio-economic situation of households, with more affluent households – or households living in areas with a lower proportion of unplanned housing – more likely to select septic tanks over pit latrines. Pit latrines, which consist of a large hole that is usually, but not always, lined with concrete rings, are clearly the preferred means of waste disposal. Septic tanks, which require more concrete and piping compared to pit latrines, cost more both in terms of raw materials as well as manpower and expertise. While they require additional expenses upfront, they often require less maintenance after installation as waste decomposes on site, rather than filling up as it

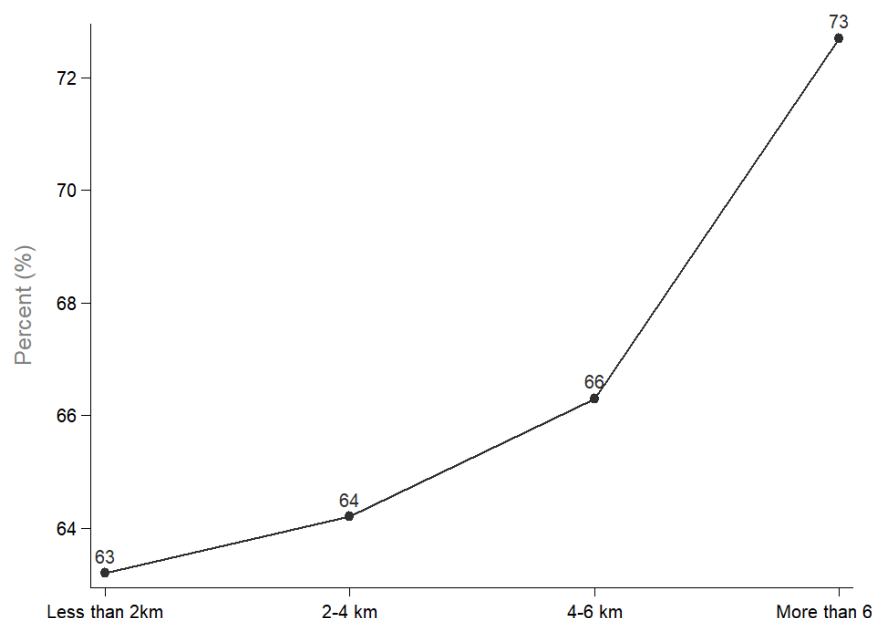
³⁸ A word of caution is that data was only collected during one season and during the wet season. Anecdotal evidence, however, indicates that water prices increase and tend to fluctuate during drier months. Regressions controlled for access to piped water and household wealth categories. Results were significant at the 1% level.

³⁹ WHO/ UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene, *Progress on Drinking Water, Sanitation and Hygiene, 2017*, pp 16; Improved facilities shared with other households have previously been reported separately and did not count towards the MDG target

⁴⁰ We also collected information on whether respondents had slabs for their toilets, but we have excluded this definition while calculating our statistics as they are likely to have been miscoded.

does with pit latrines. The choice of toilet varies by household income levels, but also by location. Areas with a higher proportion of rudimentary housing are significantly more likely to use pit latrines. We also find that households living close to the periphery of the city choose pit latrines over septic tanks (see Figure 21).⁴¹

Figure 21: Percentage of households with pit-latrines by distance from the CBD

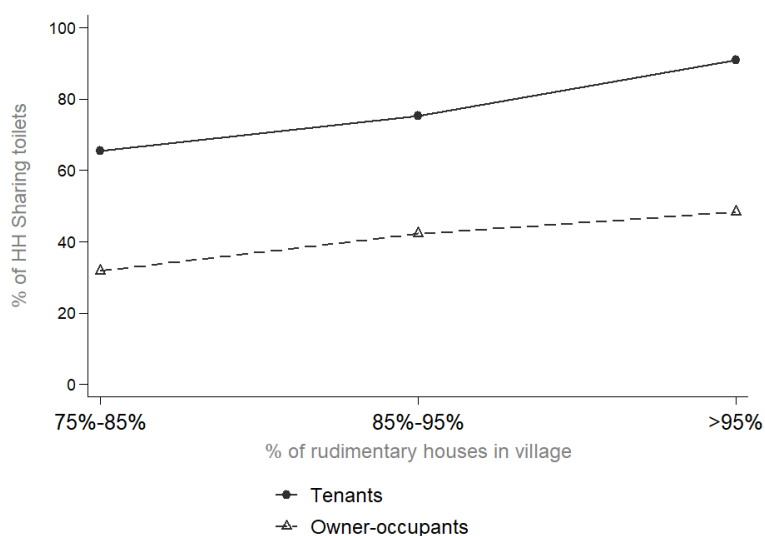


Sharing is a key aspect of toilet usage in Kigali, although the percentage of shared toilets varies by the proportion of rudimentary housing in the village, household wealth and homeownership status. A large proportion of household toilets – nearly 60% - are shared by different households. While this is an estimate, the figure is similar to what has been measured in other surveys including EICV 2013/2014 (45%), and the recent study by the World Bank/OPM (54%). Those living in villages with a higher proportion of rudimentary housing (>95% rudimentary housing) are also more likely to share their toilets compared to villages with a lower proportion of rudimentary housing (<85% rudimentary housing), while homeowners are less likely to share their toilets compared to tenants even if they live in dense unplanned areas (see Figure 22).⁴² Finally, households in highest wealth quintile are significantly less likely to share their toilets compared to those in the poorest quintile. This combination of factors suggests that poorer tenant households living in the most crowded settlements are more likely to share toilets.

⁴¹ These differences hold at the 5% level controlling for a household's wealth category, ownership status, the proportion of rudimentary housing in the village and the distance from the centre of the city

⁴² This relationship holds at the 5% level controlling for household income

Figure 22: Percentage of Households sharing toilets, by ownership status and share of rudimentary housing



Nevertheless, a large portion of shared toilets are “improved facilities” suggesting that the quality of toilets is acceptable even if they are shared. Table 16 highlights the proportion of toilets that are (i) improved and (ii) shared, comparing these results with a study completed by the World Bank/OPM in 2017. Nearly all shared toilets are improved.⁴³

Table 16: Comparison between improved, shared facilities, by survey

	Current status (2017)	World Bank/OPM Study (2017)
Improved Sanitation (not shared)	39%	43%
Improved Sanitation (shared)	58%	47%
Unimproved Sanitation (not shared)	1.4%	3%
Unimproved Sanitation (shared)	1.4%	7%

There is a large overlap between the type of toilet and the likelihood of sharing, which is likely to be problematic in terms of waste disposal in the long-run. Despite the different reasons for sharing a toilet versus choosing the type of waste treatment, households with a pit latrine are more likely to share their toilets compared to those with septic tanks.⁴⁴ Given that shared toilets are likely to fill more quickly, and residents are unlikely to empty pits due to cost constraints,⁴⁵ locations with shared pit latrines have the most potential impact from an upgrade to septic tanks.

⁴³ The discrepancies between the World Bank study and Laterite/IGCs study is likely caused by a combination of two factors. First, the World Bank conducted their sanitation study in two unplanned areas located in the middle of Kigali. Second, our study excluded the use of slabs when defining improved sanitation due to issues in coding.

⁴⁴ This relationship holds controlling for household income, homeownership and the share of rudimentary houses in the unplanned area.

⁴⁵ See Tsinda, Aime et al., “Challenges to Achieving Sustainable Sanitation in Informal Settlements of Kigali, Rwanda,” *International Journal of Environmental Research and Public Health*, Vol 10., 2013.

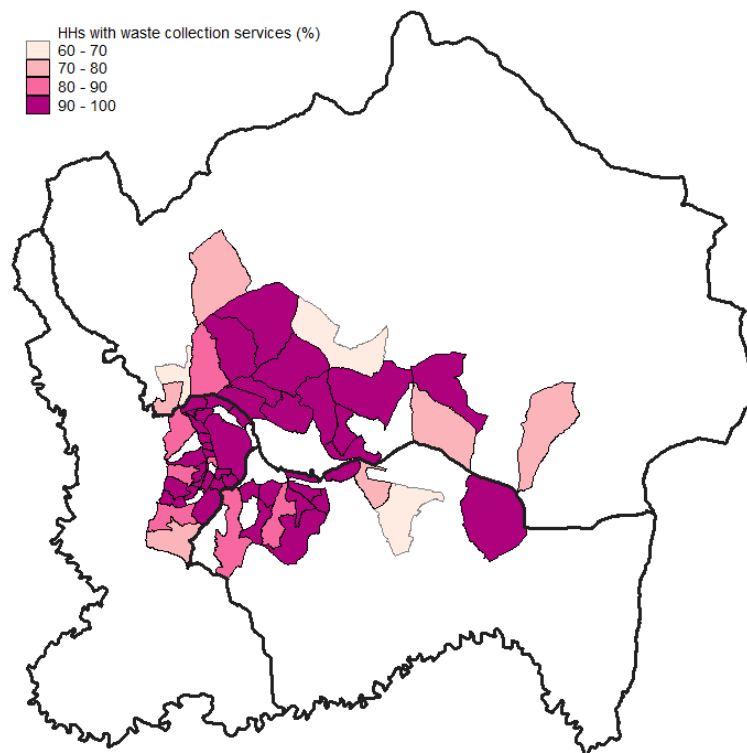
6.1.3 Access to waste collection services

As part of the survey, we asked respondents about (i) whether they received access to waste collection services, and (ii) how they disposed of their waste in circumstances where they do not have access to waste collection.

Like sanitation, waste collection is ubiquitous in unplanned settlements across the city with 89% of households reporting access. Most households (83%), report that waste collection provided privately by either a cooperative, private company or contractor and 5% report that the City Council (MVK) oversees their waste collection. Moreover, the majority of respondents report that their waste is collected every week (76%), suggesting that the service is available, frequent and functioning.

While households across different unplanned settlements are equally likely to have access to waste disposal services, those living closer to the city centre and those living closer to roads are more likely to report access. Settlements closer to the city centre are more likely to report access to access to waste collection services, as seen in Figure 23. Meanwhile, within settlements, those living near road infrastructure are more likely to report access to waste collection services.

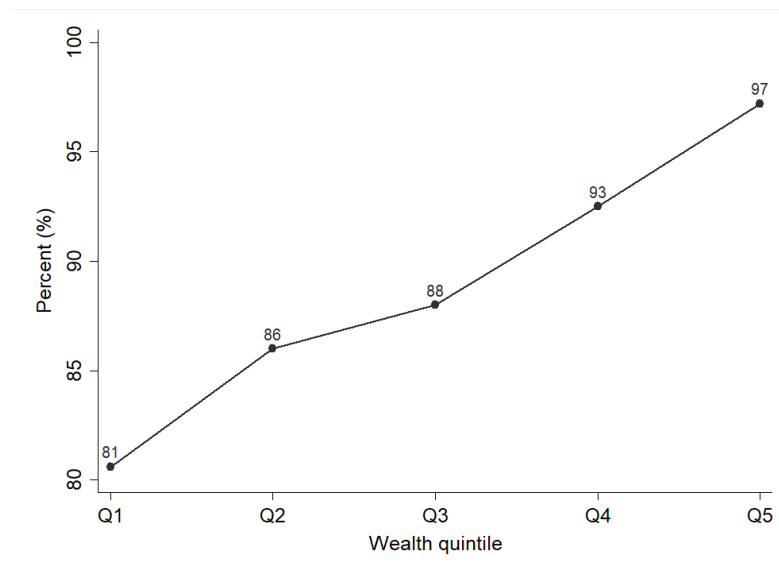
Figure 23: Access to waste collection services, by cell



Households in highest wealth categories (Q4-Q5) are significantly more likely to access to waste collection services compared to those in lower wealth categories (Q1-Q2). Given that private companies, contractors and cooperatives are the main suppliers of waste collection services – and

that these entities are likely to charge a fee for their services – it is unsurprising that access to waste collection services is at least, in part, driven by whether a household is able to pay (see Figure 24).⁴⁶

Figure 24: Percentage of residents with access to waste collection, by wealth category



Those without access to waste collection services generally dispose of their waste via means that are not ideal for the environment, suggesting that waste collection ought to be a priority area for the city. 6% of households without access to waste collection services bury their waste while 2% of households report either burning their waste or disposing it into open drains or bushes. Methods of waste disposal vary by type of unplanned settlement with a larger share of households in areas with a higher proportion of rudimentary houses (>95% rudimentary housing) reporting that they choose to dispose of their waste in open drains (1%) and bushes (1%) compared to those in less dense areas (areas with 75%-95% rudimentary housing).

6.1.4 Access to electricity

A very high proportion of households in unplanned areas report access to electricity in their dwelling (96%) – a remarkable achievement, especially considering that approximately 67% of households reported electricity access city-wide as per EICV 2013/2014. An estimated 89% of households report paying for electricity monthly, indicating a potential gap between access and usage. This gap could also be explained by off-grid electricity solutions. Access to electricity is highest for households in the highest wealth quintile and households located close to main roads.⁴⁷ These trends confirm that proximity to important transport infrastructure is a major determinant of basic service access.

SMS surveys revealed that the quality of service is variable: 43-56% of households reported between 1-7 electricity cuts over the course of a typical week, while between 42-52% reported no cuts. About

⁴⁶ This relationship holds at the 1% level controlling for ownership status, distance from the CBD, distance from a road and the proportion of rudimentary houses in the village

⁴⁷ This relationship holds at the 5% level controlling for distance from the CBD, homeownership status and the proportion of rudimentary houses in the village

54% of households that reported that any cuts lasted less than one hour, on average, implying that intermittent electricity does not cause major disruptions.

From our survey, we estimate that the median electricity expenditures are equivalent to RWF 4,000 per month or about 5% monthly wages, using median incomes. Said otherwise, this level of electricity consumption – using back-of-the-envelope calculations based on rates from REG – put the median household electricity consumption at approximately 26 kWh. This corresponds to the use of up to four 40 ampere Watt bulbs for 5 hours a day every day of the month – but with no other appliances. The low amount spent on electricity might indicate two phenomena, either that households do not spend a large amount of electricity because they lack of high electricity consuming electrical appliances or because households choose not to spend on electricity given high tariffs and low levels of disposable income.

6.2 Safety

Safety and personal well-being - critical to a well-functioning city - is often regarded as a function of the structure and design of the urban fabric, physical infrastructure and social cohesion.⁴⁸ As part of the survey we captured some elements related to each of these themes including perceptions of safety and crime, the availability of street lighting, and levels of social cohesion and trust throughout unplanned areas.

Residents in Kigali's unplanned settlements generally perceive their neighborhoods to be safe, although those living further away from the CBD report worrying less about crime compared to those living closer to the city. To measure perceptions of safety we asked respondents how many times they thought about or worried about petty crime – such as minor theft – within the previous four weeks, and 68% of households reported that they never thought of petty crime in their neighborhood within the last 4 weeks. Residents living closer from the CBD, however are more likely to worry about petty crime compared to those living further away CBD suggesting that petty crime is more of an issue in the city's core.⁴⁹

The availability of street lighting also varies based on distance to the CBD, with unplanned households further away from the city centre reporting lower access to street lighting compared to households near the CBD. An estimated 62% of households in unplanned settlements report street lighting outside their compounds at night, although the proportion of households with lighting varies depending on whether households are located farther away from the CBD and how far they live from the nearest street.⁵⁰ Given that perceptions of petty crime are higher in areas closer to the CBD, access to street lighting does not appear to have any direct correlation with perceptions of petty crime.

⁴⁸ UN Habitat, *Global Report on Human Settlements*, 2007., pp 1

⁴⁹ This relationship holds at the 5% level controlling for distance to roads, the proportion of rudimentary houses in unplanned settlements and the availability of street lighting

⁵⁰ This holds at the 5% level controlling for the density of unplanned settlements and the distance of houses to the nearest street

Households in unplanned areas that worry about petty crime more tend to trust people living in their community less, suggesting that interventions around crime prevention might also be addressed to through community mobilization initiatives. While investments in policing are likely to ensure that people obey the law, additional interventions around building more harmonious community relationships and strengthening social ties might also play a major role in improving the quality life – especially with respect to crime - for residents in unplanned areas.

6.3 Accessibility to amenities

While overall access to basic services is high, access to amenities and public infrastructure - a major determinant of quality of life in unplanned areas – does not yet meet the standards set out by the MININFRA. A lack of access to public amenities is often regarded as one of the key burdens borne by residents living in unplanned settlements, despite the fact that better access to basic infrastructure and better urban amenities is one of the reasons for migration into cities.⁵¹ Table 17 compares the average accessibility of key urban amenities against the required distances stipulated in the MININFRA National Urbanization Strategy. Water point access appears to hit Ministry targets most often while access to health services is the poorest when compared against ministerial targets. Access to bus stops appears to be high – and meets MININFRA standards for the majority of those living in unplanned settlements. However, given the few number of official bus stops and buses it is unclear whether access to a bus stop translates to a high quality of bus service experience for those using public transit.

Table 17: Medan accessibility to amenities against required distances as stipulated by MININFRA

Amenities	Required distance	Estimated required time (minutes)	Estimated median time to amenity (minutes)	Estimated distance ⁵²	% of sample within required distance
Water access point ⁵³	250 m	5	5	375 m	55%
Health services	500 m	7	25	1.9 km	12%
Market	1 km	13	15	1.1 km	38%
Primary School	1 km	13	15	1.1 km	37%
Bus stop ⁵⁴	1 km	13	5	385 m	86%
Administrative services	N/A	N/A	15	1.1 km	N/A

Using an accessibility index, which includes access all major amenities above measured in terms of minutes, we find that distance to roads that accommodate cars is a major predictor of accessibility, with those living farther away reporting worse access to key amenities, controlling for household wealth. We used Principle Component Analysis (PCA) to generate an accessibility index using

⁵¹ See Turok, I., Borel-Saladin, J. (2016) for a literature review of reasons for migration into informal/slum settlements

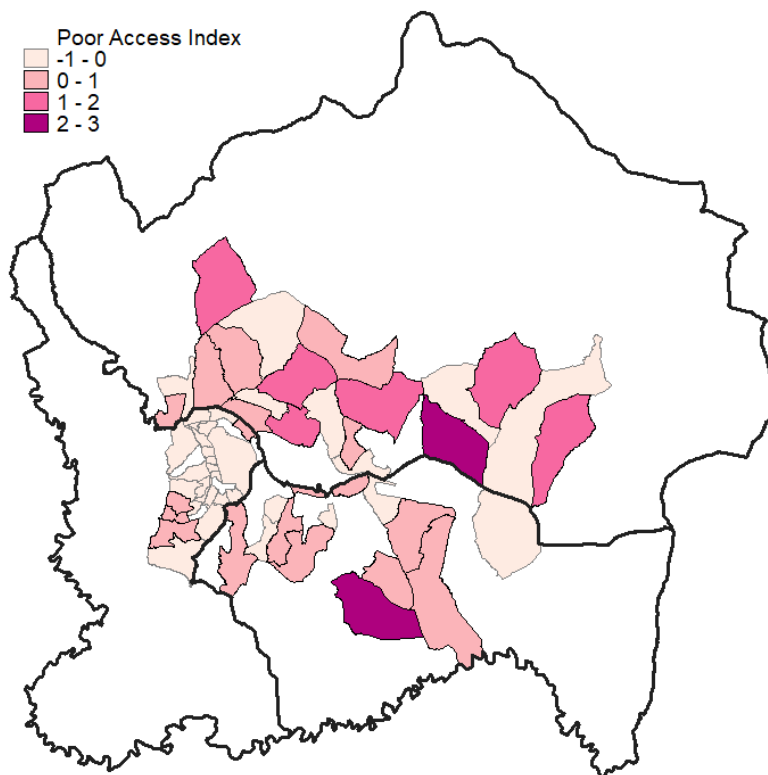
⁵² Requirements for servicing with facilities for upgraded neighborhoods were obtained from the Ministry of Infrastructure, *National Informal Settlements upgrading Strategy*, pp23. We estimated distances respondents have to travel using an average walking speed of 4.5 km per hr. Industry standards for average walking speeds vary between 4-5km per hour.

⁵³ Access to the nearest water point was calculated differently, in that the average time was estimated using categories

⁵⁴ Since these were measured after the survey was conducted, all distances are straight-line distances between the household and the Bus stop

information on the amount of time it takes residents to travel to key urban amenities.⁵⁵ Mapping this index we see that sectors located in the outskirts of Kigali are more likely to experience issues related to poor amenity accessibility, as seen in Figure 25.

Figure 25: Poor access index, by cell



However, a household's wealth profile is also positively associated with better access to public amenities suggesting that even in locations with poor access to services, wealthier households are in areas that are closer to key amenities. Controlling for geographic factors such as distance of a residence from a car carrying road, distance of a residence to the centre of the city and the share of rudimentary dwellings in unplanned settlements, we find that households in higher wealth categories – wealth quintile 5 – are more likely to have better access to key services, compared to those in wealth quintiles 1, 2, 3 or 4. This finding suggests that access to amenities is unlikely to be uniform within unplanned settlements and that wealthier residents are likely to live in dwellings that are closer to key public infrastructure.

⁵⁵ We created the Accessibility index using principle component analysis and choosing the first component. Variables that were included in PCA analysis included

6.4 Household priorities

In addition to collecting data about household access to services, our survey also captured information from households on key priority areas – including their top 5 priorities – they wish to upgrade and how they would be willing to contribute to improve their local communities.

Overall, we find that residents across the city prioritize access to roads and affordable housing above all other infrastructure. When asked about what their top priority, approximately 27% of respondents listed “Access to roads for cars” as their top infrastructure upgrading priority, followed by 15% who indicated that they wished to “Upgrade housing quality.” Homeowners are significantly more likely to request improvements to road infrastructure compared to tenants, highlighting the benefits neighborhood level infrastructure upgrades on their quality of life as well as their housing asset.⁵⁶ Tenants, on the other hand, while expressing the same general preferences, also express the importance of affordable rental housing with 17% of respondents seeing this a priority area – on par with road access.

In terms of contributions to support neighborhood improvements, respondents overwhelming report that they would most be able to provide their time either to support community mobilization efforts or their labour. Approximately 48% of respondents reported being willing to contribute their “Participation in community mobilization” as a means of ensuring better services in their neighborhood, followed by 38% of whom reported being willing to provide labour. While types of contributions did not vary by homeownership status, those in higher wealth categories were significantly less likely to reporting being willing to contribute labour or participation and significantly more likely to report being willing to provide cash contributions.⁵⁷

⁵⁶ This difference is significant at the 5% level controlling for distance from the city centre and distance from a car accessible road

⁵⁷ These differences are significant at the 5% level controlling for distance from the city centre, homeownership status, distance from a car accessible road and wealth quintiles

6.5 Box 4: Key Insights on Access to Basic Services

From our survey, we estimate that access to key basic services in unplanned settlements is high

- We estimate that 87 % have access to access to improved water, 97% have access to improved sanitation, 89% have access to waste collection services, and 96% have access to electricity, all of which highlight that residents in unplanned areas have access to key services.
- Approximately 74% of households in unplanned areas have access to all four services, while close to 0% of respondents have access to no services
- Access to key basic services in unplanned areas appear to have increased in the last four years, based on comparisons with EICV4 (2013/2014)

Access to improved water sources appears to be the least common service

- Although we estimate that 87% of households in unplanned settlements have access to improved water sources, although only 56% reported access to a piped water connection either in their house or in their compound
- Households with access to improved water varies according to the distance that households live from major roads, suggesting that ease of access to major transport infrastructure plays a role in the availability of water
- Piped water connections do not necessarily result in better access, as households face frequent water cuts. From our panel survey, we estimate that one-third of respondents reported between 1-3 cuts in their water supply in the 7 days preceding the SMS survey, while another third reported never experiencing a water cut. Respondents living in areas closer to the city centre are less likely to experience water cuts compared to others
- Households without access to a water connection in their house or compound tend to rely on public standpipes or private water sources for both for drinking and other purposes. 30% of residents in unplanned areas reported using standpipes or public springs, while 11-12% report using private water
- Respondents who purchase water and transport it using jerry-cans face some price fluctuations. From SMS surveys we found that the prices vary between RWF 47 and close to RWF 100. Water prices increase steadily – on average RWF 15 – 2k increase from the city centre, with those living 6km away from the city centre paying the highest

Access to improved sanitation is near universal, which is remarkably high given the lack of traditional sanitation infrastructure

- Most households – nearly 65% - use pit latrines as a means of waste disposal. The use of pit latrines is closely tied to the socio-economic situation of households, with more affluent households more likely to select septic tanks over pit latrines.
- Sharing is a key aspect of toilet usage in Kigali: nearly 60% of households share toilets. Nevertheless, a large portion of shared toilets are “improved facilities” suggesting that the quality of toilets is acceptable even if they are shared.
- There is a large overlap between the type of toilet and the likelihood of sharing, which is problematic in terms of waste disposal in the long-run

Waste collection is ubiquitous with 89% of households reporting access

- 83% of households report that waste collection provided privately by either a cooperative, private company or contractor while 5% report that the City Council (MVK) oversees their waste collection.
- 76% of households report that their waste is collected every week
- Settlements closer to the city centre (CBD) are more likely to report access to access to waste collection services
- Households without access to waste collection services generally dispose of their waste by burying it (6%) or burning it (2%), both of which have negative environmental consequences

A high proportion of residents report having access to some form of electricity in their dwelling

- 96% of households report having access to electricity in their dwelling, while 89% report paying for electricity monthly, indicating a potential gap that could be explained by off-grid electricity solutions.
- SMS surveys revealed that the quality of service is variable: 43-56% of households reported between 1-7 electricity cuts over the course of a typical week, while between 42-52% reported no cuts. About 54% of households that reported that any cuts lasted less than one hour, on average, implying that intermittent electricity does not cause major disruptions.
- From our survey, we estimate that the median electricity expenditures are equivalent to RWF 4,000 per month or about 5% monthly median incomes.

Kigali's unplanned settlements are generally perceived to be safe places

- Perceptions of safety – measured by asking residents how many times they thought about or worried about petty crime, such as minor theft, within the previous four weeks – indicated that 68% of households reported that they never thought of petty crime in their neighborhood
- However, residents living closer from the CBD, however are more likely to worry about petty crime compared to those living further away CBD suggesting that petty crime is more of an issue in the city's core
- Households in unplanned areas that worry about petty crime more tend to trust people living in their community less, suggesting that interventions around crime prevention might also be addressed to through community mobilization initiatives.

Access to amenities and public infrastructure does not meet the standards set out by the MININFRA

- Water point is the most accessible basic service, while health services are the poorest when compared against ministerial targets
- Using an accessibility index, which includes access all major amenities above measured in terms of minutes, we find that distance to roads that accommodate cars is a major predictor of accessibility, with those living farther away reporting worse access to key amenities,
- A household's wealth profile is also positively associated with better access to public amenities suggesting that even in locations with poor access to services, wealthier households are in areas that are closer to key amenities.

Residents prioritize roads and affordable housing above all other infrastructure, and are willing to contribute their time and labour in order to improve it

- 27% of respondents listed "Access to roads for cars" as their top infrastructure upgrading priority, followed by 15% who indicated that they wished to "Upgrade housing quality."
- Homeowners are significantly more likely to request improvements to road infrastructure compared to tenants
- Respondents overwhelming report that they would most be able to provide their time either to support community mobilization efforts or their labour. Approximately 48% of respondents reported being willing to contribute their "Participation in community mobilization" as a means of ensuring better services in their neighborhood, followed by 38% of whom reported being willing to provide labour

7. Policy Discussion

This report has attempted to shine a light on the socio-economic and living conditions of people in unplanned settlements in Kigali City. In this section we reflect on the policy implications of some of these findings for the City of Kigali. We draw on the findings from the report, a review of global best practices, and our broad understanding of the overall vision policymakers have for the City of Kigali, to offer some thoughts on key focus areas for the city.⁵⁸ We would like to emphasize the importance of adopting a gender-sensitive approach to city planning, focused in particular on single – and female – headed households, which on almost all the indicators we present appear to be the most vulnerable sub-group.

7.1 Data-driven policy making

This study was designed as a pilot to test the viability for the City of Kigali to: (i) construct a representative panel of residents in unplanned areas of the city; and (ii) to use high-frequency SMS surveys to gather useful information. Using satellite imagery techniques to identify villages with a high concentration of unplanned housing, combined with standard sampling techniques to identify households within those villages, it was possible to create a sample that is representative of the city's unplanned settlements. Furthermore, the use of high-frequency SMS data collection achieved response rates of over 50% throughout the 3-month survey period, thanks to a mix of training, incentives and reminders (see Annex 1). The high-frequency nature of the data led to the identification of patterns that would have eluded us using standard cross-sectional surveys. SMS surveys also proved a very quick and cheap way to generate information on the situation of unplanned settlements.

We believe that this survey shows that there is value for the city of Kigali to think of ways to collect high-frequency data on the situation of residents in unplanned settlements and to use this information to drive more focused data-driven policy making. As discussed in the introduction, data on the situation of residents in unplanned areas of the city is in short supply, creating a critical gap of information.

In the short term, the City of Kigali could think of ways to leverage home-grown innovations such as *umuganda* to collect data and ensure up to-date lists of current community assets – such as schools, clinics, community centres, play-areas – are available. *Umuganda* could also be used to identify and map the required infrastructure improvements throughout the city. This engagement with local leaders can also be used to estimate financing and capacity building requirements to carry out necessary infrastructure - i.e. storm water drainage, or improvements to street lighting – upgrades at the local level. Such an engagement with villages throughout the City of Kigali could provide critical

⁵⁸ These principles such as (i) ensuring that households have access to all basic services, (ii) ensuring access to affordable and quality living environments, (iii) ensuring a range of vibrant employment centres across the city, (iv) public participation in the community upgrading process, (v) ensuring compact, vibrant urban development, (vi) ensuring transit orientation and (vii) preserving the city's overall cleanliness and greenery have been highlighted in various policy documents including the National Informal Upgrading Strategy (2015), the Kigali City Development Plan (2013), the Kigali Master Plan (2013) and the Rwanda Smart City Master Plan (2017)

inputs for planning purposes, helping policy makers move from broad strategic objectives to very specific plans that respond to the concerns of citizens and local administrative units.

In the long term the City can also pursue strategic partnerships with other government institutions to leverage already existing data. Institutions such as the Rwanda Revenue Authority, REG – the electricity corporation, WASAC – the water corporation, IREMBO – the online citizen services portal, the Rwandan Police, the Ministry of Health, the Ministry of Education and of course the National Institute of Statistics, already have very detailed geographic data on various aspects of city life. Regularly combining, updating and analyzing the data collected by these institutions can yield very useful insights for city planners.

The city can also explore the option of building a panel of residents on the model of this study. This panel could be used to periodically collect both quantitative and qualitative data on key issues such as housing affordability, housing prices, interruptions to the access to basic services – such as water cuts – and employment. It could also be used to poll citizens on their preferences and satisfaction levels with respect to city-services.

7.2 Securing high-quality and affordable housing options for less affluent residents

The availability of high-quality and affordable housing is a key policy priority for the city; this study confirms that it also a key concern for residents in unplanned settlements. The study puts the problem of securing better quality and more affordable housing into context:

- Housing affordability is already a concern for more than half of tenants in unplanned settlements in the city of Kigali, who spend more than 30% of household income on rent;
- Housing affordability and the lack of land has driven new home owners away from the city centre towards the periphery;
- The cost of finance is a binding constraint to new housing construction;
- The cost of housing and land in existing unplanned settlements is high, even though the quality of housing does not meet the expected standards;
- Most residents in unplanned settlements tend to live close to their workplace and walk to work, because transportation costs are too high for them to commute – relocation only becomes a viable option for them if there is either: (i) a substantial increase in housing quality combined with a reduction in rental costs that would compensate for the cost of the commute; or (ii) a steep reduction in the cost of transport.

The combination of these challenges creates a very difficult equation for policy makers to solve in terms of: (i) where to construct high-quality and affordable housing; and (ii) who should take on the responsibility of improving housing: should it be incremental – and therefore managed by households, should it be spearheaded by government or should it be brought about through strategic public private partnerships (PPPs)?

A few short-term options that the City of Kigali could consider, include:

- **Prioritize the development of the mortgage market and work with regulators, banks, employers, and other financial institutions to encourage innovative solutions, such as building societies, to bring the interest rates applied to mortgages down.**
- **Experimenting in pilot locations whether the implementation of looser regulations and a less strict implementation of building standards would lead to increased investments in home upgrading and affordable home construction.** One hypothesis is that one of the key drivers of cost for households with respect to housing - and that is holding investment back – are strict building standard regulations. An easing of these standards might lead to a more gradual transition towards high-quality housing, largely driven by households themselves.
- **One solution pursued by other cities, has been the mapping of existing vacant government lands across inner city areas, as these lands are potential locations for new affordable housing developments.** Schemes to map out and consolidate government land spread across various ministries have been carried out in cities such as Ahmedabad, India and have served as a backbone for more concrete initiatives into where publicly or privately financed affordable housing could be constructed.⁵⁹

In the long term, important questions for the city of Kigali to look into will include:

- **How to ensure affordable housing is constructed close to the city centre and not in the periphery?** Encouraging better more adequate housing in the city centre is likely to have less of a disruptive influence on access to employment opportunities and the social fabric of the City.
- **How to promote higher density housing and slow down the outwards expansion?** This is typically best achieved by encouraging vertical construction.
- **How to innovate and promote locally sourced high-quality building materials and simple and cost-efficient housing design?** Several initiatives from Rwanda based institutions, such as SKAT consulting and Strawtec, are already offering design support and access to construction materials for low-cost homes using modular designs.
- **How to deploy financial strategies – such as value capture – so that the City of Kigali can sustain investments into the continuous upgrading of the city?**

⁵⁹ See Ballaney, Shirley; Bertaud, Marie-Agnes; Clarke Annez, Patricia; Koshy, C.K.; Nair, Bindu; Patel, Bimal; Phatak, Vidyadhar; Thawakar, Vasudha. 2013. Inventory of Public Land in Ahmedabad, Gujarat, India. Policy Research Working Paper; No. 6664. World Bank, Washington, DC. © World Bank.

- **How to encourage the participation of private investors in the construction of affordable housing?** Strategies that have been tested in other cities, have included encouraging private investors to reserve a high proportion of new development for low income housing and to apply clear standards with respect to minimum Floor Area Ratios (FAR) to promote vertical construction.

7.3 Street/lane upgrading

The report emphasizes the importance of access to roads as a major predictor of access to basic services including water and sanitation. We show that as the city expands, more and more houses are been constructed away from the main roads. This has led to the creation of isolated unplanned settlements, that are not crossed by any roads or arteries. People make their way through these settlements using small and often steep lanes and alleyways. These make access and the provision of services difficult, and significantly increase the commute times of residents.

The upgrading of roads in the city has been a major focus and priority for City authorities.

Short term options that the City of Kigali could explore - and that have been deployed in other locations – in order to upgrade lanes within unplanned settlements, include:

- **Piloting the use of community-led and community managed street and lane upgrading to encourage residents to express areas where they might want additional road infrastructure (this policy option is highlighted by UN Habitat studies on urban upgrading).** *Umuganda* might also be used to disseminate materials and other equipment from sector or district administrative units that can assist community volunteers with any incremental neighborhood upgrades.⁶⁰ Best practices and guidelines on road improvements and drain construction could also be disseminated using *umuganda* to ensure that community upgrading efforts are more effective at producing long-term impacts.
- **Involving home owners in the upgrading of lanes.** At local level homeowners could be encouraged to contribute to road or street upgrading scheme as they stand to benefit from higher home prices. Ensuring contribution from homeowners is likely to ensure owners pay, in part, for any improvements to the value of their home.

7.4 Sanitation

In terms of access to sanitation, we have shown that the lack of sustainable onsite or offsite treatment system means that households construct individual pit-latrines or septic tanks to deal with waste. This is not an environmentally optimal and sustainable solution for the city.

One short-term option that the City of Kigali could pilot as an alternative means of sanitation delivery are the use of community level septic tanks or biogas digesters. The use of a community-

⁶⁰ UN Habitat, *Designing and Implemented Street-Led Citywide Slum Upgrading Programmes*, 2016, pp 23

level waste receptacle located closer to main transportation nodes is more likely to promote waste emptying, and more sustainable modes of transport while removing the financial burden of building expensive sanitation infrastructure from the individual households. Community level sanitation could provide the optimal scale of waste collection until alternative ways of sanitation provision are introduced.

7.5 Improvements in public transport and pedestrian infrastructure

The report shows that access to public transport is one of the most important constraints for residents in unplanned areas, severely limiting the mobility of the labour force. The vast majority of Kigali's residents chose to work in proximity to where they live. They avoid the cost of transportation by commuting to work on foot. About half of heads-of-household in unplanned settlements commute to work on foot only. For these households the cost of transport is a binding constraint, that limits their ability to benefit from improved housing options or job opportunities in other locations and to experience the city and its amenities to a fuller extent.

The cost of transportation is compounded by issues of access to public transportation – in particular in the periphery – and long waiting times.

Kigali is a city that walks; and while it is important to ease the constraints for commuters, it is equally important to acknowledge that pedestrian infrastructure will continue to be an important aspect of urban mobility and to prioritize the development of a pedestrian vision for the city.

In the short term, the City – in close collaboration with the Rwanda Utilities Regulatory Authority and private transportation providers – could pilot different ways to reduce to cost of transport for long-distance commuters. We believe that this should be a priority concern for city planners. Options to reduce the cost of commuting including changing the model on which fares are based, shifting from a flat fee per kilometer model to a zoning-based fee that significantly reduces the cost of long-commutes. The reduction in income from long-distance commutes, could be compensated for by applying higher prices to short commutes. Other options can also be considered, including route-specific fares, on routes that are most used by low-income commuters, or schemes that subsidize the commute or adjust the fare, for certain target sub-groups, for example female heads-of-household who are significantly less likely to use public transport.

As a major long term investment in the upgrading of public transport in Kigali, the city is in the process of deploying a Bus Rapid Transit Lane system.

While the city's priority is to increase the number and frequency of large buses, the introducing smaller mini-buses in peri-urban areas could have a significant impact given that waiting times are longer in the periphery and fewer roads are paved.

7.6 Skills development

This study shows that there are very high returns to skills and formal education in Kigali's unplanned settlements. The quality of life of those living in unplanned settlements in Kigali is strongly correlated to their education level and consequently the type of job and wage they can expect. The median salary of someone with university education is five times higher than someone with no formal education; it is about three times higher than someone who has finished secondary school.

We recommend that city planners work closely with the relevant authorities and employers to develop a vision for skills development in Kigali's unplanned settlements. Examples from cities like Medellin, Colombia, show that cities can play an active role in shaping the geography of skill development. Ensuring for example that new libraries or educational institutions/centres are located within unplanned areas, not only changes the urban environment for people living in unplanned areas, it also opens up new educational opportunities for them.

Female-headed households (who account for about a third of households in unplanned settlements) are especially vulnerable in terms of access to employment; they are significantly more likely to be underemployed and they earn a median salary that is half that of their male peers. Developing a vision for how to better integrate single-headed female households into the economic fabric of the city is a key challenge for city planners.

Annex 1: SMS Survey Analysis

The Dynamics of Unplanned Settlements study in the City of Kigali is, as far as we are aware, one of the first uses of SMS surveys for social science research in the field of urban planning in a developing country setting. The study was unique in how it tracked in-person changes for all respondents who completed a baseline survey along three key research themes using a weekly survey spread across three months.

The following annex will describe key findings from the Dynamics of Unplanned Settlements SMS data collection process. This will include a summary of response and completion rates and average completion times, response bias including geographic clustering, changes in respondent profiles over time and the influence of response bias on key questions, and a discussion of challenges and limitations of SMS surveys for policy research in an urban context.

Literature Review

The ubiquity of mobile phones across has led to the growth of SMS based interventions across developing countries. Their low cost in delivering and collecting information has made them a popular tool for researchers, NGOs and governments. In particular, SMSs are often a common tool for outreach (L'Engle et al., 2013), marketing (Rettie et al., 2015), and as behavior change interventions to improve education (Libero et al, 2007; Cavus et al, 2009) and health (Deglise et al, 2012; Shaw et al, 2012).

SMS surveys have also been used as a data collection method, especially in the areas of disease prevention, surveillance, management and patient compliance (Deglise et al, 2012). One example of SMS being used for research comes from Berman et al who use SMSs to collect data on Ebola outbreaks in West Africa in 2014. The researchers sent out 1,000 surveys, each between 12-15 questions long, after which tailored responses to the Ebola outbreak were sent out to different demographics.⁶¹ Other researchers have used multiple SMS messages as a way of increasing participation and response rates in face-to-face surveys or mobile phone surveys (Dal Grande et al. 2016; Balabanis 2015).

Few SMS surveys have been conducted with the purpose of improving urban infrastructure and urban policy. Breuer et al (2016) lead one of the few urban studies that used SMS surveys in a developing country context to understand issues around government decentralization and local governance in Togo. The study targeted 1,498 total respondents and included a range of questions about political participation, socioeconomic status and education level.

⁶¹ Amanda Berman, Maria Elena Figueroa & J. Douglas Storey (2017) Use of SMS-Based Surveys in the Rapid Response to the Ebola Outbreak in Liberia: Opening Community Dialogue, *Journal of Health Communication*, 22:sup1, 15-23, Douglas Johnson, Collecting Data from mHealth Users via SMS surveys: A Case Study in Kenya, *Survey Practice*, Vol 9, Issue 1, 2016

To the best of our knowledge, this study on “The Dynamics of Unplanned Settlements in the City of Kigali” is the first instance of an SMS survey being used to conduct research from residents in informal/ unplanned settlements for the purposes of city planning. This study is also unique given the location, the repeated nature of the surveys, and the questions, which were related to employment status, access to basic services, and other features of urban living.

Study description

The study “Dynamics of Unplanned Settlements in the City of Kigali” consisted of two phases: phase one involved a face-to-face survey that was conducted by enumerators in person, while phase two was conducted via SMS to all those who completed the face-to-face survey. The face-to-face survey was conducted by Laterite enumerators. The survey, which lasted approximately an hour, was accompanied by a training session on the use of SMS surveys which was conducted by enumerators on household heads/ spouses. The training covered the types of questions that respondents might receive, and ended with the respondent receiving the airtime they would obtain if they were to complete a real SMS survey. While either heads of household or spouses were trained as part of the face-to-face survey, SMS surveys were only sent to the phone number of the household head. As such, written instructions on how to respond to the SMS survey were left with the respondent after enumerators completed the face-to-face survey along with instructions to assist the head of household while completing the SMS survey.

SMS surveys were conducted in nine rounds over the period of 12 weeks, with a frequency of one survey every week. The SMS portion of the survey started four weeks after the Face-to-Face survey was complete.⁶² SMS surveys were designed to cover more than one theme, and each SMS survey included a reminder that was sent to respondents three days after the initial SMS survey. Each survey included about 10-12 multiple choice and open ended questions. Respondents were sent SMS surveys regardless of whether they completed previous surveys, so that all 1,594 household heads were sent all nine SMS surveys. All respondents were asked if they consented to the survey before being asked the first question. Respondents received a RWF 100 incentive only after they completed a survey. SMS surveys were sent to respondents on all days of the week – that is, initial SMS surveys were sent across on all seven days of the week-, but were only sent at a pre-arranged time captured during the face-to-face survey.⁶³

⁶² The reason in delaying the start of the SMS survey was due to the staggered implementation of the Face-to-Face survey which took place over the course of 2 weeks. In addition, the end of Face-to-Face data collection coincided with the beginning of the holiday season, which made it feasible to delay SMS data collection for the beginning of January 2018 rather than the end of December 2017.

⁶³ In cases where we interviewed the spouse – not the household head – the optimal SMS time was answered by the spouse on behalf of the head of the household.

Each survey covered one of three survey themes so all three themes were covered twice. Each SMS survey and survey theme is highlighted in Table 18 below:

Table 18: Survey number, research theme and example questions

Survey	Research Theme	Example Questions
One, Four, Seven	Employment and remittances	<ul style="list-style-type: none"> • In the last 7 days did you work for at least an hour to earn an income? • Do you expect to return to a job in the next 7 days? • Is your job temporary? • How much did you earn in the last 7 days? • Did anyone in your household receive any remittances, in cash or in kind? • Where does this person live? • Did you or anyone in your household send any remittances, in cash or in kind? • Where does the recipient of these remittances live?
Two, Five, Eight	Residential mobility, access to basic services	<ul style="list-style-type: none"> • At any point in the last 7 days did you not have electricity in your home? • How many times did this happen? • At any point in the 7 days, did your water stop? • Did you or a family member fetch water from a tap in the last 7 days? • How much did you pay for a 20 litre jerry can of water? • Was your garbage collected in the last 7 days? •
Three, Six, Nine	Transport and mobility	<ul style="list-style-type: none"> • What form of transport did you take to travel to your main occupation the last time you went to work? • How many minutes did you spend traveling to your job the last time you traveled to work? • How many minutes did you wait for the bus the last time you traveled to your main job? • How many minutes did you take to travel to your destination? • How much did the trip cost (one way)? Please enter a number

Overall Summary statistics

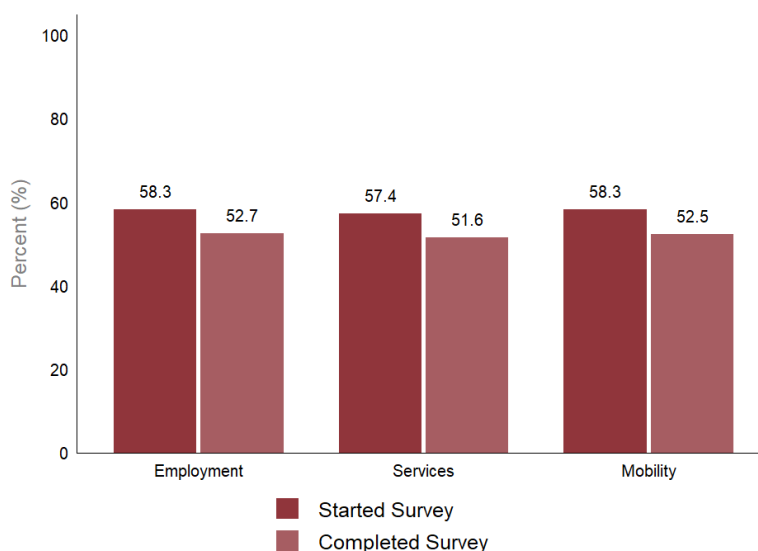
Overall, response rates (measured by a participant responding to an SMS survey), consent rates (measured by a participant consenting to taking an SMS survey) and completion rates (measured by a participant completing an SMS survey) exceeded expectations. On average, across all surveys, survey response rates were 59% of the sample, consent rates were 55% of the sample (or 93% of all people who responded to the consent question) and survey completion rates were 54% (91% of all people who responded to the consent question) - with respondents either completing the initial survey or the reminder survey (see Table 19). A very encouraging finding is that attrition across survey rounds does not increase, which might be expected given the panel nature of the study.

Table 19: Response, consent and completion rates across surveys

	Overall	SMS 1	SMS 2	SMS 3	SMS 4	SMS 5	SMS 6	SMS 7	SMS 8	SMS 9
Response	59%	61%	59%	61%	60%	59%	59%	58%	57%	58%
Consent	55%	58%	56%	58%	56%	55%	57%	55%	54%	54%
Completion	54%	54%	50%	55%	53%	54%	54%	54%	54%	53%

Overall, differences between starting and completion rates do not vary across survey themes, suggesting that no survey was especially problematic for respondents. Within survey attrition rates - that is the difference between when respondents start and quit surveys - range between 5.6-5.8% indicating no particular survey was especially difficult to finish (see Figure 26).

Figure 26: Proportion of survey starters and completers by survey theme



On average, completion rates, consent rates and response rates are comparatively high.⁶⁴ This is especially encouraging given that this survey was conducted with a vulnerable population in many of whom did not have access to formal education (see below). Our working hypothesis is that high response rates are in large part the result of face-to-face surveys, which were undertaken before SMS surveys were sent out. In addition to data collection, the purpose of the face-to-face surveys was to build trust between respondents and enumerators. Face-to-face surveys were also used to train respondents on the SMS survey methodology. We expect that this increased familiarity with the SMS surveys played an important role in ensuring respondents were more comfortable responding to the SMS surveys.

⁶⁴ See Allan H. Church., Estimating the effect of incentives on mail response survey rates: A Meta-Analysis. *Public Opinion Q* 1993; 57 (1): 62-79 for review of response rates to panel surveys using other media including email and mail surveys. See also Nina Hoe & Heidi E Grunwald. The Role of Automated SMS Text Messaging in Survey Research. *Survey Practice* [Online], 8.6 (2015)

Incentives

Although incentives of RWF 100 were given to respondents after completing a survey, the timing of when respondents received the SMS survey – whether it was immediately after completing the survey or slightly after – is unlikely to have contributed to higher response rates. We were able to test the effect of incentive timing on response rates due to issues in network connectivity where incentives to a random subset of respondents were not delivered during each survey (see Table 20). Looking at the effect of these undelivered incentives on response rates in subsequent surveys, we see that respondents who did not receive the SMS incentive immediately after responding to the survey were not significantly less likely to respond to the next SMS survey.⁶⁵ This suggests that incentive timing might not be more effective in obtaining higher response rates.

Table 20: Proportion of surveys that did not receive airtime rewards immediately after the survey was completed

SMS 1	SMS 2	SMS 3	SMS 4	SMS 5	SMS 6	SMS 7	SMS 8	SMS 9
46%	32%	6%	5%	7%	1%	1%	5%	0%

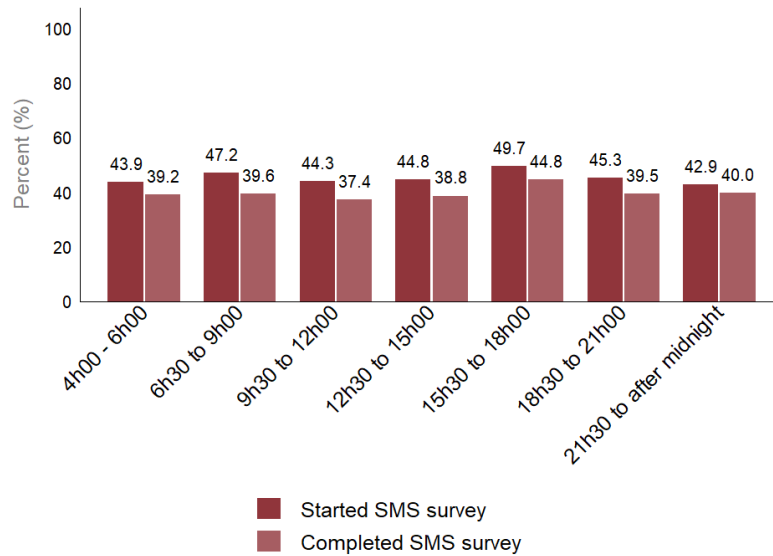
Response rates by day and time

Overall, we find little variation in response rates by day, suggesting that respondents are not more likely to respond to SMS surveys compared to any other day; we do detect some variation in response rates in terms of the time of day. Figure 27 highlights the SMS completion rates by the day and hour in which the first initial SMS message were sent.⁶⁶ The figure indicates that between 40-43% of respondents are likely to complete an SMS survey regardless of day in which it is sent. In terms of the time of day, we find that respondents were slightly more likely to respond to SMS surveys if they were delivered between 15h30 and 18h00 compared to any other time. It is important to note however that during the face-to-face we asked respondents what time they would prefer to receive SMS surveys. SMS surveys were then sent to them during the time slots they selected. Respondents preferred the receiving surveys in the evening - 18h30-21h00, 28% - while the morning time – 9h30-12h00, 22% - was the second most popular time slots.

⁶⁵ Respondents who did not receive an incentive immediately after completing an SMS survey were sent an incentive before starting the next SMS survey, although these incentives were delivered with a slight delay (2-3-day delay). We ran within person random effects regressions controlling for *ubudehe* categories, homeownership status, respondent age groups, respondent gender and household size. In all instances, the effect of not receiving an incentive immediately after completing the previous survey had no effect on response rates in the subsequent survey.

⁶⁶ Each SMS survey round consisted of two surveys: an initial survey and a follow-up/ reminder survey. The following analysis looks only at response rates by day and time of day during the initial survey.

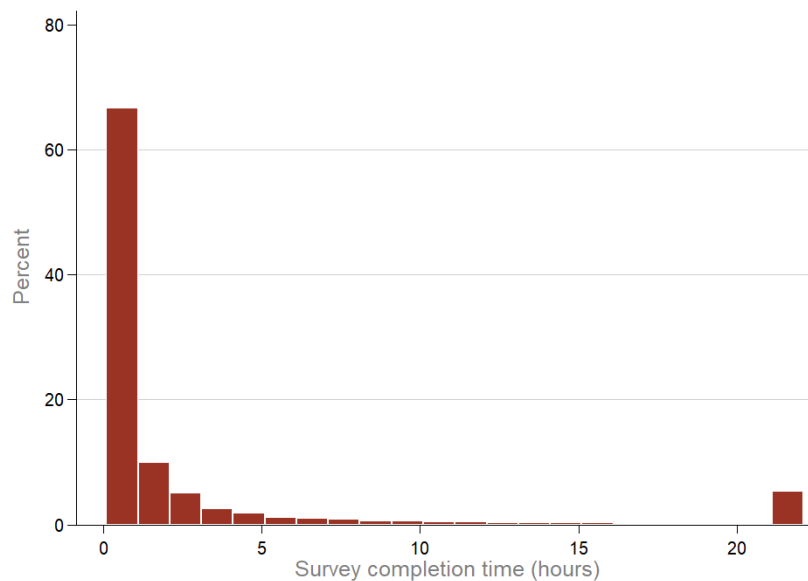
Figure 27: Initial SMS survey completion rates by day of the week (left) and time of day (right)



Survey completion time

On average, respondents took between 3-4 hours to complete each SMS survey, although the vast majority of respondents completed SMS surveys within an hour. As highlighted in Figure 28, more than 60% of survey respondents completed surveys within the first hour of receiving it, with the proportion of respondents tapering off over time. There were no significant differences in response times between surveys, or between survey themes.

Figure 28: Histogram of survey response times amongst respondents who completed a survey



Response bias

The issue of response-bias is one of the most common issues with self administered surveys, especially those administered using electronic surveys, given the additional cognitive burden that is placed on respondents.⁶⁷ The following section will review issues related to the SMS survey completion including (i) the key demographic characteristics of those that did and did not respond to SMS surveys (captured during the baseline survey), (ii) comparisons between raw and reweighted measures across key survey questions, (iii) within-person response rates and (iv) geographic clustering of responses.

Demographics

On average (i) younger respondents (18-35), (ii) tenants, (iii) those with a secondary school education and (iv) those in *Ubudehe* category 1 are all more likely to complete surveys.⁶⁸ The strongest predictor of whether a respondent would complete a survey was education level – respondents who had completed secondary school were on average 8.5 percentage points more likely to complete a survey. Table 21 highlights whether the difference in the proportion of those starting a survey and not starting a survey, and completing a survey and not completing a survey varies according to various demographic characteristics. Statistically significant differences across some demographic characteristics reveal that there is a real response bias, even though the magnitude of these difference only marginally affects the estimates.

Table 21: Differences in means between respondents non-respondents, by demographic characteristic

	Likelihood of starting survey	Likelihood of completing survey
Ubudehe Category 1 (poorest)	0.02***	0.02***
Ubudehe Category 2	0.002	0.005
Ubudehe Category 3 (wealthiest)	-0.02***	-0.02***
Tenant	0.03***	0.03***
Unemployed	-0.021***	-0.011*
Age (18-25)	0.03***	0.03***
Age (26-35)	0.03***	0.04***
Age (36-60)	-0.03***	-0.03***
Old age (>60)	-0.034***	-0.035***
Has secondary education	0.094	0.085***
Gender	0.01	0.01

Results indicate a lack of response bias between male and female heads of household is especially interesting. Male and female respondents are equally likely to answer SMS surveys suggesting that from the perspective of gender, results are unlikely to be skewed towards a certain demographic.

⁶⁷ Ann Bowling., "Mode of questionnaire administration can have serious effects on data quality," *Journal of Public Health*, Volume 27, Issue 3, 1 September 2005, Pages 281–291

⁶⁸ *Ubudehe* refers to a Rwandan system of capturing household wealth categories. See <http://www.rgb.rw/home-grown-solutions/rwandas-hgs-good-practices/ubudehe/>

Response bias in survey responses and corrections

Raw and reweighted estimates to correct for response-bias were similar across surveys. To correct for response-bias all estimates - for each survey - were reweighted using the inverse of the propensity score associated with survey completion. The propensity score was calculated by using demographic characteristics from all respondents captured during the face-to-face survey. Table 22 below highlight the differences between raw estimates from the SMS survey data and the reweighted estimates. The table indicates that reweighting responses was important to provide more accurate estimates across different variables in each of the three survey themes. However, the differences between raw and reweighted estimates are not high enough to make significant differences when making interpretations about key trends in unplanned areas.

Table 22: Raw and reweighted SMS responses by survey

Survey 1, 4, 7	Survey 1		Survey 4		Survey 7	
	Raw	Rewighted	Raw	Rewighted	Raw	Rewighted
Employment	74%	78%	74%	77%	78%	80%
Median Weekly expenditure	10,000	10,000	10,000	10,000	10,500	11,000

Survey 2, 5, 6	Survey 2		Survey 5		Survey 8	
	Raw	Rewighted	Raw	Rewighted	Raw	Rewighted
% no electricity cuts	43%	45%	55%	53%	42%	42%
% no water cuts	26%	27%	39%	38%	38%	36%

Survey 3, 6, 9	Survey 3		Survey 6		Survey 9	
	Raw	Rewighted	Raw	Rewighted	Raw	Rewighted
Median cost of travel	400	400	400	400	400	400
% walk to work	42%	44%	36%	37%	36%	36%

Within person responses

Respondents are either very likely to start/complete a high proportion of surveys (8 or more surveys) or not likely to start/complete any surveys at all. Approximately 44% of all respondents started 8 or 9 surveys, while a similarly high proportion, 37%, completed more than 8 surveys. In comparison approximately 19% of respondents do not start any surveys with 23% of respondents not completing any surveys.

The split between those who respond to all questions compared to those who respond to none or very few surveys (1 or less surveys) suggests that certain demographic characteristics are likely to contribute to a higher likelihood of responding versus not responding. Table 23 highlights the respondent profile of frequent responders compared to non-frequent responders. Overall, completers appear to be slightly younger, are more likely to have completed a secondary education and are more likely to be tenants compared to non-completers.

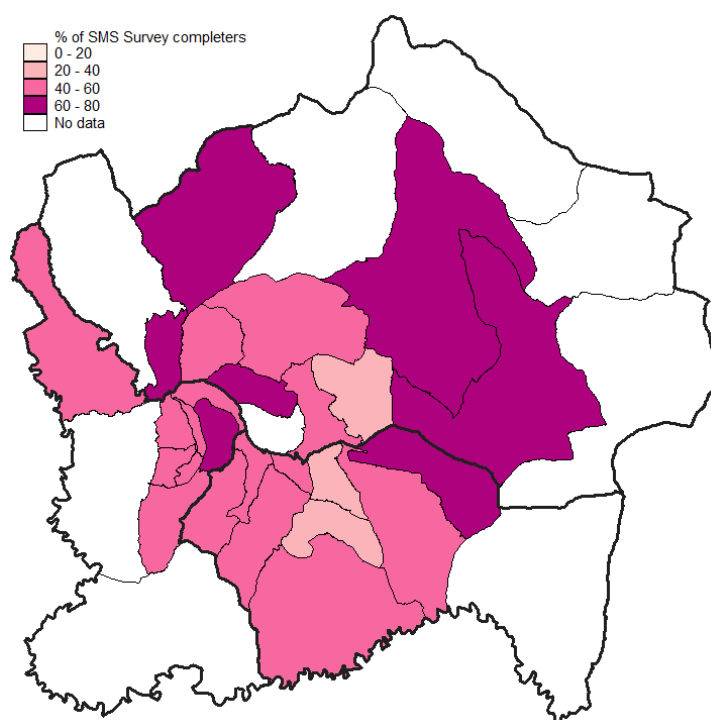
Table 23: Proportion of completers and non-completers by demographic characteristic

Demographics	Non-completers (0-1 surveys)	Frequent completers (8-9 surveys)
Age (18-25)***	3%	8%
Age (26-35)**	26%	33%
Age (36-60)**	60%	54%
Old Age (>60)***	11%	6%
Female	28%	31%
Completed secondary Education***	26%	38%
Ubudehe category 1*	7%	10%
Ubudehe category 2	35%	36%
Ubudehe category 3	57%	54%
Tenant	47%	51%
Unemployed	28%	27%

Geographic clustering

Overall, we find some evidence of geographic clustering in SMS responses, with those living further away from the CBD (>6km) responding more frequently and those living in more dense unplanned areas (>95%) responding less frequently. These differences hold controlling for other demographic characteristics such as age, education gender and *ubudehe* suggesting a “neighborhood effect” with regard to survey responses. Regardless, the distribution of responses across the city is largely uniform, indicating that SMS surveys are likely to be a useful when trying to reach a city-wide audience (See Figure 29).

Figure 29: Proportion of SMS Survey completers by sector



Self-reported reasons for non-response

Those who did not start or did not complete SMS surveys reported that network issues were the main reason for non-completion. Respondents who did not answer the first batch of SMS surveys – that is, surveys 1, 2 and 3 – were contacted to ask for the reasons why they did not respond to the survey. These respondents were asked why they either (i) started but did not complete any of the three surveys or (ii) did not start any of the three surveys. Table 24 highlights the most common reasons for not responding to the survey.⁶⁹

Table 24: Self reported reasons for non-response during first round of surveys (surveys 1-3)

	Reasons for starting but not completing survey	Reasons for not starting survey
1	Network issues (38%)	Survey came in at the wrong time (15%)
2	No answer to a question (13%)	Phone was faulty (15%)
3	Faulty phone (12%)	Network issues (14%)

Recommendations

SMS surveys are a useful means of collecting high frequency data from residents across Kigali. While the face-to-face offered more detailed insights on important demographic information across all key research themes, SMS surveys were also able to collect information on changes over time in key areas such as employment status, access to urban services, and cost and mode of transport. While this information cannot form the basis of any detailed investigation into the lives of urban residents, they offer an extremely useful and cost effective way to monitor information that might be of interest to the City of Kigali on a regular basis.

Overall, SMS surveys – as mode of research – appear to be an effective way to receive and convey information to urban residents. Response rates and survey completion rates from this study were on the very high – compared to average SMS surveys – especially considering the target population. Some important takeaways from the study include:

1. **The importance of initial face-to-face surveys:** We anticipate that high response rates were heavily influenced by the use of face-to-face surveys. We believe that conducting face-to-face surveys was important in building respondent trust.
2. **Training:** We believe that delivering a short training to respondents on how to respond to SMS surveys contributed to alleviating the fear factor and making people more likely to consent and respond.

⁶⁹ 517 respondents did not complete any of the SMS surveys after the first round of surveys were sent. However, we were only able to reach 371 respondents for phone calls despite multiple attempts to reach each of the non-respondents. Approximately 15 respondents requested changes to the phone number on which they received SMS surveys. These phone numbers were changed for later rounds of the survey.

3. **The lack of gender biases in response rates:** the lack of any significant differences in response rates between men and women is very encouraging. This is especially encouraging given that other studies looking at response rates have found differential rates, either in favour men or women.⁷⁰
4. **Geographic distribution:** Despite some geographic clustering in sectors located further away from the city centre, overall the geographic distribution of SMS responses is fairly even across the city suggesting that SMS surveys might be able to offer good geographic resolution on key research topics. Moreover, a good geographic distribution of responses might also allow for two-way communication between the city government and city residents.

The City of Kigali might find SMS surveys to be a useful tool to ask key questions or disseminate key information to city residents, both of which are key pillars of Rwanda’s overall aim of transforming urban centres into Smart Cities. These include – but are not limited to – the themes that were covered as part of this analysis. In particular, questions regarding basic service provision – and disruptions to basic services including access to water or electricity – might be of interest to the city in order to determine areas where residents might be facing major disruptions. Questions related to service disruptions were simple to answer and yielded high quality responses. In addition, the City might also benefit from using SMS technology to disseminate information to residents. These might include information on public health or public safety including flooding or landslides during the monsoon or disease outbreaks. Given that respondent geolocations are known – from face-to-face surveys and study recruitment – SMS outreach can be targeted by location or neighborhood.

⁷⁰ See Smith, W. G., *Does Gender Influence Online Survey Participation? A Record-Linkage Analysis of University Faculty Online Survey Response Behavior*, *Web Survey Methodology*, 2018

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