LINKING LAND USE, TENURE AND CONSOLIDATION IN RWANDA

INNOCENT RUBANJE

Enschede, the Netherlands, February, 2016

SUPERVISORS:
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Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation.
Specialization: Land Administration

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ABSTRACT

Land consolidation can be used for agriculture transformation and rural development. It improves agricultural productivity by fostering rational land use. Land consolidation is implemented differently depending on the country context. However, it generally uses land tenure information in the whole process, specifically for identification of the existing situation, potential changes, and updating the new situation on the ground. The plan of land consolidation should have at least the information about the existing landowner, the type of ownership, and any other rights, responsibilities and restriction on the land. In addition, the plan should provide expected possible changes. Therefore, the registered information of people-to-land relationship may be necessary to facilitate the implementation of land consolidation.

Rwanda launched a land use consolidation (LUC) in 2007 and commenced implementation in 2008 under the crop intensification program (CIP). The project started before Rwanda's land tenure regularisation (LTR) program. From 2009 up to 2013, the country completed this systematic land registration countrywide and compiled a complete record of land tenure information. All forms of tenure were brought under one statutory system.

The aim of this study is to determine the role of land tenure information in Rwanda's LUC programs. It focuses on how land tenure information was used prior to, and after LTR to support the programs. It builds on information from the interviews with government officials at National level and from within the Kirehe district, and from the farmers of Kinoni and Nasho study areas which started LUC activities before and after LTR, respectively. The government officials explained activities, the type of information required, the source of information, and how that information is used to implement these activities. Interview with farmers focused on how people-to-land relationships are affected by LUC activities. The perceptions of government officials and farmers on the relevance and better use of land tenure information in LUC program was collected. The analysis of laws and policies demonstrated the intended use, or not, of land tenure information in Rwanda's LUC. In addition, spatial data analysis was used in order to illustrate the actual changes on the ground, to analyse how parcels have been affected, and if the changes were updated in the current official cadastral shapefile.

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The main finding of this study is that prior to LTR, the information used to implement LUC was from local leaders, in conjunction with communities and hired consultants. This was because rural areas were characterised by customary land tenure that was not registered. In the post LTR period, the registered land tenure information from LTR is beginning to be used by some government projects in LUC programs. Although the registered land tenure information is available, only the cadastral shape file is being used, in the sense of facilitating the process of expropriation and compensation. This is done in the case of changes of parcel sizes, due to the introduction of infrastructures in the scheme. However, the results from the Nasho site revealed that the rights and responsibilities are changed after the implementation of LUC. Thus, information on existing rights, responsibilities and restrictions was actually needed before implementation of this scheme. It is also clear that this information is relevant in existing LUC programs. In addition, there are emerging idea for making better use of land tenure information in this program - for proper land use planning, for land rights recognition, and to facilitate land administration updating and maintenance.

Key words: *Land consolidation, land use consolidation, land tenure regularisation, land tenure information and food security*

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ABBREVIATION

AEC	: Economic Commission for Africa
CIP	: Crop intensification program
ECE	: Economic Commission for Europe
FAO	: Food and Agriculture Organization
GFI	: Government funded irrigation taskforce
GIS	: Geography information system
GoR	: Government of Rwanda
KWAMP	: Kirehe community based watershed management project
LAIS	: Land Administration information system
LTR	: Land tenure regularization
LUC	: Land use consolidation
LWH	: Land Husbandry Water harvesting and hillside Irrigation
MINAGRI	: Ministry of Agriculture and Animal Resources
MINALOC	: Ministry of Local Government
MINERENA	: Ministry of Natural Resources
MININFRA	: Ministry of Infrastructure
MINITERE	: Ministère de la terre et environnement
NUR	: National University of Rwanda
RAB	: Rwanda Agriculture Board
RNRA	: Rwanda Natural Resources Authority
RPRS	: Rwanda poverty reduction strategies
SPSS	: Statistical Package for the Social Science
USAID	: United States Agency for International Development
UN	: United Nations
UNECE	: United Nations Economic Commission for Europe

GLOSSARY

Customary land tenure: the rules to access, and dispose of the land with its resources in the community, by the respect of the existing social condition of that community. The right over the land are not be evidenced by the government but are recognised by community its self (Arko-Adjei, 2011; Paaga, 2013).

Land administration information system (LAIS): "*a web design based land registration tool developed in Rwanda in order to ensure proper land management, land administration and specifically the maintenance of land certificate issued to landholder during land registration. The change of land right is notified through administrative documents. The spatial component is not included in the attribute of LAIS*" (RNRA, 2012).

Land consolidation(LC): reallocating fragmented parcels which are used for agriculture and forming large-scale parcels for more rational land holding (Vitikainen, 2004).

Land information: refers to wide range of spatial information including socio-economic and environmental data, as well as cadastral and infrastructures information(ECE, 1996).

Land tenure information: the information (paper based or digital) of people-to-land relationship (land owner, type of right, responsibilities and restriction over the land).

Land tenure information from LTR refers also to the information provided by LTR which is in one form of the statutory tenure system.

Land tenure information prior to LTR: the information which was in the form of statutory and customary tenure before Rwanda's LTR.

Land tenure regularization(LTR): the process of recognizing all existed land rights of people or organizations over the land through administrative procedure in order to ensure formalization and deliver the land right to the people (Deininger et al., 2010, p. 50)

Land use consolidation (LUC): "procedures of putting together small parcels under one selected crop in order to manage the land and use it in an efficient and uniform manner"(GoR, 2013).

Land use consolidation programs refers to all activities which are implemented with the action of putting together the small parcel holdings under one selected crop in a specific scheme.

Parcel: for this study it is defined as land which characterised by Unique identifier, size, geometry location and boundary

People-to-land relationship: refers to how people (natural or non-natural) own the land in respect of their rights, responsibility and restriction over a specific land (size, geometry location and boundary)

Statutory land tenure: the form of tenure by which the right to use and to dispose use rights they are formalised and have the evidence provided by the government. Thus, the transfer of right is necessary formally recorded (Paaga, 2013)

1. INTRODUCTION

1.1. Background

Food security is a cross-cutting issue in international priorities: food is a basic need for well-being (Vahabi & Martin, 2014). Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutrients and food preferences (Farsund, Daugbjerg, & Langhelle, 2015). Linking land use, tenure and land consolidation is argued to play a major role in delivering food security.

Land use and land tenure are two concepts that are not easily separated: one affects the other. If land tenure issues are not considered in land use planning, it can lead to the insecurity of tenure. Furthermore, the lack of rights on land reduces the motivation to implement long-term land use plans (ECA, 2004). One of the techniques to change land use practice is land consolidation. This is considered as a tool for promoting agricultural production. (Guo et al., 2015) explained that land consolidation makes land more capable for higher production of crops; it improves crop yields and is more likely to ensure food security. However, it is generally accepted that land consolidation cannot be successful without a link to land tenure activities. Rammohan and Pritchard (2014) argue that land tenure with land consolidation together enhance food security, where the landowners are more confident and have the right to their land.

Land consolidation, at least in the European context, was adopted as a tool for resolving land fragmentation (Haldrup, 2015b), and for increasing agricultural production - without any other considerations (van Dijk, 2007). Later, it was changed and considered as a tool for rural development (Zhang, Zhao, & Gu, 2014), which includes socio-economic and environmental aspects (Liu et al., 2013). To achieve these three aspects, land consolidation procedures are generally accepted to require the use of land information (FAO, 2003b).

Land consolidation procedures vary from one country to another, but there are some general similarities. Demetriou (2014) distinguished three main stages in land consolidation. The first step is the administrative preparation that involves the request of land consolidation for a specific area, sensitization of farmers about the project, setup of an executive committee, and recruitment of a cadastral surveyor for the delineation of the study area. The second step is related to the planning activities that require the update of land owners' information for the consolidated area, land valuation, and the approval of the proposed project by all stakeholders. Implementation of land consolidation is the third step of the project. It involves demarcation of the boundaries of the new parcels, compensation to land owners, registration of new parcels and new land owners, followed by the issuance of land titles. It should be noted that the availability of tenure information is the key requirement for all the above processes.

Rwanda, as a small country of 26,388 km2 with a population of 10.5 million (GoR, 2012), is continually seeking to better utilize its lands in order to ensure productivity levels, that will subsequently ensure food security (Nabahungu & Visser, 2013). In 2004, the Government of Rwanda put in place a National Land Policy and Land law (2005) which aimed to ensure land tenure security in order to promote business in land, provide a proper land use planning and enhance LUC (MINITERE, 2004; Musahara & Huggins, 2004)

LUC was launched in 2007, and implemented in 2008 under the CIP. The government actively promoted the cultivation of a single crop by multiple farmers within a large area in order to increase agricultural production (Musahara, Birasa, Bizimana, & Niyonzima, 2014). For this approach, the extension services and provision of improved seeds, and fertilizers were considered to be easier if farmers were all

undertaking similar activities. Ministry of Agriculture and Animal Resources (MINAGRI) under CIP focused on food crops that were identified to most strongly support the food security objective. Irish potato, maize, beans, cassava, wheat and rice were the selected crops in different regions of the country. These crops were selected based on agro-climate conditions.

The approach of public-private partnerships was used for distribution of seeds and fertilizers. The program is considered successful since the production level was improved: national wide the production of wheat and maize increased by 6-times, that of cassava and Irish potato tripled, and the production of beans and rice increased by 30%. All this improvement was recorded within four years of the program implementation (Kathiresan, 2011).

At the time of LUC establishment, Rwanda had both statutory and customary land tenure systems (RNRA, 2012). Furthermore, in the implementation of LUC, the role of land tenure information was neither highlighted nor apparently considered. The ministerial order No 14/11.30 of 21/12/2010 determined the model of LUC: in article No3, MINAGRI was mandated to facilitate and implement the process of LUC.

Meanwhile, in 2009 LTR commenced, and ran until August 2013: 10.3 million parcels were demarcated and adjudicated, 8 millions of lease and freehold were prepared and issued (Gillingham & Felicity, 2014). The program provided much land tenure information, information that would normally play a role in the process of land consolidation. Yet, there was no clear relationship between the Rwanda Natural Resources Authority (RNRA) that held land tenure information, and the MINAGRI that was mandated for implementation of LUC programs.

However, during the implementation of LUC, rearrangement of parcels occurred (Kathiresan, 2011, Kathiresan, 2012). This resulted in the resettlement of some households from the consolidated area to other residential areas (Kathiresan, 2011). Therefore, there is a need to know how LUC implemented prior to LTR, and if the available land tenure information from LTR is necessary for sustaining Rwanda's LUC programs

Several studies have been carried out on LUC in Rwanda, but many of them focused on the impact of agricultural production and the increase of the size of the area to be consolidated. Kathiresan 2012 showed that consolidated areas increased from 28,016 Ha in 2008 to 502,916.55 Ha in 2011. Pritchard (2013) focused on how the aggressive land registration and CIP have reduced the tenure security and food security, and Bizoza & Havugimana (2013) focused on an assessment of the factors which influence the landowner in adopting the policy of LUC at the household level. To complement these existing studies, this research aims to investigate the link between land tenure and LUC in Rwanda, in order to determine if there really is a need of land tenure information for sustainable LUC.

1.2. Research Problem

FAO (2003b) asserts that the process of land consolidation should be undertaken to improve tenure security, increase agricultural production and support environmental protection. Therefore, if it is not planned and implemented using reliable land tenure information, it can be reasoned that it will likely result in the insecurity of tenure, leading people to be unwilling to invest in land - thus reducing agricultural output, and defeating the goal of land consolidation.

Practical experience in different countries like Denmark, Netherlands has shown that land tenure information is important from the planning stage up to implementation stage of a land consolidation

project (Vitikainen, 2004). However, the role of land tenure information in the process of LUC in Rwanda remains unclear. Muhinda and Dusengemungu (2011) showed that in Rwanda, LUC is a multi-sectorial process where the implementation is driven by MINAGRI, its agencies, and in conjunction with local leaders. Through the mobilization of farmers in the villages, the priority crop is cultivated in the consolidated area.

However, the role of RNRA, which holds land tenure information, is not known in the establishment and process of Rwanda's LUC. The achievement of these objectives normally affects people-to-land relationships, hence the need of tenure information before and during the process of land consolidation. In addition, it is not known whether land tenure information prior to LTR was considered, or if land tenure information from LTR is currently used, or if the latter is necessary during Rwanda's LUC programs. This knowledge may be key given that land consolidation programs elsewhere have generally proclaimed the need of land tenure information in order to be sustainable.

Therefore, the overarching problem driving this research is: The role of land tenure information in Rwandan LUC programs is unclear. For this, the sustainability of these programs may not be clear also – or that land tenure information is not crucial as has been previously proclaimed.

1.3. Conceptual framework

The conceptual framework related to this work is presented in Figure 1. To clarify the boundaries of this research, the main concepts are: LUC, land consolidation, and land tenure information. The theoretical relationship between the concepts of land tenure and land consolidation is discussed in the literature review – as are understandings of the role of land tenure information. The actual research focuses on how land tenure information was utilized in LUC across two periods: that coming before, and that coming after LTR. The pre-LTR period included both customary and statutory land tenure regimes. The post-LTR period only includes statutory lands. However, some form of land tenure information was available in both periods. The area of focus for this research is where the contribution of land tenure information remains unknown in LUC (both before and after LTR)

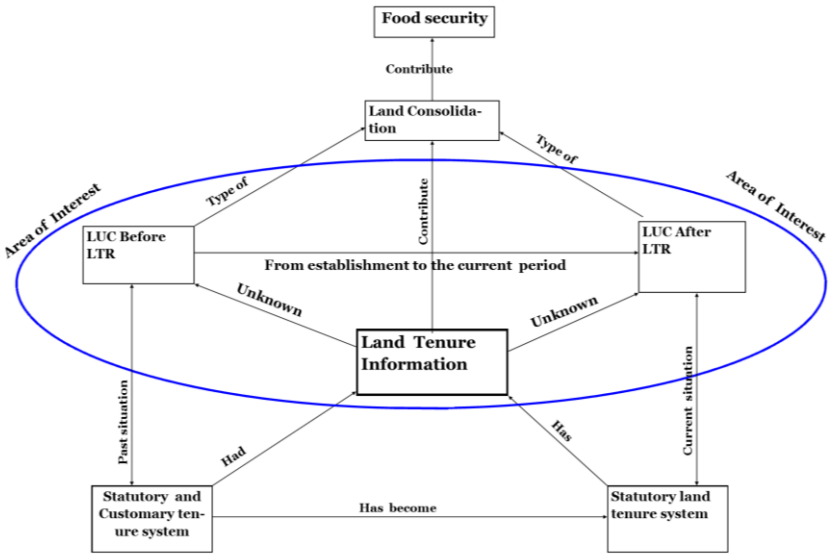


Figure 1: Conceptual framework

1.4. Research objectives

1.4.1. General objective1

To determine the role of land tenure information in Rwandan LUC programs.

1.4.2. Sub-objectives

1. To understand how land tenure information supported LUC programs prior to the Rwandan LTR
2. To establish how land tenure information from Rwanda's LTR currently supports LUC programs
3. To ascertain stakeholder perceptions about land tenure information in LUC programs

1.4.3. Research questions

1. To understand how land tenure information supported LUC programs prior to the Rwandan LTR

1.1 Did policies or laws about LUC programs consider land tenure information?
1.2 Was land tenure information was actually used in the LUC programs?
1.3 How did LUC activities actually affect people-to-land relationships?

2. To establish how land tenure information from Rwanda's LTR currently supports LUC programs

2.1 Do any policies or laws demand use of information from Rwanda's LTR in LUC programs?
2.2 Is land tenure information from Rwanda's LTR used in LUC programs?
2.3 How does the use of land tenure information from LTR impact on people-to-land relationships?

3. To ascertain stakeholder perceptions about land tenure information in LUC programs

3.1 Was land tenure information seen as relevant to existing LUC programs?
3.2 Do ideas exist on how land tenure information can better support future LUC programs?

[1] Note: The intended methods for responding to the general objective specific objectives, and research questions are provided - in detail - in the research methodology chapter

1.5. Thesis structure

This thesis has eight chapters which are structured as follow:

Chapter 1: The introduction describes the general background, justification and research problem. The conceptual framework and main objective are also presented. Finally, the sub-objectives which linked to their research questions are listed in this chapter.

Chapter 2: This chapter consists of a review of the existing literature from journals, academic documents and textbooks that build the study. The concepts discussed are food security, land tenure systems, land consolidation and types of land consolidation. It includes the effects of land consolidation on land rights and physical aspect of the parcel and the role of land tenure information.

Chapter 3: This chapter contains the details of the approach used to conduct this research. It includes research design, description of the study area and sampling techniques. It describes the method of data collection, the source of data and technique used for data analysis.

Chapter 4: This chapter presents the results concerning the support of land tenure information before LTR. The first section presents the results of how policies and laws governing the use of land tenure information in LUC programs prior to LTR. The second section present the general views of government officials on how before LUC land tenure information was used in Rwandan LUC programs. The last section presents also the results from farmers and spatial analysis of how LUC activities affected the people-to-land relationship in Kinoni study area.

Chapter 5: This chapter presents the results concerning the support of land tenure information in LUC programs after LTR. The first section presents the results of how policies and laws requiring the use of current land tenure information from LTR in LUC programs. The second section presents the general views of government officials on how currently land tenure information from LTR is supporting Rwandan LUC programs. The last section presents also the results from farmers, government officials and spatial analysis of how LUC activities affected the people-to-land relationship, and how land tenure information was used in Nasho study area.

Chapter 6: This chapter presents the results from government officials and farmers of two study areas. It shows their views about the relevance of using land tenure information in LUC programs.

Chapter 7: This chapter presents the discussion and analysis of results. Our results helps to realize the similarities or the contradictions from the findings with the previous research works.

Chapter 8: this chapter summarises the answer of each research question and the main objective.

1.6. Summary

In this chapter, the scene was set for the intended research. The background clarifies the importance of food security and how linking land use and land tenure are one of the measures for ensuring food security. In addition, it explains that land consolidation is a technique for altering of land use practices. On the other hand, this chapter shows that it has regularly been argued that land consolidation needs to be implemented with land tenure information, in order to ensure its sustainability. The case of Rwanda shows that it is unclear if land tenure information was used, or was even necessary for Rwanda's LUC activities. Thus, the main objective of this research is to determine the role of land tenure information in Rwanda's

LUC programs. Sub-objectives and research questions were provided to support the achievement of the overall objective.

2. LITERATURE REVIEW

This chapter reviews the existing literature on the theories of land tenure, land consolidation, land use consolidation and land tenure information. It presents the linking of land tenure and land use, how land consolidation affects people –to-land relationship and the role of land tenure information to sustain the land consolidation. The chapter presents also the general land reform and the historical background of land use consolidation in Rwanda

2.1. Unpacking the concept of land tenure

Land tenure is a widely used term and has more than one definition. land tenure defined as the rules which set how land should be used, possessed, or how it should be disposed of within a society (Robinson, Holland, & Naughton-Treves, 2014). Land tenure is also defined as a relationship which can be legal or customary - between people and land (FAO, 2002). In addition to that, Zevenbergen (2009), explains that land tenure systems are rules that set out to show how people can use the resources (land), for how long, and under defined conditions. Land tenure is also explained as *"the processes which secure the access to land and system of allocation, surveying and mapping, recording parcel boundary information, modification related to parcel information, alienation issues through sale, lease, and credit security; and conflict management regarding ownership boundary claims*" (Williamson, Enemark, Wallace, & Rajabifard, 2010). Moreover, the continuum of land rights describes the tenure system from the informal to formal right. Figure 2 below, adapted from Williamson et al.(2010) shows the continuum of land rights.

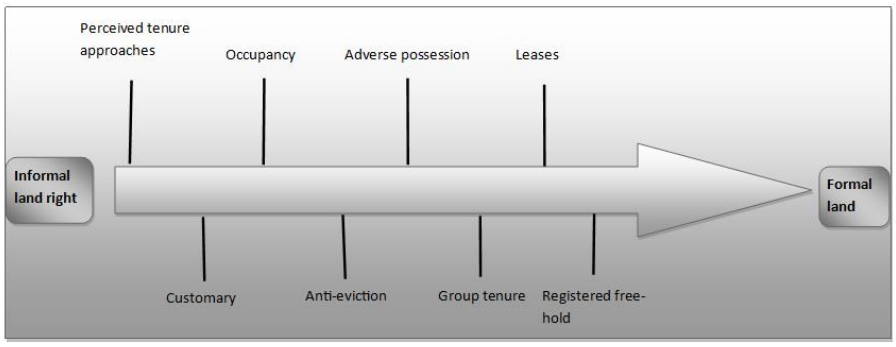


Figure 2: Continuum of land right(UN-HABITAT, 2008)

Depending on the country context, the tenure system that is not statutory or legally recognised is considered as 'informal' land tenure that is often argued to need tenure regularisation. Across the globe, land tenure is differently organised which results in various types of land rights (Zevenbergen, 2002). Customary land tenure is a broad umbrella term used to encompass traditional, indigenous and communal land tenure. The customary land tenure is defined as the rules to access, and dispose the land with its resources in the community, by respecting the existing social condition of that community (Arko-Adjei, 2011). In the customary system, the right to use and to dispose are not dependent on the evidence provided by the state-based government, but, it has to be recognised by the community. The transfer of the rights are not formally recorded (Paaga, 2013). The customary tenure system can be reformed into a statutory land tenure system where the existing social conditions and all rights are considered, and all forms registered under one statutory form. The right to use, to dispose and to transfer is written, recorded and recognised by the state (Wily, 2012).

2.2. Examining land tenure reform in Rwanda

In Rwanda, the land tenure systems in the pre-colonial period were characterised by collective land ownership under customary law. Rights on land, which were accorded by the king, were under the customary system and could be transmitted from generation to generation. However, a small part of the land which belonged to colonialists, and other foreigners, were registered and recognised by written law. After independence, the law No 9/76 of 4/3/1976 transferred all non-registered land, including those under customary law, to the state. After the law was enacted, the state recognised only the private ownership of the registered land. However, the right of people to occupy and use the unregistered land was recognised under customary law (Sagashya & English, 2009).The population growth, expropriation by the government, conflict history of Rwanda and land degradation had put pressure on the customary land tenure system. A defective land tenure system had led to the insecurity of tenure. Therefore, the regularisation of ownership was deemed necessary.

The new legal framework emphasized on the reform of Rwanda's land administration so that the right on land be recognized under written law. The principal points of organic land law were: 1) Clear recognition of right and obligation of individual and state over the land; 2) Land registration and titling should take place nationwide, and 3) Establishment of the institution with a clear mandate of land .administration. The 2% of statutory land which was considered as protected by the legal framework needed to be fully understood and confirmed before systematic registration could commence. Therefore, LTR had to bring the two systems - customary and statutory – into a valid formal right into the register by systematic registration. It was necessary to accept available supporting documents which showed how the land have been acquired like, witnesses, bill of sales, and so on. The process of LTR was required to enable a single process to bring all land rights to be provided under the organic land law (Sagashya & English, 2009).

2.3. Exploring the role of information in land administration

Diverting briefly from the Rwandan context, the importance of land tenure information requires examination to support the next part of the analysis. The ECE (1996) explained that the term land information system is "applied to a wide range of spatial information which includes environmental and socio-economic data as well as data related to infrastructure systems and cadastral". Thus, land information is not only parcel based information because it can include even the information regarding forest resources, geology, soil and many varieties of data. Therefore, land information in land administration refers also to cadastral information that consists of the records of the owner (nature or non-nature) in the relationship with the land (right, responsibilities and restrictions). Cadastral include also the information of the parcel geometry and the improvement on parcel like the value of parcel, tax, buildings, and all infrastructures which are connected to parcel geometry (FAO, 2003a).

In this study, the term "land tenure information" is used to define the information (paper based or digital) which include land right (Owner, type of ownership, right, responsibilities and restriction) and physical aspect of parcel (Unique identifier, size, geometry location and use)

The implementation of land use planning without the integration of a land administration system is argued to delay positive outcomes and even promote failure. Land information can be used to show the existing situation and update the new situation, for example, the change on shape of the parcel is recorded, the subdivision of parcel due to inheritance is registered - and other planned changes on land (FAO, 2003a). Williamson et al. (2010) goes beyond all this argues that land administration system can actually be considered as a type of information infrastructure – one that helps the implementation of land policies and management in order to ensure sustainable development.

2.4. Identifying Rwanda's Land Information

Many countries lack a coherent approach of land administration where by land information and other process are often disaggregated across the nation, provinces, and municipalities. All this need a land administration system which can be used to avoid these disparities(R. Bennett, Rajabifard, & Williamson, 2012).

Returning to Rwanda, the land administration system has two phases in its story. The first is identified inthe organic land law of 2005 where systematic land registration was proposed and implemented in 2009. Before this period, the land belonged to, and was managed by, the government: the citizens had only the right to the improvements (Sagashya & English, 2009). The second phase, the current phase, started after systematic land registration for the purpose of maintaining land information.

Rwanda's land administration is organised from Sector level up to Provincial level. There are 5 offices of registrar of land titles - 4 in the provinces and 1 in Kigali city. Every office of land registrar works together with all the districts under the province for maintenance of land information system. For any change required to land, the information is sent from Sector to District and the application is then submitted to the office of the registrar. The end process is at central level where land information is managed in the central land administration information system (LAIS) (RNRA, 2012).

LAIS control and maintain the different changes to right holders, rights, changes on parcels, and others changes like replacement of certificates, sporadic registration and to rectify errors in the land registry. The spatial component (parcel geometry) is not included as an attribute of LAIS: changes on parcels such as merge, subdivision and rectification boundaries, are performed in another component of the system which is the GIS. The system does not include the technical details which can be used for the maintenance of spatial cadastral (RNRA, 2012). Figure 3 shows all types of changes which can be performed by LAIS

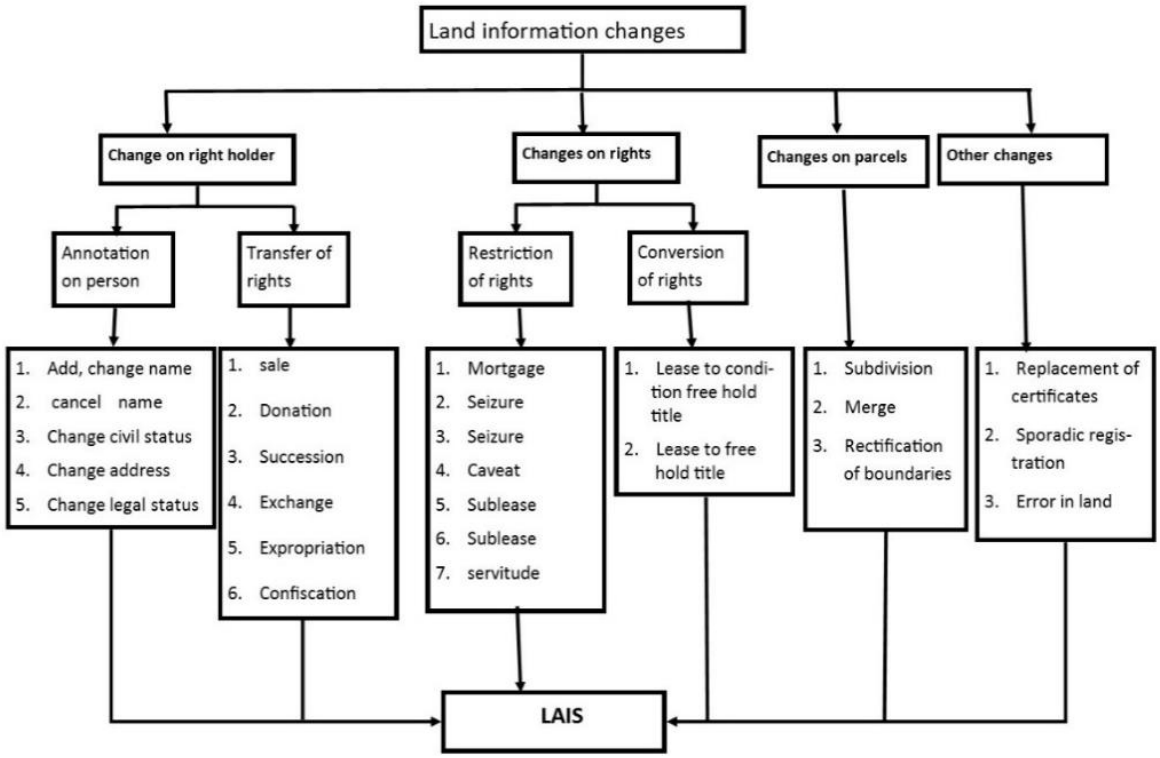


Figure 3: Land information which can be created and maintained in LAIS/ Adapted from (RNRA, 2012)

2.5. Uncovering land fragmentation and land consolidation

In its simplest expression, land fragmentation is defined as where more than one parcel is geographically separated and owned by one landowner (Boliari, 2013). Bizimana, Nieuwoudt, and Ferrer (2004) identifies land fragmentation as where one farmer can farms more than two separated parcels - and multiple persons can own one parcel. Land fragmentation is also characterized by land parcels that have non-accessibility to roads, lack of irrigation system, and where technology application is made more difficult to justify (Demetriou, Stillwell, & See, 2013). Hartvigsen (2014) showed the results from 25 countries of Central and Eastern region of Europe in 1989, where by land fragmentation has been shown as the barrier for agricultural production and rural development, especially where ownership of land and use of land are extremely fragmented (Latruffe & Piet, 2014).

Meanwhile, Vitikainen (2004) defines land consolidation as the reallocation of fragmented land which is used for agricultural, or other purposes. It is used as a supportive tool for improve agricultural production and accelerating development of rural area (Sklenicka, 2006). In addition to that, land consolidation is implemented alongside basic infrastructure development including roads and irrigation facilities (Coelho, Portela, & Pinto, 1996). The history of land consolidation shows that it was started in Denmark in the 1750's, in the sense of avoiding the system of noble landlords and creating private land ownership (FAO, 2003b). In other parts of Europe, land consolidation was developed from the end of 19th and 20th century (Vitikainen 2004). As the time went on the concept was developed and started to incorporate the broader issues related rural development (socio, economic and environmental aspects) (FAO, 2003b).

2.5.1. Classifying land consolidation

Generally land consolidation is classified in 4 types which known as 1).Comprehensive land consolidation: generally lead to reallocation of parcels(Pašakarnis and Maliene, 2010; Österberg, 2000);. 2)Voluntary group land consolidation which can be done by formulating cooperatives, parcel exchanges and it can be enhanced by government (Meha & Idriz, 2010; Sonnenberg, 2002); 3)Simplified consolidation which tend to be like comprehensive one, but with the relaxed requirement(Demetriou, Stillwell, & See, 2012); Finally Individual land consolidation based on agreement between the people themselves without intervention of government, to join the use of their lands. it also based on informal and sporadic approach, in addition to that it is market oriented in the form of lease, buy and selling for economic of individual considerations (FAO, 2003b; Lerman & Cimpoies, 2006).

2.5.2. Investigating the sustainability of land consolidation

Literature shows the shifting goals of land consolidation from increasing agricultural production to a broader rural development perspective (van den Noort, 1987). In this regard, the sustainability of land consolidation can be looked at from three aspects: social, economic and environment. Besides agricultural production, during land consolidation, there is a need of improvement of natural condition, and landscape (Kovandova, 2006). Therefore, there is a need of environmental impact assessment before any implementation of land consolidation (Crecente, Alvarez, & Fra, 2002). In phases of implementation, the activities of environmental protection such as erosion control, irrigation systems, transport accessibility, conservation areas, and social activities are needed (Coelho et al., 1996). In addition, the social behaviour during land consolidation projects depends on the approach used, that is why Coelho et al. (1996) argue that land consolidation fails where it comes as new in the face of land owners. But where the information of proposed plan comes before and agreed by all stakeholders, the project is more likely to be successful.
The sustainability of land consolidation is perhaps best observed by the longer term benefits derived from it. Demetriou (2013) explain the benefits of land consolidation based on some agricultural arguments: like proper organisation of farms by decreasing land fragmentation of ownership; agricultural mechanisation

activities, increase and improved shape of parcel; and increase of production in the scheme of land consolidation.

2.5.3. Understanding the effect of land consolidation on people-to-land relationship

Sonnenberg (2002) explained that the exchange, reallocation or readjustment of the right of ownership and use of land are basic instruments used for land consolidation. Furthermore, after land consolidation, the rights of use and ownership on parcels are not imperatively held by the same right holder.

After land consolidation, the change of ownership and use right have to be registered in a deed or in other document. Moreover, the relation of tenants and owners may change as the results of the exchange process. In that situation, both the owner and land user agree on the new relationship: the land owner accepts the new tenant and the tenant accepts the new land owner, on his or her cadastral parcel (Louwsma & Lemmen, 2015).

The change of ownership right goes together with the change of parcel size as the results of land consolidation(Pašakarnis & Maliene, 2010). Beside the enlargement of parcel holding, the effect of land consolidation on parcels is also caused by the others provision of basic infrastructures in the scheme - irrigation and drainage infrastructure, roads construction, land levelling and change of land use.(FAO, 2003b)

In this study the effect land consolidation on people-to-land relationship is regarded and subsequently examined as follows: 1) the effect on people - possible changes of right holder (the owner) of a parcel due to land consolidation by reallocation, exchange or other causes; 2) the effect on right - possible changes to the existing rights (to use, to modify, to control, to exclude etc...) due to the implementation of land consolidation. It refers also to possible effect on existing responsibilities and restriction (easement, caveat, mortgage, sublease etc...) due to the implementation of land consolidation; and 3) the effect on land - the effect on physical aspect in this study is regarded as the changes in size, use and boundary of a parcel due to implementation of land consolidation.

2.5.4. Investigating the role of land tenure information for sustaining land consolidation

During land consolidation project design, the plans which shows all engineering works like irrigation system, roads, canals, land levelling and drainage system, have to be presented on a parcel map. This enables adjusting the plan with the parcels and also creates understandings of the possible changes what will happens at parcel level (Cay, Ayten, & Iscan, 2010). Not only physical changes, many types of land consolidation like comprehensive, voluntary and individual land consolidation, require the exchange of land which implicate the change of right holder (Huong, 2014). Therefore, it is generally argued that there is a need for tenure information to clarify the existing right holder, rights, land and possible change prior to implementing land consolidation.

FAO (2002) argues that the exclusion of land administration systems as a starting point of a land consolidation project results in failure of all aspect of the project and causes the situation on-ground to become worse. The parcel adjudication and recordation is fundamentally needed, regardless of the motivation of land consolidation. The basic and initial stage are the same, all require the existing land right holder, or occupier who can be affected. The allocation of land to landless, and the consolidation and redistribution of land in more proper way, require detail of the existing ownership and the use of each parcel(ECE, 1996).

The implementation of land consolidation involves public inspection to check every parcel per right holder (tenant, owner). Therefore, the data should be fixed at a certain date, which at the end can be prepared for using as a public inspection tool. Furthermore, the existing people-land relationship can change, for that the link with cadastral and registry is required (Lemmen et al., 2012).

The plan of land consolidation should have a least the name of land owners (natural or non-natural persons), and the nature of tenure - including the lease rights, easements and mortgage. It should also include the boundaries, shape, size and value of each parcel. In spite of the fact that all this information appears in the land registry, some information may need cross checking on the ground in case that are not registered. The detailed plan with all possible changes should be presented to the land owner for validation. The implementation is followed with the update of land registry and issuance of land title (UNECE, 2005).
The land tenure information is used in planning stage by identifying land owners, existing boundaries, type of ownership, right, and finally the existing responsibilities and restriction. It is use also to show the possible changes like the parcels which are likely to be affected, size of affected parcels and show possible changes of owner, right, responsibilities and restriction. Land tenure information is used also for update the changes which follower by issuance of new land title(Demetriou, 2014; FAO, 2003b).

2.6. Describing LUC in Rwanda

In Rwanda, LUC is defined as ""*the unification of land parcels with an estimated easier and productive farming than the fragmented parcels*"(GoR, 2010). In 2002 the PRSP (Poverty reduction strategy paper), proposed the way forward for consolidating land. Households had to consolidate their parcels to ensure that each holding had at least a 1ha block. To achieve this, the families were requested to cultivate common rather than fragmenting parcels through inheritance (GoR, 2002). Sagashya and English (2009), from National land tenure reform program of 2007, said that the size of parcels vary with the population density. In the west and northern part of Rwanda, the average parcel is 0.17Ha, in eastern parts it is 0.77ha, whilst the national average size of parcel is 0.35ha To achieve the required 1ha, at least over a half a million household would have to surrender their parcels, but receive compensation, according to the policy (Musahara & Huggins, 2004).

Later, LUC was established and launched in 2008 under CIP. It was not only established with a CIP but also with resettlement of the people from agricultural area to residential areas. This was done to avail free land for agriculture and for forming a residential village that would facilitate people to access of government facilities like basic infrastructures easily (Muhinda & Dusengemungu, 2011). Therefore, the objective of LUC was based on improving agricultural land division for enhancing agricultural production and contributing to land use planning in villages (Herman et al., 2014). Table 1 shows the objectives of LUC compared to other types of land consolidation in different countries

Table 1. Comparison of objective of LUC of Rwanda with objectives of land consolidation in Europe

*******:Primary objective ******:Secondary objective *****:Minor objective **0**:Not the objective

Objectives	Finland	Germany	The Netherlands	Sweden	Rwanda
Improvement of Agricultural land division	***	***	***	*	**
Improvement of forest land division	**	*	*	***	0
Improvement of property division in village centre	*	***	***	0	0
Reallotment of leasehold	*	***	***	*	0
Enlargement of farm size	**	***	***	*	***
Land use planning in village centres	*	***	***	0	***
Acquisition of land for municipal/ state in village centres	0	**	**	0	0
Readjustment of building land	*	**	**	0	0
Improvement of drainage networks in the land consolidation area	***	***	***	*	0
Implementation of environmental and nature conservation project etc	*	***	***	*	0
Promotion of regional development projects	*	***	***	*	0

Source:(NUR, 2013b)

In 2011, a MINAGRI assessment revealed that LUC had shifted from consolidating the use of land to an emphasis on other components for more being productive. Kathiresan (2011) list the components which are considered as majors to enhance LUC: increase input use efficiency; crop and varietal appropriation; integrated pest and disease management; mechanization of farm activities in consolidated areas; integrated soil fertility management; resettlement of people from agriculture areas to the residential areas; promote hillside irrigation with provision of basic infrastructures (Dams, irrigation canals, terraces, feeder roads connections, drying ground etc...), and clarification of land ownership issues before implementation of development plans.

MINAGRI is mandated for technical implementation of LUC through the Rwanda Agriculture Board (RAB). Based on the suitability of an area for a specific crop, and available land for every district, the RAB, in collaboration with local leaders, estimate the size of the area to cultivate the selected crop. The agreed figure is captured in the performance contract which the districts mayors sign with President of the Republic of Rwanda. After the agreement on the crop and the size of lands to be consolidated, the district and agronomist sectors, along with farmers advisors, start mobilisation. The farmers of a selected schemes are encouraged to join the program based on the provision benefits they will gain. Everyone willing to join the program receives fertilisers, seeds and others extension services. For those who accept to join, they receive fertilisers and seeds based on the size of each parcel. The government (MINAGRI) or private company supply the seeds and fertilisers then after harvesting, the farmers are requested to pay. The steering committee at national level is composed by MINAGRI, MININFRA, MINIRENA, MINALOC, Private sectors, Provinces and District authorities (Muhinda & Dusengemungu, 2011). Figure 4 shows the implementation process of LUC in Rwanda.

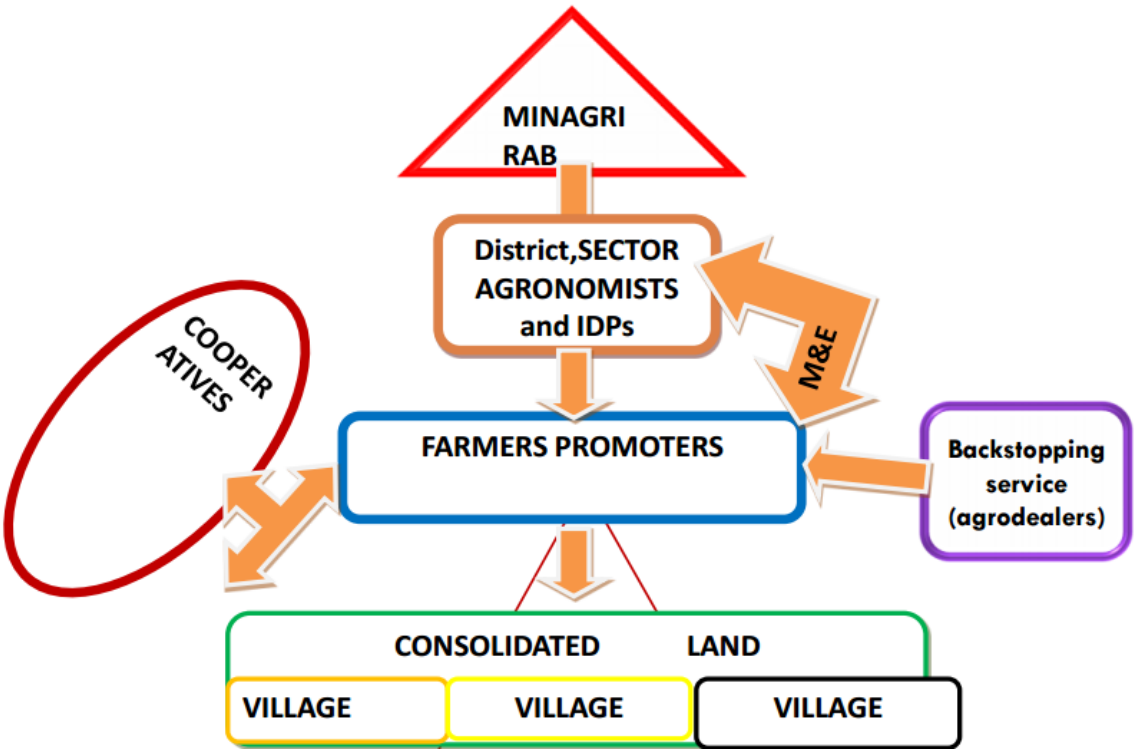


Figure 4: Rwanda's LUC implementation process. Source:((NUR, 2013b)

2.7. Summary

In this chapter, a review of literature provided the overview of the role of land tenure and land consolidation for food security. The land reform of Rwanda was reviewed in order to explore how tenure system changed from customary to the current formal statutory tenure system. The current land information system of Rwanda was presented and an exploration of which information is usually required for land consolidation was also undertaken. Different types of land consolidation were presented and how they affect land rights and physical aspect of parcels during implementation was considered – as was the sustainability of those approaches. In general, the literature argues it is necessary to use land information (land tenure information in this research) for creating sustainable land consolidation.

3. RESEARH METHODOLOGY

This chapter describes the approach used for data collection and analysis to provide answers for each research question – and respond to the overarching objective. (Figure 5) shows the overarching process, divided into pre fieldwork, field work, and post field work phases. Before going into each phase in depth, the study area is first presented.

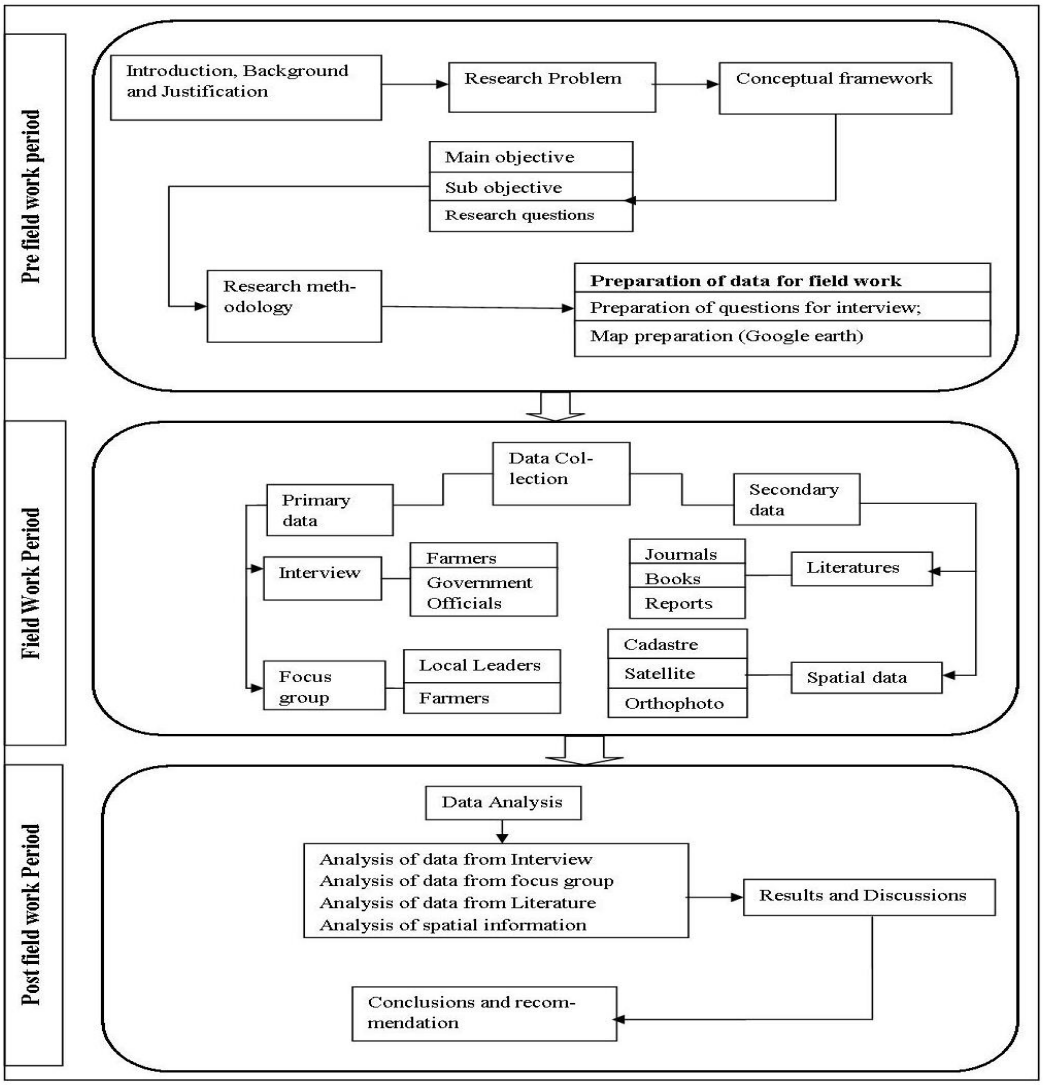


Figure 5: Research Design Framework

3.1. Study Area

The study was carried out in the Kirehe District located in the Eastern Province of Rwanda. The Eastern province was the first to implement the national LUC programs. The district is composed of 12 sectors. Three criteria were taken into consideration whilst selecting the study area. Firstly, a location was needed that had experienced LUC activities long enough ago to enable some form of examination of impacts. In this regard, Kirehe was the first district to implement the LUC program in 2008 (NUR, 2013a). Indeed, it undertook LUC before LTR. Secondly, a location that had completed LTR early was also idea. Kirehe district is amongst the districts which finished systematic land registration and issuance of land title early in 2011, with support of Kirehe community based watershed management project (KWAMP). Thirdly, a mix of sites where both LTR and LUC had occurred first was preferred. In Kirehe, there was the available sites of LUC - which started before and after LTR.

Two specific sites meeting the above conditions were selected in Kirehe district. One was Kinoni site which is located in Kigarama sector. The site started LUC in 2008 before LTR. The second site is Nasho which is located in the Mpanga sector where started in 2012, after LTR. LUC for this site was implemented by a government funded irrigation taskforce (GFI) which has the mission of modernization of agriculture by promoting hill side irrigation, mechanisation and avoid dependence on rain-fed agriculture in driest part of the country (MINAGRI, 2013).

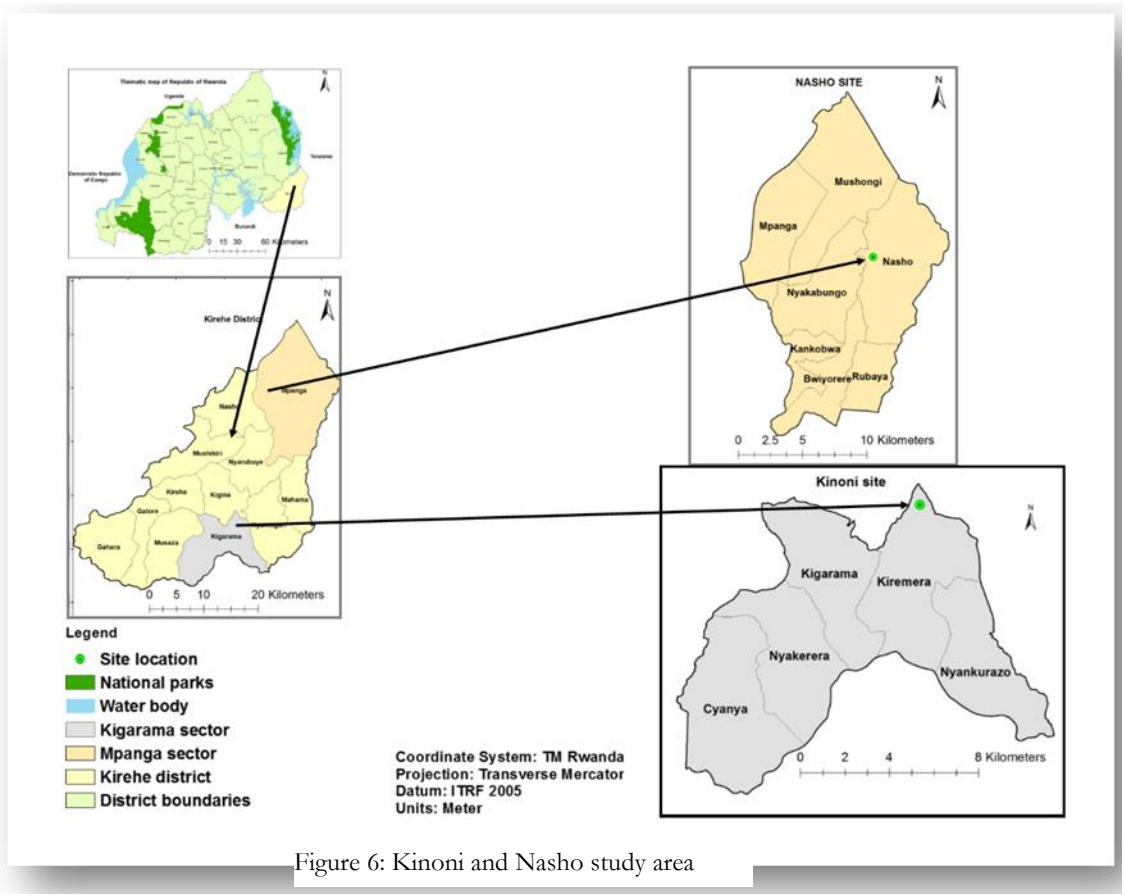


Figure 6: Kinoni and Nasho study area

3.2. Overarching methodological approach

The research objective is fundamentally about observing and understanding an existing system – from multiple perspectives. In this regard, the mixed methodology research philosophy was considered relevant: qualitative and quantitative data were collected from different sources, analysed, and eventually synthesized via triangulation. Quantitative approaches describe the dimension and distribution of changes. Qualitative approaches are directed and holistic, and give a fully developed understanding of a study context (Woolley, 2009). It was expected that using a mix of methods would allow a more complete understanding on the role of land tenure information, based on the results from Observations from government officials, supported with information from farmers. Additionally, spatial analysis also was used to provide a more objective standpoint. The table 1 summarises the methodological approach.
Table 1: Research matrix

Specific objectives	Research Questions	Source of information	Data Analysis Techniques	Anticipated Result
To understand how land tenure information supported LUC programs prior to Rwandan LTR	Did policies or laws about LUC programs consider land tenure information?	Literature Review of policies, laws	Summarise literature	Guidelines of law and policies about the use on of land tenure information prior to LTR
	Was land tenure information actually used in the LUC programs	Government officials(MINA GRI&RNRA)	Content analysis and coding the main theme, with Atlas.Ti	General picture of how land tenure information was prior to LTR in Rwanda's LUC
	How did LUC activities affect people-to-land relationships LUC?	Farmers, District official, Spatial data	SPSS and ArcGIS software	Type of LUC activities& the changes brought by those activities
To establish how land tenure information from Rwanda's LTR currently supports LUC programs	Do any policies or laws demand use of information from Rwanda's LTR in LUC programs?	Literature Review of policies, laws	Summarise literature	Guidelines of laws and policy about the use of land tenure information from LTR
	Is land tenure information from Rwanda's LTR used in LUC programs?	Government officials(MINA GRI&RNRA)	Content analysis and coding the main theme, with Atlas.Ti	The integration of available land tenure information in Rwanda's LUC program in Rwanda.
	How does the use of land tenure information from LTR impact on people-to-land relationship	Government officials and farmers; Spatial data	SPSS& Atlas.Ti and ArcGIS software	The changes happened, the use of land tenure information to identify the existing situation and expected changes. Finally help in update the changes.
To ascertain stakeholder perceptions about land tenure information in LUC programs	Was land tenure information seen as relevant to existing LUC programs?	Government officials, Focus Group Discussion,	Content analysis and coding the main theme, with Atlas.Ti	• List of what is considered as relevance of land tenure information in existing LUC programs • Mechanism of fully integration of land tenure information in LUC
	Do ideas exist on how land tenure information can better support future LUC programs?	Interview with government and literature	Content analysis and coding the main theme, with Atlas.Ti	

3.3. Sampling techniques

Selection of appropriate sampling techniques is necessary in order to avoid bias (R. Kumar, 2005). Regarding the interview with individual farmers, 20 farmers for each site were selected. The sample size was decided based upon the time availability and financial means allocated to the study. Within each site, the 20 farmers were selected using simple random sampling. For this technique each element in the population had the equal chance to be selected (R. Kumar, 2005). Using excel, random sampling enabled 20 respondents from each site to be retrieved. For the Kinoni site, the list was provided by the local district agronomist, while for Nasho it was given by GFI (which as earlier stated, implemented this scheme).

Regarding interview with government officials, judgmental sampling (Kumar, 2005) was used to select eight government officials. This technic was used because these respondents were considered as the key informants who are more likely to give the relevant information due to their attribution in relation with LUC. Five officials of the MINAGRI were composed: one official in CIP, one in the planning department, and 3 officials from the projects KWAMP, GFI and LWH. In RNRA one respondent was selected at Provincial level and another one in the District land office. Finally the District agronomist was selected too.

Focus Group Discussions were composed of farmers and committee members of cooperatives which operate in the scheme, local leaders helped in the choice of participants by including different categories of people (i.e. women, youth and men).

Regarding Spatial data, the current official cadastral shape file, orthophoto of 2008 and google earth images of two study areas(for each site, two images one for before and after LUC) were used for spatial analysis.

3.4. Data collection activities

3.4.1. Primary data

Semi structured interviews were used for interactions with government officials. The questions or thematic areas covered were related the role of land tenure information prior to, and after, LTR was completed, with respect to Rwandan LUC. For this, the participants were requested to provide information about: 1) the activities and the required information which are generally necessary for implementing LUC; 2) the source of information; and 3) how land tenure information was used or if was necessary to supply the needed information to implement the required activities. Beside these direct questions, government officials were requested to give their perception about the use of land tenure information in LUC. For this, they gave their views on the relevance of using land tenure information for the existing LUC program. In addition, their ideas about better use of land tenure information for supporting future LUC programs were collected too. For GFI and district government officials, they were contacted in order to gain information on how the scheme was implemented and the role of land tenure in this implementation.

Structured interviews were conducted with the selected 20 farmers per site, to understand how they were affected (people–to-land relationship) by the implementation of LUC. To determine the effect of LUC on land, the data collected were focused on change of land use, parcel size, and visibility of boundaries after implementing LUC. To determine if the implementation of LUC changed the existing landowners, the data on how farmers acquired the land in the scheme (reallocation, inheritance, and exchange of parcels, purchase and rent) were collected to see if LUC caused the exchange or reallocation. To determine if the rights, responsibilities and restriction were changed, the farmers were requested to provide the information on right they had before LUC and those they held after. In addition, they were requested to explain how they knew if their rights were affected and changed due to LUC.

Figure 7: Structured interview with farmers

Focus Group Discussion were used in the two sites in order to understand the participant's knowledge on how LUC affects their parcels and their rights. Furthermore, participants provided the information of what they considered as relevant in using land tenure information in LUC.

Figure 8: Focus Group Discussion with farmers

3.4.2. Secondary data collection

Regarding spatial data, an orthophoto of 2008 and the current cadastral shape file was obtained from RNRA. The combined analysis of the orthophoto with high-resolution images from Google Earth allowed evaluation on whether changes at parcel boundary level were visible.

For the Kinoni site, a Google earth Image of 6/25/2006 (before land consolidation) and Orthophoto of 6/24/2008 (after land consolidation) were used to illustrate the changes. For the Nasho site, the Orthophoto of 6/24/2008 (before LUC) and Google earth image of 6/25/2014 (after LUC period) was used. For each site, the illustration of changes at parcel boundary level was done by presenting images of different periods for the same location.

Regarding literature reviews, different grey literature sources including Rwanda poverty reduction strategies of 2002; Vision 2020 document; National land policy of 2004; Organic land law of 2005, Ministerial order of land consolidation of 2010; new organic land law of 2013; the Farm LUC document; and Rwanda poverty reduction strategies of 2013 were used. From these documents, information regarding the consideration of laws and policies about the use of land tenure information in LUC program was examined. Besides that, the ideas of better using land tenure information for future LUC programs were explored in these documents.

3.5. Methods for Data Analysis and Synthesis

Content analysis was used to find the main theme from qualitative data from the government officials and Focus Group Discussion. Atlas.Ti software helped with coding the identified main themes. The Statistical Package for Social Science (SPSS) software was used for categorizing responses and closed ended responses from the structured interviews with farmers, which were transformed into numerical values (Codes).

Analysis of spatial data started with multi-temporal images to illustrate the changes at plot boundary level. Two software tools were used to download Google earth images: the current available images were downloaded by using Universal map downloader, and those of years before were downloaded by EL-shay smart web online software. Geo reference was done by ArcGIS software. The illustration was done by comparing the images of different periods. The cadastral shape file was overlapped on the current images to determine if the official data is the same as the current ground situation. Thus the disparities or similarities between officials' data and ground truth proved how the land tenure information was used or was necessary for LUC. Besides that, analysis of the changes of parcel size in the scheme was also performed. This analysis was able to show the average size of parcel in the scheme and the number of parcels which were affected after implementation of LUC. In addition to that the parcels which were not allowed for subdivision were also extracted.

The data from different source was brought together to form the answer of research question in case it was required. After finding main theme from each question, the information which converge was brought together to form an argument and the information which divergent was brought together too. This was allowed to find different views on one research question. In case the spatial data was necessary for the question which was already answered by interview, it was permitted to have the large information on that specific question.

3.6. Summary

The overarching methodology outlined in this chapter shows the specific techniques used to answer the research questions in terms of data required, data collection, and data analysis. The triangulation of the information from Government officials, farmers, focus group discussion, laws and spatial data helped to understand the level of support and relevance of land tenure information in LUC programs.

4. PRE-LTR RESULTS

This chapter focuses on the situation before LTR. Overall, the consolidated results reveal that policies and laws didn't consider the use of land tenure information prior to LTR in the LUC program. The information from central and local government officials shows that the land tenure information prior to LTR was not used to support LUC. The rural areas were characterised by the customary system and the information was not registered. The information regarding people-to-land relationship was gathered from local communities during the implementation of LUC. Also, of importance for the overall results is that in the Kinoni site, LUC activities didn't affect people-to-land relationship largely because of the type of LUC undertake (called 'simple'). The following subsections give the details of the results of this objective.

4.1. Laws and policies governing the use of land tenure information in LUC programs prior to LTR

LUC was explained briefly in different laws and policies with its importance in Rwanda's agriculture sector and in rural development as a whole. Only one Ministerial order of 2010 determined the model of LUC and its production.

Vision 2020 stated that Rwanda should be in the middle-income countries by 2020. The land use and agricultural transformation were considered as one of the strategies to achieve the goal. For agricultural transformation, the vision 2020 stated that the well-organised settlement in a rural area will be the entry point of consolidating land in order to create enough space for modern farming. The document suggested moving out the people who live in the agricultural area to the residential centres by resettlement process(GoR, 2000). MININFRA (2009) explained the approach of resettlement as expropriation, where the people who live in the scheme of LUC, have to be expropriated and compensated. The compensation could be done by giving another parcel in a residential area or by money. This approach was considered difficult: because no free land existed, even the source of funds for compensation was lacking. The policy also advocated a second approach: exchange. This is possible if one who has the parcel in the scheme of LUC, exchanges with another who has a parcel in the residential area.

The Rwandan Poverty Reduction Strategies (RPRS) explained that consolidation scheme should be at least 50Ha with 1ha as the minimum size of each parcel holding. The achievement of this was to encourage people to cultivate in common and not fragmentation of parcels through inheritance (GoR, 2002). The statement of having 1ha in the scheme of land consolidation is the same as the organic land law of 2005. In Article 20b, the law stipulates that "It is prohibited to reduce or subdivide a parcel of land reserved for agriculture if the results of the subdivided parcel are less than a hector"(GoR, 2005). 1ha as the minimum size of parcel in the scheme of LUC was considered as the optimum size which can be productive for one household, in terms of agriculture output

Besides those laws which explained LUC in brief, ministerial order No 14/11.30 of 21/12/2010 determine the model of LUC and its productivity. Article 2 defines land consolidation as "the unification of land parcels with an estimated easier and productive farming than the fragmented parcels"(GoR, 2010). In Article 4, the ministerial order, explain the main objective of LUC as rural development and transformation of agriculture, to increase production and improve lives of Rwandan's people, especially in rural areas. In article 6, 7, 8 and 9 the Ministerial order explains three types of model for land consolidation and the respective role of government:

Facilitated farming contract: The model is based on the agreement between a number of land owners and the buyer or tenant. MINAGRI facilitate the negotiation in the case is needed. However, the land owners retains all rights over the land. The contract is based on the willingness of land owner. The approach is applicable when investors or big farmer make a contract with many smallholders' farmers in the targeted scheme of LUC(GoR, 2010).

Cooperative farming: The model consists of the establishment of cooperatives, where the farmers can join voluntarily and merge the use of their parcels for cultivating one selected crop. The cooperative farming has to be in accordance with the law of cooperative societies in Rwanda (GoR, 2010). Article 7, explains that cooperative has to be registered. The whole properties which are owned by cooperative have to be registered under his name(GoR, 2007).
Farming Corporation: the model involves the investors where they contribute a cash as share. In such cases, the farmers and investors own shares in one corporation. This model is based on sharing between farmers and investors, in the sense of improving agriculture and increasing production (GoR, 2010).

In these cooperatives, contracting and corporation farming, the ministerial order did not explain how the land under these three models should be registered, or how they will manage the cases of change in tenure in case there is any. In addition, the involvement of the land administration institutions is not highlighted. Moreover, from the policies and laws described above, there is no consideration of using land tenure information prior to LTR in LUC programs.

4.2. The use of land tenure information in LUC programs prior to LTR

The information from government officials at national level reveal that there are different activities implemented with LUC. Therefore, the information required depended on which type of activities. Generally, the results show that before LTR, no information which was from land administration authorities. LUC Activities, required and source of information, and how this information was used are presented in this section.

4.2.1. Types of LUC activities prior to LTR

The Information from the MINAGRI/CIP department reveals that LUC activities, in practice, are considered as one of two types: **modern** and **simple** LUC. The provided names are not documented anywhere, but the respondent used the terms to differentiate the two. The implemented activities of each type mentioned above are explained as follow:
Simple LUC: The implementation of Rwanda's LUC started with this type in 2008 under the CIP, and currently is still implemented. The approach consists of the mobilisation of farmers to cultivate their (neighbouring) parcels simultaneously with the same crop: the government provides the extension services, selection of crop and the inputs. When farmers accept to include the use of their parcels, no other basic infrastructures are expected. Hence, no change of parcel size or boundary, no exchange of parcels, no reallocation or other activity can change the existing situation. The only change is based on the cropping system, because for those farmers who joined the program, they are requested to cultivate one selected crop. The explanation from RAB shows that this is the most implemented type of LUC country wide. Mobilisation is done by the local authority from district up village community leaders. The implementation of it is done sporadically (farmers do not join the program at the same time).

Modern LUC: The type is considered 'new' and it is often implemented in irrigation areas with other activities which may change the size of parcels and land owners. The outcome from government officials of KWAMP, LWH and RAB reveal that the common activities implemented with this type are: feeder roads; irrigation dams; irrigation canals; drying ground; resettlement; and progressive and radical terraces. In case there is a parcel that is affected as a whole or a part, the affected parcel holder gets compensated according to the expropriation law. Apart from the infrastructures that can affect some parcels in the scheme, the rest remains as they were before. No enlargement of parcel holding, no reallocation, or exchange of parcel is expected to be done in the scheme of LUC. After implementing the scheme as it was designed, every farmer is requested to cultivate a selected crop depending on the season. This type is

normally implemented with the funds of Government and donors through the projects which operate under MINAGRI.

4.2.2. Type and sources of required information for implementing LUC prior to LTR

The type and source of required information required to implement LUC before LTR are summarised in table 2. The observation is that no information was from land administration authorities like RNRA.

Table 2: Type of and sources of required information for LUC prior to LTR

Type of LUC	Type of information required	Source of information prior to LTR
Simple LUC	Location and size of scheme	District agronomists& farmers
	Suitable crop for a selected area	District agronomist& RAB staff
	Size and owner of each parcel	District agronomists & farmers
	The quantity of fertilisers	District agronomists& Agro-dealer
Modern LUC	Location and size of scheme	Hired Consultant
	Size and owner of each parcel	Hired Consultant & local leaders
	The parcel likely to be affected	Hired Consultant
	The size to be expropriated	Hired Consultant
	The type of crop	Hired consultant Project staff
	The value of the land	Private valuator
	Who will be resettled	Hired consultant& the project

4.2.3. The use of required information to implement LUC activities prior to LTR

Regarding **simple LUC**, the information required depended on the activities which should be implemented in the scheme. Table 2 shows that the information required was based on the size of the scheme, the size of each parcel, and type of crop and land owner. Before starting anything, a meeting with farmers is organised to agree on the program. For those who accepted to join, the district and sector agronomist, in conjunctions with village leaders, establish the way of measuring every parcel and enumeration of land owners in the scheme. This was done because every farmer received fertilizers and seeds according to the size of the parcel.

Regarding **modern LUC**, this type is characterised by activities that change the existing structure of parcels by the introduction of new infrastructures. Table 2 shows that the information required generally is the same as simple LUC. However, there is the addition of knowing who will be affected by planned infrastructures and the value of parcels to be expropriated. Many information required to implement this modern LUC was gained by a hired consultant who had a contract with the project in charge of implementation these activities. The hired consultant or companies have the mandate to clarify the necessary requirement for implementing LUC in a selected scheme. Except value of land, which is provided by the private evaluator, other information created by consultants, project staff, and local leaders. In essence, in the absence of a cadastral, the projects created the required land information from scratch. Before LTR, the hired consultant with his team conducted a field survey to determine the size and owner of parcels who would be affected, and possible resettlement options.

The information from MINAGRI and RNRA reveal that the land tenure information prior to LTR was not used because it was not registered, especially in rural areas. The information of people–to-land relationship was determined by a consultant with local leaders in order to know the holdings and size for each parcel.

4.3. The effect of LUC activities on people-to-land relationship in the Kinoni scheme prior to LTR

The information from farmers of Kinoni site, district agronomist and from the illustration of Kinoni Images revealed that LUC activities didn't change parcel, right and right holder. The details of LUC in Kinoni scheme are presented in this section.

4.3.1. The effect of LUC activities on parcel in Kinoni scheme

Table 3 below shows the results from the interview with the farmers of the Kinoni site on how the LUC activities affected their parcels.

Table 3: The effect of LUC on parcel in Kinoni LUC scheme

Type changes on physical aspect of parcel due to LUC	Yes/ Respondent	No/ Respondent	Total respondents
Change of parcel size	0	20	20
Change of parcel boundaries	0	20	20
Change of land use	0	20	20

Regarding **the change of parcel size**, the Table 3 shows that out of 20 respondents, no farmer had his or her parcel size changed due to LUC in Kinoni scheme. This was because no infrastructures were introduced in the scheme, no parcel enlargement or other activities changed the size of the parcel. This information is confirmed by focus group discussions: regardless of the size of a parcel owned before joining the program, everyone was allowed to use their own, as long as the cultivated crop complied with the selected one.

Regarding **the changes of land use**, for all 20 respondents, the use of their land did not change – at least broadly speaking. This is because even before LUC, their parcels were used for agriculture use. The only change was the type of crop based on one selected crop to be cultivated for a specific season. The information from the district agronomist was the same as from farmers. In addition, the agronomist explained that LUC was not as successful as it could have been due to some cases of the farmers who still cultivate mixed crops in the same farm (Annex 2.).

Regarding **the visibility of boundaries**, Figure 9 (**a** and **b**) below shows the situation before and after LUC. Both images were taken in dry season whereby the greenness start to disappear. The illustration of Figure (**a**) shows some boundaries or anti-erosion measures between parcels with different types of crops. Figure b shows the introduction of terraces mixed with individual trees. From the illustration of Figure (**b**), it seems that the boundaries between parcels have been changed. However, all respondent explained that their parcels boundaries were still visible after joining LUC program. This was because even if the terraces were introduced, everyone tried to materialise the boundaries by small visible signs which permitted two neighbouring farmers to recognise the boundary of their parcels (Annexe2).

Figure 9: Kinoni scheme before and after LUC

4.3.2. The effect of LUC on existing land owners and their right in Kinoni scheme

Regarding the **effect on existing land owner**, data on how farmers acquired the land were collected. Figure 10 shows that out of the 20 respondents no one acquired land by reallocation or exchange. In addition to that, the 18 respondent used the same parcels before implementation of LUC. The results reveal that those who joined LUC after were tenants. From the information, it can be seen that LUC activities did not change the land owners. This was confirmed by the information from the focus group discussions where they explained that no activities of LUC which changed the land owners in Kinoni scheme. For the farmers who rented or bought the land, the only proof they had was the paper agreement between them and the seller or landlord. The legal validity of such an agreement, at least in terms of the LTR process, is unclear.

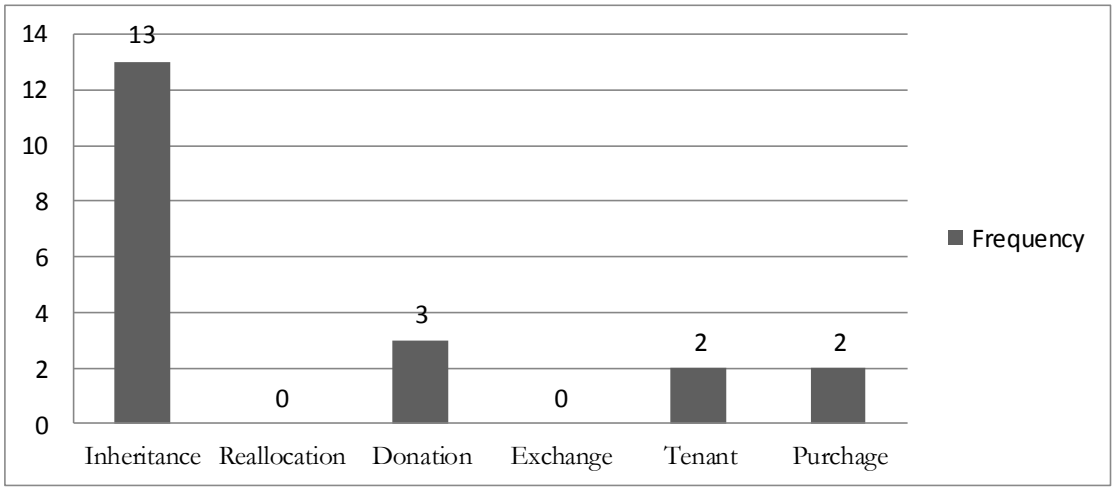


Figure 10: Mode of land acquisition in Kinoni LUC scheme

Regarding the **effect of LUC on existing right**, the results revealed that all 18 respondent confirmed that after joining LUC, their rights on land were the same as before, except the right to change the crop. Five respondents said that the only right which has been changed due LUC was the right to modify the use of their land. The explanation was that after growing a crop that had been selected in the scheme, everyone had to respect the selected crop rotation.

The information collected from district government official is in some ways contradictory. The information from them suggested that that LUC is voluntary - everyone is free to choose the crop of his or her choice. But for the one who does not want to join the program of LUC, they cannot get the facilities like fertilisers and extension services. The explanation is that the government invested in LUC the money for fertilisers and seed to specific crop in a specific area. Therefore, whoever did not agree to join the program was not allowed to benefit from these facilities. Thus, many farmers explained that the first motivation to join LUC was to gain these facilities from the government.

The government officials explained that the 50% of seeds and fertilisers which government provided to the farmers as subsidies played a major role to increase the participation in the program of LUC.

The focus group discussions confirmed the information of official's government: their views revealed that no change of right after joining LUC as long as everyone joined voluntarily. The evidence was that some of the farmers continued to cultivate their chosen crops in the scheme.

Regarding **responsibilities and restriction**, in the scheme of Kinoni, no one from respondents had the mortgage, sublease or caveat on his or her parcel before joining LUC. This was because before LTR it was difficult to use the non-registered land for mortgages. The same applied to sublease or caveat. But the information from focus group discussion revealed that these kinds of caveat was there in the form of disputes. And was controlled by local leaders who tried to be intermediate in any case.

4.4. Summary

The land tenure information was not used because it was not registered. But also, the need of it was based on the type of LUC. The case of Kinoni has shown that not necessarily that LUC change the existing people to land relationship. But the join of land use was considered as enough. By this, the implementers explained that not much details of information of were required. The information of existing people-to-land relationship was identified during implementation of LUC by using farmer themselves. It has also seen that this type of LUC is more implemented in many parts of the country as explained by government officials at the national level.

5. POST-LTR RESULTS

This chapter focuses on the situation after LTR. It presents the results related to the use of land tenure information from LTR. The results reveal that the national land policy demands the use of this information in any land related activities for better land management. The government officials at the national and local level and farmers of Nasho study area explained that this information is beginning to be used in LUC programs. The detailed results of this objective are described in the following subsections

5.1. Laws and policies relating to LUC requiring the use of LTR land tenure information

The current National land policy of 2004 explains the establishment of a land network which is supposed to receive and distribute information for the rational use of land. The land network explained in the policy referred to the land information system which was supposed to be built after Rwanda's LTR program. Therefore, this information is currently held in LAIS. The land policy stated that this information shall be the core of all actions concerning land management and the good use of land (MINITERE, 2004).

Article 4 of new organic land law of 2013 defines LUC "as a procedure of putting together small plots of land in order to manage the land and use it in an efficient and uniform manner so that its productivity is increased"(GoR, 2013) Article 30 of this organic land law explains that the modalities of implementing LUC shall be provided by MINAGRI. These modalities are presented in Ministerial order which determines the model of implementing LUC (please see section 4.1).

RPRS of 2013 explains that the agriculture has to change from subsistence to commercial oriented. The document repeats the modalities of LUC as cited in the ministerial order. However, it encourages the consolidated land rental model which involve agricultural entrepreneurs. This will be based on the lease agreement at least 10 years with the number of land owners of a selected scheme.

The national land policy clearly demands the use of land tenure information from LTR in all land-related activities. Moreover, the new organic land law and RPRS revealed the new intended approach of LUC - but do not show how this land tenure information should be actually used.

5.2. Actual use of land tenure information from LTR in LUC programs

The results from government officials at the national level reveal that the same type of LUC (modern and simple) which was implemented prior to LTR, are still implemented currently. The required information to implement LUC activities are the same, but the source of information has changed

Table 4 below shows that some of the information which was collected from local community leaders, consultants and agronomists are now from RNRA which is in charge of keeping land tenure information of the whole country.

Table 4: Type and sources of required information for LUC after LTR

Type of LUC	Type of information required	Source of information after LTR
Simple LUC	Location and size of scheme	District agronomist&RAB staff
	Suitable crop for a selected area	District agronomist&RAB staff
	Size and the owner of each parcel	RNRA
	The quantity of fertilisers	District agronomists local leader
Modern LUC	Location and size of scheme	Hired Consultant
	Size and the owner of each parcel	RNRA
	The parcel likely to be affected	RNRA
	The size to be expropriated	RNRA
	The type of crop	MINAGRI
	The value of the land	Private valuator
	Who will be resettled	RNRA

5.2.1. The use of required information to implement LUC activities after LTR

Regarding **simple LUC**, the Table 4 shows that the required information from RNRA is the size of each parcel, the landowner, and size of the scheme. District agronomists delineate the scheme of LUC by using satellite images in ArcGIS or by using GPS on the ground. The delineation map is overlapped to the cadastral shape file in order to know exactly all parcels included in the scheme. Using this approach, the fertilisers to be supplied for a specific scheme and for every farmer can be known before the meeting. The second approach is that the districts agronomists continue delineating the scheme and providing the inventory of land owners in the scheme. The farmers receive fertilisers and seeds after presenting land titles by which the size of parcel is known. For this case, the use of cadastral shape file for some is considered as not necessary.

Regarding **modern LUC**, the results from LWH and KWAMP officials revealed that the cadastral shape file and lists of land owners from RNRA are used to implement this type of LUC. Different to the approach used before LTR, the parcels which are likely to be affected can be identified without the huge work of inventory and measurement of parcels in the scheme. Instead of including those activities in the contract, the cadastral shape file is given to the consultant to overlap it on the LUC plan. Therefore, all expected changes are identified. The consolidation layout plan is used in the meeting with farmers by which everyone knows if he will be affected by planned activities.

Depending on results from different respondents of MINAGRI, only an official from LWH project claimed the necessity of using the information regarding existing right and responsibilities which people had over the land. He said, "*Considering the surprises which we are still facing like to pay someone who has a disputed land or other restrictions, this information should be used to avoid those mistakes which happen sometimes*". This is confirmed by RNRA official who said that all land use planning activities should use this information as a whole, instead of using only the cadastral shape file. This is because all rights and restrictions like mortgage, caveat, easement, sublease etc. are registered

5.3. Effect of LUC activities and the use of land tenure information from LTR in the Nasho scheme

For the case, the LUC was implemented in 2012 by GFI. The project is under hillside irrigation. Figure 11 shows Nasho LUC layout plan implemented under two system of irrigation, one for gravity and other for pumping system. The whole site is reserved for one selected crop per season.

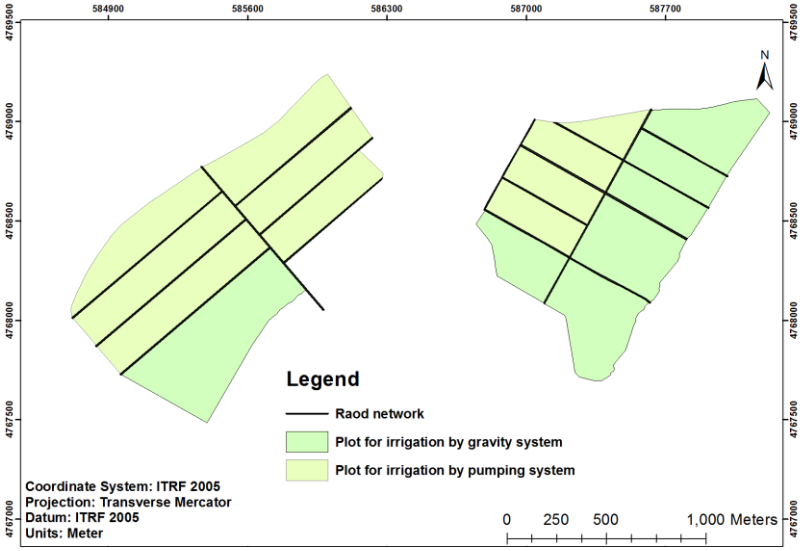


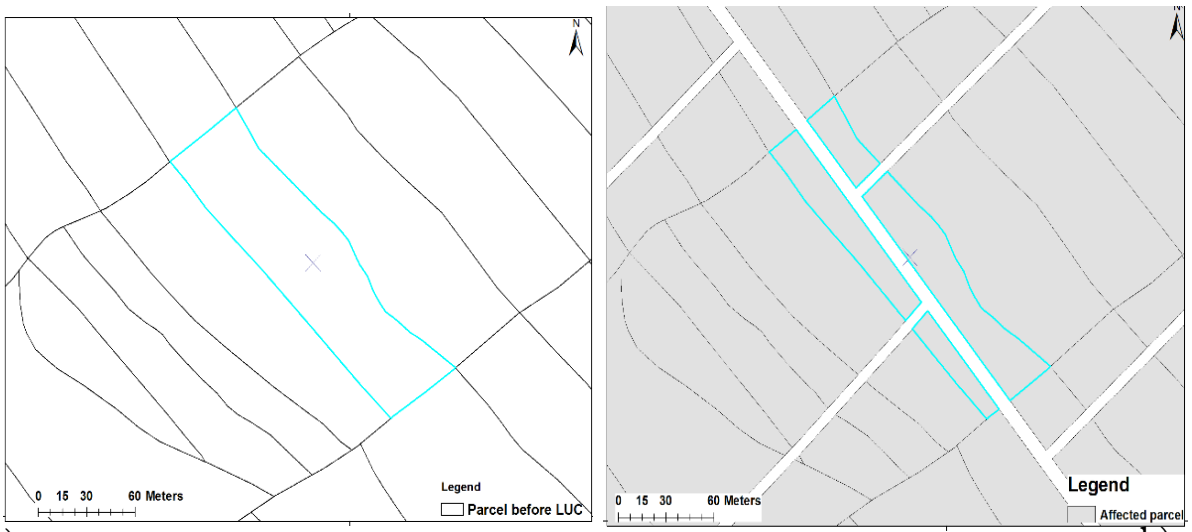
Figure 11: Nasho LUC scheme (source: RAB, 2015)

5.3.1. The effect of LUC activities on parcel in Nasho scheme

Table 5: The effect of LUC on physical aspect of parcel in Nasho1 LUC scheme

Type changes on physical aspect of parcel due to LUC	Yes/ Respondent	No/ Respondent	Total respondents
Change of parcel size	6	14	20
Change of boundaries	0	20	20
Change of land use	0	20	20

Regarding **change of parcel size**, The effect of LUC activities on parcel in Nasho scheme
Table 5 shows that 6 out of 20 respondents suggested their parcel size has been changed due to LUC. The changes were caused by the introduction of roads in the scheme (Annex3). Besides that, spatial analysis using ArcGIS shows the size of 208 parcels has been reduced because of the introduction of roads in the scheme of Nasho. Both layers of cadastral shape files and layout plans were used for the analysis. Figure 12 shows a sample of one parcel (**a**) which was split into four parcels (**b**) after LUC.



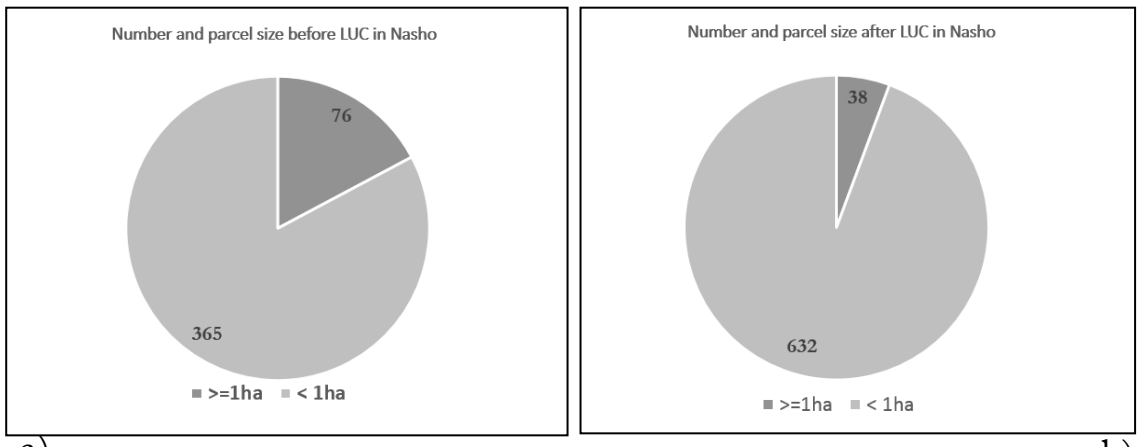
a) Figure 12: A sample of affected parcel by roads in Nasho scheme (Source: RNRA, 2015) b)

Table 6 shows the analysis made on sample of the six parcels that were identified by the respondents as affected by road construction. The table gives the details about the original parcel size the new size; and the size which has been reduced due to introduction of roads. The total area which has been reduced for six parcels affected is 994 m2.

Table 6: Sample of affected parcels by roads in Nasho site

Parcel ID	Original Area(m2)	Parcel ID	New area(m^2)	Area(m^2) reduced by road
1	10763	1.1	1520	35
		1.2	9208	
2	10167	2.1	460	164
		2.2	9543	
3	10485	3.1	7923	283
		3.2	2279	
4	11168	4.1	560	169
		4.2	10439	
5	8534	5.1	7254	305
		5.2	975	
6	7656	6.1	2	38
		6.2	7616	
TOTAL	**58773**		**57779**	**994**

Therefore, the introduction of roads in Nasho scheme increased the fragmentation of parcel holdings. Due to 208 affected parcels, the number of parcel holding in the scheme was increased from 441 up to 670. Figure 13 (**a** and **b**) below shows the number and size of parcel before and after LUC. The figures shows that the number of parcels less than 1ha was 365 before LUC. While after, this number have been increased to 632 parcels and beyond.



a) b)

Figure 13: Number and size of parcels before and after LUC in Nasho scheme

Regarding **land use change** and **visibility of boundaries,** all 20 respondents explained that LUC did not change the use of their parcels, and the boundaries parcels are still visible. However, GFI official and focus group discussion explained that some errors of unclear boundaries occurred in a case of mechanisation. In such cases, the two farmers adjudicate the boundaries together with support of site coordinator to avoid the disputes. Figure 14 and 15 below illustrate the situation before and after LUC. Figure 15 shows the situation after, where the roads divided the site into big plots and inside every one plot the boundaries of parcels are still visible.

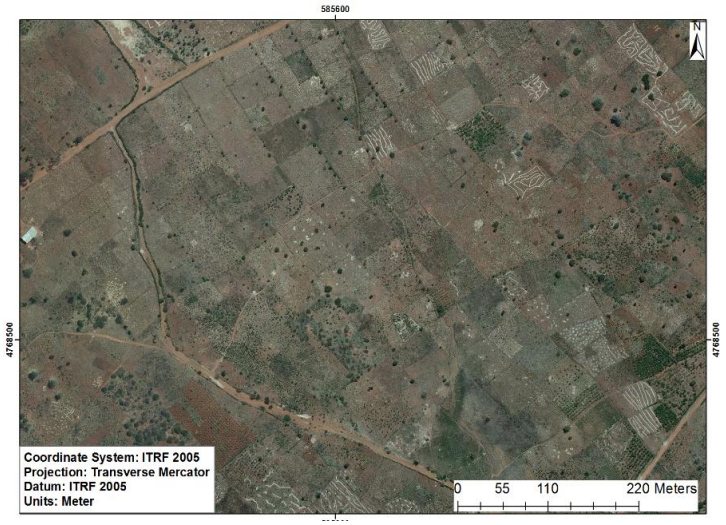


Figure 14: Nasho scheme before implementation of LUC (Source: RNRA, 2015).

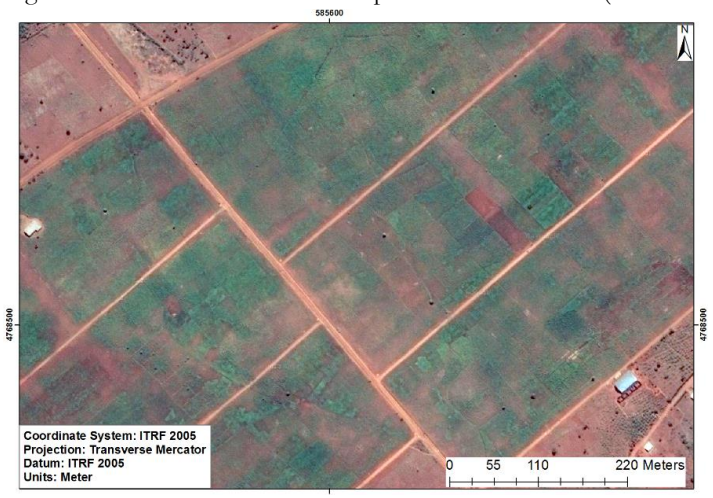


Figure 15: Nasho scheme after LUC (Source: Google earth, 2015).

5.3.2. The use of land tenure information to show possible effects of LUC activities on parcel in Nasho scheme

The GFI officials explained that in collaboration with RNRA, the cadastral shapefile was used in the planning process before implementing LUC in Nasho scheme. It was used to reveal the size of every parcel in the scheme; the parcels that were likely to be affected by planned roads connection; and the size to be expropriated. This knowledge facilitated the implementers the estimation of the budget for compensation where the roads would pass through.

The consolidation layout plan of the scheme was overlapped with the cadastral shapefile in order to know the number and size of parcels, the affected parcels and the size which tend to be expropriated. Furthermore, the printed consolidation layout plan with parcels was used in the meeting with farmers so that each and every one could know exactly if he or she will be affected or not.

The interview with farmers and the focus group discussion revealed that they were informed about the expected changes of parcels during the meeting. They explained that the Nasho layout plan with cadastral shapefile was placed on the wall of the cell office and explained by the technician of GFI. After that, everyone knew if his or her parcel was amongst those who would be affected by roads. This plan was supposed to stay at the cell office so that everyone who has a parcel in the scheme should know what will happen.

Regarding **the update of changes on parcels**, even if the cadastral shapefile was used in the planning process for the Nasho scheme, the information from 6 affected respondents' show that no one has a title which corresponds to the actual size of their parcel. Besides that, the spatial analysis of Nasho scheme shows that there was no update on the changes made on the parcels.

Figure 16 below shows that the cadastral shape file before LUC are the same as the current shape file (Figure 17) after its implementation. The non-update of changed parcels is due to many reasons but the main are as follow:

The implementers after payment of the expropriated area said that the update should be requested by land owner at district level, and that they should pay for the service because he or she was compensated.

The farmers claim that the project which changed their land should take responsibility to give them the new title which corresponds to their parcels

RNRA officials explained that every project which was implemented by the government or private companies, and that changed the existing registered information, should take responsibilities of updating those changes with RNRA - and facilitate the land owners to get the new land titles which are in accordance with the real parcel layout on the ground.

Figure 16: Nasho cadastral shapefile before LUC (Source: RNRA, 2015)

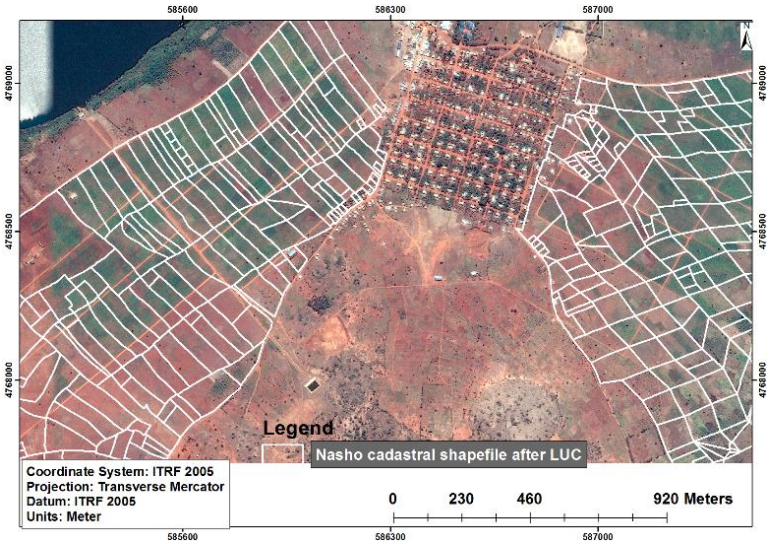


Figure 17: Nasho cadastral shapefile after LUC (Source: RNRA, 2015)

5.3.3. The effect of LUC activities on the existing land owners and their rights in Nasho scheme

From the Figure 18, the results reveal that all 20 respondent used their land even before LUC. The outcome from respondents shows that no one acquired parcel by reallocation, or exchange in Nasho scheme. It was confirmed by focus group discussion that no activities related reallocation or exchanged happened during the implementation of Nasho scheme. This is because the implementation of LUC was not supposed to bring these activities

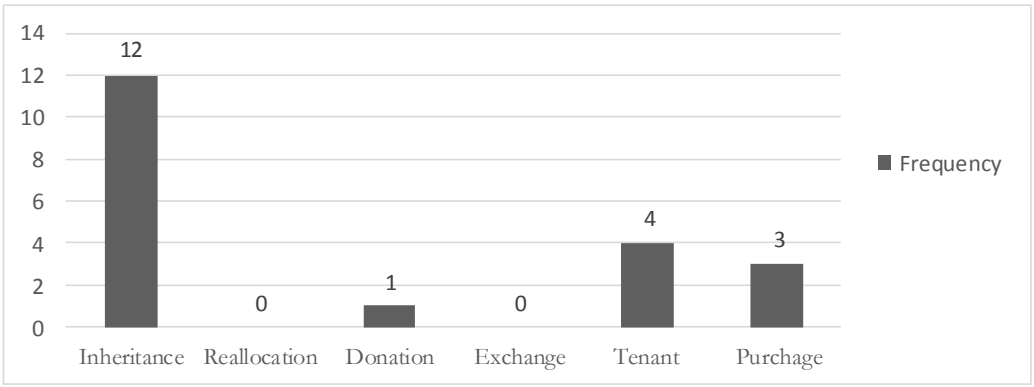


Figure 18: Mode of land acquisition in Nasho LUC scheme

Regarding **change of existing responsibilities and restriction**, the results reveal that 1 out of 20 respondents had mortgage on his parcel before joining LUC. The respondent explained that the mortgage was registered and land title was in the bank. The agreement with the bank was to cultivate tomatoes, while after joining LUC this is cultivate in one season in case is selected. Besides that, the information from focus group reveal that there are some cases of restriction like caveats which are already registered. This is happen when there some people who have the disputes on one parcel. In this case, the disputes are registered as caveat until the court decide for whom the parcel is belonging.

Regarding the **changes of existing right** Figure 19 shows that the right to sell and to modify the use (change of crop) has changed after LUC. Regarding the right of sell, 4 out of 20 respondents explained that they do not have right to sell. This was because the results of split parcels were less than 1ha which is required by the law. All 20 respondent explained that they do not have right to modify the crop after joining LUC. The information from the GFI official explained that it is an obligation to cultivate the selected crop especially where the government has provided the expensive infrastructures of irrigation and feeder roads. This is done in a sense of covering the cost spent during the preparation of the site.

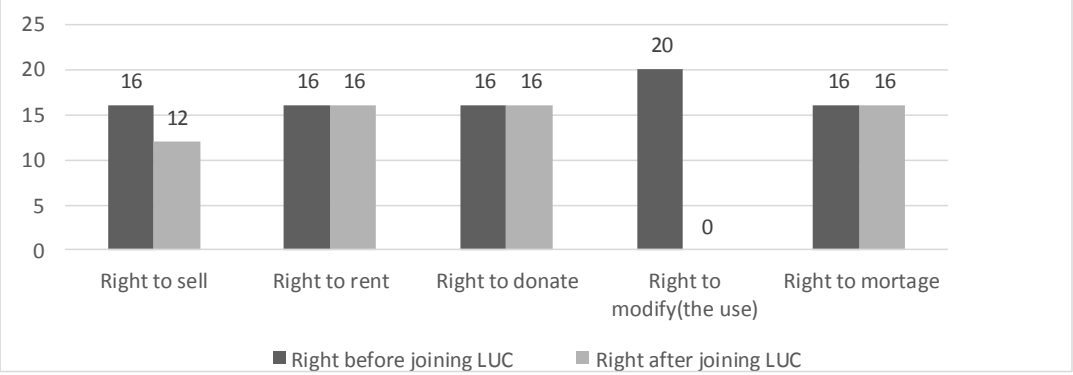


Figure 19: The effect of LUC on land right in Nasho scheme

In addition, the spatial analysis showed that there were many parcels which were supposed to not be subdivided according to the law. Figure 20 below shows the spatial analysis of affected parcels. Due to the splitting, the 208 parcels affected have become 437 parcels. Among 437 new parcels generated, 416 are less than 1ha. Therefore, according to the law, these parcels should not be subdivided.

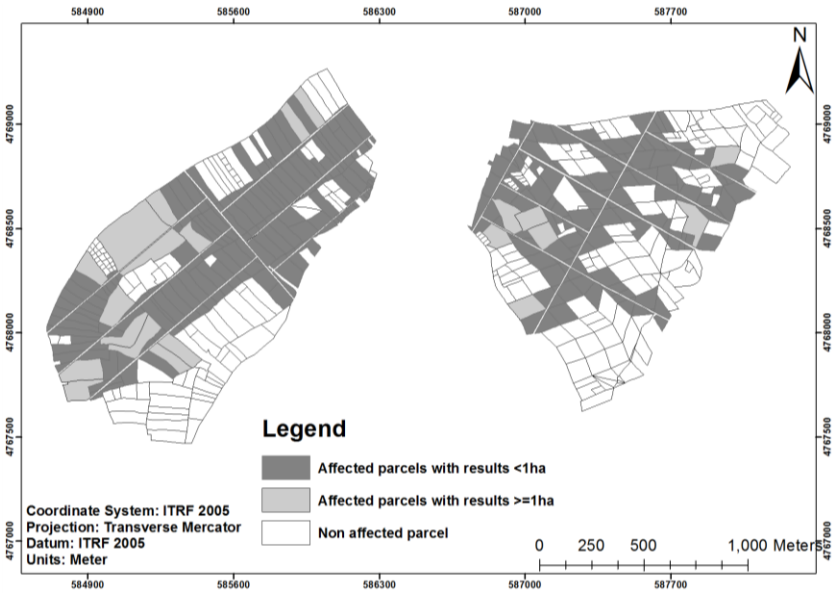


Figure 20: Subdivided parcels which are less than _1Ha

5.3.4. The use of land tenure information to show the existing right, responsibilities, restrictions and possible changes in Nasho scheme

In the planning process, the information regarding the existing rights, responsibilities and restrictions was not used in the Nasho scheme, as explained by the GFI official. This was not considered necessary: no change of ownership or rights was intended.

The focus group discussion reveal that the information of the existing rights, responsibilities and restrictions was not suggested at the meeting held before implementing Nasho LUC scheme. In addition, the farmers who were not allowed to sell their parcels had no idea about the law which prevented subdivision of a parcel - if each split parcel would be less than 1ha.After analysing the effect of LUC activities on the right in Nasho scheme, the results were sent to RNRA and GFI official. The feedback from RNRA official suggested that some institutions do not know well exactly which information they need for implementing such projects.

For the farmers who cannot sell or register each split parcel, he explained "*this case would not be happen because the implementers should know the rules. Therefore, no decision I can announce for you now for those subdivided parcels*" On the other side, GFI which implemented the Nasho scheme, explained that this is a new case for which needed to be treated as such. He explained that the farmers should not be victims because the roads have been introduced by the government. Therefore, advocacy will be done for those cases in collaboration with RNRA

.

5.4. Summary

Generally, the results from this chapter show that the land tenure information from LTR was used in LUC program to some extent. The current National land policy of 2004 proclaim the use of land tenure information in all land related activities. It encourages all stakeholders in relation to land management to use this information for good rational of land use. However, the ministerial order which determines the modalities of implementing LUC, is silent about the necessity of land tenure information in this program. The general information from the government officials at national level (MINAGRI and RNRA), reveal that after LTR the required information to implement LUC are collected from RNRA. To verify how this was done, the study was focused on the site of Nasho to see the effect of LUC activities, and the use of land tenure information. As the results show that there were changes of parcel size due to the introduction of roads. And the change of existing right and responsibilities after implementing LUC in Nasho scheme. The information from the national level was similar to what found at Nasho study area. The cadastral shapefile is the only information from RNRA which was used in planning process in Nasho scheme. The information of rights, responsibilities and restriction was not used. The main reason was that the implementers did not know exactly which information was necessary

6. STAKEHOLDERS PERCEPTIONS RESULTS

This chapter presents the results related to the relevance of land tenure information for the existing LUC program, and presents the ideas of stakeholders (farmers and government officials) on how land tenure information could be better for the future LUC program.

6.1. Relevance of land tenure information to the existing LUC programs

The relevance of land tenure information was perceived differently depending on the type of LUC. The information from RAB/CIP department and the district official revealed that the land tenure information is more required for "modern" LUC. This is because the type changes the existing situation by including other activities like resettlement, roads connections and irrigation infrastructures. Therefore, information people-to-land relationship is required. Contrary to simple LUC, they explained that the information of existing right, responsibility and restriction is not so relevant since this type does not change anything. Once again, since the farmers have their land title, this is considered as enough information as long as it has the size of the parcel which is required before receiving fertilisers. Besides that, the farmers and government officials explained the relevance of land tenure information for the existing LUC program in the following points.

The use of land tenure information to ensure farmer's security of tenure

The outcome of focus group discussions reveals that in general before LTR, there were disputes based on unclear ownership of parcels, the problems of boundaries and size of parcels. There were the cases of families who disputed one parcel based on the issues of unclear inheritance. Furthermore, before supplying fertilisers to the farmers in the scheme, it was necessary to know exactly who was the land owner, and the size of each parcel in the scheme. After LTR, they felt secured because each parcel is registered under a specific person. There is no longer measurement of parcels during LUC because the size of each parcel is already registered. However, before LTR, this measurement caused the disputes because it was not so easy to agree on the size obtained. The government officials admitted that the non-use of this information can be a source of tenure insecurity. The explanation is that the relevance of this information will help in cases where changes which might require compensation. Therefore, it would void confusions over payment of someone who has a parcel which is already disputed.

The use of land tenure information in the program of LUC increases farmer's participation and production

Both the interviews with government officials and focus group discussion reveal that after LTR, farmers are interested in joining the LUC program. Having a land title increased their confidence because they feel that their rights are recognised. Furthermore, they participate in decision-making forum (meeting) as it is possible to know exactly who will be affected if there is any infrastructure which will pass through their parcels. The district agronomist confirmed that the farmers are ready to implement agricultural technics provided by government compared to the period when they did not have their land title. Therefore, the expectation is that this participation will increase agricultural production.

The use of land tenure information to speed up the process of LUC

The focus group discussion and government officials reveal the same views about speeding up the process of LUC enabled by land tenure information. Regardless the type of LUC, the results reveal that before adopting the use of land tenure information the implementation took a long time. This was clearly visible when it was necessary to measure every parcel using a measuring tape so that a farmer could get fertiliser which corresponded to his or her parcel size. District agronomists were requested to work together with

the local community to identify details regarding owners and their land in case there was not the project which supports by hiring the enumerators to perform that job. Now, using a cadastral shape file, every parcel in the scheme and its size is known. In addition, the parcels which will be affected are also identified even if cross checking is always required. Another relevance explained by LWH official is that the use of this information has reduced the budget which was spent in collecting the required data.

The use of land tenure information helps to know the possible changes and update
The information from RNRA reveals that there is an issue of updating the changes made on the ground. This is because some transactions or the implementation of government projects, which change the existing registered information, like LUC, do not involves RNRA or the District land office. As the LUC activities affected people-to-land relationships, it is more relevant to use land tenure information in the whole process of it. Consequently, it will be easy to update all changes made after its implementation.

6.2. The ideas of better use of land tenure information for future land consolidation programs

The results from previous research questions and ideas of government officials establish how land tenure information can be better used for the future land use consolation program. The ideas from the above sources are summarised in the following points:

The assessment of done by MINAGRI shows that LUC shifted from increasing agriculture output to the source of rural development as a whole. This assessment proposed the following components be implemented with LUC. Mechanization of farm activities in consolidated areas; integrated soil fertility management; resettlement of people from agriculture areas to the residential areas; promote hillside irrigation with the provision of basic infrastructures (Dams, irrigation canals, terraces, feeder roads connections, drying ground etc...) and environmental protection measurement. The assessment demands that the land ownership issues have to be taken into consideration in case this approach is adopted in the country. These approach which change the existing situation are defined in laws and policies, but also MINAGRI started to implement them.

Ministerial order of 2010, which determine the modalities of implementing LUC, and RPRS present three categories of LUC which have to be encouraged: Consolidated land rental model, Facilitated farming contract and Cooperative farming section 4.1 explains how these proposed models have to be implemented. In this way, the information from LWH reveals that there is a pilot project of implementing land rental consolidation (leasing land to investors). This model consists of leasing the land to investors and give a sublease of at least 10 years. Therefore, before implementing it, there is a need to know the existing owners, their rights and responsibilities so that the renter can be sure to operate on land which does not have problems like disputes. The idea is that for this approach the project has to involve RNRA to provide the information regarding people -to-land relationship in the selected scheme. And help them in transactions between land owners and investor. This is done in case the land owner are in accord with the proposed model.

The information from RNRA official reveal that all project which changes the land and ownership should use land tenure information for better land use planning and management. Although systematic land registration has covered the whole country and the available LAIS, not all changes are being updated. This is the fact that the government institutions and privates companies implement their projects without the involvement of land administration authorities, RNRA as the institution which deals with land use planning and management, suggested that all implementation of land use plans should do be incorporated in national up to cell level land use planning. Therefore, it will avoid the disparities which frequently

happened. The suggestion is that there should be a law or policy which bind or demand the use of land tenure information for all institutions involved in land-related activities.

RAB through CIP has the project of mapping LUC schemes country wide. The information from RAB reveals that by using Orthophoto of 2008 from RNRA which has 0.25m of resolution, arable land was retrieved. This was done for country wide after removing water bodies, rivers, town, built-up areas, forestry and other non-agricultural areas. By using different techniques which involved crop specific requirement and metrological stations, the suitable crop was selected as well as the size of the site in every district. The idea of using land tenure information better in this program is that after getting finish the mapping with the suitable crop, the consolidation layout plan will be sent to RNRA. This plan will be included in land use planning at cell level. Besides that, each district will be requested to keep all shape files of planned sites. During implementation the shapefiles will be overlapped with cadastral data or other information in case the way of implementing LUC will change the existing situation on the ground.

The MINAGRI officials suggest that there should be a platform of data sharing for which will help to include this information in a planned project. Selling data to the government and private companies was suggested as the way of getting them easily. Consequently, will both benefit the RNRA to recover the cost using for data maintenance and for the clients the data will be fast obtained. For RNRA, suggest that the implementers of LUC should also know exactly which information are required for a specific project. This was because some information regarding right, responsibilities over the land in the scheme was not used while it was necessary.

6.3. Summary

The implementation of LUC claimed the necessity of land tenure information. The results from this chapter show that the land tenure information is relevant in: right recognition, an increase of agricultural production, speed up the process and updating the changes. It was seen also that the approach of implementing LUC is changing time by time. This requires the better use of land tenure information because, the proposed LUC activities can change the existing right holder, right, responsibilities and restriction. The overall suggestion is the involvement of land administration authorities in LUC programs in the whole process. Therefore, all existing situation, possible changes will be identified before implementation. Furthermore, all changes will be updated easily.

7. DISCUSSIONS

This chapter discusses the results presented in the previous chapters. It compares the results of two cases about the support of land tenure information in LUC programs. The findings are confronted to the literature review which explains the general use of this information in land consolidation programs. In addition, the analysis goes to the effect of LUC activities on the parcel, people and right in the study areas. Thus, this effect reflects the relevance of the use of land tenure information in LUC. Finally, the analysis focuses on how land tenure will better support the future Rwanda's LUC programs

7.1. Analysing the legal provisions on the use of land tenure information for Rwanda's LUC

The changes brought by implementation of land consolidation are the evidence of the necessity of a clear legal framework which defines all processes. The adjudication of existing ownership, provision of changes and the management of them all should be defined in the legal framework of land consolidation(Haldrup, 2015). Contrary to Rwanda, by the time of launching LUC there was not a specific law or policy which guided the procedures to implement the program. However, these laws and policies proposed the model of LUC which can change the existing people-to-land relationship. The example is the organic land law of 2005 and RPRS which proposed 1ha of parcel holding in LUC scheme.

On the other side, the studies found that the size of parcels varies with the population density. In the west and northern part of Rwanda the average of parcel per household, 0.17Ha in eastern is 0.77ha while the national average size is 0.35ha (Musahara & Huggins, 2004; Sagashya & English, 2009). This shows that the required parcel holding size in the scheme of LUC was bigger than the average size of parcel holding in Rwanda. The two situations are contradictory because if land holder should have 1 ha it means many changes can happen in the scheme unless every one before implementing LUC had a parcel above 1Ha. Therefore, this is the evidence which required the law to define how the changes of tenure should be managed during implementation of LUC

We can think that the non-provision of management of tenure issues in LUC program is because there wasn't the registered land tenure information. However, the results reveal that the available registered information from LTR was not clearly defined or required by the law or policies as the important element to use in LUC program. Only National land policy is clear about the use of land tenure information in land related activities for better land management. The laws which supposed to define how this information should be used in the LUC program are silent on that. So far, this silence may be considered as a gap as long as these laws propose the approach of LUC which can change the right over the land and parcels its self.

All these systems require first the use of land tenure information to identify the existing rights and ownership, and to propose the possible changes. Therefore, the ministerial order which currently guides the implementation of LUC should bind or oblige the implementers of LUC to use this land tenure information. In case laws are silent, it may be necessary that policymakers establish the ways of explaining the laws. If possible, make amendment of existing ones in such a way the use of land tenure information appears as an important component to taken into consideration when implementing LUC.

7.2. Analysing how land tenure information was used to support LUC program

The use of land tenure information in LUC programs is discussed in this section. The general step of using land tenure information was adapted in Box 3. of (FAO, 2003b) and (Demetriou, 2014)

Table 7: general steps of using land tenure information in Rwanda's LUC program

Use of land tenure information prior to LTR	General step of using land tenure information for implementing LC (Adapted from Box 3 of FAO,2003)	Use of land tenure information from LTR
Using land tenure information to show the existing situation (people –to- land relationship)		
—	Identification of existing land owners in the scheme	✓
—	Identification of existing of ownership(Lease, sublease, freehold)	—
—	Identification of existing type of right	—
—	Identification of existing responsibilities restriction (Mortgages, easement, caveat etc...)	—
—	Identification of existing cadastral parcel layout	✓
Using land tenure information to show possible change which will occur after implementing land consolidation		
—	Preparation of consolidation plan which show new parcel layout	✓
—	Identification of parcels which will be affected by the infrastructures (roads, irrigation infrastructures etc.)	✓
—	Identification of the size of affected part of parcels	✓
—	Show possible changes of existing situation (right, responsibilities and restriction)	—
Using land tenure information to update new situation		
—	Survey new boundaries of parcels	—
—	Registration of new situation(new owner, right and restriction)	
—	Issuance of new land title	—

✓ : Where land tenure information was used —: Where land tenure information was not used

Results from both government and farmers revealed that land tenure information prior to LTR was not used (Table 7) because there was not registered information. UNECE (2005) explained that not always all required information are registered, hence, before implementation of the land consolidation plan, it is necessary to meet the community for getting more information. It may be possible also to implement land consolidation by using information from communities without depending on registered information in case is not available.

The simple LUC which was implemented in Kinoni site did not change the existing situation on the ground. For that, RAB officials admitted that this type does not necessarily requires the use of land tenure information. This simple LUC has some similarity with Individual land consolidation type. This type is implemented without the introduction of infrastructure, reallocation or exchange. The farmers are encouraged to join the use of their parcels (FAO, 2003b). This type of consolidation is implemented based on informal and sporadic approach, based on the willing of land owners (Lerman & Cimpoieş, 2006). For this case land consolidation can be implemented without the support of government as long as the farmers themselves agreed on the joint of land use. The results showed that during the establishment of

LUC this land tenure information was not the basic requirements. This was explained by the national government officials and the results of from Kinoni scheme.

Contrary to this, the modern LUC which was implemented in Nasho site proclaimed the use of land tenure information based on the way it affected the existing situation. From the Table 7 above, the results show the extent to which land tenure information from LTR was used in LUC program compared to how it is generally used as explained by literature. The results revealed that only information for identification of affected parcels was used. This was done for facilitating the compensation process in the case of expropriation. However, Lemmen et al (2015) explained that the right, responsibilities or restriction are associated with the spatial unit. And the changes of it is associated with the changes of them. This was realised in Nasho scheme where the introduction of infrastructures on the existing land has changed also the right and responsibilities over the land.

The way the cadastral shapefiles were used in Nasho scheme may be it was for the interest of the implementers but not for the farmers. We argue this because the reason was to facilitate the process of compensation only. However, it is highly needed to take care of the existing right, responsibility and restriction of people who have the farms in the area which is intended to implement. UNECE (2005) explained that the plan of land consolidation should have at least the name of land owners (natural or non-natural), the nature of tenure which includes the type of ownership (lease right full ownership).

The results showed that the non-use of this information was because of unawareness of implementers about the necessary information which was required before implementing LUC. This is clear where MINAGRI official said that cadastral shapefile is enough to use in the planning process. It is possible that the projects could not know the whole information which is really required. But there should be the collaboration or the involvement of RNRA in the process of LUC because it has all information related to people-to-land relationship. . UNECE (2005) states that land administration authorities are the prime source of information and basic requirement for supporting the land consolidation in order to be sustainable.

Despite the use of cadastral shape file in Nasho scheme in the planning stage, the results showed that no change had been updated. This was confirmed by the current cadastral shape file from RNRA which is the same as before implementing LUC. However, on the ground, the roads have changed the size of existing parcels. Different reasons of non-updating were raised and are presented in section 5.3.4. Consequently, the farmers have the land titles which are not corresponding to the actual size of their parcels. This can deprive some rights like, mortgage, selling and sometime to pay the taxes which are not corresponding to their parcels. Generally after implementing land consolidation projects, it may be found that the actual situation on the ground is not in conformity with the official cadastral plan of that developed area. Therefore, in such case it is necessary to redesign the cadastral layout plan which ends up with the issuance of new land titles to the land owners(Demetriou, 2014).

7.3. Analysing the effect of LUC activities on land people-land- relationship

The analysis of the effect of LUC activities on people-to-land relationship based on the results from two sites of study areas (Kinoni before LTR and Nasho after LT. Table 8 below, shows the general land consolidation activities and those implemented in two schemes of the study area. The general activities were adapted in (FAO, 2003b) and (Demetriou, 2014). These activities always affect the existing situation in the scheme of land consolidation. Based on the changes caused by these activities, the land tenure information is considered as relevant in the whole process.

Table 8: General land consolidation activities which requires the use of land tenure information.

Activities affected people-to-land relationship (Kinoni site)/prior to LTR	**General activities which affect people-to-land relationship in the process of land consolidation**	**Activities which affected people-to-land relationship in Nasho site/After LTR**
—	Reallocation of parcels	—
—	Exchange of parcels	—
—	Lease system	—
—	Change of existing right(right, responsibilities and restriction	✓
—	Merging parcels	—
—	Enlargement parcel holding	—
—	Removing boundaries	—
—	Feeder roads	✓
—	Recreation spaces	—
—	Irrigation and drainage system (Irrigation canals, dams, drainage channels etc...)	✓
✓	Erosion control like radical and progressive terraces)	—

✓ : Implemented in the study area. —: Not implemented in the study area.

Generally land consolidation affect the land by reallocating fragmented parcels(Vitikainen 2004) and enlargement of parcel holding. The results of Kinoni and Nasho sites contradict this literature. From both study areas no cases of enlargement of parcel holding or exchanges. For this, it is clear that the results of LUC or its objective is slightly different to the conventional land consolidation in terms of enlargement of parcel holding. However, there are similar about the aim of increasing agricultural output.

Table 8 shows that in Kinoni site, no activities which changed the existing situation. However, it is clear that the activities implemented in Nasho affected people-to-land relationship. Even if the results of LUC Nasho scheme is different to the general knowledge of output of land consolidation, but it has changed the existing situation. After land consolidation, the number of parcels in the scheme are more likely to be reduced and parcel holding become bigger than previously. However, in the results of the Nasho scheme, it shows that the parcel holdings become many and small. Before implementing the LUC, number of parcels were 441 then after they become 670. The parcels less than 1ha were 365 and after they become 632. This finding is confirmed by FAO (2003b) where explains that the effect of land

The increase in the number of parcel holdings and the reduction of parcel size after implementation of LUC in Nasho scheme can be seen in different ways. First these results explain the relevance of using land tenure information in LUC programs. This is because this type of LUC changes the existing right, parcel and it can even change the owner. Second observation comes as another study which could be done to see how the increase of fragmentation of parcel holding will respond to the objective of LUC which is to increase agricultural output. Sklenicka et al. (2014) explained that the small fragmented parcel holding has disadvantages which complicate activities of farming, sometimes having inappropriate shape and can become impossible for mechanisation. This was seen in Nasho, where mechanisation is difficult because

for each period of land preparation there should be another adjudication of boundaries. This sometimes raises the disputes between two neighbouring farmers. It may be also a challenge for the service provider especially in terms of extension service, travelling time and even for production. In summary, this can well understandable after an analysis of social-economic output of this type of LUC.

7.4. Analysing of relavance of land tenure information for future LUC program

The relevance of land tenure information is become more and clear in LUC program based on the results from two sites and the general information from MINAGRI and RNRA. NUR (2013b) explains that the objective of LUC at starting point was the increase in agriculture production, no change of tenure; no inclusion of infrastructure; no environmental protection was provided. This type of LUC was found in Kinoni site and the results showed that the use of land tenure information was not highly needed in order to implement LUC even if it was not available. However, currently the approach of LUC changed and it claim the use of land tenure information because of the effect of it on people, right and parcels and also because of different benefits of it. The explanation of these is clear based on results from the site of Nasho, government officials and even from the current government land law and reports. All these approaches need to use the tenure information before implementing LUC because they change the existing parcel size, existing right and even the existing land holders.

It has been seen that the use of land tenure information is relevant in different ways depending on the views of farmers and government officials. The main points realised were focused in increase of farmer participation, recognition of the right, speed up the process and help in update of the new situation. All these views can be the basis of goog use land tenure information and it similar to what other researchers found. In Slovenia, the study showed that the active participation of farmers lead to the success of the objective of land consolidation. In addition, using the knowledge of participated farmers can improve the complexity of land consolidation like giving their opinion on how the reconstruction of existed parcels, the location planned infrastructures (Lisec et al., 2014).

The implementation of land use plans leave out the disparities between ground true and official data when implementers don't take responsibility of updating. This was explained by a respondent from RNRA. The finger is pointed to different institutions in rural or urban areas which change the existing registered information and yet don't take responsibilities of updating. One of the relevance of using land tenure information in the whole process of LUC is the regular update of changes which happen after its implementation. The implementers of LUC in collaboration of RNRA have to make sure if any change which is planned to be made on the parcel is allowed. Therefore, after implementation of LUC, all changes has to be updated and followed by the issuance of new land title.

The better use of land tenure information in the future LUC program can be seen in different ways. First of all, based on the results and the proposed approach of LUC, it is necessary to involve the land administration authorities in activities of LUC. There should be a clear platform of data sharing between MINAGRI and RNRA because currently the information of people-to-land relationship are registered under LAIS.

Lerman & Cimpoies (2006) found that large parcel holding produces high family income. This is because the productivity increase when the number of parcel holding decreases. The authors showed that this is possible when the market mechanism for land consolidation through the system of leasing or buying is adopted. Therefore, the benefits are for both lessees through the increased income and lessor with the income from the payment for his parcel. The results showed that LUC from Kinoni site and Nasho site did not reduce land fragmentation, especially in Nasho site about 125 parcels their size have been reduced

which was increased the number of parcel holding. To avoid this, land lease (land bank) could be a solution in case it is done voluntarily. However, another approach like reallocation or exchange, could also increase or decrease the existed parcel holding and implicate the change of land owners.

Bennett et al (2015) found that the reallocation and exchange of parcels in Ethiopia had increased the existing plot. The maximum gained was 0.083 while minimum was 0.003 ha. On other hand, the loss varied from 0.101Ha to 0.006Ha. The land bank was found to be fit for purpose of land consolidation as it allows the approach of leasing for a specific time and land owner remains with all right over his land. If the approach could be adopted it may be a solution of land ownership fragmentation.

The same as the above literature, currently MINAGRI proposes other form of LUC by using approach of land bank. For this the land tenure information could be better used in the form of facilitating the approach.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1. Conclusion

This research sought as the main objective, to determine the role of land tenure information in Rwandan LUC programs. To achieve this objective, three sub objectives were set out from the main objective. The specific objectives include: (1) To understand how land tenure information supported LUC prior to Rwandan LTR; (2) To establish how land tenure information from Rwanda's LTR supports LUC programs; (3) To ascertain stakeholder's perceptions about the use of land tenure information in LUC programs.

1. To understand how land tenure information prior to Rwandan LTR supported LUC program

To achieve this sub-objective, three research questions were answered:
*The research question 1.*1 sought to answer how laws and policies were considered the use of land tenure information in LUC program. The results show that the laws and policies did not consider the use of land tenure information prior to LTR in the LUC programs. Before Rwanda's LTR, no laws and policies were designed to guide the implementation of LUC. The organic land law and other policies focused on land related issues in general. They only considered LUC as a tool for agriculture transformation, for increasing production and food security. The commonality of these laws and policies is that everyone should have at least 1ha in the scheme of LUC. No parcel reserved for agriculture or animal husbandry is allowed to be subdivided if each of the subdivided results is less than 1ha.

The research question 1.2 sought to get insight on the land tenure information prior to LTR was used in LUC programs. To answer this question, the data pertaining the LUC activities, required information, sources of information, and how that information was used to implement LUC activities, were collected. The results presented in section 4.2 of chapter 4 illustrate the activities, required information and sources of information. The results reveal that the land tenure information prior to LTR was not used in LUC programs. Before LTR, the rural areas were characterised by a customary system and the land was not registered. The information regarding people-to-land relationship was collected from local leaders, local community and district agronomist. This information was registered sporadically only in urban areas through district land administration offices.

The research question 1.3 focuses on the Kinoni study area, it researches how LUC activities affected the people-to-land relationships in the area. The data relating on how people, rights and parcels have been affected and changed by LUC activities were collected. The results show that LUC activities did not change the existing situation (people, right and land) in the Kinoni scheme. This was because of the type of LUC implemented in that area. Simple LUC was implemented in the Kinoni scheme. The approach is based on mobilisation, the farmers were encouraged to join the use of their land under a selected crop. Regardless the size of parcel holding, everyone remains with his parcel as it was before joining the program. No infrastructures which can change the size or boundaries was introduced in the scheme. Beside the mobilisation, the government provided seeds, fertilisers and technical assistance for those who joined the program of LUC.

2. To establish how land tenure information from Rwanda's LTR supports LUC programs

Research questions 2.1, sought to understand whether laws and policies demand the use of land tenure information in LUC programs, in post-LTR contexts. The results reveal that current national land policies demand the use of land tenure information from LTR in land related activities. The policy explained that

after Rwandan LTR, the land information will be used by all stakeholders involved in land use for better land management. However, from all policies and laws which currently explain the model of implementation of LUC, the use of land tenure information is not highlighted. It was realised that the approaches defined by the ministerial order of LUC, RPRS and other policies, require the use of land tenure information. This is because these approaches, like leasing and corporation LUC approaches, all need the change of the existing people–to-land relationships. In addition, the assessment done by MINAGRI suggest the inclusion of irrigation components in the scheme of LUC, feeder roads, resettlement of people from agriculture zone to the residential areas and environmental protection. The implementation of these techniques leads to changes with the parcel itself, change of land owner and even the right which people have over their parcels. Therefore, the use of land tenure information from LTR is required to show the existing situation, the possible changes and help in executing updates to the new situation, even if the policies and laws did not explain how it should be used.

Research question 2.2 gives the insight on whether land tenure information from Rwanda's LTR is currently used to support LUC programs. The information from local and central government officials reveal that land tenure information from LTR is currently used. However, it is not used as a whole, only cadastral shape file are used. The common explanation is that this cadastral information is used in a sense of facilitating and reducing the budget of the works which normally were performed by the hired consultants.

Some activities like road, dams, irrigation canals, drying ground are often implemented with modern LUC. Before adopting the use of cadastral shape files, a project hired the consultant to conduct a feasibility study on a selected scheme. The work included also the measurement of each parcel which is likely to be affected by planned infrastructures in the scheme. But now according to the responses, cadastral shapefiles and consolidation layout plan are used to identify the parcels which can be affected by implementation of LUC. In addition, the plan is used in the meeting session with farmers where everyone can be aware of what will happen for his parcel.

Research question 2.3 attempted to understand how LUC activities, using land tenure information from LTR, impacted the people- to-land relationship. The results from the farmers of Nasho scheme and spatial analysis showed that the people –to-land relationships were affected. The size of 208 out of 441 parcels was reduced because of the the introduction of new roads in the scheme. All the 20 respondent claimed that after joining the program, they no longer have rights to change the crop. For those whose their parcels have been affected, they don't have right of transferring the subdivided parcels according to the law. This was because the information concerning the existing right, responsibilities or restriction was not used to know what is possible for change. Both farmers and implementers confirmed that this information was not used. The farmers were not informed if they will lose the right to transfer after being affected. The implementers (GFI) also considered that no one will lose the right after implementing LUC, as long as everyone will stay with his/her parcel. Another explanation on non-usage of this information regarding existing right is that the land administration system is young so that implementers are not familiar with all information which are really required before implementing LUC.

3. To ascertain stakeholder's perceptions about land tenure information in LUC programs

Research question 3.1 explored the ideas on the relevance of using land tenure information to the existing LUC programs. The results show that this information is relevant to the existing approach of LUC. Predominant relevance was perceived in modern LUC due to the changes that followed its implementation. The introduction of infrastructures in the scheme of LUC causes the changes of existing parcel size and resettlement for some cases. All these changes affect both right holders, existing right and the parcels itself. Hence, the relevance using land tenure information is to show the existing situation,

possible changes, and then updating all changes which happen after implementation. Besides that, for simple LUC, the relevance of using land tenure information was perceived as to facilitate the implementers to know the size of each parcel in the scheme. The explanation from focus group discussion and government officials raised also the following relevant points related to using land tenure information in existing LUC programs:

- ✓ recognition of the right which leads to security of tenure
- ✓ farmers participation which leads to adopting the system and increase production
- ✓ speed up the process and reduce the budget
- ✓ contribute for maintenance of land administration system

Research question 3.2 sought to get insight into whether there are suggestions on how the land tenure information can support better the future LUC programs. The results show that these ideas are described in the reports, from RNRA and MINAGRI government officials. . This is because, there should be an inclusion of other infrastructures like irrigation system, roads in the scheme of LUC which can change the existing situation. Furthermore, the land bank through the leasing LUC system is the approach which is currently encouraged by MINAGRI. Hence, the investors (big farmers) will have the agreement with many small farmer holders for leasing their lands at least 10 years which will give the investor right of the sublease. The land tenure information will be used from planning up to implementation for clarifying the existing people –to- land relationship, possible changes and issuance of sublease to the lessee. The RNRA consider the better use of land tenure information as a support of land use planning and maintenance of land administration system. Therefore, all institutions in relation with land use they requested to involve the RNRA in those project which can change the existing registered information.

General conclusion

The objective of this study was to determine the role of land tenure information in Rwanda's LUC. The use of land tenure information is generally proclaimed because the implementation of land consolidation changes the existing situation (people, right, land) after its implementation. Generally, land consolidation affects the people-to-land relationship by increasing parcel holding by reallocation or exchange. All these changes require the use of land tenure information which plays a role in clarifying the existing situation, possible changes and after contribute to update the new situation.

The results of this study contradict this general effect of land consolidation on people-to-land-relationship. The results showed that no reallocation, no exchange, no increase of parcel holding, no change of land owner was caused by the implementation of LUC in the study area. However, the results from Nasho, where there was the introduction of roads, showed that fragmentation of parcel holding was increased, but the parcel size decreased. This contradiction is understandable because the aim of LUC is to join the use of parcels. Therefore, smallholder continues to use their land but under one selected crop which at the end is expected in the way of increasing production.

Although the LUC do not increase the parcel holding and do not change the land owners, it affects the people-to-land relationship so that the use of land tenure information was necessary. The results reveal that many farmers in Nasho site don't have the right to the sell because the results of subdivided parcels are not complying with 1ha which is stipulated in the land law of 2013. All these effects show that the information regarding existing rights and responsibilities were not used as it was confirmed by implementers themselves and farmers. The only information which was used is cadastral shape file in a sense of knowing the parcels which are likely to be affected which at the end helped the implementers the process of compensation. It was also seen that the approach of LUC changes time to time which brings the idea of better using land tenure information for the future the program.

The new approach, which should be encouraged, is a land rental model and it was considered as the best solution. This is based on the agreement between one investor with a number of small farm holders, whereby the investor can have the right of a sublease of at least 10 years. For this approach, the use of land tenure information will be highly needed before implementation. All information of ownership, type of right and responsibilities, will be sorted out to ensure that the agreement between two parties is based on true information. Thereafter, the investor will be given a sublease, which will help to get a loan for more investment.

The general conclusion to the main objective is that: The information from government officials combined with the interview with farmers of two study areas in Kirehe district showed that land tenure information prior to LTR was not used. However, the available land tenure information from LTR is currently used to some extent. Furthermore, it was found that this information is necessary in LUC programs.

8.2. Recommendation

The general recommendation is that:

- ✓ Results derived from this case study demonstrate that it is possible to initiate land consolidation without the use of registered land tenure information. Then after, the availability of this information, may be used to support the program.

To maximise the use of available registered Rwanda's land tenure information, it is recommended to the MINAGRI to:

- ✓ Promote the involvement of land admiration authorities in the implementation of LUC
- ✓ Not only use of cadastral shape file but also the inclusion of the information regarding existing right, responsibilities and restriction are required before implementing LUC
- ✓ Amend the Ministerial order or provide the document which explains how the land tenure information should use in LUC
- ✓ Advocacy for the farmers whom their parcels were affected by roads so that they can get the new land titles
- ✓ Collaborate with RNRA to provide the solution about the law which avoid the subdivision of parcels in case the results will be less than 1 ha. This is because it may be impossible for the provision of infrastructures to pass through the parcels above 2 ha only.

This research emphases only for the role of land tenure information, but further research interested in this domain, are recommended:

- ✓ Design an inclusive clear process of Rwanda's LUC from planning up to update the changes happened during implementation
- ✓ Use local spatial knowledge in decision making for LUC.
- ✓ The analysis of social-economic impact of LUC program

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APPENDICES

APPENDICE 1: Interview with government officials and farmers

Interview1: Addressed to farmers who have farms in the scheme of LUC

My name is Innocent Rubanje; I am conducting this research as a student from University of Twente, faculty of geo-information sciences and earth observation for land Administration in Netherlands. My research is for determination of the role of land tenure information for LUC case study of Kigarama and Nyamugali sector in Kirehe District. Your information will be used for academic research and you are guaranteed on the confidentiality of them.

Section 2: The effect of LUC on people-to-land relationship

1. How did you acquire the parcel in this scheme?

Inheritance ☐
Purchase ☐
Tenant ☐
Exchange ☐
Reallocation ☐
Donation ☐
Others ☐

2. When did you start to use this parcel?

Before LUC ☐
During LUC ☐
After LUC ☐

3. If you are a tenant what proof do you have which can show your use right?

Agreement paper ☐
Sublease certificate ☐
No proof ☐
others ☐

4. In the following right, what did you have before and what you don't have after joining LUC program?

Right to sell ☐
Right to rent ☐
Right to donate ☐
Right to modify(the use) ☐
Right to mortgage ☐

5. What do you think as the cause of loss of some right after joining LUC?

……
……

6. What are the responsibilities did you have before joining LUC

Mortgage ☐
Caveat ☐
☐

Sublease
Easement ☐
No one ☐

7. Did these responsibilities and restriction considered before implementing LUC?

……
……
……

8. After joining LUC, the size of your land remained the same

Yes ☐
NO ☐

9. If not what caused the changes of your parcel size

Road ☐
Irrigation canals ☐
Terraces ☐
Dam construction ☐
Merging of parcels ☐
others ☐

10. How did you know if your parcel will be affected

In the Meeting ☐
Consolidation layout plan ☐
During implementation ☐

11. If the size of your parcel has changed did you receive the new title which corresponding to the current size?

Yes ☐
NO ☐

12. After joining LUC is the land use of your parcel changed?

Yes ☐
NO ☐

13. . If the use of your land has been changed do you have title with the current use?

Yes ☐
NO ☐

14. After joining the use of your parcel is the boundary still visible

Yes ☐
NO ☐

Interview2: Addressed to the officials in charge of implementation of LUC at national level (RAB, KWAMP, LWH, MINAGRI department of planning)

1. What are the policies, laws and regulations which guided the implementation of LUC? (Prior to LTR/After LTR)

2. What are the provisions and guidelines regarding the use of land tenure information for LUC? (Prior to LTR/After LTR)

3. What are LUC related activities?

4. How these activities affect the land (change of boundary, size, and land use)?

5. Is the LUC activities can change the existing owner?

6. After implementing LUC is the right over the land remains the same?

7. What is the information required for implementing LUC activities?

8. What are the source of this information ((Prior to LTR/After LTR)?

9. How this information was/is used to implement LUC activities (Prior to LTR/After LTR)?

10. Do you consider this existing land tenure information as relevant in LUC program?

11. If yes can you please tell me what do you see as the relevance to use this information for the existing LUC program?

12. Is the approach of implementing LUC will remain the same?

13. If not how do you think can be used better for future LUC program?

Interview3: Addressed to the officials in charge of implementation of LUC in study area (GFI, District agronomist)

1. What are the policies, laws and regulations which guided the implementation of LUC? (Prior to LTR/After LTR)

2. What are the provisions and guidelines regarding the use of land tenure information for LUC? (Prior to LTR/After LTR)

3. What were LUC related activities you implemented in this scheme?

4. Did you have the LUC layout plan?

5. Did you consider the existing responsibilities and restriction which farmers had over the land before implementing LUC

6. How did you know if some had such responsibilities over his land?

7. How these activities affected the land (change of boundary, size, and land use)?

8. Is the LUC activities changed the existing owner in the scheme?

9. After implementing LUC is the right over the land remains the same?

10. What was the information you required for implementing this scheme of LUC?

11. What was the source of every information?

12. How did you use this information in the process of implementing LUC?

13. Did you have the cases of exchanges or reallocation during the implementation of this scheme of LUC?

14. If there were the changes did you help the farmers to update the changes which happened on their land?

15. Do you consider this existing land tenure information as relevant in LUC program?

16. If yes can you please tell me what do you see as the relevance to use this information for the existing LUC program?

17. Is the approach of implementing LUC will remain the same?

18. If not how do you think can be used better for future LUC program?

Interview 4: Addressed to land registrar of eastern province and district one stop centre coordinator

1. Do you have an an idea on how LUC was established and how it is implemented?

2. Are there the policies, laws and regulations which guided the implementation of LUC? From its establishment up to now?

3. What are the provisions and guidelines regarding the use of land tenure information for LUC? (Prior to LTR/After LTR)

4. Are you involved in LUC activities?

5. How land administration authorities supported LUC before LTR?

6. How do you use land tenure information from LTR to support LUC?

7. Do you consider this existing land tenure information as relevant in LUC program?

8. If yes can you please tell me what do you see as the relevance to use this information for the existing LUC program?

9. Is the approach of implementing LUC will remain the same?

10. If not how do you think can be used better for future LUC program?

Interview5: Addressed to Focus Group Discussion

1. When did you know the program of LUC in this area?

2. Do you have some changes on your land or for the land owner which occurred during LUC?

3. How did you know if the changes will happen after implementing LUC?

4. What activities which have changed the existing situation in this scheme?

5. Did you participle voluntary in this program of LUC?

6. Were the changes of happened updated after implementing LUC?

7. Did you have dispute immerge caused by unclear tenure situation during LUC?

8. After joining LUC do the farmers remained with their rights over the land?

9. Before joining LUC are the cases of some who had some responsibilities on land like (Mortgage, caveat, easement, and sublease)?

10. If these cases happened, did the implementers considered them before implementing LUC?

11. How did they know if someone had such responsibilities and restriction over land?

12. Do you consider this existing land tenure information as relevant in LUC program?

13. If yes can you please tell me what do you see as the relevance to use this information for the existing LUC program?

APPENDICES 2: FIELD PHOTOS IN KINONI CASE STUDY AREA

Figure 21: Mix of Maize and tomato in the Kinoni scheme of LUC

Figure 22: Materialisation of boundaries after land preparation in Kinoni LUC scheme

APPENDICES 3. INTRODUCTION ROADS IN NASHO SCHEME

Figure 23: Introduction of roads in Nasho scheme of LUC