THE ROLE OF CADASTRAL INFORMATION IN PERI-URBAN SETTLEMENT PLANNING IN KIGALI CITY

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March, 2019

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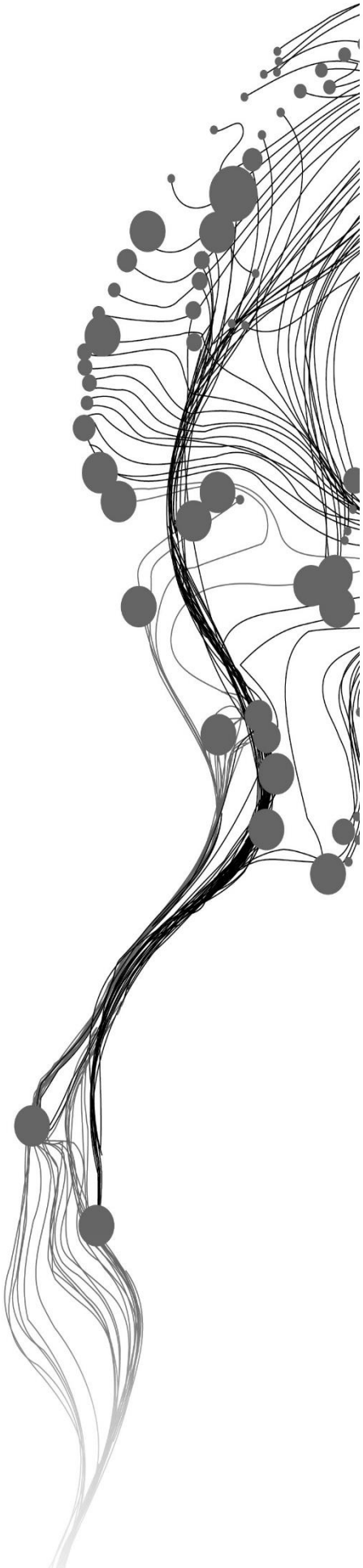

THE ROLE OF CADASTRAL INFORMATION IN PERI-URBAN SETTLEMENT PLANNING IN KIGALI CITY

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DISCLAIMER

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ABSTRACT

The world is becoming more urbanised, and the associated growth of peri-urban areas implies in most cases changes in landuse and land rights. Spatial plans are prepared to regulate land use changes, utility provision, and the related redistributions of land use and rights in the course of urbanisation. However, the process of plan implementation is often hampered due to the question of land rights in land re-adjustment. It is therefore important to understand what types of information inform the process of plan preparation and implementation. In many countries of the global south, different documents such as utility bills play a role in plan preparation and implementation. However, in Rwanda, a complete cadastre is in place; which could, in theory, be used for planning and implementation of peri-urban settlement plans. Therefore, the main aim of this study was to investigate the process of preparing and implementing a settlement plan in a peri-urban area of Kigali with specific focus on how cadastral information is used by governmental and non-governmental actors for land readjustment.

Nunga site in Kigali city was chosen as the study area based on its special preparation and implementation of the settlement plan. The site had many individuals owning different pieces of land; during the preparation of the plan, new regular and equal sized parcels were drawn, which left space for utilities, green spaces and recreational places. The implementation of the plan involved a land readjustment process (land consolidation, re-parcellation and re-allocation). In a country with full cadastre supposed to secure the land tenure; this study area was a good case to the role of cadastral information in the process of plan preparation as well as land readjustment during the implementation of the plan. This study used a mixed method approach. Qualitative method involved expert interviews with professionals in urban planning and land administration fields in Kigali as well as a focus group discussion with the committee representing people in the resettlement process. The quantitative method involved questionnaires which allowed to gather individuals' perception on plan preparation and implementation processes. GIS method involved landuse classification to map landuse change and the spatial analysis of the plan and the cadastre.

The plan implementation has brought changes to land uses, land rights, neighbourhood composition, parcel sizes, and parcel layout. The dominant landuse was agriculture before the plan; the dominant landuse is residential in the plan while the current dominant landuse is grassland, because the implementation is still ongoing. Changes in land rights occurred, the most important one being that after plan implementation no one has the rights to subdivide the land anymore. Old and new residents are relatively similar in age distribution while the levels of formal education and income are higher for new residents. The plan implementation implied land readjustment, which merged parcels, re-parcellated and redistributed them to owners. This brought about excessive changes in parcel boundaries and structure. Comparing the land acquisition and land reallocation processes in the study site with standards for land readjustment procedures according to UN-Habitat several discrepancies were found. Compensation and cost sharing were not involved at Nunga site, and the level of participation of residents differs for the phase of plan preparation (lower), on one hand, and implementation phase (higher), on the other. However, as expected cadastral information was used in both the preparation and the implementation of Nunga settlement plan. Most of its uses include the uses of parcel boundary layer as the basis to create new planned parcels and to estimate the needs for utilities during plan preparation. During plan implementation, the parcel boundary layer was used in land readjustment, specifically for land acquisition, parcel merging and land reallocation purposes. The owners' identity information was used to identify parcel ownership and status of land in the site during plan preparation in order to anticipate the changes that would need to take place during implementation. And the land title was used to claim for land rights during the implementation of the plan.

Keywords: settlement plan, cadastral information, peri-urbanisation, land readjustment, peri-urban settlement plan, land information system, cadastre, plan preparation, plan implementation

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1. Introduction

1.1. Background and justification

The world is becoming more urbanised. Today 55% of the world population lives in cities, and it is projected that 68% will be living in the cities in 2050 (United Nations, 2018). The core city in many countries is overloaded, and the urbanisation is oriented towards the peri-urban areas. The peri-urbanisation process implies dynamics in land acquisition for housing and infrastructure development, which in turn brings excessive land use changes.

While urbanisation refers to the physical expansion of cities and urban population growth, as well as changes in lifestyle and social structure from "rural" to "urban" forms, the process of peri-urbanisation focuses on the zones of expansion along the outer limits of the city and associated land use changes in the rural environment (Winarso, Hudalah, & Firman, 2015). People move from both core city and rural areas to the urban periphery; these movements are brought about by different economic, social, legal and institutional factors. These factors are termed as push factors motivating rural people to go to the peri-urban areas as well as pull factors accelerating people from the core city to the peri-urban (Rauws & de Roo, 2011). This movement to the peri-urban accelerates movement in land transactions in peri-urban areas; this is justified by Adam (2014), who found that peri-urbanisation places the area under competition for land among people of different background which results in dispossession of some people's land. Kusiluka, Kongela, Kusiluka, Karimuribo and Kusiluka (2011) in the paper on the impact of land acquisition on indigenous community's livelihood found that land acquired in the peri-urban brings problems including the loss of land, disruption of economic activities, land-related conflicts, relocations of people to poorly developed areas, inadequate and late compensation for loss of land and property. Goldman (2011) argued that in urbanisation process, there is a considerable land market transformation and speculation in the context of land rights. Land speculation and dispossession in the urban periphery, where new projects are taking place, is the main business in some cities.

At the same time, peri-urbanisation creates the need for new utilities to serve the new urban area. The settlement area is expected to have basic utilities essential to sustain life for inhabitants. Important basic utilities to keep the settlement habitable include roads, sanitation facilities, water facilities and electricity (Malano, Maheshwari, Singh, Purohit, & Amerasinghe, 2014). In peri-urban settlement processes, land is acquired by the government or investors to set up utilities in the area or inhabitants organize themselves in provision of utilities or through informal supply of utilities as Hossain (2013), for example, describes in the case of Dhaka, where local leaders and well-positioned residents organise themselves and supply the water in the informal settlement unconsidered by the government. As a result, the provision of utilities also affects land rights due to the fact that utility provision and land use patterns shape each other (Moss, 2003) and the impacts of human activities in changing the landscape is associated with changes in the cultural landscape (Li & Deng, 2017).

Planning and policy instruments are intended to regulate land use changes, infrastructure development, utility provision, and the related redistributions of land rights and uses in the course of urbanisation. For example, master plans and comprehensive development plans may be prepared by urban and regional planning agencies for specific peri-urban areas, the city or whole metropolitan regions. Several researches were done to analyse the role of spatial plans on urbanisation like the research on " urban land use change: the role of strategic spatial planning" which found that the role of spatial planning in urbanisation is found in the intentions expressed in the plans; the means to implement the plans and the external condition influencing the implementation of the plan (Hersperger et al., 2018).

However, the process of plan implementation is often hampered due to the question of land rights in land re-adjustment. For plan preparation and implementation, the government may draw on various information

sources related to land rights. It is therefore important to understand what types of information inform the process of plan preparation and implementation.

In many countries of the global south, different documents such as utility bills play a role in plan preparation and implementation. However, in Rwanda, a complete cadastre is in place; which could, in theory, be used for planning and implementation of urban master plans, and specifically peri-urban settlement plans. The cadastre records owner, the rights (relationship) and the parcel (spatial unit) information. So, the cadastral system provides the basic services for land administration (Enemark, 2010). Hence, this study describes the process of preparing and implementing a settlement plan in a peri-urban area of Kigali with specific focus on how cadastral information is used by governmental and non-governmental actors for land readjustment.

1.2. Research problem

Due to a high displacement of people to the peri-urban areas, the cities in Rwanda elaborate the settlement plans and enforce its implementation as the tool to manage the peri-urban settlement processes. However, when it comes to the implementation of the plans, land rights are affected mostly in land acquisition and reallocation processes. For example, parcels' boundaries are changed to give away the path for utilities provision or land is taken by people able to cope with the requirement of the plan. This poses the question on what role the cadastral information plays in the preparation and implementation of those plans as far as land rights are concerned. Kigali is a good case to understand the role of cadastral information in the planning and implementation of the plan because (1) it is a city that is experiencing and promoting urbanisation; (2) Kigali has a master plan since 2013 that is being implemented and (3) Kigali has the full cadastre since 2012.

1.3. Conceptual design

This research focused on the relationship between two government planning instruments meant to guide landuse and rights changes in peri-urban settlement processes; the master plan and the cadastre. One part of the master plan which is settlement plan is a concern, and I have looked into its preparation and implementation as two main concepts.

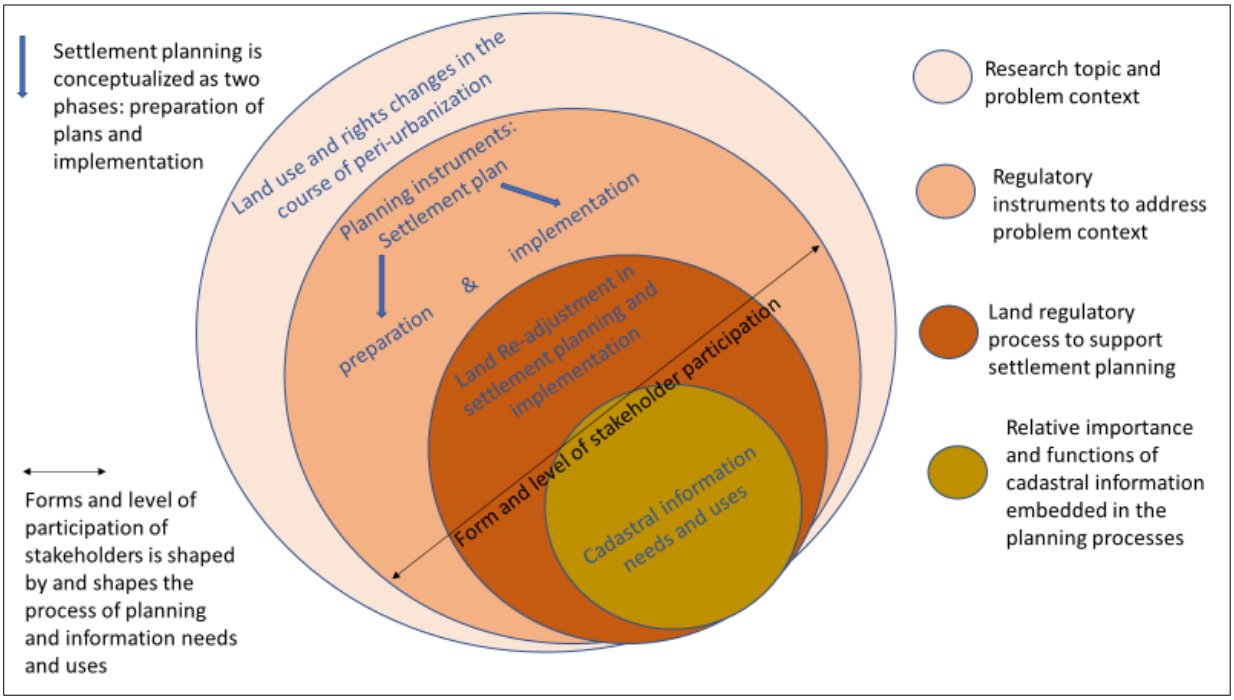


Figure 1: Conceptual design

The figure 1 captures the general idea of this study. Peri-urbanisation causes excessive landuse and rights changes. The settlement plan is prepared to regulate the landuse change. The implementation of settlement plans requires land readjustment process which interferes with land rights in case of land acquisition and reallocation. Cadastral information should play a role as a tool to secure land rights and support spatial planning due to its capability of having spatial information to the parcel level. Therefore, this study investigates the role that the cadastre plays in the preparation and implementation of peri-urban settlement plans. The main conceptual elements depicted in figure one are further elaborated on in the literature chapter of the thesis.

1.4. Research objective

The general objective of this research is to investigate the process of preparing and implementing a settlement plan in a peri-urban area of Kigali with specific focus on how cadastral information is used by governmental and non-governmental actors for land readjustment.

1.4.1. Sub-objectives

1. To describe how land uses and rights changed during the plan implementation
2. To compare the neighbourhood characteristics of the site before the implementation of the plan and nowadays
3. To investigate what, by whom and for what purposes cadastral information was used in settlement plan preparation and implementation
4. To identify the participation level of residents in settlement plan preparation and implementation?

1.4.2. Research questions

1. To describe how land uses and rights changed during the plan implementation
    a. What is the proportion of land uses before the implementation of the plan and nowadays?
    b. How was the change in land rights during the plan implementation; what types of land rights changed?
    c. How was the land for utilities provision acquired in the implementation of the plan; how many parcel boundaries changed?
2. To compare the neighbourhood characteristics of the site before the implementation of the plan and nowadays
    a. What are the differences in socio-economic status of old and new landowners?
    b. What are the pulling or pushing factors for old residents to leave and for new residents to come in Nunga site during the implementation of the plan?
    c. How happy people were before the implementation of the plan and nowadays?
3. To investigate what, by whom and for what purposes cadastral information was used in settlement plan preparation and implementation
    a. What information held by the government as well as from the intra-governmental meetings, landowners' meeting and other actors consulted was used in the plan preparation and implementation?
    b. Was the cadastral information used in the plan preparation and implementation, Why or why not and how?
    c. How was the land acquired and (re)allocated during the implementation of Nunga settlement plan, how cadastral information was used in those processes?
    d. Was information communicated back to the cadastre about the changes, how and by whom?
4. To describe the degree and kind of participation of residents in settlement plan preparation and implementation

a. Who are the main actors and what were their functions and tasks in the plan preparation and implementation?
b. To which level did the landowners participate in plan preparation and implementation?
c. How informed were people about what was going on during the plan implementation?
d. What is the level of satisfaction in the implementation of settlement plans by old and new landowners?

1.5. Thesis structure

The research was conducted in six months, and it is organized in six chapters.

1. Introduction and justification of the research

This chapter presents the background information about the topic and the gap in the research addressed by this research, the justification of the research problem, the research objectives and research questions.

2. Literature review

This chapter presents what is already published related to the topic; published materials on landuse and rights changes in peri-urbanisation process; on the role of masterplan in peri-urbanisation process; on documents to use in the implementation of peri-urban settlement plan; on the use of cadastre in peri-urbanisation process, and role and level of stakeholders' participation in plan preparation and implementation were reviewed.

3. Research methodology

This chapter presents the background of the case study, the research design, data collection method, data analysis method, sampling design, limitation of the study and the research matrix.

4. Results

This chapter presents the findings from the fieldwork as per each sub-objective.

5. Discussion of the results

This chapter discusses the findings of the study compared to the prescriptive frameworks and empirical research on planning.

6. Conclusion and recommendations

This chapter draws a conclusion and recommendations for further studies based on finding and literature.

2. Literature review

This chapter reviews the literature on the topic of landuse and rights changes in the course of peri-urbanisation, as well as associated main planning instruments and planning relevant information in support of the conceptual scheme and structure of the research objectives.

2.1. Land use change in peri-urban settlement process

Urbanisation is one of the major drivers of land use change particularly in developing countries (Wu, Zhang, & Shen, 2011). However, land use change is not limited to the core city, but the land use dynamics are highest in peri-urban areas (Hersperger et al., 2018). The peri-urban area is the transitional zone between urban and rural areas that are undergoing urbanisation. Landuse change is thus obvious in this area since it is a zone of transition (Fosudo, 2014). The first step in the development of peri-urban areas is land use change (Tosics, 2013).

Patterns of land use change deserve more attention in peri-urban areas because the land use change increases the pressure on the environment by destructing and fragmenting the natural habitat as well as loss of agriculture land (Nilsson, Pauleit, Bell, Aalbers, & Nielsen, 2013). For example, a study conducted on urbanisation and land use changes in peri-urban area of Ciawi-Indonesia found the rapid land use change in Ciawi peri-urban area where the agriculture land and wetland were reduced to 4% and 2.51% in only two years from 2013 to 2015 while the increase for villa and hotel was 3.1% (Cahya, Martini, & Kasikoen, 2018). The study by Ge and Li (2017) also found that in Shanghai, the growth of industrial land in the peri-urban area has caused the loss of agriculture and forest land where the agriculture land reduced by 37.4% in Shanghai from 1990 to 2009. Consequently, residential and manufacturing land was mixed which lead to environmental problems in the peri-urban areas of Shanghai. It was argued by Shkaruba, Kireyeu and Likhacheva (2017) that due to the high demand of land in peri-urban areas, the ecosystem of green and open spaces is under high pressure that causes ecosystem fragmentation and forests losses. Though farming in peri-urban area is a significant source of livelihoods for urban households, Settlement has been expanding to peri-urban area of Addis Ababa at the expense of losing farmland and vegetated areas (Abo-El-Wafa, Yeshitela, & Pauleit, 2018). In addition, the investments in land for housing and infrastructure in peri-urban areas transform the landscapes in complex ways (Zoomers, van Noorloos, Otsuki, Steel, & van Westen, 2017).

2.2. Land rights changes in peri-urban settlement process

The land is crucial for the enjoyment of human rights including the rights to life, the rights to food, the right to housing, the right to property and the right to development (Tura, 2018). Various tenure systems such as ownership, leasehold, customary and informal rights are exercised in peri-urban areas, because of the mix urban-rural characteristics in the area (Tacoli, 2002). However, land rights in peri-urban areas are neglected in the process of urban expansion and development, and the land in peri-urban areas is at high risk due to the high demand of land (Quan, Fei Tan, & Toulmin, 2004).

Peri-urban land is important to residents, but also attractive to urban dwellers, private small- and large-scale developers, government and non-government organisations with competing interests (Narain & Nischal, 2007). Peri-urban areas are subject to intensive construction through formal and informal processes which may bring different land tenure and administration systems into conflict and contestation (Lombard, 2015). Evidence in many African countries shows that land rights of people in peri-urban areas are neglected, which is an important factor that undermines the tenure security. For example, in Ethiopia, the process of peri-urban settlement is based on land acquisition from local peri-urban farmers, whose land is reallocated to private developers who can pay for a lease, which ends in dispossession and termination of existing land rights of the peri-urban farmers.

The impacts of peri-urbanisation on land rights is unavoidable; large number of peri-urban landowners lost their land to give way to urban development and expansion programs or the area is expropriated and redeveloped to provide basic infrastructure. The high demand of land for urbanisation put very strong pressure on land rights of local farmers (Adam, 2014). In Kigali, the out-migration from the core city to the peri-urban has influenced the irregular subdivision of land and the dynamism in the land market (Mugisha & Nyandwi, 2015). And this dynamism is supported by law governing land in Rwanda where it is stated, "*land rights may be transferred between persons through succession, subdivision, gift, inheritance, ascending sharing, rent, sale, sublease, exchange, servitude, mortgage or any other transaction, in conformity with the conditions and methods provided for by the laws and regulations*" (Government of Rwanda, 2013).

2.3. The role of master plans in peri-urban settlement process

Peri-urban areas accommodate the rapidly increasing population in many cities of the world (He, 2015); the urban growth and development require incorporating the peri-urban area into the city administration's master plan (Adam, 2014). An accepted principle is that the master plan influences patterns of landuse and landcover. Master plans contain information on the location and size of planned built-up areas in various densities, land use mixes, extension of infrastructures and strategic projects (Hersperger et al., 2018). Some land uses in the master plan are compulsory like farmland, wetland and historical areas; their development should be controlled while others are non-compulsory like residential area that might change into other uses depending on the market needs (Tian & Shen, 2011).

Master plans have played a crucial role in regulating space to cope with the demand for land, economic growth and population growth (Ge & Li, 2017). It was argued by Hersperger et al. (2018) that the role of spatial plans is found in the intention expressed in the plans, the means to implement the plans, and the external condition influencing the implementation of the plan. The study conducted by Putta and Ravadi (2014) claimed that due to unplanned conglomeration of industries and unauthorized constructions in peri-urban areas of Indian cities; master plans were prepared to preserve the land under intensive agriculture, prevent over spilling of premature urban growth in various cities, prevent the occurrence of slums and unwanted disorganised growth. After four years, it was found that the master plan played a very useful role in limiting urban sprawl.

Some master plans do not consider the peripheral areas and are hence inadequate to act as effective solutions to the dynamic reality in the peri-urban areas (Geneletti, La Rosa, Spyra, & Cortinovis, 2017). However, the Government of Rwanda has aimed at promoting planned urban development for optimal and rational development by establishing a national land use master plan, indicating how land in given areas should be used. In addition, main cities developed their master plans, for an orderly development (Mugisha & Nyandwi, 2015). In this perspective, the City of Kigali looked forward and prepared settlement plans for different peri-urban areas in line of implementing the overall Kigali masterplan. And it is stated in Rwanda land law that all land leases, transfers and uses should respect the physical/settlement plan of the area where the land is located (Government of Rwanda, 2013).

2.4. Settlement plan preparation and implementation framework

The master plan provides framework for site development plan. The site development plan is prepared by borrowing ideas from the zoning system of the master plan like: the permitted land use type, maximum floor area ratio, maximum building height, maximum lot coverage ratio, maximum open space ratio, location of the entrance, minimum car parking standard and public facilities contribution (Tian & Shen, 2011). In the context of Rwanda, the site development plan is comparable to the settlement/physical plan; it is developed to implement residential zones proposed in the master plan by allocating different uses to land in the site. A settlement plan is a fundamental guide to the physical development of the community and the decision making; it is made of maps, diagrams, charts and descriptions (Southern New Hampshire Planning Commission, 2004).

UN-Habitat promotes five principles for sustainable settlement planning; (1) adequate space for streets and an efficient street network, (2) high density, (3) mixed land use, (4) social mix (houses affordable in different price ranges and tenure types in order to accommodate different incomes) and (5) limited land use specialization. In order to implement these principles, urban development should have clear planning framework, with set criteria for public space such as streets, affordable housing and the integration of land uses (UN-Habitat, 2018).

Furthermore, the impact of the plan in shaping the future growth of the city or town depends on the degree to which the plan is implemented; without the implementation, the plan has no real value (Southern New Hampshire Planning Commission, 2004). However, the implementation of the plan is not always straight forward; many factors influence the implementation of the plan. For example, the study by Hameed and Nadeem (2008) found, "excessive delays in plan preparation and approval process, weak institutional set up, lack of coordination among government departments, inadequate financial resources, legal lacunas, lack of dissemination of plans, and lack of political will" as factors that hindered the implementation of Lahore city masterplan. The study on "Peri-urban land use pattern and its relation to land use planning in Ghana" found that social differentiation, economic and political challenges have hindered the structured and planned urban development as proposed in the master plan of Takoradi and Bolgatanga cities in Ghana. The failure to implement the plan was specifically due to the lack of legal regulations, the customary tenure system and the lack of citizens participation in the planning process (Kleemann et al., 2017).

The plan implementation depends on the role of the plan, the quality of the plan and the type of spatial plans which may be visionary plans, detailed plans, set of guidelines, plans as means of solving specific problems, plans for attracting investment and so on (Stefanović, Josimović, & Danilović Hristić, 2018). It was argued by Tian and Shen (2011) that the successful plan implementation depends on the degree of understanding of the plan, the type of the plan, the quality of the plan, the timeline to implement the plan, and the control of land market or land demand.

The purpose and the use of plan may vary, so its evaluation is challenging. Whether a plan is implemented at the city or local scale, the evaluation should be adapted to the purpose (Lyles, Berke, & Smith, 2015). Different approaches are used to evaluate the implementation of the plan. Performance and conformance approaches are used by many scholars to assess the plan implementation. Performance approach focuses on the role of the plan in making the decision; the success in plan implementation depends on its supports in decision making. Conformance approach focuses on the outcome of the implementation; the success in plan implementation depends on the outcome on the ground when comparing to the plan (Berke et al., 2006). The study by Rudolf and Grădinaru (2017) proposed the evaluation approach that links the plan quality to the implementation; communication-and action-oriented approach. An analysis of the communication- and action-oriented dimensions of the plan quality was done, and the classification of local plans according to their scores on communication- and action-oriented dimension was done. It was found that the performance of the local plans is positively correlated with communication-oriented and action-oriented dimensions. Hence, the quality of the plans is significantly correlated with their performance.

Nonetheless, the spatial planning framework should provide strategic policy documents that give ways to address land-related challenges; it should provide the principles to analyse the local context, and it should consider the planning instruments already in place (Diepart, 2008).

Referring to the above, this study discusses land readjustment as a land regulatory process to support settlement planning. Land rights documents and databases are discussed as instruments to address land-related challenges and inform the process of plan preparation and implementation. Public participation is discussed as a tool that shapes the process of planning, and information needs and uses.

2.4.1. Land readjustment during the implementation of the plan

In many peri-urban areas, land is divided into many small, irregularly shaped and sized plots with different landowners having different interests in land. This structure is a challenge to physical development with reference to planning guidelines. Land readjustment aims at reorganizing the land use and rights patterns in an area by merging parcels, installing roads and sewage system, and reserving land for public spaces like recreation, schools and other infrastructures. The idea is to redistribute planned land back to the original owners. Land readjustment provides the room for consulting and negotiating with landowners, rather than forcing them to sell their land. Again, land readjustment provides the rights of return to the landowner even though it may not be the exact original location; there is an opportunity for landowners to remain in the same neighbourhood and maintain their social links (UN-Habitat, 2018). In addition, land readjustment should comply with the landuse plan; however, the competent authority can adjust the landuse plan to match the land readjustment (van der Krabben & Lenferink, 2018).

According to UN-Habitat (2016), land readjustment should follow this process: (1) conceptualize the project: identify the legal framework, choose the location, determine the desired landuse, check the status of land records, set up the project management, conduct the feasibility study and make initial presentation to stakeholders; (2) gather data: baseline study, stakeholders mapping, detailed enumeration, participatory enumeration; (3) develop a draft plan: analyse data, draw up physical boundary of the physical plan, plan finances and land consolidation, fix boundaries of individual plots, discuss and get approval; (4) finalise the plan; (5) implement the plan: make new boundary on the ground, assign plots and manage compensation, build infrastructures, sell and develop the reserved land. Land readjustment starts with choosing the location where existing land uses are inconsistent with optimal development. Then get consent from landowners to consolidate land as a unit for planning. The final step is land re-allocation, where a smaller plot, but of higher value, is returned to the landowners according to the size or value of the land that was initially contributed. The difference in value between serviced and un-serviced land is often enough for landowners to accept reduced land sizes (UN-Habitat, 2018). Landowners contribute more by accepting to reduce their land to cover the cost of the project; the deducted portion of land is sold at the end of the project to pay for planning, administration and construction costs. Then, the remaining land is allocated to the landowners based on their shares in the project. The reallocation process is area or value-based (Yilmaz, Çağdaş, & Demir, 2015).

Land readjustment process should be self-financed. There is no standard for who pays what and who gets what. However, the costs and benefits should be fairly and equitably distributed. Land is divided into three categories to calculate the project costs: land to reallocated back to the original landowners; land reserved for infrastructures and public space; and land reserved for the district to cover the cost of the project (UN-Habitat, 2016). It was argued by Adam (2019) that land readjustment is built in self-finance or partial-finance process; it is an effective tool for financing urbanization. After land readjustment takes place, landowners receive back land that is suitable for development; for landowners whose land reduced a lot, they get cash as compensation (Lin, 2005).

Land readjustment should in theory result in a situation where everyone benefits. Landowners benefit from increased land values and the government gets a well-planned settlement without the compulsory land acquisition of land. However, land readjustment is relatively complex and requires reliance on strong local governance systems and the context of land administration of the country. This is why some developing countries are unable to implement land readjustment in practice (UN-Habitat, 2018). For example, the inefficient land information management, lack of public support and ineffective land reallocation have affected the effectiveness and efficiency in land readjustment in Turkey (Yomralioglu, Uzun, Tudes, & Eren, 1996). It was argued by LeRoyer (2012) that in developing countries land readjustment is hampered by the fact that public participation is not integrated with urban planning and there are weak land records. In China, major problems faced in land readjustment are related to the land valuation; landowners tended

to overvalue their land. And the issue of land reallocation which was time-consuming to agree with people on allocated land after re-parcellation (Li, L & Li, X., 2007).

In developed countries, various approaches exist. For instance, in Germany the government takes the lead in plan preparation and implementation. In this case, after planning for infrastructures, land is reallocated to the owners, and they get the land from the original land. In France, on the other hand, land readjustment is the landowners' responsibility; although the government might take the initiative. In Japan, local government, private entrepreneurs or landowners can take the initiative and implement the readjustment (Larsson, 1997).

Although land readjustment supports urban development, its effectiveness in land development was criticised. The study by Lin (2005) used a case study of land readjustment in Taipei, and found that land readjustment promotes land development at the project level but not necessarily at the level of an individual plot; in case of a plot with several owners, land readjustment converts the land to single ownership which deprives individual landowners to their shares. Supriatna and van der Molen (2014) said that the problem of gentrification cannot be solved by land readjustment because the distribution of serviced land is limited to original landowners but not low-income households, this is in case the owners of small plots not meeting the required size are left behind in land reallocation. It was also argued by LeRoyer (2012) that the reduction of plot's size in land readjustment causes problems in informal settlements where most people rely on extra space to earn rental income, do small-scale agriculture and/or other business activities.

2.4.2. Land rights documents used in plan preparation and implementation

Planning requires information on existing land uses like urban features, settlements, road networks, vacant land, etc. and integrate them with trends in population growth (Ricketts, 2018).

The challenges in land use plans are associated with the fact that they are less specific depending on the plan. For example, some plans contain maps with high geographical accuracy and clear boundaries; whereas other plans lack a visual representation altogether (Hersperger et al., 2018). There is a need for landuse information at the cadastral level for the city to plan a residential area (Ricketts, 2018). It is therefore crucial to think of documents that may support the plan implementation in terms of land rights recognition to establish occupancy.

According to Durand-Lasserve and Royston (2002), " any evidence of recognition by the authorities and proof of residence are considered important to establish a claim to land. Examples are ration cards of the public distribution system, identity cards, letters addressed to the family, tax receipts and electricity bills" (P. 51). In a similar vein, the UN recognizes that the security of occupancy in slums and informal settlement of some urban areas of the world is granted by the proof of payment of utility bills, oral evidences, informal customary rights and perceived secure tenure (UN-Habitat, 2004). An example of this is described by Richter (2011), who found that in Karnataka, India, the documentation of land parcels is locally and historically constructed in different ways and various documents such as electricity bills can be used to claim land rights. Another example is Hossain's study (2013) of water and land access in informal settlements Dhaka. Here non-recognition of property in an informal settlement (Boshoti) by the government has created the informal appropriation of land. In this case, the land transactions are based on handwritten agreements signed by influential local inhabitants and local leaders. The signed document is considered similar to the official registration at the government registry office and is therefore of value to the buyers (Hossain, 2013).

In Rwanda, these forms of land rights claim, and documents play a limited or no role, because of strong statutory law enforcement. The law governing land states that the ownership of the land should be evidenced by a certificate of land registration issued by the registrar of land titles (Government of Rwanda, 2013).

2.4.3. The use of cadastral information in plan preparation and implementation

The value and importance of land information as a fundamental component to achieve sustainable development are recognized by decision makers; this is due to its ability to integrate different datasets (spatial and non-spatial) to support decision making. Land administration systems linked with geospatial data deliver a range of benefits to the society, and one among them is the improvement of landuse planning and implementation (UN-GGIM, 2015). Spatial plans and cadastre are strongly connected. Spatial plans show the location of the objects in the future; in other words, it provides a guide for the new spatial development (new cadastral object) in the concerned place. Therefore, the cadastral data and spatial plans should be integrated (Bydlosz, Bieda, & Parzych, 2018).

Urbanisation in most developing countries has pushed the boundary of the core cities towards the peri-urban areas, and the land in these areas is subject to re-parcellation (Adam, 2014). Therefore, there is a need for a tool to manage the re-parcellation and secure tenure rights in peri-urban areas. In this case, the cadastre which include the geometry of the land parcel, the record of interests in land (rights, restrictions and responsibilities), the ownership of the parcel and its improvements is established for different purposes, among them, to assist in the management of land and land use planning (FIG, 1995).

The land management paradigm sees the cadastre as the engine of land administration system (Williamson, Enemark, Wallace, & Rajabifard, 2010). The cadastral map is fundamental to support transformation of illegal areas and regulate the occupation of new subdivisions and new expansion area (Amado, Poggi, Martins, Vieira, & Amado, 2018). According to the publication by FIG (1995), the cadastre provides excellent opportunities to assist in controlling the size of parcels, to prevent excessive fragmentation, to control the shape of the parcels, to avoid uneconomical subdivision of land, to control the reallocation of land, to control landuse, to control measure of land ownership, to control the value of land and to control the land acquisition for common purposes. Also, according to UN-Habitat (2016), land readjustment requires information on who owns what rights where. If those records are not available, the cadastre for an area should be created; and updating the records should be part of the land readjustment project.

2.4.4. Participation in plan preparation and implementation

Public participation provides exchanging knowledge and information to improve the spatial planning process. It is helpful in creating a consensus between stakeholders, and increase the general support for plans. All mature spatial planning systems contain procedures to involve stakeholders throughout all the processes (Hassan, El Hefnawi, & El Refaie, 2011). Public participation in decision making process is an important element in developing spatial plans; however, it is often limited to commenting on prepared spatial plan which often causes critics or rejections by the public (Bizjak, 2012). Public participation in planning process is critical in order to ensure the broad level of acceptance and ownership. Participation is addressed at three levels, (1) particular attention is given to community voices: community is considered as planning partners and not as target group; (2) involving all technical departments to establish strategic assignment during the planning and implementation; (3) local authorities coordinate the development effort made by the higher authorities; they have to negotiate and find the balance between conflicting and/or competing interests (Diepart, 2008).

In land readjustment, participation refers to a process in which landowners, tenants, public authorities, community organizations, land professionals and private developers are involved in decision making. When the land owners put together land and planned as a unit, they increase inclusivity and participation in the urban process (UN-Habitat, 2018).

The degree of participation ranges from informing the public to the full citizens' control in the preparation and the implementation of the spatial plan (Bizjak, 2012). Arnstein (1969), in his paper "A Ladder of Citizen

Participation" developed eight levels of participation that help in the analysis of the citizen participation; eight levels were arranged in a ladder pattern with each step corresponding to the extent of citizens' power. From less to high participation, (1) manipulation and (2) therapy; these types of participation correspond to prohibiting people to participate in planning or implementing projects, but powerholders educate or cure the participants. (3) informing and (4) Consultation; from these types, citizens may hear and be heard but no assurance that their opinions are taken into consideration and no assurance of changing the decision made by powerholder. (5) Placation, in this type citizens can advise but the powerholder take decision. (6) Partnership; this type refers to sharing responsibility with citizens in planning or implementation processes. (7) Delegated Power; in this type citizens delegate majority representatives to obtain majority seats in decision making. (8) Citizen Control, in this type citizens have full managerial power. However, Layson and Nankai (2015) revealed that one cannot assume that more public participation necessarily leads to more satisfaction with the decision outcomes, or the better the quality of the plan. This means that several factors influence satisfaction of urban redevelopment projects such as gender, level of education, age, time lived or stayed in the area, besides the level of participation.

3. Research methodology

3.1. Background of the case study

The research was conducted in Kigali, Rwanda. Due to a high displacement of people to the peri-urban areas, the city of Kigali is forced to manage the urban growth for the effective use of land. In this context, the city of Kigali has developed physical or settlement or physical settlement plans for the settlement sites in peri-urban areas of Kigali. The settlement plan is the detailed plan of an area zoned residential in the master plan; the details include the parcellation, utilities paths, the type of housing required, the green spaces reserve and the recreational areas. For this research, a study area was identified in Kicukiro district which is one of the three districts composing Kigali city. The study site is called Nunga and it has the size of 70.9ha. The study area was chosen based on merit for its special preparation and implementation of the settlement plan. The study area site had many individuals owning different pieces of land; during the preparation of the plan, new regular and equal sized parcels were drawn which left space for utilities, green spaces and recreational areas. The objective of the district is to see a properly planned settlement able to accommodate a big number of people on a small piece of land, with all parcels accessing road, connected to electricity and water. What is notable about this project is that landowners were asked by the district to implement the plan themselves, an approach which the district referred to as "participatory approach" to the project. As a measure to ensure implementation of the plan, landowners were given two years for implementation which resulted in many people to sell their land. In a country with full cadastre supposed to secure the land tenure; this study area is the good case to analyse the role of cadastre in the preparation and implementation of the plan. The cadastre in Rwanda includes in one database the spatial unit (parcel), the owner identity (name, ID, address, gender, age, etc.), the ownership type, land rights type and the land use. The cadastre is managed by Rwanda Land Management and Use Authority (RLMUA), this institution makes all changes and it is decentralized to the district level. The study area is shown within the administrative units of Rwanda in the map below.

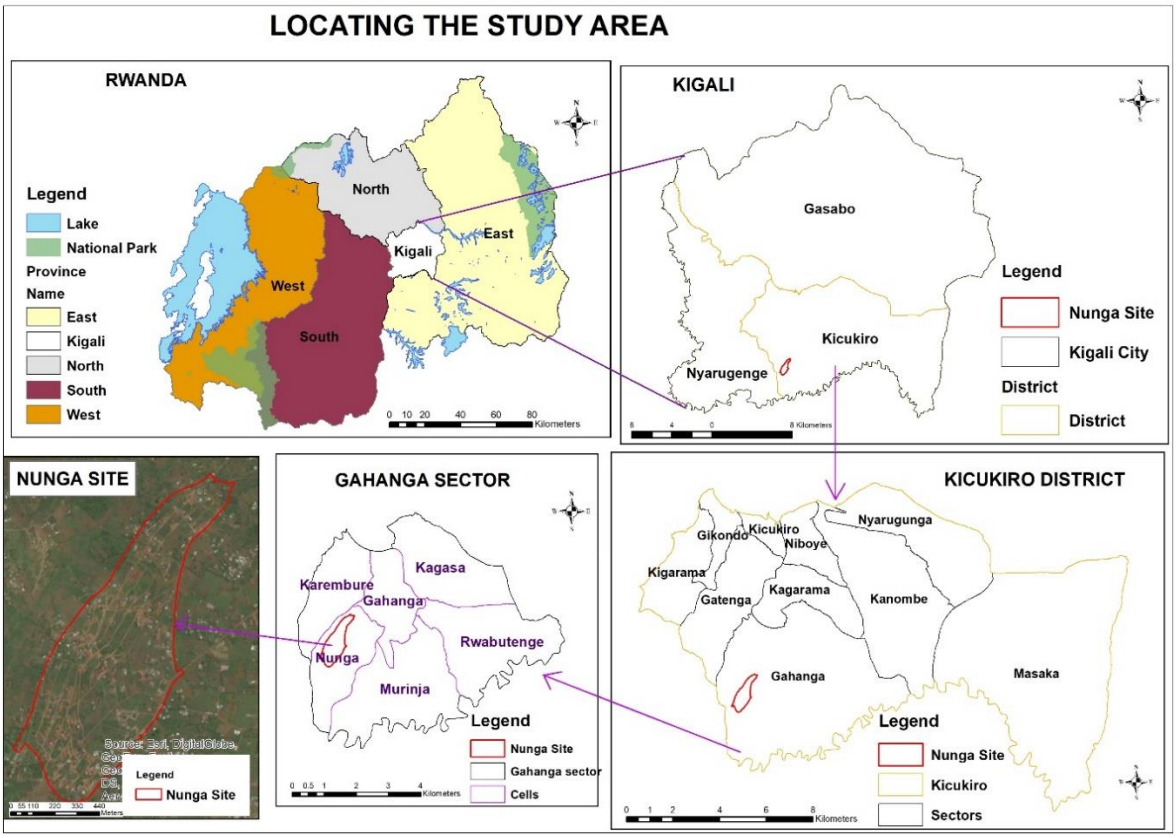


Figure 2: Study area description

3.2. Research design

This research used a mixed method approach to answer the research questions. The choice of mixed-method was based on the specific objectives of the research. Therefore, qualitative, quantitative and GIS methods were used in this research. Qualitative method involved expert interviews and focus group discussion. Quantitative method involved field survey using questionnaires. GIS method involved land use change mapping; and the spatial analysis of the plan and the cadastral map.

3.3. Research approach

The research approach is based on the specific objectives. Some collection methods apply to more than one sub-objective, for example different parts of the questionnaire were used to collect data for different sub-objectives. Therefore, the data collection and data analysis methods are described for each specific objective below.

Sub-objective one: To describe how land uses and rights changed during the plan implementation

- **Data collection method:** a mixed method was used to answer the questions under this research sub-objective. The GIS mapping was used to map land use change and to identify changes in land rights (parcel boundary changes); spatial data such as orthophoto, satellite images, the plan layer and cadastral parcels layers were used. The source of those data is provided in appendix 1. Focus group discussion with the elected committee on representing landowners during the implementation of the plan was conducted. The interview with WASAC, the District and the city of Kigali was conducted. The focus group discussion and interviews revealed the practices in utility provision. The field survey using questionnaire was used to find out types of land rights changes; the accessibility to utilities before and after the plan implementation and land rights affected during utility provision. The questionnaire was administered by 91 respondents (60 new landowners and 41old landowners).
- **Analysis method**: land use classification was used to analyse land use change during the plan implementation, and the overlay analysis was used to analyse changes in parcel boundaries, the supporting software was ArcGIS. Descriptive statistics using frequency counts were used to analyse the perception of landowners on land rights changes; and finally, the content analysis was used to thematize how land for utility provision was acquired during plan preparation and implementation.

Sub-objective two: To compare the neighbourhood characteristics of the site before the implementation of the plan and nowadays

- **Data collection method:** quantitative and qualitative methods were used to answer questions related to sub-objective two. The quantitative method involved questionnaire addressed to ninety-one respondents including old residents, who lived in the neighbourhood before plan implementation, and new residents, who acquired plots in the course of plan implementation. The qualitative method involved the focus group discussion with the resettlement committee. The questionnaire and focus group discussion helped in finding the neighbourhood composition in the site before and after the plan implementation; the reasons for people to stay or leave the site; and the perception of people on changes in the neighbourhood.
- **Data analysis method:** descriptive statistics using frequency counts and ratios were used to analyse socio-economic data from old and new residents as well as the level of happiness; SPSS software supported this analysis. Both frequency counts and content analysis were used to analyse the pull and push factors to live in Nunga site; Atlasi.ti supported content analysis.

Sub-objective three: To investigate what, by whom and for what purposes cadastral information was used in settlement plan preparation and implementation

- **Data collection method:** To answer questions related to sub-objective three, I used expert interviews with government officials involved in plan preparation and implementation; the focus group discussion; and GIS analysis. Nine key informants were interviewed from the following institutions: City of Kigali (CoK), Kicukiro District, Rwanda Housing Authority (RHA), Water and Sanitation Corporation (WASAC), Rwanda Land Management and Use Authority (RLMUA), the Ministry of Infrastructure (MININFRA). Based on local knowledge, those are institutions supposed to participate in the preparation of settlement plan, and key informants from those institutions are well positioned to know the information used in plan preparation and implementation. The focus group discussion and interviews revealed the practices in land acquisition and reallocation. The information mentioned by experts as needed for plan preparation and implementation was counted to produce the graph showing the important data needed to prepare and implement the plan. The GIS was used to compare the plan and the cadastre to see the consistency in order to validate the use or non-use of the cadastral information in plan preparation.
- **Analysis method**: Content analysis was used to develop typologies of information based on source and purpose; the software to support this analysis was Atlasi.ti. To find the most useful information in plan preparation and implementation, I used the frequency counts of words mentioned by experts as the most useful information in plan preparation and implementation; SPPSS software was used. The overlay analysis was used to analyse the consistency between the plan and the cadastre; ArcGIS software provided the environment for this analysis.

Sub-objective four: To describe the degree and kind of participation of residents in settlement plan preparation and implementation

- **Data collection method:** expert interview, focus group discussion and questionnaire were used to answer questions on sub-objective four. The focus group discussion with resettlement committee and the expert interviews conducted with the district, City of Kigali, GeoInfo Africa Ltd (private company), and Rwanda Housing Authority revealed the actors and their functions in plan preparation and implementation. The questionnaire provided the information on participation level and the level of satisfaction for landowners. To assess the level of participation, Arnstein' levels of participation were operationalized into five categories that makes sense in Nunga site.

No	Participation by Arnstein	Operationalized for assessing Nunga settlement plan preparation and implementation
1	Manipulation	Landowners were informed but there was no room for feedback
2	Therapy	
3	Informing	Officials hold meetings with landowners, but it was not clear if their input was considered
4	Consultation	
5	Placation	Landowners advise the authorities, but they judge the feasibility and take decision
6	Partnership	Landowners delegated majority representatives
7	Delegated power	
8	Citizen control	Landowners took the lead

Table 1: Operationalising Arnstein's participation levels

- **Analysis method:** the content analysis was used to develop typologies of actors involved in the plan preparation and implementation; the supporting software was Atlasi.ti. Descriptive statistics using frequency counts and ratios were used to analyse the level of participation and satisfaction during plan preparation and implementation.

3.4. Sampling design

This research used questionnaires, expert interviews, and focus group discussion. Different types of sampling were used to select respondents and interviewees. Due to the lack of official sampling frame, google earth image was used to count for visible buildings, and the number of buildings was 281. But according to the sector, only 118 among the developed houses are already occupied. Therefore, 118 people were taken as the sampling frame, from which the study targeted the entire population.

A snowball sampling was used to choose the key informants to participate in expert interviews which is a sampling technique in which few individuals are selected and they identify who become part of the interview (Kumar, 2011). In this research, the city and district planners were identified; the two respondents connected the researcher to other key informants from other institutions mentioned in the data collection part.

The selection of people to participate in focus group discussions used purposive sampling technique which is a technique in which the researcher chooses the sampling unit according to his/her analytical aim (Kumar, 2011). Therefore, the resettlement committee was selected because they represent new and old residents, thus, was able to provide all the necessary information on how the plan was prepared and implemented. The committee of course does not reflect everyone's opinion, but they have a good overview of the process; and the questionnaire also served to gain a wider perspective.

3.5. Ethical considerations

My research involved landowners, and experts in urban planning and land administration in Rwanda (private and public). Therefore, the consent was asked for responding, recording or taking notes while in questionnaire administration, expert interviews and focus group discussion. The information obtained is treated confidentially, and participants are kept anonymous. Collected data is used for research/educational purposes only. The results are honestly presented without falsification.

3.6. Limitation of the study

Though, the study was able to demonstrate the use of cadastral information in peri-urban settlement planning in Kigali; it would be preferable to conduct a focus group discussion with key informants from all institutions involved in planning to explore more about the use and limitation of the cadastral information in planning, but time of the study did not allow this.

The study could not talk with people who moved away from Nunga site during the implementation of the plan; it would be better to interview them in order to know the reason to leave the site, because different reasons were given by the committee and residents who stayed. Talking to them would also help in understanding the dynamic displacement within the peri-urban areas.

3.7. Research matrix

Research questions	Data source/ collection method	Analysis method	Output
Sub-objective 1: To describe how land uses and rights changed during the plan implementation			
a. What is the proportion of land uses before the implementation of the plan and nowadays? b. How was the change in land rights during the plan implementation; what types of land rights changed? c. How was the land for utilities provision acquired in the implementation of the plan; how many parcel boundaries changed?	-GIS mapping -Questionnaire -Focus group -Expert interview -GIS analysis	-Landuse classification -Descriptive statistics -Content analysis -Overlay analysis	- A map showing landuse changes before and after the plan - Graphs and tables showing changes in land rights - Map showing parcel changes
Sub-objective 2: To compare the neighbourhood characteristics of the site before the implementation of the plan and nowadays			
a. What are the differences in socio-economic status of old and new landowners? b. What are the pulling or pushing factors for old residents to leave and for new residents to come in Nunga site during the implementation of the plan? c. How happy people were before the implementation of the plan and nowadays?	-Questionnaire -Focus group discussion	-Descriptive statistics (frequency counts and ratio) - Content analysis	-Graphs and tables showing socio-economic status of new and old landowners -Typologies of factors pulling and pushing people to live in the site -Graphs showing the level of happiness before and after the plan
Sub-objective 3: To investigate what, by whom and for what purposes cadastral information was used in settlement plan preparation and implementation			
a. What information held by the government as well as from the intra-governmental meetings, landowners' meeting and other actors consulted was used in the plan preparation and implementation? b. Was the cadastral information used in the plan preparation and implementation, Why or why not and how? c. How was the land acquired and (re)allocated during the implementation of Nunga settlement plan, how cadastral information was used in those processes?	-Expert interview -Focus group discussion -GIS analysis	- Content analysis - Overlay analysis	- Typology of information used to prepare and implement the plan - Activity diagram showing how land was acquired and distributed - The map showing the cadastre before and after the plan implementation

d. Was information communicated back to the cadastre about the changes, how and by whom?			
Sub-objective 4: To describe the degree and kind of participation of residents in settlement plan preparation and implementation			
a. Who are the main actors and what were their functions and tasks in the plan implementation? b. To which level did the landowners participate in plan preparation and implementation? c. How informed were people about what was going on during the plan implementation? d. What is the level of satisfaction in the implementation of settlement plans by old and new landowners?	-Expert interview -Focus group discussion - Questionnaire	-Content analysis -Descriptive statistics (frequency and ratio)	- Typology of actors and their tasks in plan preparation and implementation - Graphs showing the participation level - Graph showing the level of how people were information - Graph showing the satisfaction level

Table 2: Research matrix

4. Results

This chapter presents the findings structured according to sub-objective and as such follows the conceptual scheme for this study as shown in figure 1. First, in section 4.1 to 4.3, I describe what kind of changes have taken place in Nunga site due to plan implementation in terms of changes in land uses, land rights, overall neighbourhood composition; as well as the general perceptions among residents of these changes. Then, in section 4.4, I describe in more detail the types and uses of information during the process of settlement change (plan preparation and implementation) with specific focus on the uses of cadastral information. Finally, in section 4.5. the role of stakeholders and participation of Nunga residents in plan preparation and implementation is elaborated.

4.1. Changes in land use during the plan implementation

This section describes changes in terms of landuse coverage before the plan, landuse proposed in the plan and current landuse.

4.1.1. Nunga site in Kigali masterplan

Nunga site was zoned for agricultural use in the overall Kigali masterplan. The settlement plan is in line with the overall master plan giving more details for the zoning of the master plan to enable implementation.

However, the district together with the city of Kigali chose to change Nunga site from agricultural use to residential zone, because of housing needs in Kigali; and they chose this area because it is strategic and was less inhabited compared to other areas in the district. So, the cost for redevelopment is less than a densely populated area. The figure 3 below shows how Nunga site was changed from original agricultural to residential land use in the Kigali city master plan.

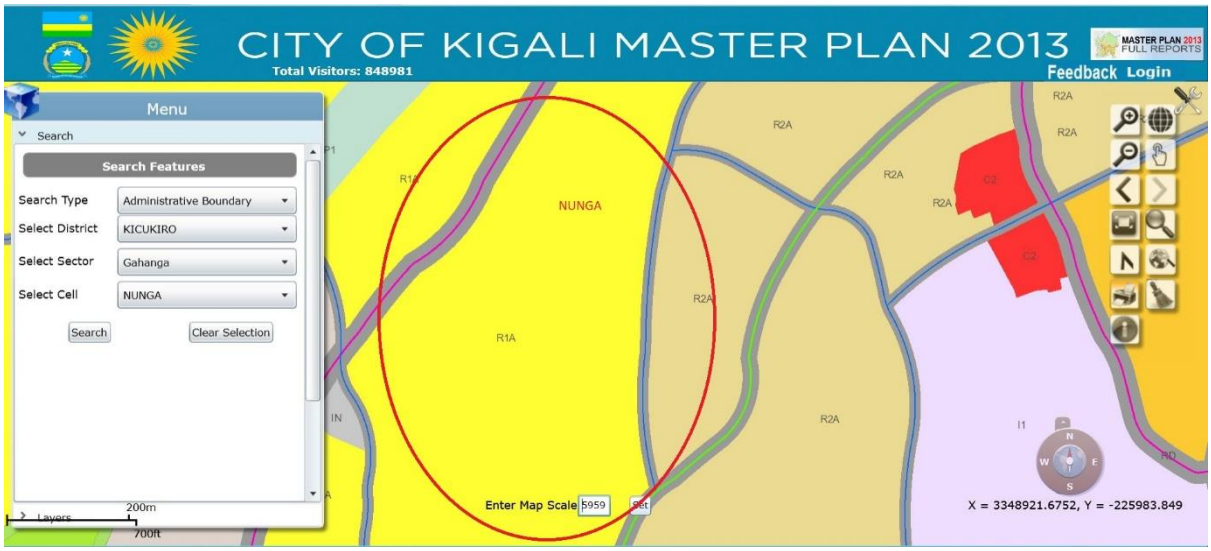


Figure 3: Web GIS Kigali city master plan overview
Source: Screenshot from the city of Kigali master plan online
(: mixed single-family residential; : low rise residential; : Neighbourhood level commercial)

I have compared land use in Nunga before the plan, landuse according to the settlement plan and actual landuse in Nunga in order to see changes overtime and the impact of the settlement plan in this area.

4.1.2. Landuse before the plan

Before the plan, Nunga site land was used as presented in the following map in figure 4.

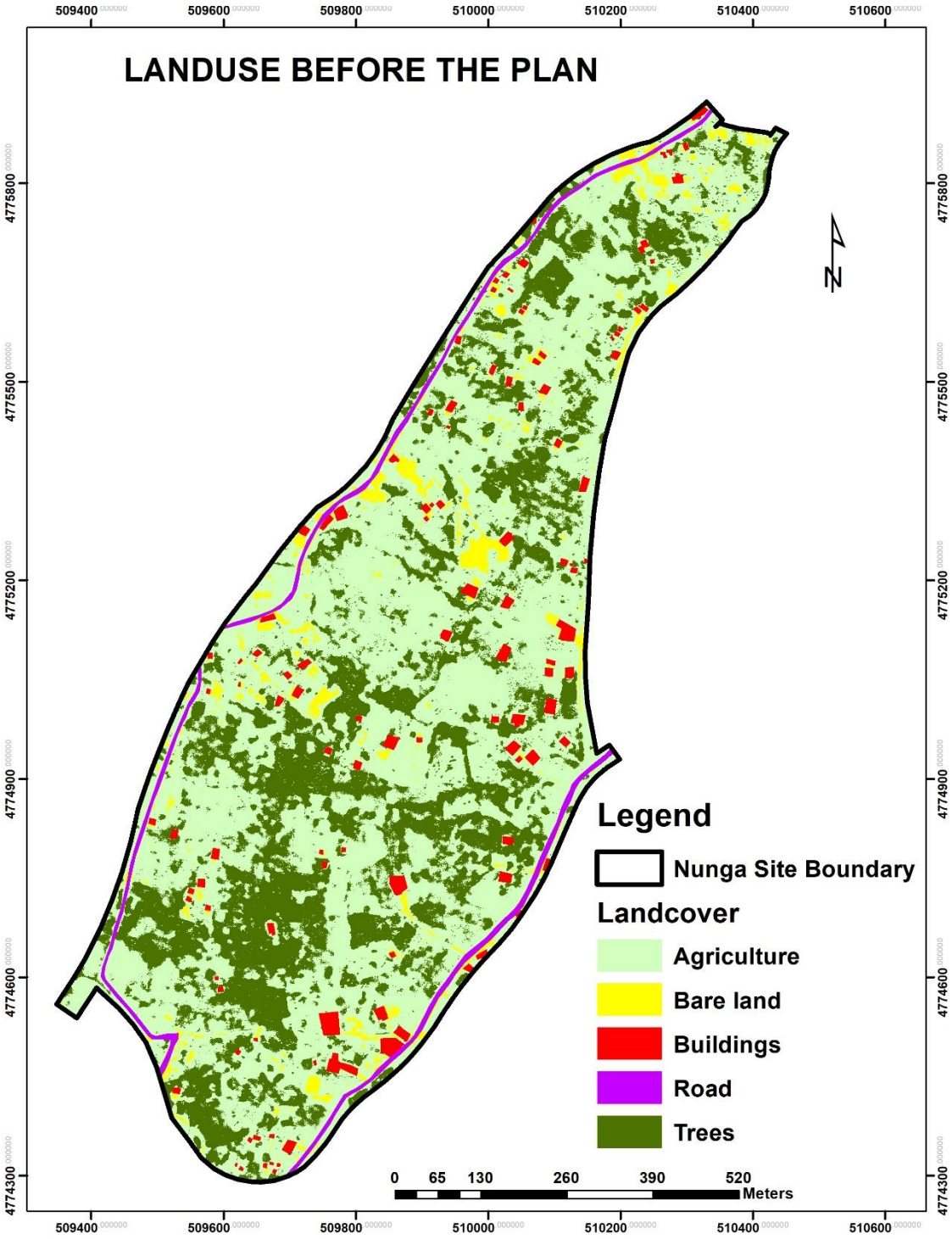


Figure 4: Land use before the plan in Nunga
Source: Map prepared by the author from orthophoto images

The figure 4 shows that the dominant landuse use before the plan was agriculture followed by trees. In this case, trees refer to forests and scattered tree plantations. Buildings were relatively few and scattered; and the site overall was nestled between two roads that lead along the NW and SE edges of Nunga settlement.

4.1.3. Landuse according to the settlement plan

The plan proposed the use of land as presented in the map below (see figure 5)

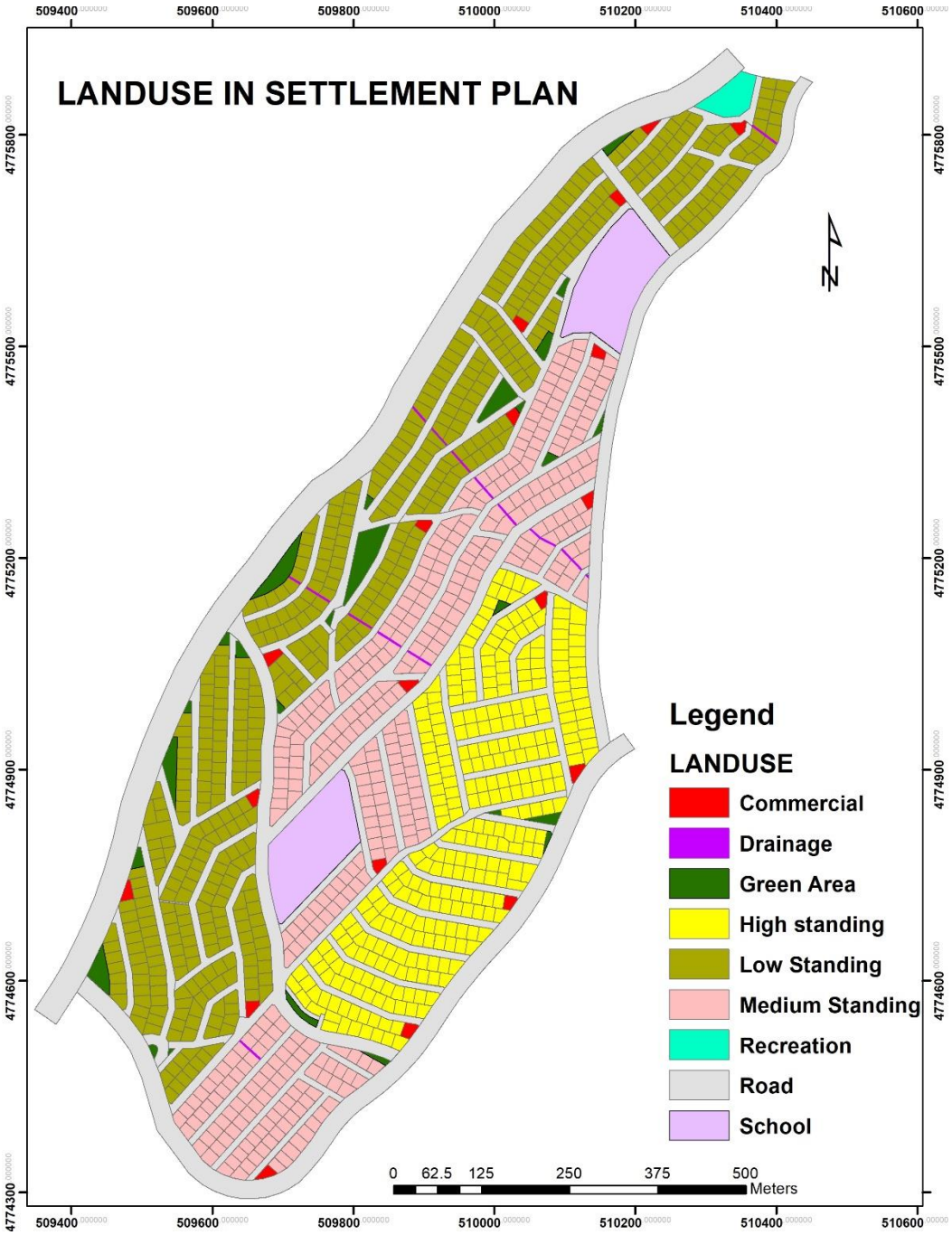


Figure 5: Nunga settlement plan
Source: Map prepared by the author from the plan layers collected from the city of Kigali

The landuse according to the plan shows that the dominant landuse is residential housing which combines high standing, low standing and medium standing housing. There is no land zoned for agricultural use, but several roads have been planned, both larger main roads leading through the settlement as well as side smaller roads. Planned commercial areas are relatively evenly spaced across Nunga; and land is reserved for two schools and green areas.

4.1.4. Current landuse at the time of writing

The currently existing landuse is presented in the figure 6 below.

Figure 6: Actual landuse in Nunga site
Source: Map prepared by the author based on current satellite image from google earth

Figure 6 shows that already land occupied by buildings has increased in comparison to the land use before the plan implementation, especially in the south and southwest of the settlement. Roads have also been put in place. Still, the dominant landuse is grassland. This is because agriculture is no longer allowed because of changes in landuse of the plan. Grassland therefor indicated many unoccupied plots waiting for construction, and grasses are grown in those plots.

4.1.5. Comparison between landuse before the plan, landuse according to the plan and current landuse at the time of writing

In order to quantify the land use changes depicted and described above, the comparison of land uses in terms of area covered before the plan, according to the plan and current is presented in the table 3. However, the plan did not indicate the size of the house, only the plot size was provided. Therefore, I compared the size of the plots planned for housing with the size occupied by building before and after the plan.

Landuse	**Area covered (hectare)**		
	Before the plan	**Plan**	**After the plan at the time of writing**
Agriculture	43.8	0	0
Residential plots/buildings	1.8 (total area of buildings)	40 (total area of plots)	12.2 (total area of buildings)
Tree plantation/grassland	21	1.3	32.6
Bare land	2.6	0	0
Road	1.7	26.2	26.1
Recreational	0	0.3	0
Social infrastructure	0	3.1	0
Total	70.9	70.9	70.9

Table 3: Comparison of land use coverage

For visualisation and interpretation purposes of landuse changes, the area covered per land use was also plotted in the graph as per the figure 7.

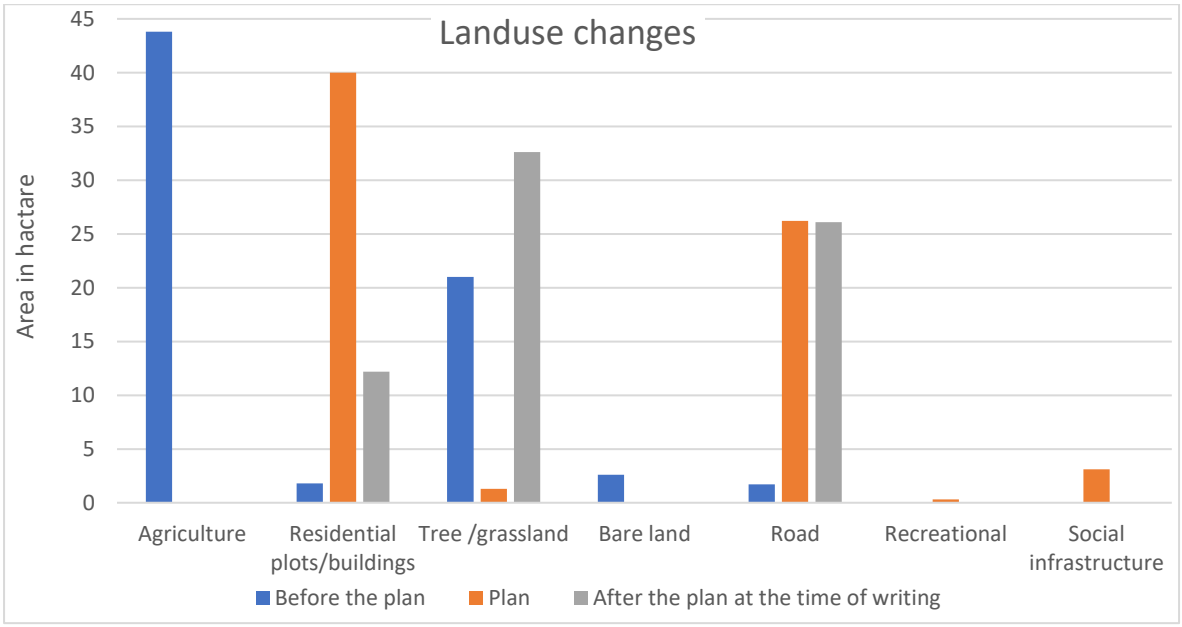


Figure 7: Landuse changes

The results show big changes in landuse; the dominant landuse was agriculture before the plan but the plan did not reserve land for agriculture and the actual uses do not comprise agriculture in the site. The dominant landuse is residential in the plan, and a third of the area planned for residential is implemented. The current dominant landuse is grassland because the implementation is still ongoing, and grasses cover unoccupied land before its development as per the plan. The implementation of road is almost completed, and there is much increase from 1.7ha before the plan to 26.2ha current occupied area. It was also noticed that there is no implementation yet on the land planned for recreational and social infrastructures.

Such drastic change in landuse in Nunga and the increase in parcel numbers (as shown in figure 5) are associated with land rights changes, also because people who used to live on agricultural can no longer engage with this livelihood activity. How land rights have changed overall in Nunga during plan implementation is described in the following section.

4.2. Land rights changes

Changes in land rights are presented in terms of types of land rights, parcels structure, and land rights affected by the utility provision.

4.2.1. Changes in types of land rights

I classified land rights into use rights, the rights to rent the land, the rights to claim for compensation, the rights to inherit the land, the rights to sell the land, the rights to subdivide the land and the right to use the land as collateral. For each of these types of land rights, table 4 provides a measure of change in land rights. The detailed table based on individual responses is provided in appendix 2: it lists the percentage of old landowners, who said that they had the respective type of right before and after plan implementation.

Land rights	Before the plan		After the plan	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Use rights	**32**	**78**	**6**	**14**
Renting rights	39	95	29	70
Compensation rights	33	80	24	58
Inheritance rights	41	100	27	65
Selling rights	41	100	36	87
Subdivision rights	**41**	**100**	**0**	**0**
Collateral rights	40	97	35	83

Table 4: Land rights changes

It was found that many changes in land rights occurred in the subdivision rights where no one has the right to subdivide the land anymore. The use rights have also changed where only 14% of respondents said that they can use the land how they want compared to 78% reported as having this right before plan implementation. 65% of respondents said that they have the right to pass on the land as inheritance presently, while the remaining 35% stated that they can no longer do this, because it is no longer possible to subdivide the land. The latter think that they do not have the right to pass on land as inheritance anymore in a de facto way because practicing the right would require the right to subdivide. Some people do not have land titles yet; consequently, they responded that they could not sell and transfer their land, nor use it as collateral. It was noticed that some respondents doubted about compensation rights, they were not sure if they have this right or not.

4.2.2. Changes in parcels structure

Another indicator of changes to land rights are the parcel boundaries themselves. It was found that all parcels have changed the boundary (see figure 8).

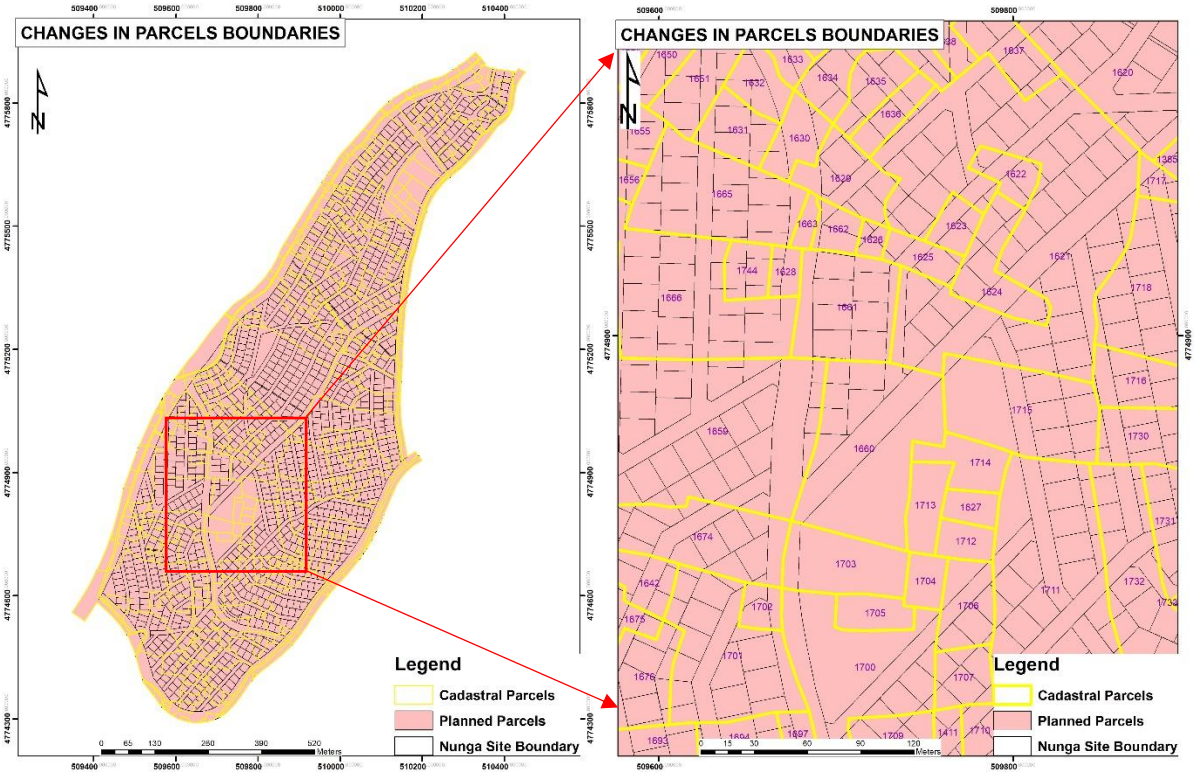


Figure 8: Parcel boundary changes

During plan implementation, all 392 parcels in the old cadastre have changed the boundary; and now the site has 1317 parcels. The plan has brought changes also in parcel structure; all the parcels have changed, some plots were merged with others to form a parcel with the required size, and others were subdivided into many plots.

Changes in parcel structure also affected some houses in the site (see figure 9).

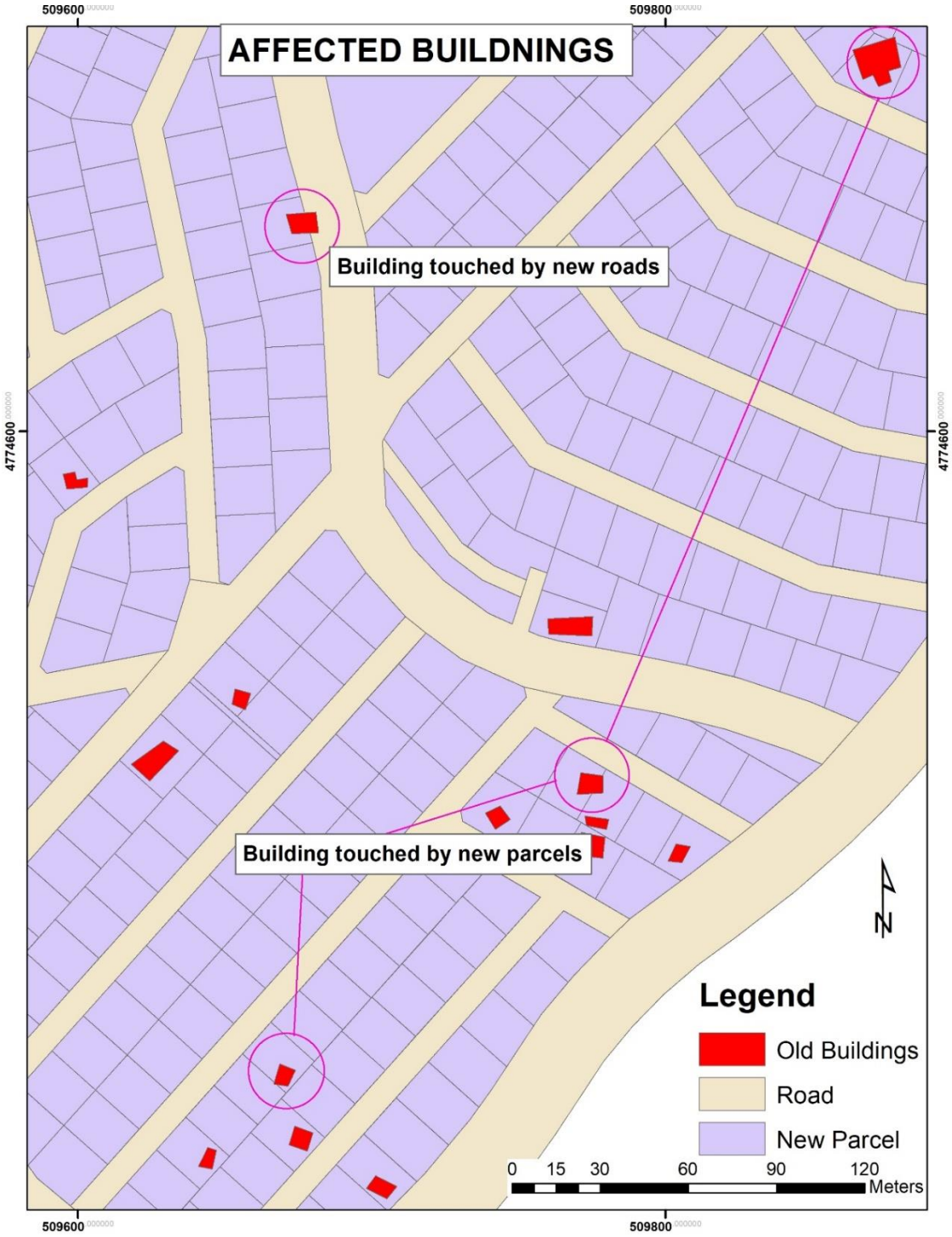


Figure 9: Affected building

The map shows some houses located across the boundaries of new parcels, and those houses are under risk of demolition when implementing the plan. It was also argued by one participant of the focus group discussion that "*I do not know if the company considered the existing houses when preparing the plan. According to the plan, the beacon was to place in the living room of my house. Can you imagine? The plan found me here, and I want to stay here; I wrote to the district to change the boundary of the plot, but I am still waiting for the response.*"

4.2.3. Utility provision and land rights

Before the implementation of the plan, the majority of people did not have access to utilities such as road, water, electricity and sewage system, but after the implementation of the plan, the accessibility has increased.

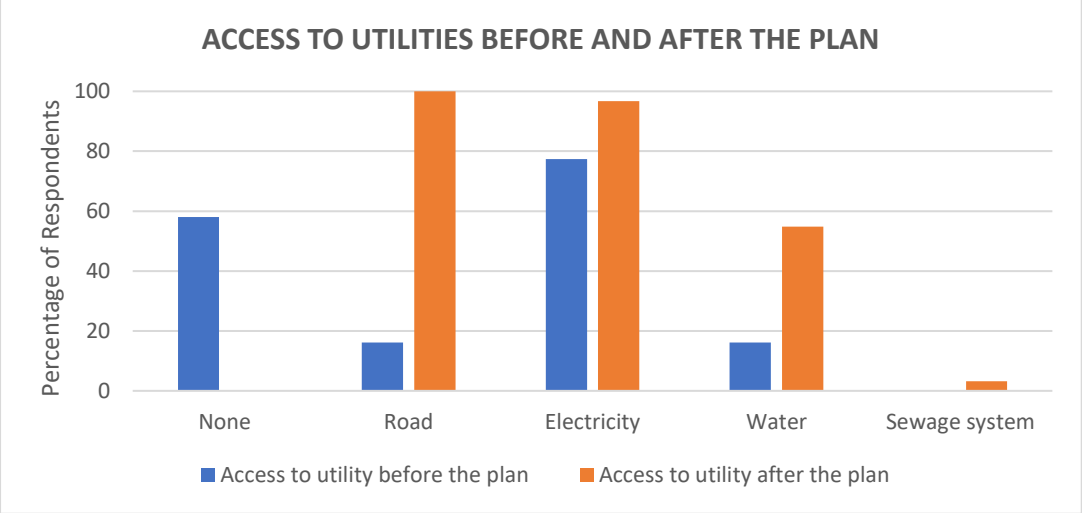


Figure 10: Access to utilities before and after the plan

The figure 10 shows that more than 50% of respondents did not have access to any of the above utilities before the plan but nowadays everyone has access to roads, 93% of respondents have access to electricity, 55% of respondents have access to water and 3% of respondents have access to sewage system. Furthermore, it was noted during the fieldwork that the utility provision in the site was still ongoing.

The increase in accessibility to utilities in the site required individual land taken for those utilities. Many plots were affected by utility provision as shown in figure 11 below for the case of transportation utility.

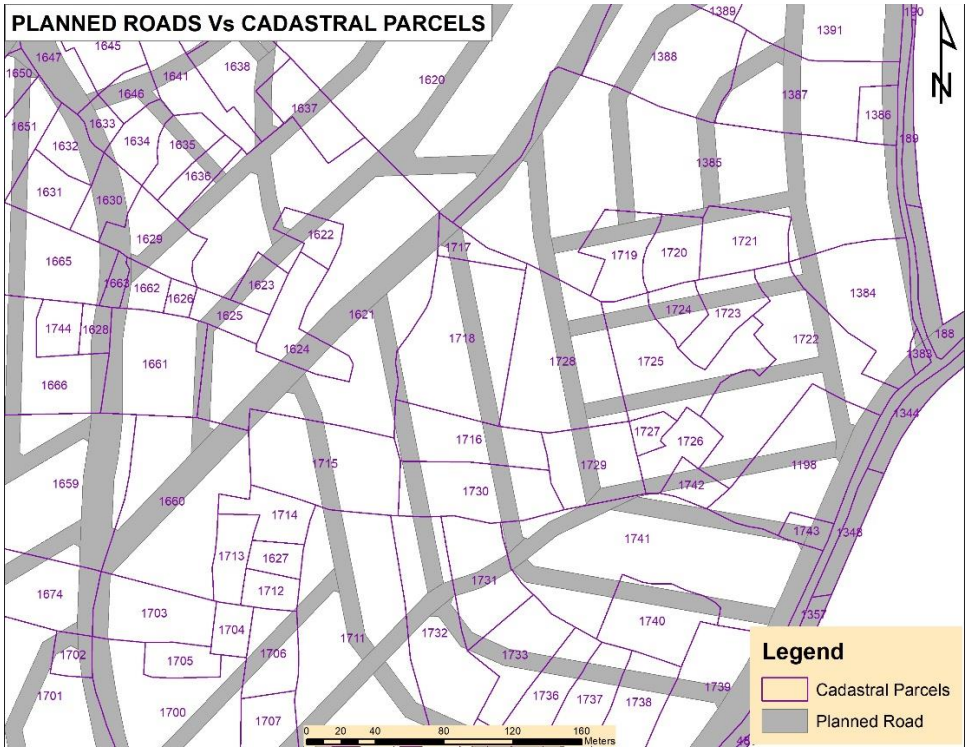


Figure 11: Affected plots by planned roads

The map shows that the majority of plots were affected by planned roads, where they were planned to pass through individual plots.

I also asked residents if their land was affected by utilities provided in the site; to which 83% of the respondents answered positively (see figure 12).

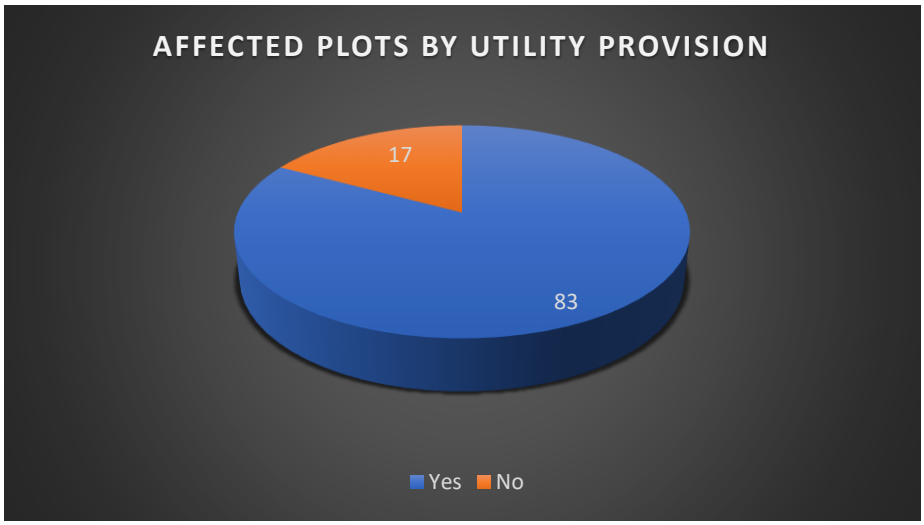


Figure 12: Affected plots by utility provision

Normally, when the utility providers want to supply utilities in the site, they negotiate with landowners, expropriate and compensate them, but it was different in Nunga site. It was agreed between the landowners and the local authorities that the land that will be taken by roads and water infrastructures would not be compensated. The reason given to landowners was the fact that the land value would increase with access to utilities, like road and water facilities; and that such increase in land value could be considered a form of compensation.

There are different views on this matter. From the interviews it was found that there was no budget for infrastructures and compensation at the district level as it turned out during implementation, with more or less forced about this solution. But some government officials consider it a win-win situation where the government settled people in a planned manner without the budget, and the value of the land increased with access to the infrastructures. Other government officials also considered it a kind of best possible arrangement noting that, "*it is the responsibility of the government to provide utilities to people because they pay taxes, I consider what was done in Nunga as kind of arrangement.*" Others said that the lack of money for expropriation had pushed the district to come up with that idea and at the end it has worked because the value of land has increased.

What is surprising is that landowners did not share the cost for public infrastructures. In fact, roads took portions of land from some landowners; for those whose lands were not taken by infrastructures, they were safe to keep the entire land. Owners whose lands were taken by infrastructures did not get compensation as it was agreed between landowners and government officials before the plan. However, new residents, who bought the land in the site paid for public infrastructures through development fees.

Given that in the end, increases in land value were presented as a form of compensation for land lost to utilities according to the government's argument, I wanted to know how this was reflected in the experience of residents by asking residents about the land value before and after the plan. The result is presented in figure 13 below.

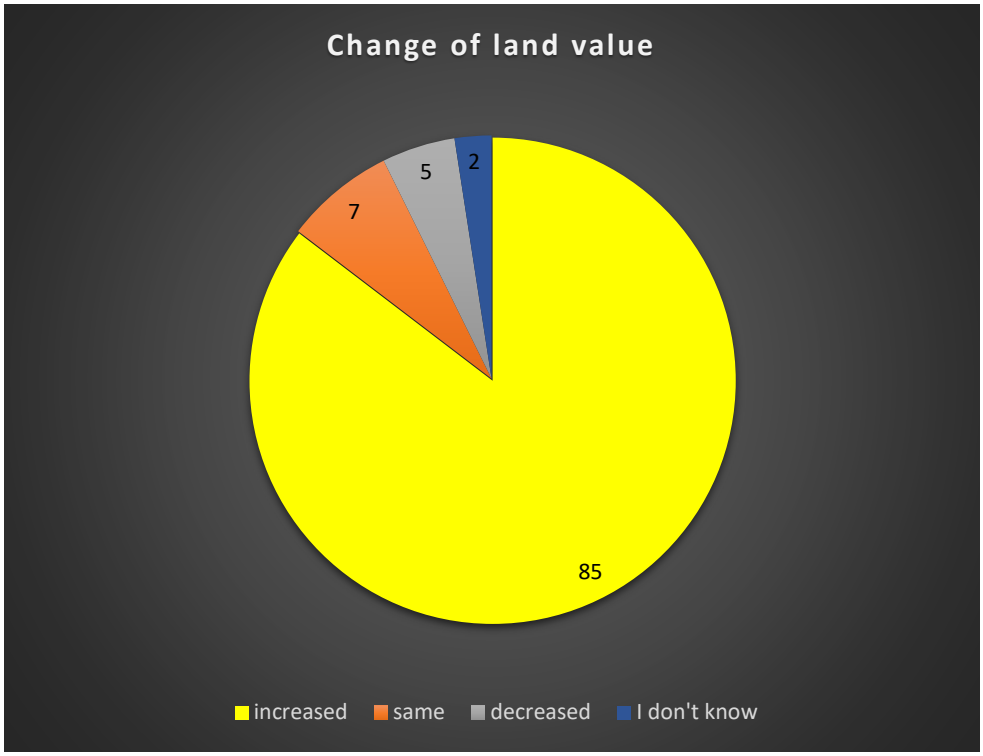


Figure 13: Changes in land value after the plan

Residents confirmed the increase of land value where 85% of respondents said that the value of their land has increased, 7% of respondents said that the value did not change, 5% of respondents said that the value of their land has decreased and 2% said that they do not know if the value increased or decreased. However, those who said that the value has decreased are the ones who lost most land to utility development.

According to FAO (2002), landuse and land rights determine the living condition in an area. The substantial changes in landuse and rights in Nunga site during the implementation of the plan were not merely a matter of changes to the physical layout of the settlement and related changes in land values but is association with significant changes in the population and overall character of the settlement. Many people moved away, while others moved to Nunga. The following section describes changes in neighbourhood characteristics and the reason for people to move to and from the site.

4.3. Changes in neighbourhood characteristics of Nunga site

The settlement plan has brought many changes in Nunga neighbourhood identity. Some residents have relocated but many new residents moved to the site, and the number of inhabitants has increased. In this study, two categories of people were differentiated to see the impact of the plan on the neighbourhood: old residents, who lived in the neighbourhood before plan implementation, and new residents, who acquired plots and houses in the course of plan implementation. The changes in the neighbourhood characteristics will be described in more detail in the following sub-sections.

4.3.1. Socio-economic characteristics of the neighbourhood

Nunga site was inhabited by 400 people before the implementation of the plan while nowadays it is inhabited by 1117 people, from which 294 are old and 823 are new. It means that 106 people moved from Nunga site. The old landowners who stayed could afford the requirements of the settlement plan by creating other means of living rather than agriculture. Some old landowners kept more than one plots from

their land after re-parcellation, this is why the number of parcels (see section 4.2.2) is bigger than the number of owners.

In order to describe changes in the population of the neighbourhood, socio-economic data were collected and summarized in appendix 3. The emphasis was put on age characteristics, educational background, source of income and monthly amount of income of respondents based on which the differences in the socio-economic status are described.

Differences in age distribution

Four groups as categorized by IndexMundi (2018) were used to categorize people in age: 15-24 years (early working age), 25-54 years (prime working age), 55-64 years (mature working age), 65 years and over (elderly).

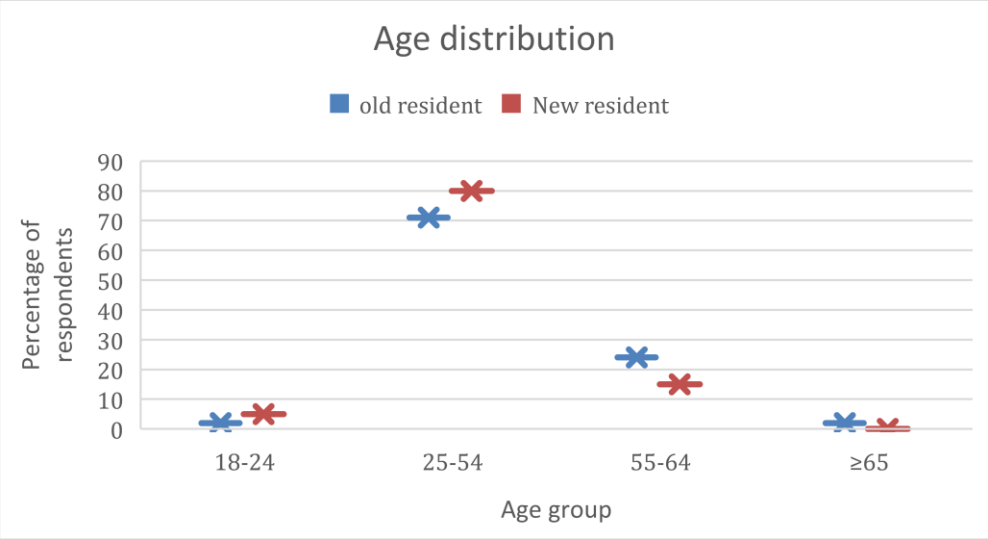


Figure 14:: Age distribution in Nunga site

The age distribution as shown in figure 14 for both old and new residents is relatively similar. The majority of both groups is of prime working age between 25 and 54 years of age with 71% of the old, and 80% of the new residents belong to this age group. In the higher age group of 55 to 64 and above, the percentage of old residents is higher than the percentage of new residents while the inverse is the case in the early and prime working age. Otherwise, there are no noticeable differences, but overall this indicates that the site attracts younger people.

Differences in educational attainment

While differences between old and new residents in terms of age distribution are not very pronounced, there are clear differences in education level of the two groups. The majority of old residents did not go to school or attained primary school while for new residents 93% attained secondary school or higher as shown in figure 15.

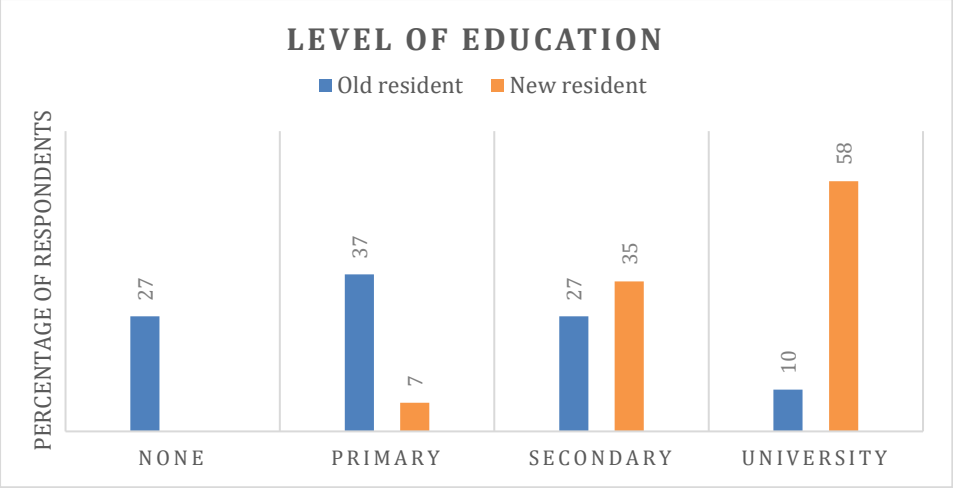


Figure 15: Educational level of new and old residents

It was also found that at least everyone from the new resident group attended the school and the majority attained the university level while 27% of old resident group did not go to school and the majority attained the primary level (37%). This gives the difference in education level of two groups; new residents are more educated than old resident.

Differences in employment and income levels

Data on income (source and monthly salary) per respondent was collected to see the differences from two categories (old and new residents).

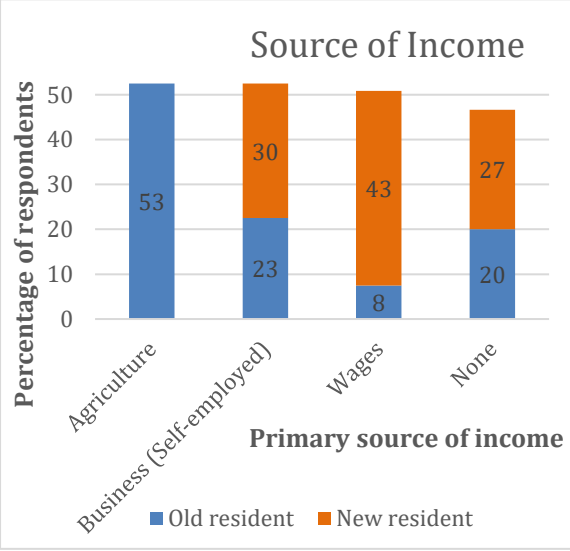


Figure 16: Source of income

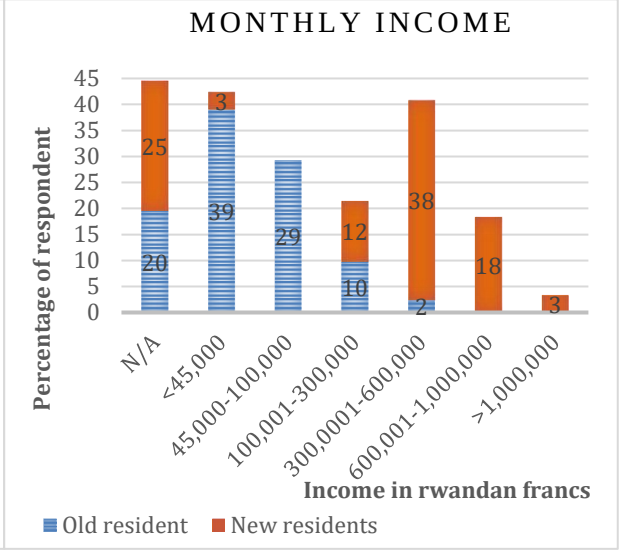


Figure 17: Monthly income

The figure 16 on the left shows that the majority of old residents are self-employed and/or subsistence farmers while the majority of new residents are working on salary basis. The figure 17 on the right shows that the income of new residents is higher than the income of old residents, where 71% of new residents earn more than 100,000 Rwf per month while only 12% of new residents earn more than 100,000 Rwf per month. No one in old residents group earns more than 600,000 Rwf while 21% of new residents group earn more than 600,000 Rwf. There is a big gap in income between the two groups. However, the high unemployment was noticed from two groups where 27% of new residents and 20% of old residents are jobless (see figure 16)

With the influx of new residents, the neighbourhood composition has changed. While old and new residents are relatively similar in age distribution, the levels of formal education and income are higher for the new residents.

4.3.2. Push and pull factors for residents in Nunga site

Another dimension to describe changes in neighbourhood characteristics pertains to the reasons for people moving to and from the site. In the following sections the factors which influenced old residents to leave and new residents to come to the site, are classified as push and pull factors respectively

Push factors: why (old) residents left Nunga during plan implementation

It was found that 106 out of 400 landowners left the site during the implementation of the plan. Old residents who are still living in the site and resettlement committee were asked about what could be the reason for people to leave the site during the implementation of the plan. According to residents there are three main push factors; while the committee emphasized on one of them.

The current residents explained as most important reasons for neighbours and other old residents having left the area the following: (1) the inability of local people to comply with the requirement of the plan (types of houses proposed); (2) people who wanted money to start a new life elsewhere and (3) people who had no other options and had to sell their land (i.e. change of primary activity, and/or the plot is planned for social facilities like school).

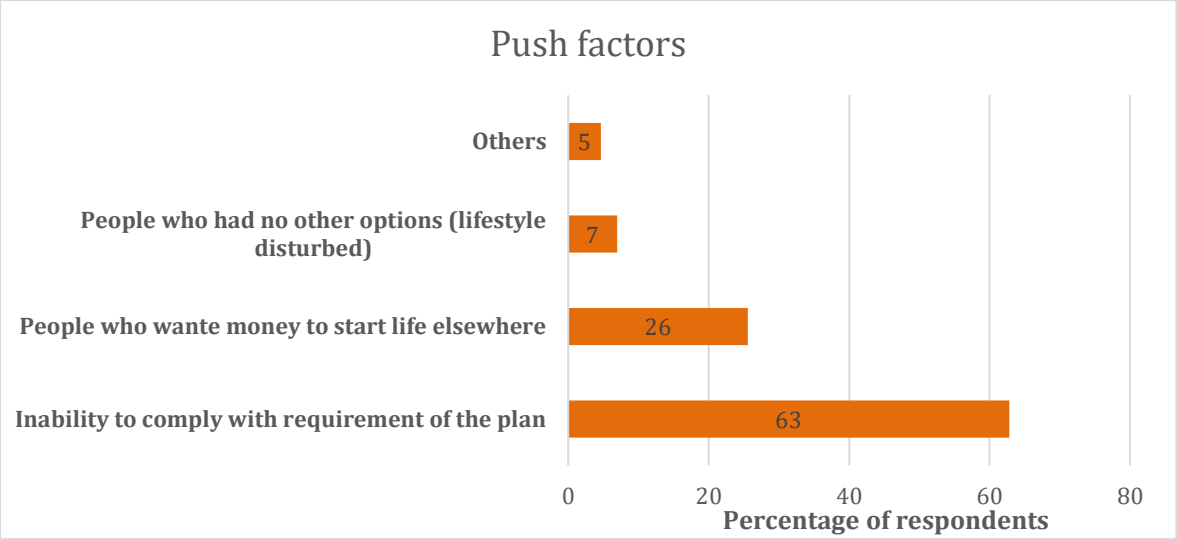


Figure 18: Push factors for residents to leave the site

Regarding the first main reason, it was found that 63% of respondents think that the main reason for people to leave the site is the inability to comply with the requirement of the plan. The plan proposed three categories of buildings in the neighbourhood; high rise buildings which are buildings with higher than four floors, mid-rise buildings with one to four floors and low-rise buildings with ground floor only. The figure 19 below shows required houses in the site.

Figure 19: Pictures showing housing development in Nunga site
Source: Pictures taken by the author from the field work

The first picture (upper left) shows mid-rise houses in the site; the second picture (upper right) shows low-rise houses in the site and the third picture (bottom left) shows that the area is still under construction and the fourth picture (bottom right) shows that there are still vacant plots to build. The three categories of houses were planned in order to allow also low-income people to afford to build in the site. However, it was revealed that some residents could not afford even the low-rise housing (of the kind shown in figure 19, bottom left) and they decided to move and that is the first push factor.

Regarding the second reason, the majority of Nunga site inhabitants before the plan were low income. During the implementation of the plan, some residents got enough money to start life elsewhere depending on the size of land they had. Therefore, they wanted to get profit from their land, and they chose a suitable place for them to start new life. This is the second push factor.

The third reason, 7% of old residents said that people who left the site did not have other options because their normal lifestyle was disturbed. For example, some people were farmers and they cannot practice agriculture in the residential area. And lastly, 4% of respondents gave other answers like: "I do not know the reason; people who left have their own reasons; people who left did not understand the benefit of the plan."

The main reason given by the resettlement committee on the push factors corresponds with the third reason found during the questionnaire administration with residents. For the committee, the most important reason to leave the site is landuse change "*the area changed from agriculture to residential, and most people were farmers. So, tell me what a farmer can do in this site? It is better to go where you can still farm if it is your main activity*" said the committee. Therefore, some people who only practice agriculture sold their land and moved to rural areas where they can buy enough land to continue their activity.

The study could not find people who left the site to ask them about the push factor. Neighbours who stayed in the site gave the information. However, the study found new residents and asked them about the pull factors, which are described in the following section.

Pull Factors: why (new) residents moved to Nunga during plan implementation

There is a high demand for affordable houses in Kigali. Around 60 percent of Kigali city dwellers are renting houses (Tashobya, 2015). The majority of city dwellers do not have their own houses, and they cannot afford to build houses in the core city of Kigali. This is why the development is oriented towards the peri-urban areas. The results show that the pull factors are related to housing needs in Kigali as shown in figure 20 below.

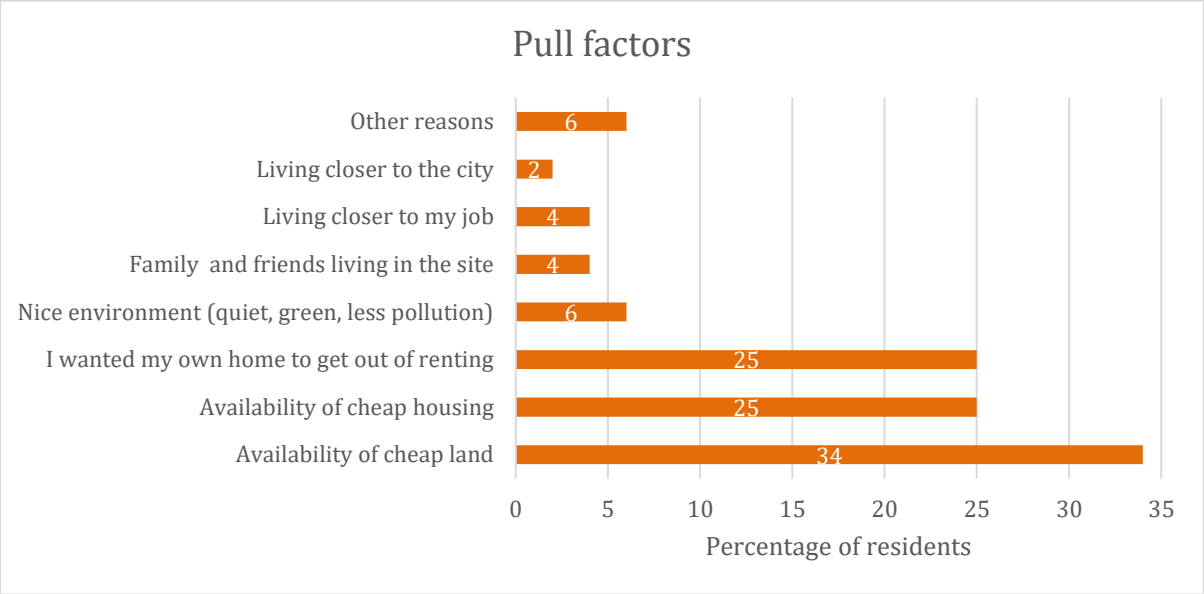


Figure 20: Pull factors for residents to come to the site

The results show that the main pull factors are the availability of cheap land and housing in Nunga site compared to the core city, and the will of people to get their own house and leave the rental market. In addition, it was found that most new residents came from the urban areas of Kigali.

4.3.3. Perception of people on the neighbourhood changes

The plan has brought many changes in the neighbourhood. The changes in neighbourhood composition and reasons for movement have already been described above. Other changes include those directly related to planning objectives: new infrastructures and changes in land uses, which in turn bring about new living conditions. It is important to hear from local people how they perceived those changes. The findings are presented in the following figure 21.

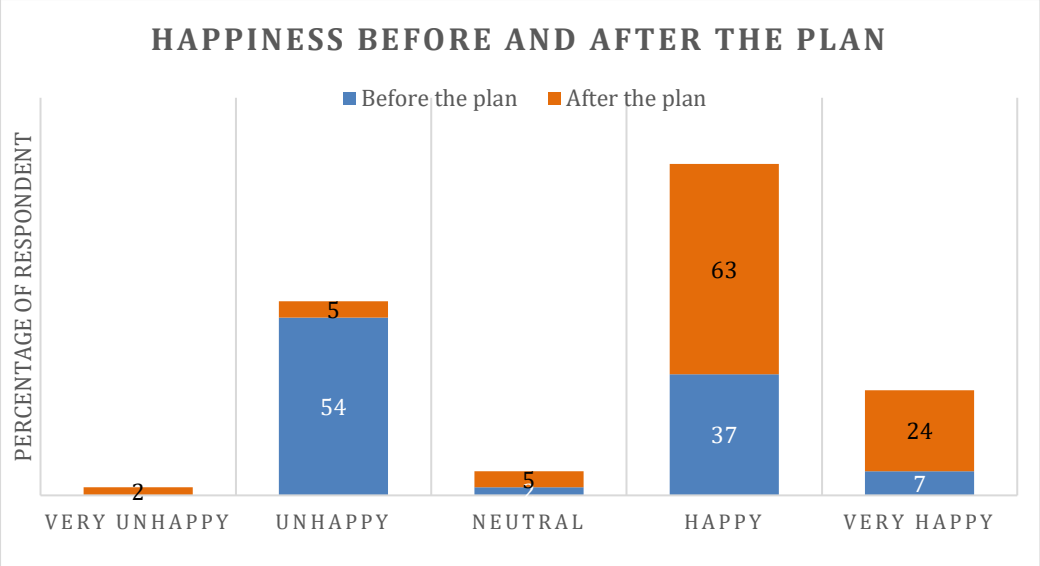


Figure 21: Level of happiness before and after the plan (among old residents)

Overall, the majority of old residents, who have stayed in Nunga during and after plan implementation, are happier now than before the plan; 54% of residents were not happy while after the plan 63% are happy and 24% very happy; it means that the plan has brought worthy changes.

"Happiness," however is only a relatively vague indicator of people's perceptions and could be related to a variety of factors and have different reasons. For example, the resettlement committee confirmed the overall sense of satisfaction with changes while emphasizing aesthetic values and social cohesion as reasons, as expressed in the following quote from the focus group discussion: "*we do not mind with the difficulties, challenges or how tough the implementation was because we can see the good outcome from the plan. The area was rural but now we are proud to live in this beautiful and developed neighbourhood. All residents of the neighbourhood are so good. We visit each other, we celebrate together, we help each other, we have whatsApp group; it is as if our neighbourhood is a big family*".

The notion of "neighbourhood as big family" and emphasis on different forms of socializing in the neighbourhood, that the committee expressed, relates to my survey item about residents' "feeling at home." Here, I asked both old and new residents about how they feel at home in the neighbourhood after the plan implementation.

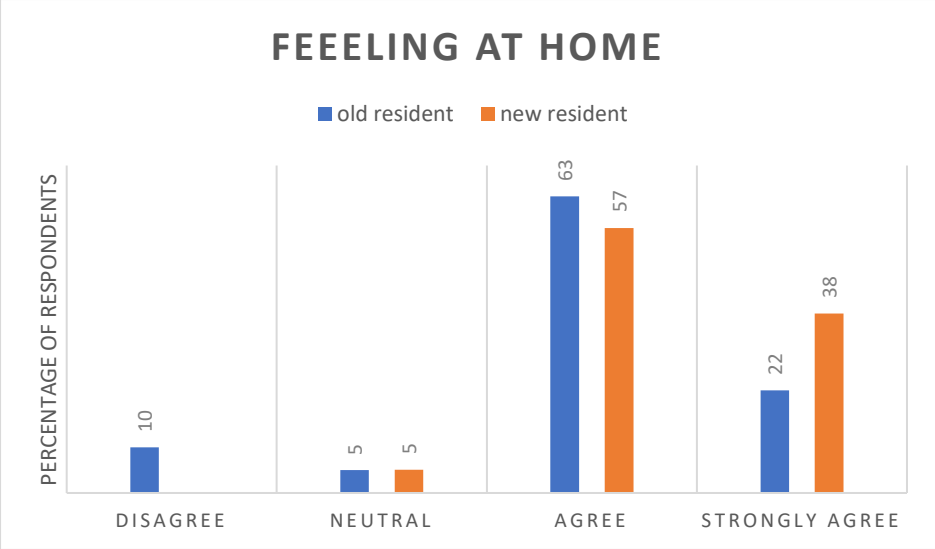


Figure 22: Feeling at home in the site for both new and old residents

It was found that the majority of new and old residents feel at home in the neighbourhood after the plan implementation. Surprisingly, 10% of old residents said that they do not feel at home; I was curious about what could be the reason. During the focus group discussion, I found that old residents are not confident, because they see themselves living together with rich people and their houses are still in poor conditions. They compare themselves with the newcomers and get a sense of social differentiation related to the category of income.

After having described what changed in the settlement and how these changes are generally perceived by residents in the preceding sections, the following section 4.4. dives deeper into the role of information, especially the uses of cadastral information, during the process of change, namely during plan preparation and implementation.

4.4. Information uses in Nunga settlement plan

In order to learn about the role of cadastral information in plan preparation and implementation, the scope of inquiry included the broader context of information use. Therefore, this section addresses information needed to prepare and implement the plan; the use of cadastral information and its update; the role of cadastral information in land acquisition and reallocation, as well as the data sharing practices during the implementation of the plan.

4.4.1. Information needed in plan preparation and implementation

Different institutions needed different data depending on their role in settlement plan preparation and implementation.

In plan preparation, data needed are presented in figure 23 where the frequency of the word being mentioned by interviewed experts is an indicator of importance of the information in plan preparation.

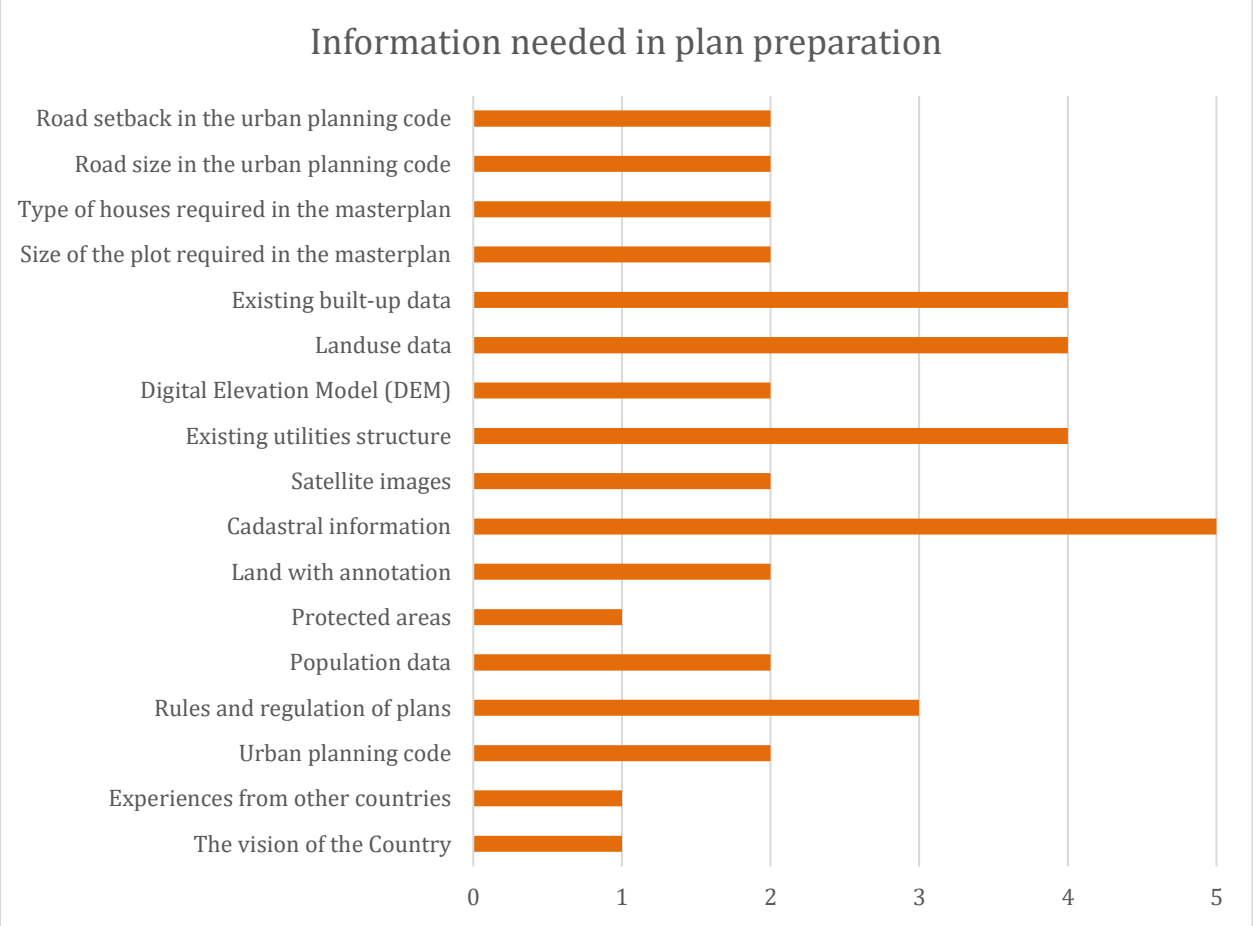


Figure 23: Frequency of information needed in plan preparation

The cadastral information is mentioned most frequently followed by land use data and related to this data on built-up area, as well as utilities structure and information regarding rules and regulations of plans.

Information needed in plan preparation is also presented in table 5 in detail, where the kind of information needed is per institution. Here we see that most needed information was not only mentioned frequently by a respondent from one or few institutions, but that the importance of some of types of information also applies to various institutions.

Type of data \ Institution	MININFRA	WASAC	RHA	CoK	District	GeoInfo	Frequency
The Vision of the Country	✓						1
Experiences from other countries	✓	✓					1
Urban planning code	✓		✓				2
Rules and regulation of plans	✓		✓			✓	3
Population data	✓	✓					2
Protected areas			✓				1
Land with annotation				✓	✓		2
Cadastral information		✓	✓	✓	✓	✓	5
Satellite images		✓				✓	2
Existing utilities structure		✓	✓		✓	✓	4
Digital Elevation Model (DEM)		✓				✓	2
Landuse data			✓	✓	✓	✓	4
Existing built-up data			✓	✓	✓	✓	4
Size of the plot in the masterplan					✓	✓	2
type of houses in the masterplan					✓	✓	2
Road size in the urban planning code					✓	✓	2
Road setback in the planning code					✓	✓	2

(✓: yes, the data is needed),

Table 5: Information needed per institution in plan preparation

Cadastral information is the most needed information in plan preparation mentioned by five institutions and followed by data on the land use, existing built-up and utilities in the site mentioned by four institutions respectively. It was also revealed from table 5 that institutions at the central level need general information, for example, vision of the country was mentioned by the ministry of infrastructure, while institutions at the local level need more detailed information, for example, the district mentioned the plot size, the type of houses, the road size as the most important information for plan preparation.

During the implementation of the plan, the data needed are presented in figure 24 where the frequency of the word being mentioned by interviewed experts is an indicator of importance of the information in plan implementation.

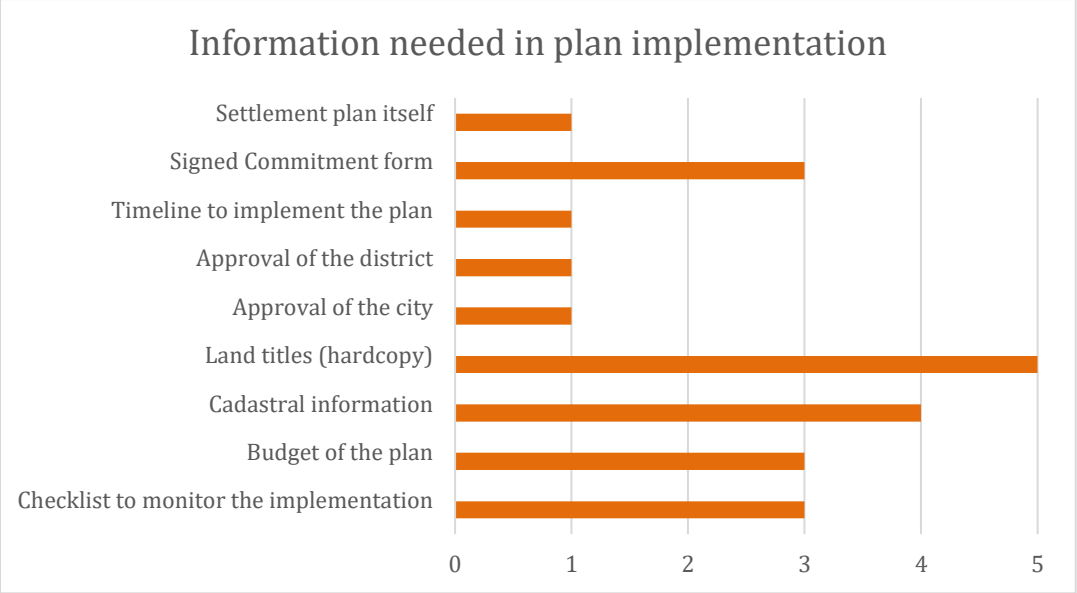


Figure 24: Frequency of information needed in plan implementation

The land title is the most frequently information needed in plan implementation, followed by cadastral information, as well as commitment form, budget of the plan and checklist to monitor the implementation mentioned by 3 institutions.

For plan implementation, the needed information per institutions is also detailed in table 6, and the frequency is shown.

Type of data \ Institutions	MININFRA	CoK	WASAC	RHA	RLMUA	District	Geo-Info Ltd.	Frequency
Checklist to monitor the implementation	✓	✓		✓				3
Budget of the plan		✓		✓		✓		3
Cadastral information			✓		✓	✓	✓	4
Land titles (hardcopy)		✓	✓		✓	✓	✓	5
Approval of the city					✓			1
Approval of the district					✓			1
Timeline to implement the plan			✓					1
Signed Commitment form					✓	✓	✓	3
Settlement plan itself					✓			1

(✓: yes, the data is needed by this institution)

Table 6: Information needed per institution in plan implementation

The results show that for plan implementation the most frequently mentioned information is hardcopy land titles mentioned by 5 institutions, followed by cadastral information mentioned by 4 institutions. In the case of Rwanda, I consider land title as a product of cadastre, because it is a print out of the information about the owner, the rights of the owner, the drawing of the parcel and the location description. Therefore, cadastral information is the most important information to implement the plan in general.

4.4.2. The use of cadastral information in plan preparation and implementation

If cadastral information is most useful information in both the preparation and the implementation of the plan as evidenced in the preceding sections, it is important to investigate how it is specifically used in the process of preparing and implementing Nunga settlement plan. After having described the context of plan preparation and implementation in the preceding sections of this chapter also with view on the general changes in land use and rights patterns, the following sections will therefore zoom into the core element of this research (as per conceptual scheme in figure 1) by detailing the uses of cadastral information.

The uses of cadastral information in plan preparation and implementation of Nunga site followed a procedure with twelve steps as presented in the figure 25 below.

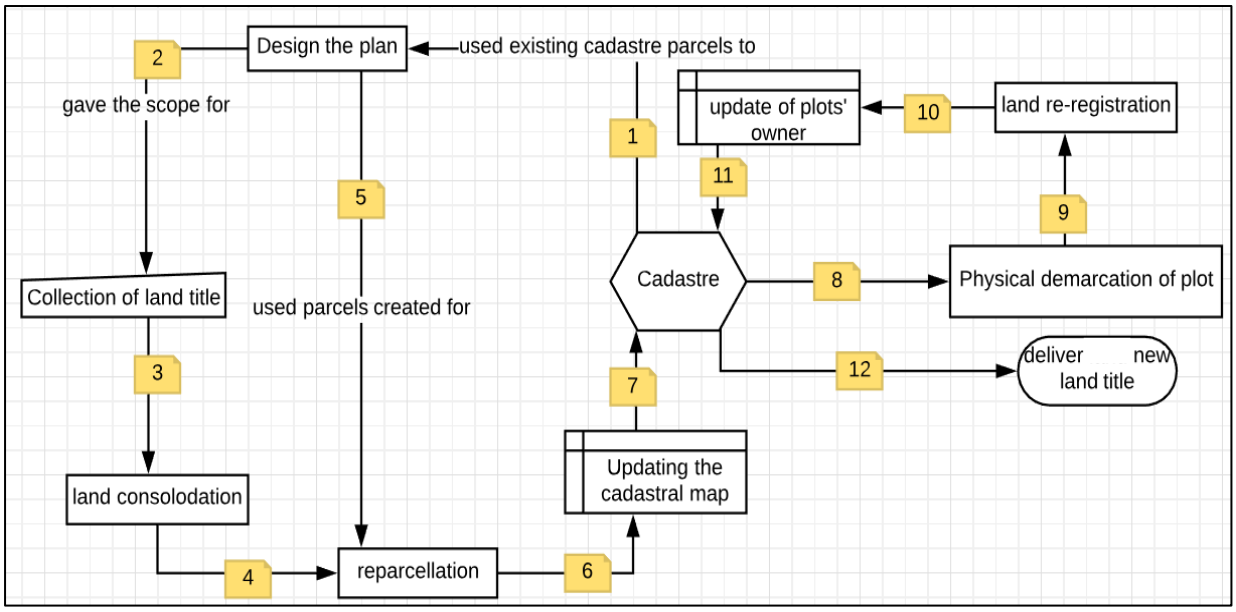


Figure 25: Uses of cadastral information in plan preparation and implementation

Figure 25 shows the use of cadastral information in the whole processes of plan preparation and implementation of the plan. It was found that the cadastre played a central role in plan preparation and implementation. The entry point for plan preparation used cadastral information to design the plan (step1). The last step (step 12) used the cadastre to deliver the land title for the plots according to the new layout of the settlement. Further down I will zoom in even further into these steps when describing the land acquisition and reallocation process (figure 26) involving steps 3 to 12 and the land registration process (figure 28) involving steps 8 to 12.

Before zooming in further, the following sub-sections describe the uses of three main types of cadastral information in plan preparation and implementation. Based on interviews, the three main types are: parcel boundary layer, the identity of the owner as well as the land title. More details about the uses of that information and actors involved are also presented in appendix 4.

Type of cadastral information used in plan preparation

The parcel boundary layer was used as the basis to create new planned parcels of the settlement plan (see figure 25), where the private company, GeoInfo Africa, who was responsible for preparing the plan, should try the best to minimize affecting the existing parcels, to avoid damaging the whole plot and to keep the existing roads. The expert from GeoInfo Africa stated, "*the land agency has mapped all parcels of the country. We overlay the boundary of the site with the parcels from the land agency and their parcels are very useful mostly in knowing in*

reality how the structure of the existing plots is; how can we replot but do not affect too much the structure; how the road can pass in the plot of someone but the rest of the plot is useful and can be used by the owner." Parcel boundary layer was also used by utility providers to estimate the demand for water, the number of connections needed, and the length of pipelines as stated by the expert from utility provider: "*we used cadastral information for preliminary studies to estimate water needs and the length of pipelines in the site. We needed cadastral parcels to see how many plots and buildings to serve as a reference to our planning for utilities in the site. We estimated service pipes, number of customers now and in the future according to the cadastral parcels*".

While in plan preparation only the parcel boundary layer was used, in plan implementation the parcel boundary layer, the owners' identity and the hard copy land titles were used as described below.

Types of cadastral information use in plan implementation

The parcel boundary layer was used in land readjustment process, where parcels were merged to form a unit of planning, then new planned parcels were created, and land was redistributed to owners (see figure 25). From the parcel boundary layer, people were able to find out how plot boundaries changed, the contribution of each parcel to the new parcel and demarcated the plot accordingly using the beacons; *"we prepared the map comprising the old parcels and the new parcel of the plan. So, people were able to find out that this new plot is composed of portions from these old parcels and the size each contributed. The committee was trained to read those maps, and they could direct people"* said the official from the land agency.

Owners' identity information was used to know who owns what in the site, to know the status of land in the site (if the land was used as collateral, if the land is in conflict or if the land is not registered to someone), and to see the implication of the plan in the site (how many people to approach, how many people affected). In case the land was used as collateral, the district negotiated with the banks to give them the land title as it was the requirement for land consolidation by the land agency, and then the district gave back the new land title of the land after reallocation. The banks were willing to give the land title because it was explained that they would get the land title with the value of the land increased. In case the land is not registered the district helps people to register.

The settlement plan was explained to landowners, and they needed to provide land titles for the plan to be implemented. The district had to convince people about the plan, and people were voluntarily handing in the land titles. If the landowner submitted the land title, it was considered that he/she was committed to implement the plan; "*no matter what you can do, the plan will damage plots. You will see plots merged with others; you will see roads passing in individuals' plots; you will see people losing their land depending on the shape of the existing and new parcel. You cannot avoid that. So, it's understandable that the district should come with the strong facts to convince people about the plan and handing in the land title to be given to us. When local people agree with the plan, they hand in the land title, and we are insured that people are committed to consolidate and replot land as per the plan*" said the official from the land agency. Land titles were collected and updated in the cadastre as a single parcel for replotting, and it was easy to see the progress of the project through corresponding updates of the cadastre.

In a nutshell, cadastral information was used for different purposes by different institutions in plan preparation and implementation. The private company used cadastral information to prepare the plan and to implement it. The district, city of Kigali and Rwanda Housing Authority used cadastral information for administration purposes, assessing the plan and monitoring its implementation. Rwanda Land Management and Use Authority used cadastral information for joining parcels and updating the cadastre as per the plot approved in the settlement plan.

During plan preparation, the land agency was not directly involved, but did provide parcel boundary information to be used by the private company when designing the plan. How cadastral information specifically was shared is described later. First, the practices of land acquisition and reallocation are

described below as these also show the use of cadastral information in plan preparation and implementation in more detail.

4.4.3. Land reallocation and the use of cadastral information

In Nunga site, land reallocation was a process that followed the workflow shown in figure 26 below.

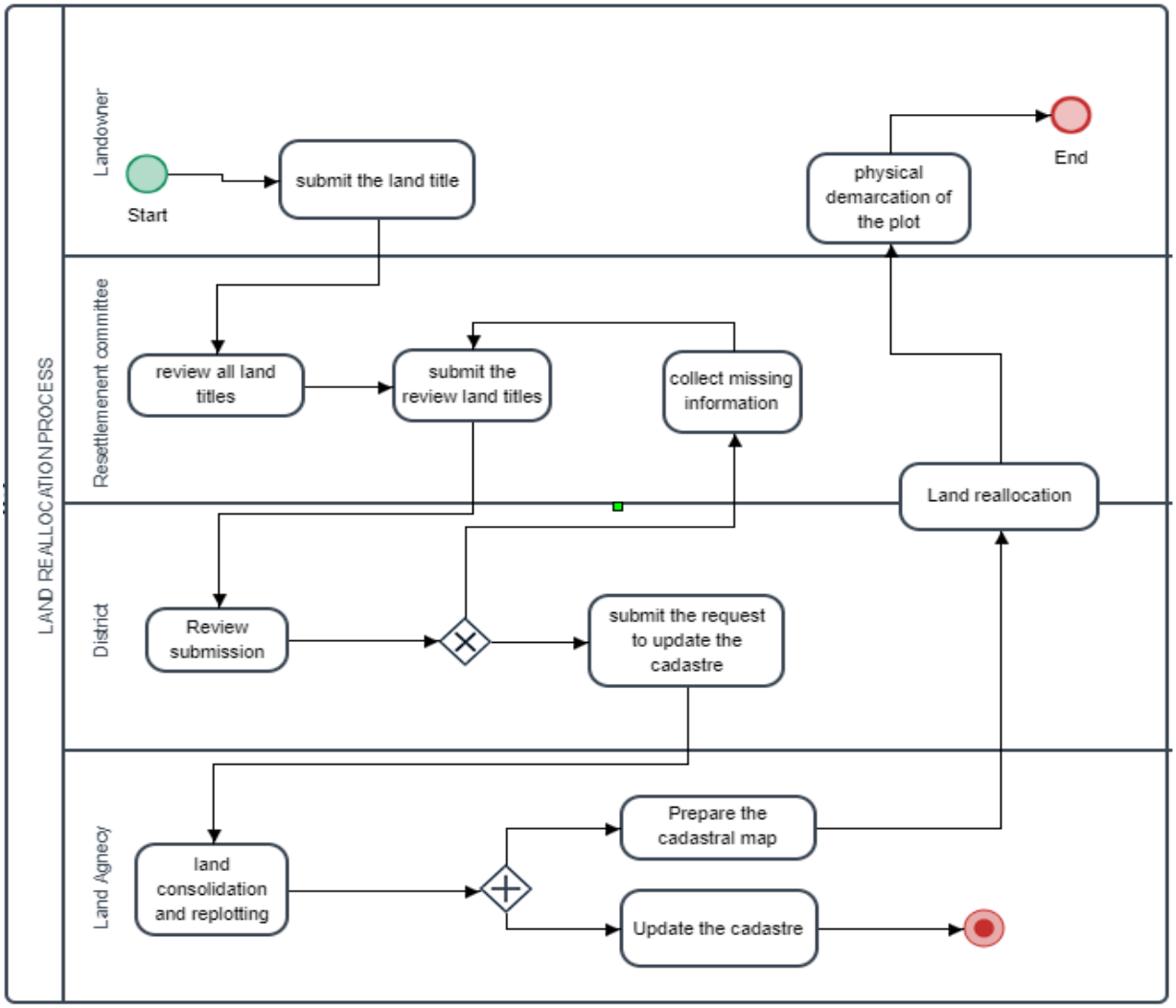


Figure 26: Land acquisition and reallocation process
Source: prepared by the author based on compiled information from interviews

(: exclusive gateway (condition for only one path to be taken); : parallel gateway (parallel paths are taken independently); : start; :end)

The land reallocation in Nunga site started with landowners handing in the hardcopies of the land titles in order to join parcels and receive back the new titles reflecting what is in the cadastre after updating. The resettlement committee was responsible for collecting land titles and send them to the district. The district reviewed the document and submitted it to the land agency when it was complete. Then, the land agency merged the parcels and subdivided them as per the plan. The land agency prepared the map including the cadastral parcels before and after to be used by the district and resettlement committee to reallocate land to owners. The map is submitted to the district and the resettlement committee and it is used for physical demarcation of the plots with owners of plots being present. People identified what happened to their lands and beacons were installed for each plots' boundary. The map used for demarcation is provided below.

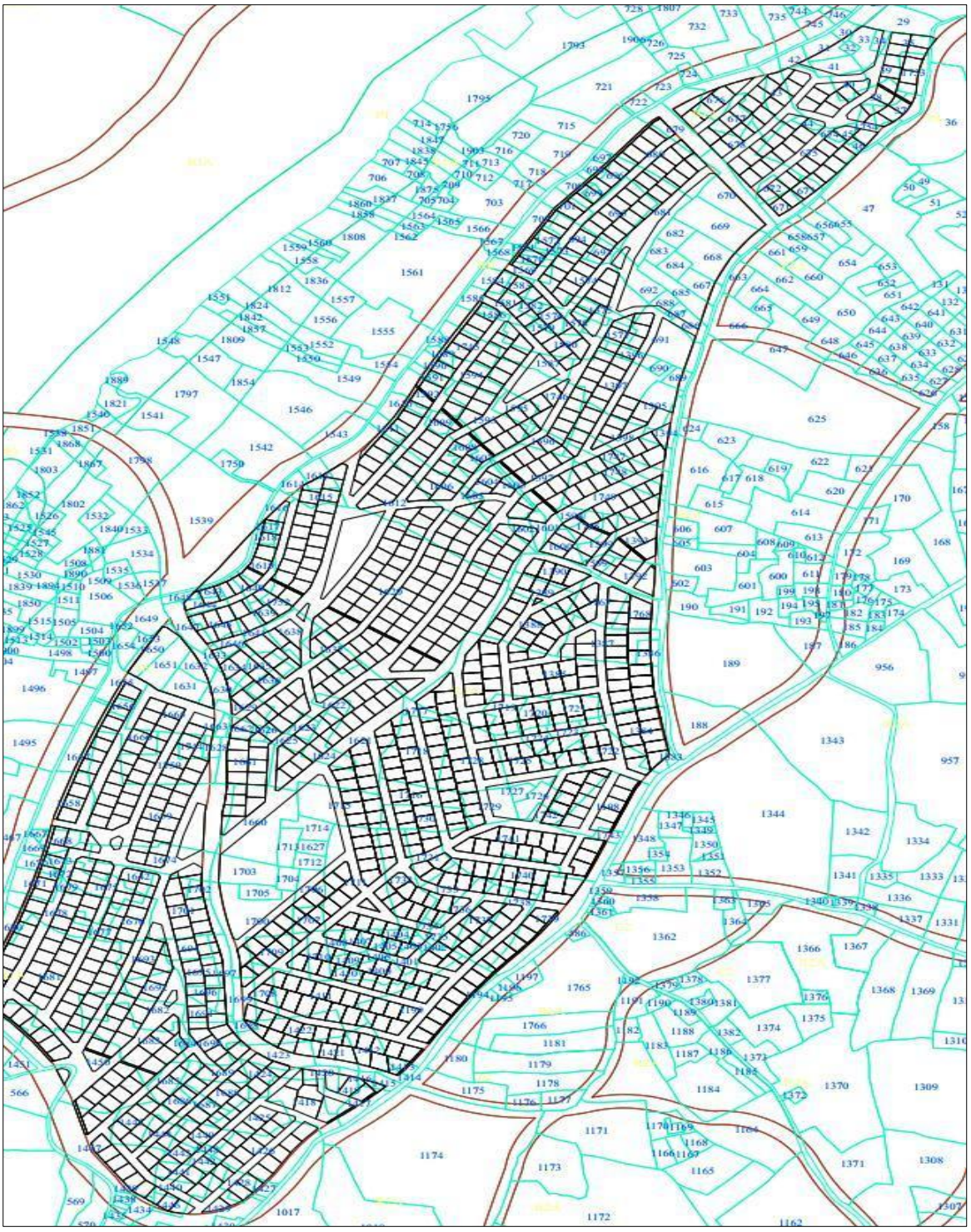


Figure 27: Map with old and new parcels used in demarcation
Source: the picture taken by the author from the hardcopy map used in land reallocation

Figure 27 shows old parcels in green and new parcels in black. Old parcels were labelled with unique parcel identification (UPI) for people to locate their parcels easily.

After land reallocation, land registration of the new parcel followed. The process for registering a new parcel is presented in the following figure 28.

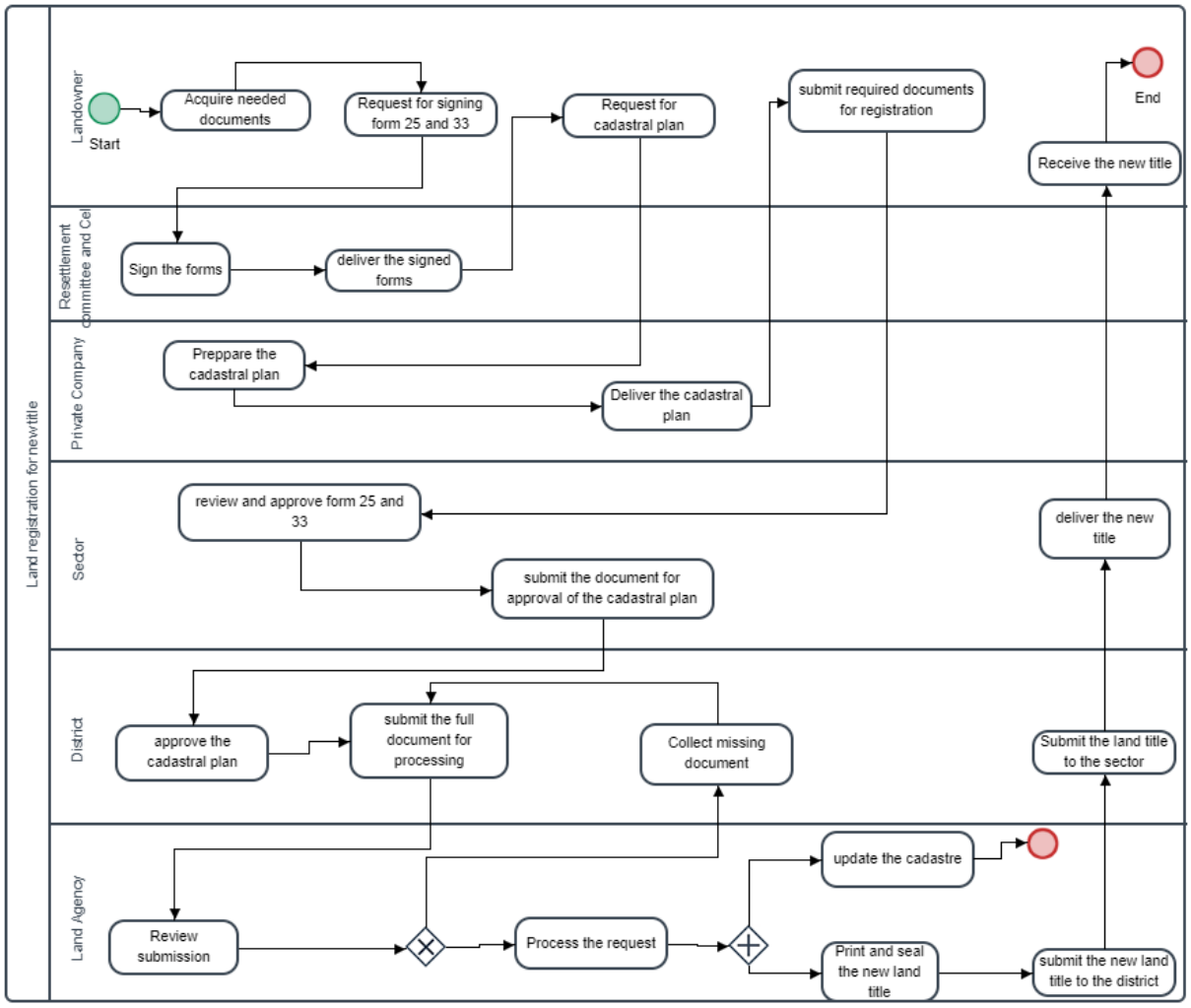


Figure 28: Process for registering the new parcel
Source: prepared by the author based on compiled information from interviews

(: Exclusive gateway (condition for only one path to be taken; : parallel gateway (parallel paths are taken independently); : start; : end)

The land registration process for new parcels started with landowner acquiring required documents to register land (the form 25 requesting first registration, the form 33 confirming ownership of land and the cadastral plan). Form 25 and 33 were filled and signed by the resettlement committee and the cell executive secretary. Those forms were used by the landowners to request for a cadastral plan to the private company (Geo-Info Africa Ltd.). Forms and cadastral plan were submitted to the sector where the sector land notary approved the forms. The sector submitted the document to the district where the district land manager approved the cadastral plan. The district submitted the documents to the land agency for updating the cadastre and providing the new land title. The land agency reviewed the document. If it was well done, the request was processed, and the land title was released. If something was missing the documents were sent back for collecting missing information. In the case of new buyers, they add the sale agreement and the proof of payment as requirements to register land. The templates of required forms are provided in appendices 5,6,7 and 8.

Depending on the size of the land, the owner could register all plots from his/her land. However, the idea was to accommodate many people on a small land, so, the owner was supposed to sell other plots and keep one. If the owner decides to keep all plots from his/her land, he/she can pay development fees for more

than one parcel and develop all of them. If the plot combined portions of land from different owners, the cadastral map provided the size that each owner has contributed, and the committee recorded all of them to share the money from the sales, or one of the owners kept the land and paid out others' portions.

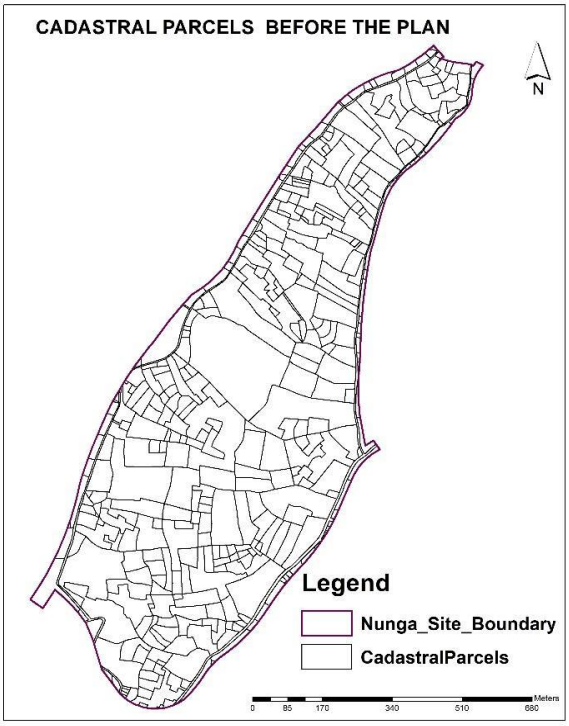
The reallocation of the land was not based on the size each contributed to the land consolidation. Landowners identified how the boundaries of their plots changed and kept the remaining land at the same location. This means that landowners got the reduced or the entire land at the exact original location of the parcels, depending on whether the land was affected or not by utility provision.

4.4.4. Information sharing and updating of the cadastre

Information needed in plan preparation and implementation is shared after communication through official letters, meetings, workshops or calls.

In plan preparation, cadastral information was acquired from the land agency by the district and it was shared with the private company. During plan implementation, the land agency was more involved in updating the cadastre and giving back the new land titles and sharing information about the status of land in the site. Cadastral maps and land titles were shared with the resettlement committee and landowners. The needed documents for the land agency to update the cadastre were: the minutes of the district council, the approval from the city of Kigali, the plan itself, documents from landowners and the official letter requesting replotting.

During the implementation of the plan, all needed documents were submitted to the land agency, and the plan was updated in the cadastre as shown in the maps below.



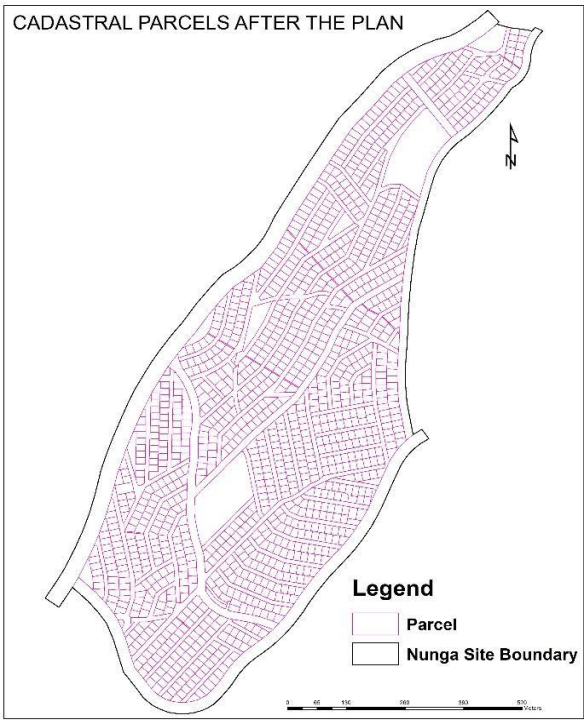


Figure 29: Cadastral parcels before the plan *Figure 30: Cadastral parcels after the plan*
Source: Maps prepared by the author from data acquired from the land agency

Figure 29 and 30 above show the changes in parcel size, boundaries, layout and road distribution before plan implementation and according to the settlement plan. The map on the left side shows that the pre-plan parcels layout was not planned, unequally distributed; and without access to the road for many parcels.

In the planned layout (map on the right side) parcel size, shape and relative position allow for land to accommodate many more people providing access to several additional roads through the settlement.

While the results so far are presenting a relatively linear and smooth process of plan preparation and implementation, the described process of land registration, changes in parcel structure and rights, and the agreement between landowners and officials about no compensation show that the process is also negotiated and incremental in nature. For example; it is not clear why re-registration was necessary, because the landowners already provided the land title for land consolidation, and the land agency has the cadastre before and after the plan. The land agency could have produced land titles for the new plots without the landowners to do registration again. I asked the officials from the land agency why this re-registration was necessary despite them having a database. One official said " *what you are saying is not possible in practice, you might find one new plot made of portions of land from different owners. So, it is difficult to know who is going to be the owner. We, therefore, leave it to the committee, and once they agreed, the owner came with the documents and we re-register the land.*". To explore this aspect of planning more, it is important to consider the role of the committee and other actors involved in the preparation and implementation of the plan. Therefore, the following sections describe the role and level of participation of different stakeholders in plan preparation and implementation.

4.5. Participation of stakeholders in plan preparation and implementation

The following sub-sections describe main actors and their tasks in plan preparation and implementation to find out the role each institution played in these processes. Then, the level of participation is described in order to investigate what the district calls "participatory approach," and finally, closing the results chapter, the overall level of satisfaction of residents is summarized reflecting the perceptions of people on how the plan was prepared and implemented.

4.5.1. Main actors and their tasks in plan preparation

Different actors with different tasks were involved in plan preparation and implementation. The main actors in plan preparation were: the district, the city of Kigali, Rwanda Housing Authority and private company (more connecting lines see figure 31). The main tasks were: (1) site selection, where the district and the city of Kigali selected the suitable site for development in line with implementing the overall master plan and responding to requests for construction by citizen; (2) meetings with different stakeholders including residents; (3) design of the plan by the private company; (4) assessment and approval of the plan by the district, the city of Kigali and Rwanda Housing Authority.

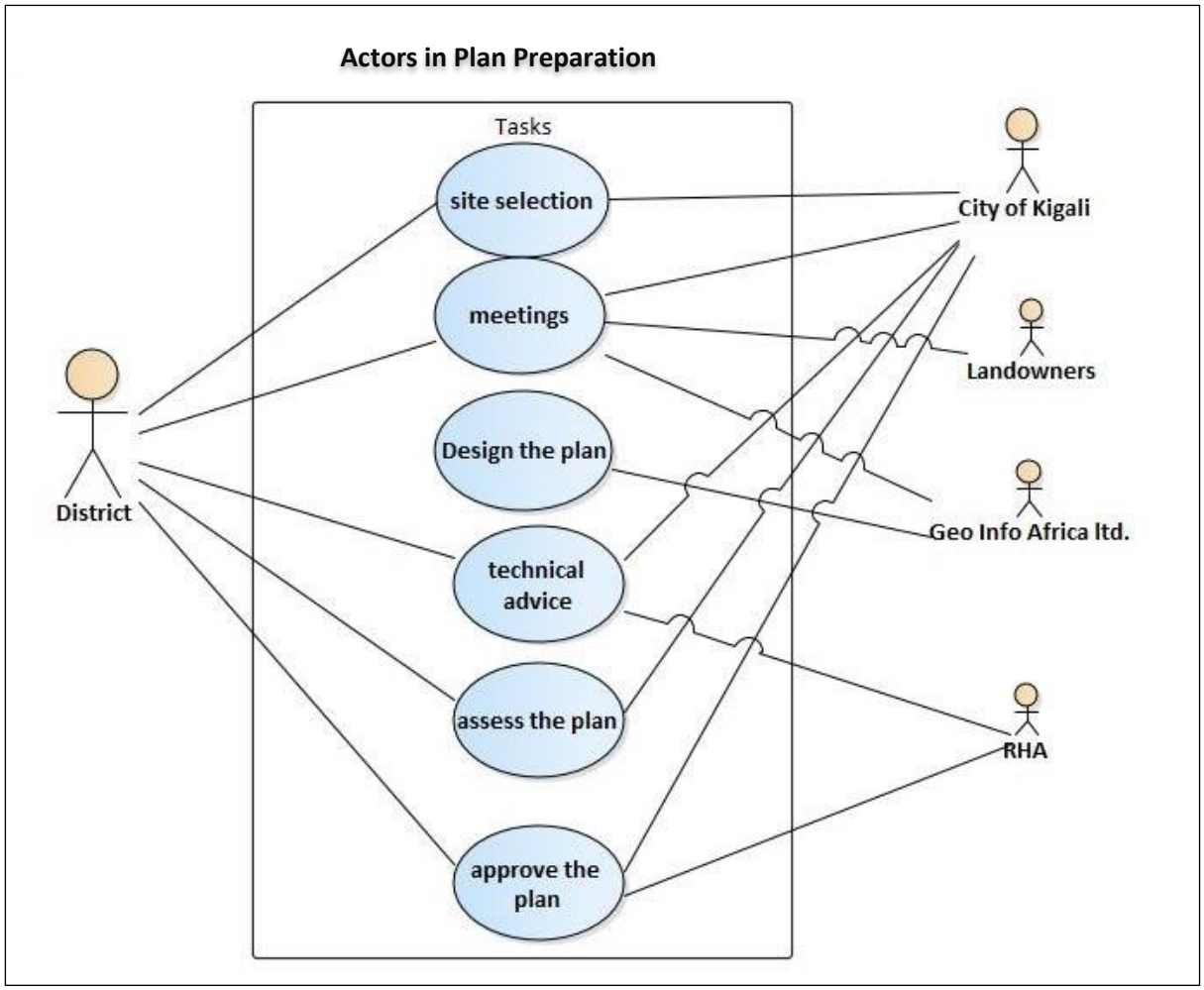


Figure 31: Actors in plan preparation

The tasks range from technical advice to the work of making the plan. The technical team composed of experts from the district and the city of Kigali was formed. The team started by selecting the site for redevelopment, and the team was responsible for holding meetings with residents of Nunga to convince them about the importance of implementing the plan, and for assessing and approving what the company has done. The private company prepared the plan based on their expertise and the regulations in the overall masterplan and the urban planning code.

While few institutions were involved in plan preparation, the implementation added more institutions as described in following sub-section.

4.5.2. Main actors and their tasks in plan implementation

In addition to the institutions involved in plan preparation, the resettlement committee, Rwanda Land Management and Use Authority, residents and buyers are added during the implementation of the plan (see figure 32)

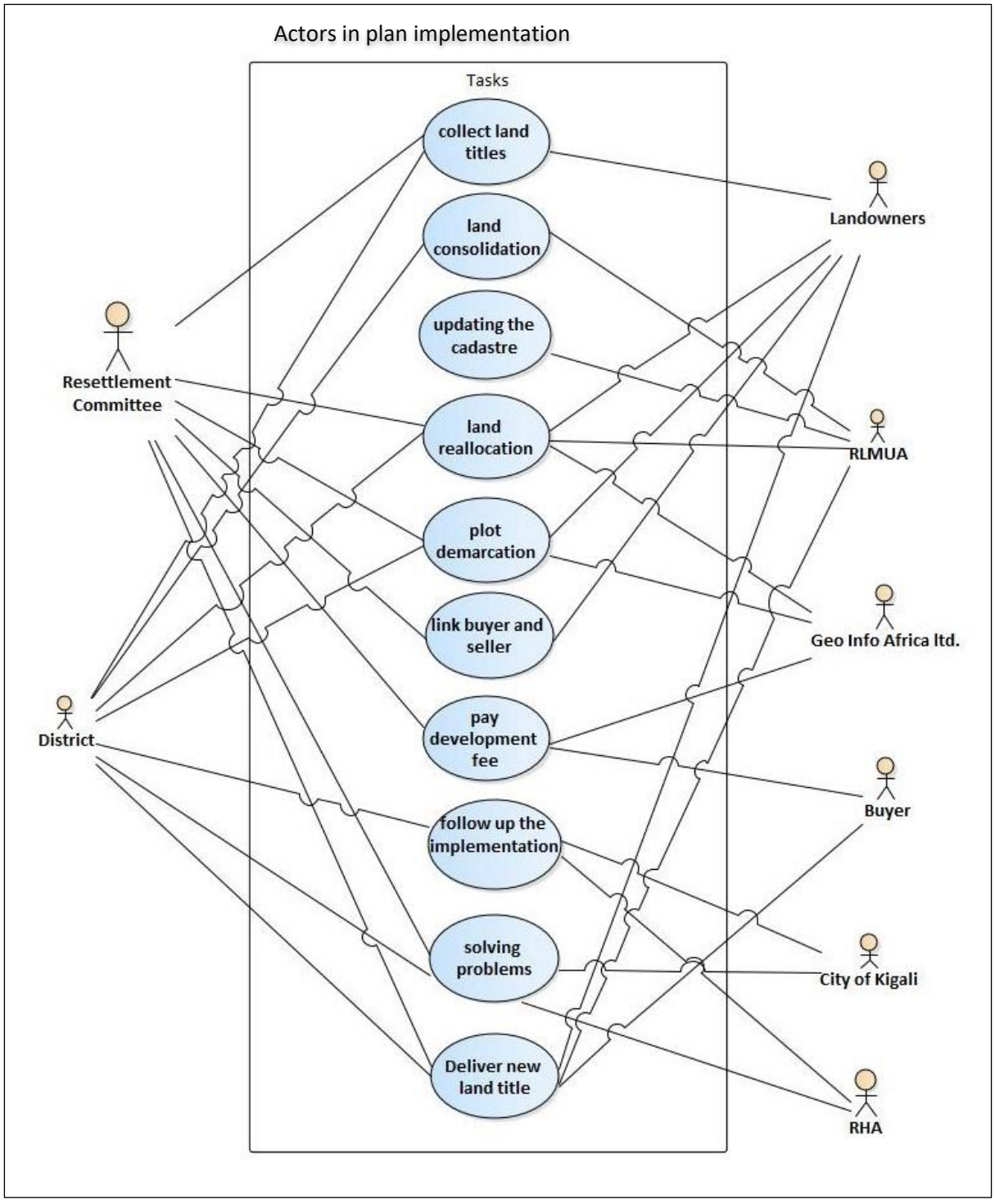


Figure 32: Actors in plan implementation

The resettlement committee played a big role during the implementation of the plan; local people trust the committee because they know that they are among them and they advocate for the people's interests. The committee collected land titles from landowners, submitted them to the district, facilitated in the demarcation of the new plots, linked buyers to current landowners, prepared the sale agreements, solved problems and facilitated people to get back the land title and the construction permit after parcel adjustments.

The district also played a big role as it was involved in almost all activities (see connecting lines in figure 32). The district collected all land titles from the resettlement committee and submitted them to the land agency for land consolidation. After updates of the cadastre, the district was involved in land reallocation and physical demarcation of plots together with the resettlement committee and landowners; and delivered new land titles from the land agency to landowners. The district together with the city of Kigali and Rwanda Housing Authority assessed the implementation of the plan and assisted the resettlement committee in solving problems that arose during the implementation.

The private company (Geo-info Africa Ltd.) constructed roads, helped landowners to identify the boundary of new plots, and gave the cadastral plan (fiche cadastrale) to owners and buyers after payment of development fees.

Rwanda Land Management and Use Authority as custodian of the cadastre, consolidated land, updated the cadastre according to the plan and gave back new land titles.

While the individual actor groups and respective task distribution are relatively straightforward, the processes of working together during plan preparation and implementation are less so. For instance, communication and collaboration between different government institutions were criticised by a government official, who noted that different government agencies prepare different plans according to their own priorities, and these plans can contradict one another in a given site. He explained the problem as follows: "*we encountered many challenges in making our plans. RHA is mandated to make urban development plan; then RLMUA made their own plan which they call National landuse master plan. We have MINICOM responsible for industries, and they also need to show their industry masterplan. We have the ministry of agriculture; they also make agriculture development masterplan. We have RDB in charge of tourism, they also develop a tourism development masterplan and RTDA make road development masterplan. Now, if I map this area as a green space in my urban development plan; in the same area, RDB makes it a tourism site, maybe somewhere to place a good hotel to accommodate tourists; then MINICOM said you see this area is close to border and water body it is strategic for industrial zone, and they zoned it industrial, while RLMUA zoned it forest reserve in their national landuse plan. Then there comes RTDA which might say; we need a bypass for trucks, so, let's zone this land road reserve. So, one plot has different plans from different institutions, so who will implement the plan, because after all, the road will demolish everything. This is how things are done here. But we are trying to solve this issue, and it was said that all the institutions that are involved in master planning should sit together and integrate their plans so that we know that this institution has planned this in this area and so, others will not make mistakes.*"

An example was given by Kanamugire (2017) in his article "Food security fears rise as urbanisation takes root in Rwanda." he claimed that some districts have had to change their master plan due to high urbanisation that took over agriculture land; while the ministry of agriculture insisted that local authorities should adhere to the provisions of the master plans categorising land use for agriculture if the national food needs are to be met. This is what happened in Nunga site, it was zoned for agriculture, but then it was turned residential due to high demand of land for housing in the district. However, the study did not ask the ministry of agriculture about their opinions on changing this area from agriculture zone to residential zone, but neither the district nor the city of Kigali experts mentioned this ministry as the stakeholder in plan preparation and implementation. Again, no institution mentioned above was involved in Nunga settlement plan; which may be interpreted as an indication of low communication between government institutions in planning.

4.5.3. Participation level of residents in plan preparation and implementation

Five levels of participation as described by Arnstein (1969) in his paper "A Ladder of Citizen Participation" were used to assess people's participation in Nunga settlement plan preparation and implementation. Arnstein's levels were translated into the specific context of the study (see table 1 in methods section).

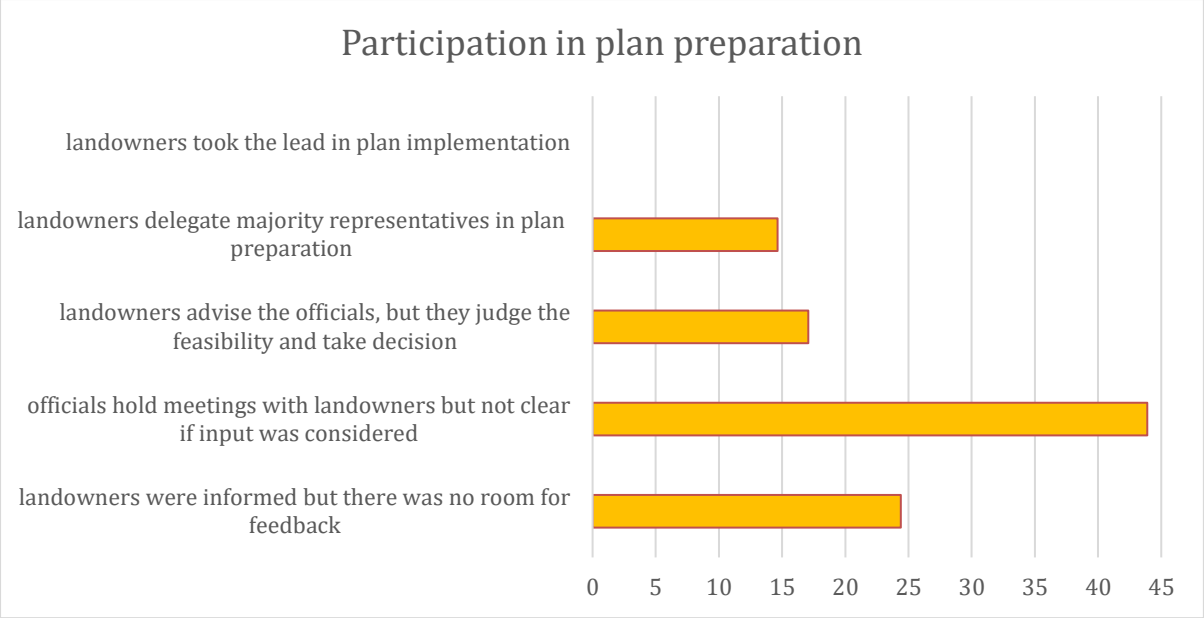


Figure 33: Participation in plan preparation

The results from the questionnaire revealed that the level of participation in plan preparation was low. 44% of the respondents reported that the participation during plan preparation was limited to the officials holding the meeting and hearing from people, but it was not clear if and how peoples' input was considered in plan preparation; this is the second lowest level of participation on the ladder. The low level of participation was also confirmed during the focus group discussion with the resettlement committee, where the participants said that the district held meetings with residents and explained about the plan, that had already been developed. According to one committee member: "*we did not prepare the physical plan, the district thinks on our behalf for the development of the site and the district in general, we were not aware of anything, they came to us with the draft plan in the first meeting. However, we were invited to the validation meeting of the final plan and we gave some comments to improve.*"

The results regarding the level of participation are noticeably different for the phase of plan implementation (see figure 34). The difference in participation of landowners between plan preparation and implementation phases is also reflected in the constellation of actors and their roles in the earlier figures 31 and 32 respectively.

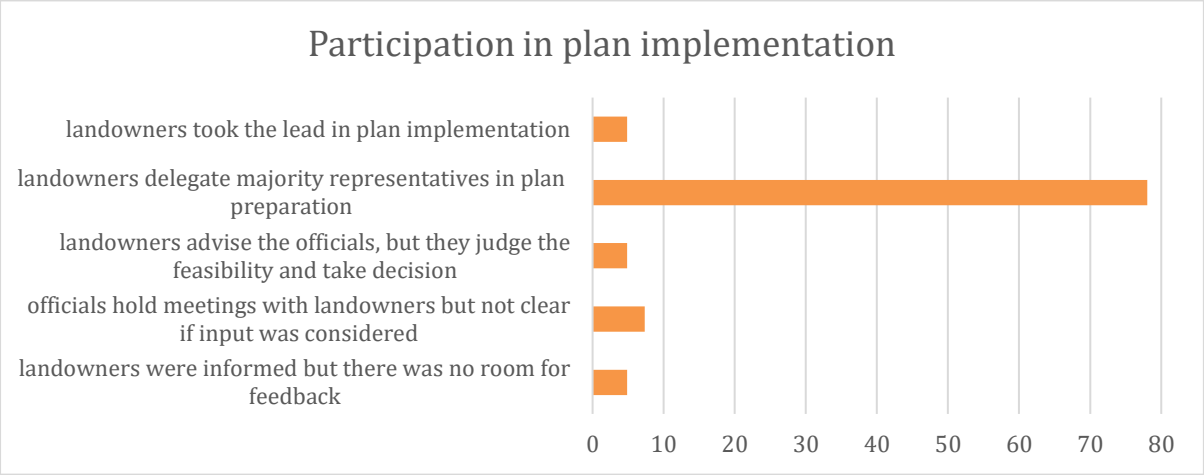


Figure 34: Level of participation in plan implementation

78% of respondents said that residents elected the committee to represent them in all activities related to plan implementation. This is the second to the highest level of participation on Arnstein's ladder. This is also in line with the aims and expectations of the government, who wanted to prepare the plan, but wanted local people to elaborate a strategy of implementation and take the lead in the implementation process.

In order to know what people meant by this level of participation, I asked why and how the committee was formed. During the focus group discussion, participants said "*it is not possible for the district to reach all landowners or to hold regular meetings with all landowners. Therefore, the district asked landowners in the site to vote for representatives that will manage the process of plan implementation.*"

People elected the representatives, and they commit themselves to serve people without payment; *"we were voted to represent and facilitate people voluntary, we did not ask for payment, we have done this to serve the country and we understood the benefit for our site to be developed. People trust us because we are among them and we also have the land in the site too"* the committee said.

I asked the committee how people get information if the responsibility was given to the committee and they said "*we created the WhatsApp group for all landowners and share updates every day. So, everyone was aware of what was going on. But we also call upon meetings occasionally, because not everyone has a smartphone.*"

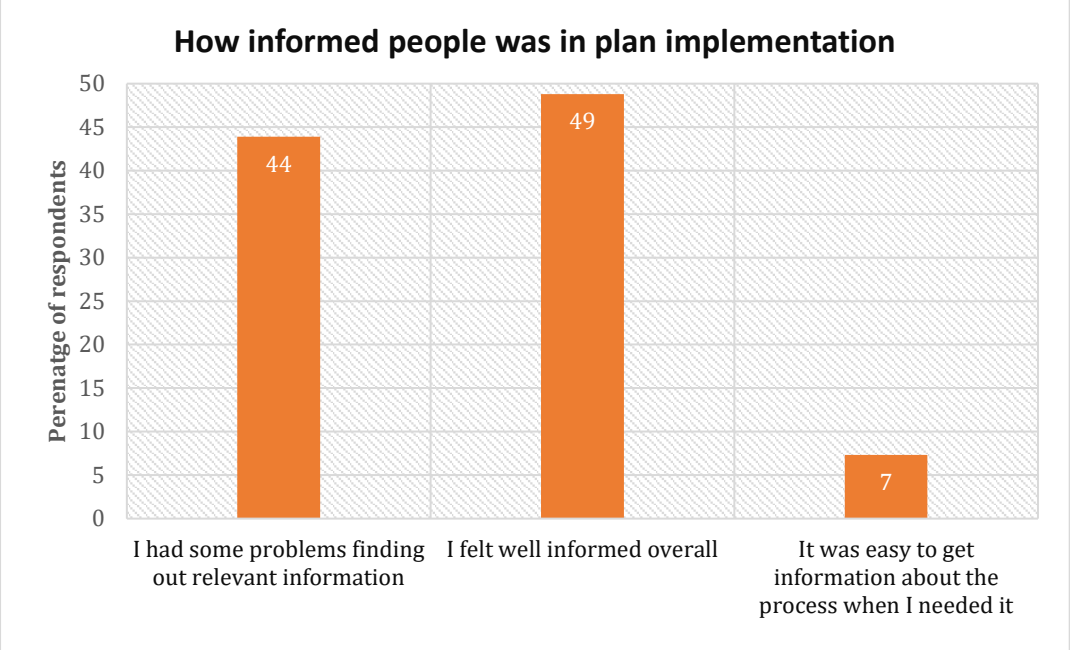


Figure 35: How people were informed during the implementation of the plan

However, even though the majority of respondents felt well informed overall during the plan implementation, 40% of respondents said that they had difficulties in finding information about what was going on.

Given the many changes brought through plan implementation and the discrepancy in participation between plan preparation and implementation, a final point of interest was to learn about the overall level of satisfaction with the process. This is briefly shown in the final section below.

4.5.4. Level of satisfaction with practices in plan preparation and implementation

Despite the differences in participation level in plan preparation Vs. implementation, the satisfaction among residents with both is relatively high (see figure 36), but it is higher with respect to the implementation phase.

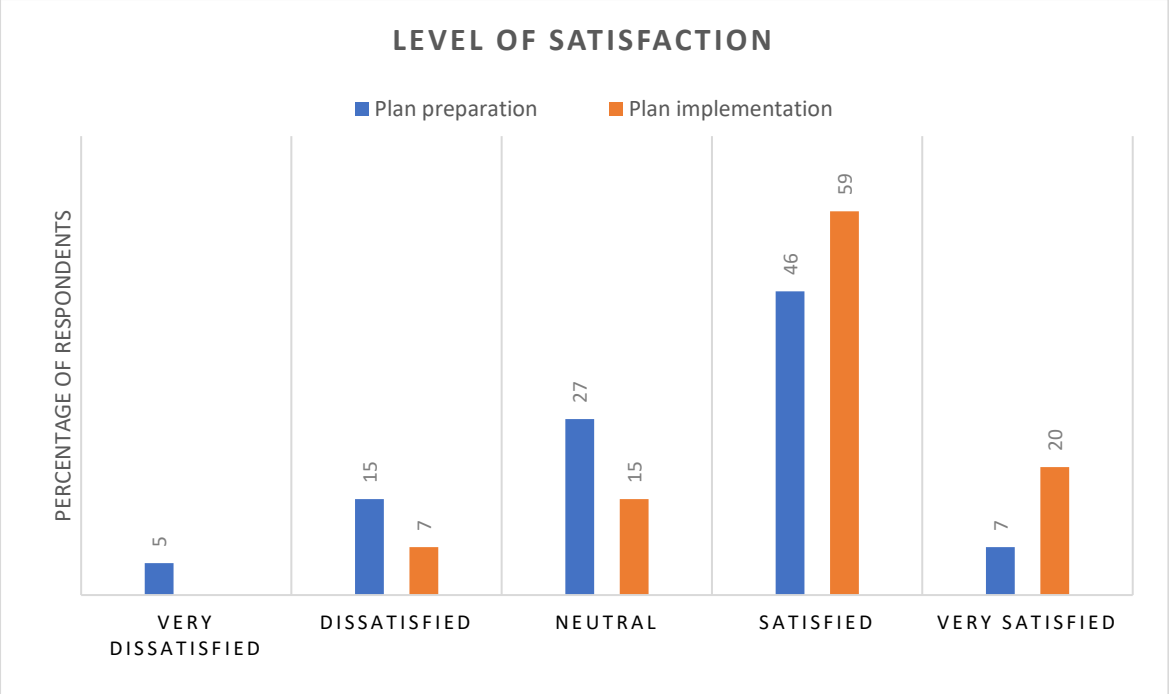


Figure 36: Level of satisfaction in plan preparation and implementation

Only old residents were asked about the satisfaction with plan preparation and implementation because new residents came during the implementation stage.

5. Discussion

In the following sections the findings will be discussed in comparison to other literature and structured according to the sub-objectives of the study. In this discussion two types of comparisons to literature are made: between the findings and a) prescriptive frameworks, e.g. for land development as suggested by UN-Habitat or as posited in Rwandan laws; as well as b) comparable empirical research on plan implementation.

5.1. Changes in land use during peri-urban settlement process of Nunga site

The city's overall plan may inform and guide the land development approach. It can determine where development is desired or permitted, and direct its development (UN-Habitat, 2016). In the case of Nunga site a change in zoning was done: while it was zoned for agricultural use in the overall Kigali master plan, due to housing needs in Kigali, the master plan was updated for Nunga site to be a residential area. This disagrees with Tian and Shen (2011) that some land uses in the master plan like agriculture and wetland are compulsory and should be controlled during the implementation.

Spatial plans should promote diverse landuse and social mix. It should ensure that there is enough land for streets, public spaces, affordable housing and basic utilities (UN-Habitat, 2016). The findings show that Nunga settlement plan reserved enough land for different uses. 57% of the total land in the neighbourhood were planned for housing, 37% for streets, 4% for public infrastructures (schools and health centre), and 2% for public spaces. However, no land was reserved for agriculture. This agrees with the argument by Nilsson, Pauleit, Bell, Aalbers, and Sick Nielsen (2013) that landuse change in peri-urban area increases the pressure on the environment by destructing and fragmenting the natural habitat as wells as loss of agriculture land.

5.2. Changes in land rights during peri-urban settlement process of Nunga site

It is stated in Rwandan land law that land rights may be transferred between persons through succession, subdivision, gift, inheritance, ascending sharing, rent, sale, sublease, exchange, servitude, mortgage or any other transaction, in conformity with the conditions and methods provided for by the laws and regulations (Government of Rwanda, 2013). The findings revealed major changes on two of the seven land right types studied, namely subdivision and use rights. It was also noticed that there is less self-determination of residents over some types of land rights, for example, inheritance. Some residents said that they cannot bequeath the land because inheritance requires subdivision which is not possible anymore in the site. For other land right types, changes were noticed, but it was related to individual cases, for example, someone without land title cannot sell the land.

Other research on land redevelopment processes provides evidence of dispossession of original rights holders and displacements. For example, in peri-urban areas of Ethiopia, land is acquired from farmers and reallocated to private developers who can pay for a lease, which ends in dispossession and termination of existing land rights of the peri-urban farmers (Adam, 2014). What was done in Nunga is different. Land was not acquired and reallocated to private developers, but land was consolidated and reallocated to owners after re-parcellation. However, in Nunga also, the process ended in some people selling their land and relocating elsewhere, sometimes without any other choice. The government has tried to find alternative solutions for urban redevelopment by adopting other approaches rather than expropriation. However, if some people have to relocate, the impact is the same as expropriation. In Nunga it appears that so far relatively few people moved compared to the number of people who stayed based on this study's findings, but "*there is no fixed number yet about people who displaced because the plan implementation is still ongoing, but we can say that 30% of residents have already gone*" said the committee during the focus group discussion.

During land readjustment, some landowners may receive a smaller plot than they are entitled to; and hence, should be compensated financially (UN-Habitat, 2016). However, in Nunga site, it was agreed between

landowners and the district that land taken by infrastructures will not be compensated; and the problem is the equal sharing of infrastructure costs among landowners.

5.3. Changes in neighbourhood during the implementation of the plan

The findings for push and pull factors are typical for suburbanization dynamics but because there were residents in Nunga site before we have it mixed also with processes of gentrification.

The findings show that after the plan implementation, the levels of education and income are higher for new residents than old residents. Majority of old residents were farmers while most new residents are urban salaried work. This is indicative of a form of gentrification process which refers to "*a process of the rehabilitation of working-class residential neighbourhoods by middle-class homebuyers, landlords, and professional developers*" (Lees & Ley, 2008). This is different from what the district wanted; the district prepared the plan to accommodate all categories of income and all original residents to stay; this is proved by three categories of houses planned in the neighbourhood, but it was found later that the site attracted high income. One official from the city argued, "*when we make the plan, it increases the value of the land and the place becomes super standard. Low-income earners find themselves no longer fitting in the area, and mostly move to slums or rural areas. This is a major challenge that we are facing because we intend to develop an area affordable to all citizens, but eventually, we later find that people were displaced, and the new rich people occupied the area. This is something that we cannot stop because the land market is free, you are free to sell your land anytime.*" The findings show that majority of new residents came from the slums of Kigali with the aim to have their own houses in a planned and affordable place. If relocated people from Nunga site moved to the slums where new residents came from, it would be the exchange of people from/to the peri-urban areas/slums.

The term "fitting" used by the official agrees with the argument from the focus group discussion where the committee argued that the fact that the area changed from agriculture to residential is the major cause for people to leave the site because they were farmers and do not have anything to do in the site anymore. This is in line with the publication by UN-Habitat (2016) where it is stated that land readjustment is not a pro poor tool, and it may end up profiting local powers or property developers; it can trigger gentrification and push out poor tenants. The implementation of Nunga settlement plan led to land readjustment; the site has gone through gentrification process which ends in some people leaving the site. However, the limitation to interpret this result is that we do not know where residents who moved went to, but it is likely that they were of even lower income groups since they could not afford staying.

Indicative of a gentrification trend are also references made by the committee characterizing the changes in the neighbourhood with words like "beautiful and developed" (as opposed to rural) and the mentioning of a "whatsApp" group to indicate "social cohesion," that are references to aesthetic and technological ideas of modernity.

Overall, the findings on the perception of residents on neighbourhood changes show positive perception of changes among old residents, but some divisive dynamics also exist due to higher socio-economic differentiation.

5.4. Nunga settlement plan preparation and implementation framework

According to Hersperger et al. (2018) the role of spatial plans is found in the intention expressed in the plans, the means to implement the plans, and the external condition influencing the implementation of the plan. It was found that the intention of preparing Nunga settlement plan was related to responding to housing needs in Kigali but not necessarily to develop Nunga site; this is why Nunga changed from agriculture to residential area. There was no budget to implement Nunga settlement plan; this is why the district developed people centered-approach to implement the plan which ended in a self-financed land

readjustment process. Following sub-sections discuss land readjustment, the use of cadastral information and stakeholders participation as parts of settlement plan implementation.

5.4.1. Land readjustment during peri-urban settlement process of Nunga site

Land readjustment process is undertaken differently depending on the country context with the initiative or the implementation being taken by the government, developers or landowners (Larsson, 1997). In Nunga, the government took the lead in plan preparation, but during the implementation of the plan, the representatives of landowners took the lead.

According to UN-Habitat (2018), land readjustment starts with choosing the location where existing land uses are inconsistent with optimal development, then get consent from landowners to consolidate land as a unit for planning. In Nunga site, the district hired the company to prepare the plan and consulted landowners at the implementation stage.

Land readjustment should result in a situation where everyone benefits. Landowners benefit from increased land values and the government gets a well-planned settlement without the compulsory land acquisition of land. Each landowner should receive a plot of land that is smaller but worth more than the original plot (UN-Habitat, 2016). In Nunga site, not everyone benefited from land readjustment, or the benefits were not equally distributed. Land was reduced for some landowners but not all; land not affected by infrastructure provision was kept entirely by owners. However, the government got a planned settlement.

Land readjustment process should be self-financed as far as possible; this is possible only if the value of the land increases so that the district can sell portions of shared land to cover costs. The land reserved is sold at the end of the project to pay for planning, administration and construction costs (UN-Habitat, 2016). Nunga redevelopment process was self-financed. The source of money to cover the costs for the project was called "development fees" paid by buyers of plots in the site. The old landowners did not pay the money or contribute land to cover the planning, administration and infrastructure fees. This disagrees with the course of action suggested by UN-Habitat (2016) that the costs and benefits should be distributed fairly and equitably in land readjustment. It is difficult to say that the cost was shared in Nunga settlement plan implementation because only new landowners paid the development fees. I find this as unequal treatment of citizens; why payment of development fees by new landowners, not old landowners? However, old landowners who decided to keep more than one plot paid the development fees for the other plots. This is the district strategy to discourage people from keeping more plots because the district wanted to accommodate many people on small land due to the high demand for housing in Kigali. But this might interfere with land right in case it is considered as forced selling. Again, it was found from the interview that the buyers were given a maximum of two years to develop the site according to the plan. Those are measures of enforcing the implementation of the plan which might also interfere with land rights in case the land is not developed within that period.

At the end of land readjustment process, landowners are entitled to the formal land title or other document specifying their rights (UN-Habitat, 2016). In Nunga site, after land reallocation, landowners were supposed to re-register their land. The process of registering the land was long and rather complicated as the descriptions of this process in the results chapter show.

To summarise land readjustment process in Nunga site with reference to the course of action suggested by UN-Habitat, a comparison table is provided below.

No	Land readjustment (LR) suggested course of action by UN-Habitat	Land Readjustment (LR) course of action in Nunga redevelopment project
1	Ask the consent from landowners	The consent was asked at the implementation stage
2	No compulsory land acquisition in LR	All landowners committed to the plan by giving the land title for land consolidation
3	Consolidate land to form a unit of planning	Land was consolidated and planned as a single unit
4	Sharing land to cover LR process	Land was not shared; the costs of the project was covered by fees paid by buyers of the plot in the site
5	Self-financed LR process	Nunga redevelopment process was self-financed by the so-called "development fees."
6	Cost sharing between landowners in LR	Cost was not shared since only new landowners paid for the project costs
7	Benefit all landowners in LR	Some landowners did not benefit because infrastructures took most of their lands and no compensation was involved
8	Everyone gets smaller land than before	Not everyone got the smaller land. Only owners whose land were affected by infrastructure provision
9	Land value increase	The value of the land increased in Nunga site in general
10	Manage compensation	No compensation as agreed before the implementation of the plan
11	Preserve land titles after LR	Land re-registration was done to have new land titles
12	Residents stay in the neighbourhood	Some residents relocated from Nunga site

Table 7: Land readjustment in Nunga Vs course of action by UN-Habitat

5.4.2. The use of cadastral information in plan preparation and implementation

According to UN-Habitat (2016), land readjustment requires information on who owns what rights and where. If such records do not exist or are out of date, land information for the whole area must be created before the project can proceed (UN-Habitat, 2016). The redevelopment of Nunga site found the area with all land records and have given the information on parcel structures and ownership used as the basis to prepare and implement the plan.

The findings show that cadastral information was the most important information used by different governmental and non-governmental institutions in plan preparation and implementation. The plan preparation and implementation used especially: parcel boundary layer, owner's identity and land title as kinds of cadastral information. This shows that the cadastre served multiple functions; it was not only used to identify and secure land rights, but it supported the preparation and the implementation of the plan. This agrees with the suggestion by FIG (1995) that the cadastre should assist in controlling the size and shape of parcels, and controlling the reallocation of land.

In a nutshell, the findings on the use cadastral information show that cadastral information (parcel layer) was used as the base map to prepare the plan; then the planned parcels brought changes in the cadastre and it was updated according to the plan. At the end, the updated cadastre was used to demarcate the plots on the ground. This is aligned with the argument by Faludi (2013) that spatial planning is interrelated with cadastral data; for example, the planned landuse for a set of parcels in the plan can affect the parcel boundaries of the cadastre. In Nunga site, the cadastre informed the plan; the plan informed the update of the cadastre, and the cadastre informed the changes on the ground.

5.4.3. Public participation in plan preparation and implementation

Nunga settlement plan implementation involved land readjustment process. According to UN-Habitat (2016), during the conceptualisation of land readjustment project, authorities should explain the project to

residents, landowners and occupiers. The public should be informed about the current and estimated future values of the plots after the readjustment in order to get the stakeholders commitment. However, public participation is often limited to commenting on the prepared spatial plans which often causes critics or rejections by the public (Bizjak, 2012). This is exactly what happened in Nunga site, the district prepared the plan and came to explain to local people in a meeting. However, community participation is not homogenous; during the implementation of the plan, most participation took place through members of the committee. This is the second to the highest level of participation on the ladder by Arnstein (1969). It was noted that the committee did a lot of "voluntary" work during the implementation of the plan. I can interpret this kind of participation, on one hand, as participation in response to a lack of resources (money); this is also proved by the argument from the planner that he would have preferred to expropriate people, develop infrastructures and then place people back, but no money was available for expropriation (see section 4.2.3). On the other hand, I can interpret this kind of participation as participation in the context of "sovereign development" where the government is promoting the mindset of self-reliance, dignity and economic independence (Webster, 2015). This is proved by the quote from the committee (see section 4.5.3) that the committee has committed to serve the country without asking for payment, and they got the inspiration from the president that they have to find solutions to their problems themselves without always waiting for donors.

In general, the information must be open, and the process of land readjustment must be transparent. Maps, plans and statistics should be made available for people to understand the project goals and details (UN-Habitat, 2016). The resettlement committee coordinated Nunga settlement plan implementation. Maps were displayed at the cell office to allow people to check boundaries of their new plots; and the whatsApp group was created to facilitate daily interaction with the committee and landowners, and between residents to share the information. However, some people reported having difficulties in finding what was going on during the plan implementation.

Although different researches evidenced the importance of public participation; the question remains as to whether citizen participation will influence their satisfaction. The study by (Wu and Jung (2016) found that the high level of citizen participation is positively associated with citizen satisfaction. The study by Layson and Nankai (2015) found that it is not necessary that the more the public participation, the more the satisfaction, hence the more the quality of the plan. Many different factors influenced the satisfaction of the public, and the level of participation is among them. Though, the low level of public participation in Nunga settlement plan preparation, residents were overall satisfied with plan preparation and implementation. This agrees with the above studies that many other factors influence the level of satisfaction and participation is among them.

6. Conclusion and recommendations

This study aimed at investigating the process of preparing and implementing a settlement plan in a peri-urban area of Kigali with specific focus on how cadastral information is used for land readjustment. This was achieved through describing changes in landuse and rights during the implementation of the plan; comparing the characteristics of the neighbourhood before and after the plan implementation; analysis of cadastral information uses in plan preparation and implementation and describing the degree and kind of stakeholders' participation in plan preparation and implementation. Recommendations for further studies and for the country to improve practices in land readjustment are also provided.

6.1. Conclusion

Peri-urbanisation is going on in Kigali and has brought changes in land use and rights. The city of Kigali and Kicukiro district have prepared Nunga settlement plan to regulate the landuse change in that area. The implementation of Nunga settlement plan required land readjustment which affected land rights in land acquisition and reallocation process. The study findings revealed the practices in Nunga settlement plan preparation and implementation.

At the onset of this study, land acquisition, utility provision, land rights change and landuse change were considered as separate elements in the process of settlement plan implementation in the research proposal (see appendix 9 for original conceptual scheme); and the use and flows of cadastral information were treated as something that could be observed as a separate entity. Although this separation between process and respective elements carries into the results of this thesis due to original operationalization of sub-objectives, an important insight from this study is the embeddedness of cadastral information uses and flows in the respective process of planning and implementation; and the links between information uses and participation as they are now shown in the conceptual scheme of the thesis in figure 1 and with main findings added in figure 37 below.

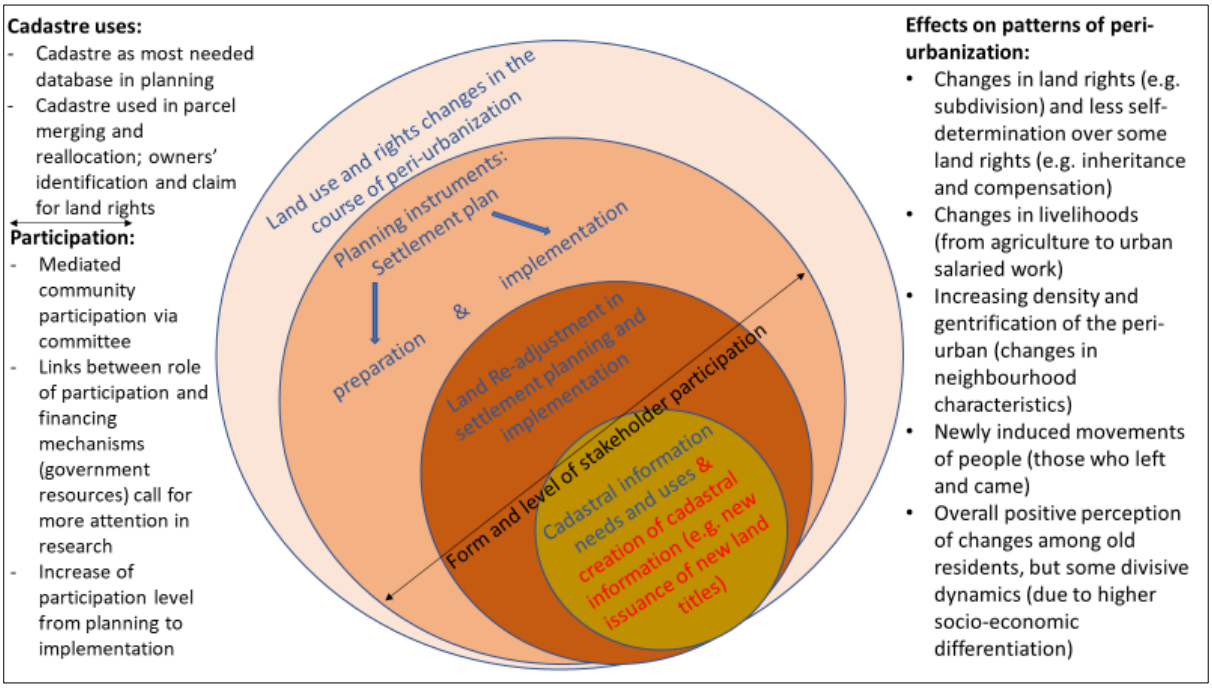


Figure 37: Summary of findings

The figure 37 summarises the main findings with respect to the effects of planning on peri-urbanisation, cadastral information uses, and forms of participation.

During the implementation of Nunga settlement plan, it was found that there was excessive landuse change within a short period. In three years, agriculture land was reduced from 43.9% to 0% of the total land in the neighbourhood while residential houses increased from 1.8% to 12.2%, and roads increases from 1.7% to 26.1% of the total land in Nunga site. Land rights changed accordingly, among seven types of land rights studied; the majority of respondents claimed changes in subdivision and use rights; and for some other rights like compensation and inheritance, a lack of self-determination of some respondents whether they have those rights or not were noticed. Changes in land use and rights were associated with changes in neighbourhood characteristics. The movements of people to Nunga site brought changes in population in the site with differences in education and income categories which are higher for new residents than old residents. Many reasons are behind this movement; on one hand, the main pushing factor according to individuals' perception is the inability of people to comply with the requirements of the plan, while according to the resettlement committee the main pushing factor is the change of livelihood activity due to landuse change from agriculture to residential. On the other hand, the main pulling factor for people to move to the site is the availability of cheap land and housing in the area compared to the core city. Though, changes in neighbourhood characteristics, overall old residents are happy with changes and feel at home in the neighbourhood.

Through the process of preparing and implementing Nunga settlement plan, cadastral information has got potential uses. Parcel boundary layers, owners' identity and land title were the most important kinds of cadastral information used to prepare and implement the plan. The parcel boundary layer was used as the base map to the plan preparation; the structure of the parcels was the starting point to create new parcels. Parcel boundary layer also informed all process of land acquisition and reallocation during the implementation of the plan by giving information on how many land titles to collect for land consolidation, seeing the progress of land consolidation on the map, giving information to landowners on how their boundaries changed, demarcating plots on the ground; and producing new land titles. Owner's identity provided information on who owns what in the site which was also the starting point to see how many people affected by the project and to understand the feasibility. The land title was used as a proof of ownership and was considered as a proof of commitment to the project in case it was handed in by the landowner for land consolidation.

Though, important uses of cadastral information in preparing and implement Nunga settlement plan; land readjustment process in Nunga site shows quite deviation to the standards of land readjustment by UN-Habitat. Landowners did not contribute portions of land to cover the costs of the project; land reduction for public infrastructures was not systematic to all landowners in the site; the land reallocation was not based on the size or value of the land each landowner contributed to land consolidation; and the compensation was not involved for land taken for road development.

The forms and levels of stakeholders' participation have shaped the process of plan implementation, information needs and uses. The number of actors increased from preparation to implementation; thus, the level of residents' participation increased from the preparation to the implementation of the plan, but it was noted that the participation was done through the committee, and it was a "voluntary" work by committee. Almost all stakeholders needed cadastral information for their tasks in plan implementation (see figure 32), this shows that cadastral information was very useful in preparation and implementation of Nunga settlement plan, and it has proved its potential to do more than securing land tenure.

In general, the study was able to find out the role of cadastral information in settlement plan preparation and implementation which is the contribution to land administration literature.

6.2. Recommendations

For Further research

- It is not known where old residents who left the site went to; I had the impression that this kind of movement of people from/to the site might bring the exchange of location between higher and lower income people in case new residents came from the slums of Kigali and the old residents moved to affordable housing in slums of Kigali. Future research is recommended to understand the dynamics of displacement within peri-urban areas as a result of planning.
- I call upon more studies, comparing the process of plan preparation and implementation for a country without the cadastre, in order to evaluate the relative importance of the cadastre in different spatial planning domains and to motivate the rest of the world to register their land.
- I recommend more studies, similar to the one presented here, to show how cadastral information is used or can be used in other planning domains and areas, including planning of agricultural regions.
- I recommend more studies on the relations between, (1) participation as "free labour" in light of lack of resource versus participation as a symbol of "sovereignty"; (2) participation by the community, by the elected representatives and by volunteer group. These types of participation depend on political and economic context of plan implementation, and the relations between these types and context could be a good future research path in comparison to a ladder.
- This study focused more on how cadastral information was used for land readjustment, and little on people's perceptions and commitment. Further studies are recommended to explore on the latter, especially on people's preferences in land readjustment.

For the country

- It was noted that Nunga settlement plan is now considered as the model for other settlements in peri-urban areas of Kigali where the implementation of plans is yet to start. However, I would recommend revising the land readjustment process, specifically to improve the cost and benefit sharing among all landowners.

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Appendices

1. Source of spatial data

Name of data	Type of data	Source	Publication date	Date of collection	Use
Nunga Parcel boundary layer (old cadastre)	Vector	RNRA	2012	2016	For MSc study only
Nunga parcel boundary layer (new cadastre)	vector	RLMUA	2018	04/10/2018	For MSc study only
Nunga settlement plan layer	vector	City of Kigali	2016	25/09/2018	For MSc study only
Kigali orthophoto	raster	WASAC	2015	1/10/2018	For MSc study only
Satellite image	raster	Google earth	2018	10/2018	Open access

2. Changes in land rights

s/n	Use rights		Renting		Compensation		Inherit		Sell		Subdivide		Collateral	
	B	A	B	A	B	A	B	A	B	A	B	A	B	A
1	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
2	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
3	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
4	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
5	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
6	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
7	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
8	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
9	✓	✓	✓		✓	✓	✓	X	✓	✓	✓	X	✓	✓
10	✓	X	✓	✓	✓	✓	✓	X	✓	✓	✓	X	✓	✓
11	✓	X	✓	✓	✓	✓	✓	X	✓	✓	✓	X	✓	✓
12	✓	X	✓	✓	✓	✓	✓	X	✓	✓	✓	X	✓	✓
13	✓	X	✓	✓	✓	✓	✓	X	✓	✓	✓	X	✓	✓
14	✓	X	✓	✓	✓	✓	✓	X	✓	✓	✓	X	✓	✓
15	✓	X	✓	✓	✓	X	✓	✓	✓	✓	✓	X	✓	✓
16	✓	X	✓	✓	✓	X	✓	✓	✓		✓	X	✓	✓
17	✓	X	✓	✓	✓	X	✓	✓	✓		✓	X	✓	✓
18	✓	X	✓	✓	✓	X	✓	✓	✓		✓	X	✓	✓
19	✓	X	✓	✓	✓	X	✓	✓	✓		✓	X	✓	✓
20	✓	X	✓	X	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
21	✓	X	✓	X	✓	X	✓	✓	✓	✓	✓	X	✓	✓
22	✓	X	✓	X	✓	X	✓	X	✓	✓	✓	X	✓	X
23	✓	X	✓	X	✓	X	✓	X	✓	✓	✓	X	✓	X
24	✓	X	✓	✓		✓	✓	✓	✓	✓	✓	X	✓	✓

25	✓	X	X	✓	✓	✓	✓	✓	✓	✓	✓	X	X	✓
26	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
27	X	X	✓	✓	✓	X	✓	X	✓	✓	✓	X	✓	X
28	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
29	X	X	✓	X	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
30	X	X	✓	X	✓	X	✓	✓	✓	✓	✓	X	✓	✓
31	X	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	X	✓	✓
32	✓	X	X	X	X	X	✓	✓	✓	✓	✓	X	✓	✓
33	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
34	X	X	✓	X	✓	X	✓	X	✓	✓	✓	X	✓	X
35	X	X	✓	X	✓	✓	✓	✓	✓	✓	✓	X	✓	✓
36	✓	✓	✓	X	X	X	✓	X	✓		✓	X	✓	X
37	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	X	✓	✓
38	✓	✓	✓	✓	X	X	✓	✓	✓	✓	✓	X	✓	✓
39	✓	X	✓	X	X	X	✓	X	✓	✓	✓	X	✓	X
40	✓	X	✓	✓	X	X	✓	✓	✓	✓	✓	X	✓	✓
41	✓	✓	✓	✓	X	✓	✓	X	✓	✓	✓	X	✓	✓
T	32	6	39	29	33	24	41	27	41	36	41	0	40	35
%	78	14	95	70	80	58	100	65	100	87	100	0	97	83

(A: after the plan implementation; B: before the plan implementation)

3. Socio-economic characteristics of new and old residents

		Old residents		**New residents**	
Variables	**Attributes**	Frequency (n=41)	Percentage (%)	Frequency (n=60)	Percentage (%)
Age	18-24	1	2	3	5
	25-54	29	71	48	80
	55-64	10	24	9	15
	≥65	1	2	0	0
Gender	F	23	56	29	48
	M	18	44	31	52
Education	None	**11**	**27**	**0**	**0**
	Primary	15	37	4	7
	secondary	11	27	21	35
	University	**4**	**10**	**35**	**58**
Source of income	None	8	20	14	23
	Agriculture	**21**	**51**	**0**	**0**
	Wages	3	7	28	47
	Business (self-employed)	9	22	18	30
Monthly income (Rwf)	None	8	20	15	25
	<45,000	16	39	2	3
	45,000-100,000	**12**	**29**	**0**	**0**
	100,001-300,000	4	10	7	12
	300,001-600,000	1	2	23	38
	60,001-1,000,000	**0**	**0**	**11**	**18**
	>1,000,000	**0**	**0**	**2**	**3**

(Rwf: Rwandan francs)

4. Uses of cadastral information

Nº	Data	Why	How	By who
1	Parcel	Land readjustment	Joining parcels to form unit for planning	• Resettlement committee • Landowners • Buyers • Geo-Info Africa ltd. • The district • City of Kigali
			Replotting parcels	
			Reallocate parcels	
		Minimize the cost of redevelopment	Avoid damaging many plots	• Geo-info Africa ltd. • District • City of Kigali
			Avoid damaging the whole plot	
			Keep existing infrastructure	
		Estimate utility demand	Length of pipeline	• WASAC • Geo-Info Africa ltd. • District • City of Kigali
			Number of connections needed	
2	Owner	Find land with annotation	Mortgages	• RLMUA • District • City of Kigali • RHA
			Conflict	
			Protected area	
			Not registered land	
		To know who owns what	Identify owners in the selected site	• RLMUA • Resettlement committee • Landowners • Buyers • District • City of Kigali • RHA
			Identify owners after replotting	
			Link commitment form with owners	
			Matching owners with new parcels	
3	Land title	Progress of the project	Putting together collected titles	• RLMUA • Landowners • Buyers • Resettlement committee • District • City of Kigali
		Proof of ownership	Having the title means you own land	
		Proof of commitment to the project	When you hand in the title, you agree with the project	

5. Form 25 (first registration form)

Edition Nov 2014

FORM 25

INYANDIKO ISABA IYANDIKISHA RY'UBUTAKA BUTABARUWE

Umwirondoro

Njyewe/Twebwe: ....

Irangamimerere: ....

Indangamuntu/Pasiporo: ....

Aderesi: Akarere ka Kicukiro Umurenge wa Gahanga Akagari ka Nunga

Umudugudu wa ....Telefoni : .... E-mail: ....

Cyangwa

Isosiyete/ONG/Ishyirahamwe ry'umwuga/Idini/Koperative/Ibindi..................

Njyewe (Uhagarariye mu buryo bwemewe n'amategeko):..................

Indangamuntu/Pasiporo: ....

Aderesi: Akarere ka.................. Umurenge wa ....Akagari ka ....

Umudugudu wa ....Telefoni : .... E-mail: ....

Ndasaba iyandikisha ry'ubutaka butabaruwe

Amakuru ku kibanza/Isambu

Nimero y'ikibanza/isambu (UPI): ....

Umujyi wa Kigali/Intara: Umujyi wa Kigali

Akarere: Kicukiro

Umurenge: Gahanga

Akagari: Nunga

Impamvu yo gusaba iyandikisha ry'ubutaka butabaruwe

....

Ubutaka nara bwguze..................

Inyandiko zisabwa n'ibigomba gukorwa kugira ngo iyandikisha rikorwe

Kopi y'ibiranga nyir'ubutaka/ba nyir'ubutaka	
Icyemezo cyo kuba washyingiwe/Icyemezo cy'uko uri ingaragu	
Icyemezo cy'umutungo utimukanwa cyatanzwe n'Ubuyobozi bw'Akagari ubutaka buherereyemo cyemejwe n'Ubuyobozi bw'Umurenge	
Inyandiko yemeza nimero y'ubutaka (UPI) iyo izwi	
Iyo nimero y'ubutaka itazwi: Ifishi y'ubutaka (*Fiche Cadastrale*) yemejwe n'umukuru w'ibiro by'ubutaka by'Akarere na raporo y'ipimwa ry'ubutaka yashyizweho umukono na nyir'ubutaka, abo bahana imbibi, umukozi wapimye ubutaka n'umuyobozi w'Akagari k'aho ubutaka buherereye	

24/7/2016
Itariki

....
Umukono w'usaba (abasaba)

Byakiriwe kandi bisuzumwa na:

Itariki: 01/08/2016

Umukono: ....

Kashe

KICUKIRO DISTRICT ONE STOP CENTER

6. Form 33 (Form to confirm ownership of land by local authorities)

Edition Nov 2014

REPUBULIKA Y 'URWANDA

FORM 33

UMUJYI WA KIGALI/INTARA .....Y.K.....
AKARERE KA...Kicukiro....
UMURENGE WA ...Gahanga....

ICYEMEZO CY'UMUTUNGO W'UBUTAKA

Ubuyobozi bw'Akagari ka..NUNGA..... buremeza ko Madamu ..... na Bwana ..... bafite/afite umutungo w'ubutaka bwabaruwe kuri N°..... mu Mudugudu wa ....., Akagari ka ...NUNGA.....Umurenge wa ...GAHANGA....., Akarere ka ..KICUKIRO....., Intara ya UMUJYI WA KIGALI

Ubwo butaka bufite, ugereranije, metero 20. kuri 15.. bukaba bugenewe ..GUTURA...
(Ubuhinzi, Ubworozi, Gutura, Ubucuruzi, Amashyamba, ...)

Buremeza kandi ko uyu mutungo nta makimbirane ufite.

Umunyamabanga Nshingwabikorwa w'Akagari ka ....NUNGA.....

Itariki 20./07./20.16

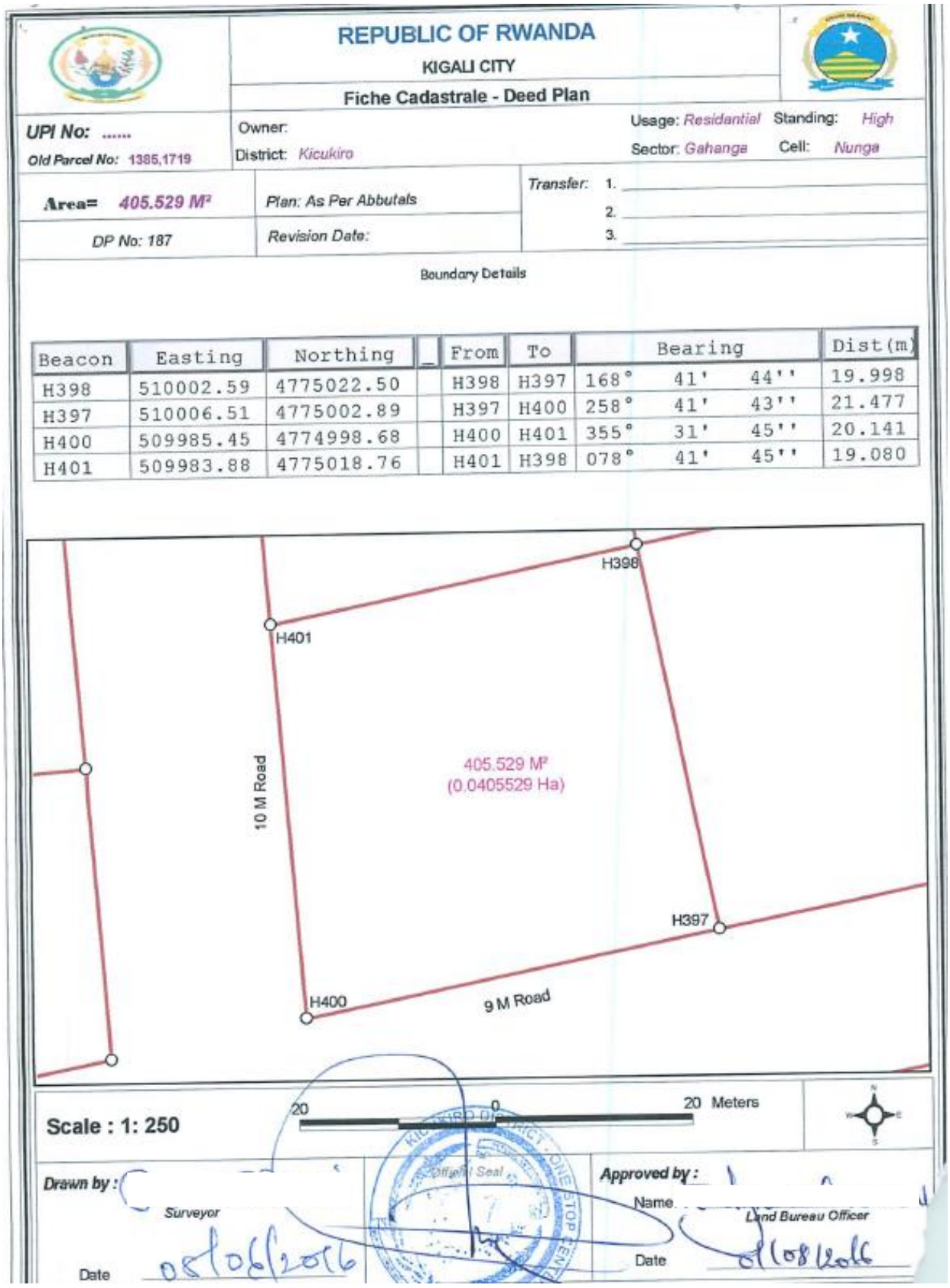
Umukono na kashe .....

Byemejwe n'Umunyamabanga Nshingwabikorwa w'Umurenge wa...Gahanga.....

Itariki 20./07./20.16

Umukono na kashe .....

7. Cadastral Plan



REPUBLIC OF RWANDA

KIGALI CITY

Fiche Cadastrale - Deed Plan

UPI No: .....

Old Parcel No: 1385,1719

Owner:

District: Kicukiro

Usage: Residantial Standing: High

Sector: Gahanga Cell: Nunga

Area= 405.529 M²

Plan: As Per Abbutals

DP No: 187

Revision Date:

Transfer: 1. 2. 3.

Boundary Details

Beacon	Easting	Northing		From	To	Bearing			Dist(m)
H398	510002.59	4775022.50		H398	H397	168°	41'	44''	19.998
H397	510006.51	4775002.89		H397	H400	258°	41'	43''	21.477
H400	509985.45	4774998.68		H400	H401	355°	31'	45''	20.141
H401	509983.88	4775018.76		H401	H398	078°	41'	45''	19.080

Scale : 1: 250

20 0 20 Meters

Drawn by :

Surveyor

Date 08/06/2016

Official Seal

Approved by :

Name

Land Bureau Officer

Date 8/08/2016

8. Sale agreement

AMASEZERANO Y'UBUGURE BW'UBUTAKA MU MURENGE WA GAHANGA/
"SITE KINYANA"

Aya masezerano agamije gufasha uguze n'ugurishije ubutaka bwatunganyijwe mu Murenge wa Gahanga, Akagari ka ..Nunga.... ngo butuzwemo kandi ababuguze n'abagurishije bishyurane binyuze mu mucyo bafashijwe n'ubuyobozi bw'umurenge na komite yatowe n'abafite ubwo butaka.

Amasezerano akoze ku buryo bukurikira :

Hagati ya Bwana, ...ufite ID №........ yatangiwe mu Karere ka ..Kicukiro....Umurenge wa ..Gahanga.....na Madamu we...ufite ID №.............. yatangiwe mu Karere ka ...., Umurenge wa ....bitwa/ witwa abagurishije/ugurishije ubutaka muri aya masezerano

Na

Bwana na (Madamu) ...ufite/bafite ID № PP ....yatangiwe mu Karere ka NYARUGE . RUSHAKA Umurenge wa..Kirundo. bitwa/yitwa abaguze/uguze ubutaka muri aya masezerano;

Humvikanyweho ibi bikurikira:

Ingingo ya Mbere:

Ugurishishije ubutaka abugurishije nta makimbirane arimo kandi nta gahato

Ingingo ya 2:

Uguze ubutaka abikoze kubushake kandi agomba kuzashyiraho inyubako ihagenewe hakurikije "plans" zateguwe;

Ingingo ya 3:

Ugurishije agomba gufasha uguze kubona ibyangombwa by' ubutaka aguze;

9. Original Conceptual design of the study in the proposal