



UNIVERSITY of  
RWANDA

*College of Science and Technology*

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**Requirement analysis on Public Key infrastructure and fingerprint  
enabled solution for land administration information system  
Case of the transaction by land sell**

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A dissertation submitted in partial fulfilment of the requirements for the degree of Masters of Science in  
Information System.

Option: e-government

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Kigali, Rwanda, April 2021

## **Declaration**

This research project is my original work and has been presented for a degree in any other University nor published anywhere.

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This research project has been submitted for the thesis module examination with my approval as the University Supervisor.

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NSHUTI Arielle

## **DEDICATION**

This work is dedicated to my family and for all those who have supported me along the trajectory up to the completion of this project. Thank you all and may the almighty God bless you

## Abstract

The implementation of Public key infrastructure and the fingerprint through systems inter-connection is trusted to play a role in Transaction by Land Sell at sector offices in Rwanda, whereby the current system is semi-automated through the Government Platform Irembo which can result in fraudulent cases, duplication of the required document which is already recorded in some system and unnecessary trips made by Beneficiaries. This research project addressed the issues of how different systems that relate to Land information can be integrated using Information and Communication Technologies.

The proposed solution will be supported by making the linkage between the National Identification Agency NIDA (with data on each resident from 16 years of age and biometric information), Land administration information system, the Electronic Mortgage Registration System eMRS (with data on an enrolled mortgage); the Courts (with data on got cases about land questions); Rwanda Revenue Authority (with data on land taxes); and the Banks (with the mode of payment). This study examined current technological and system capabilities that are already in place for the process of the transaction by land sell at the sector level as the Rwandan government has the politic of implementation of ICT solution to facilitate its citizens to get services more efficient, cost-effective, quick and transparent.

The study was conducted using qualitative research methodology approach, structured interview question was generated, and conducting it to different user department and agencies together with other stakeholders, we have found the problem of long-distance that customer takes to Sector Land Office, the time that the process takes, much hard copy documents to complete the application file to be submitted. For resolving these problems, we proposed the harmonization of the existing systems by matching the identifiers to fully integrate and be able to share individual data in back end systems.

Using fingerprint of the landowner to retrieve needed data to fulfill the application online that will resolve the problem of duplication of data when submitting hard copies document and remove the time that takes the process of the service and the use of PKI to help the land notary to make a digital signature when received the application online. As a result, we have designed the proposed workflow, which can be implemented after being evaluated by the office in charge of land service. The outcome from this research project will support and simplify the process and activity of Transaction by land sell on three parties Governance, citizen, and business.

*Keywords:* Public key infrastructure (PKI), Finger Print, System interconnection, Land Transaction

## **List of Acronyms**

DRLT: Deputy Registrar of Land Titles

DLO: District Land Office

DB: Database

EMRS: Electronic Mortgage Registration System

ICT: Information Communication Technology

LAIS: Land Administration Information System

NIDA: National Identification Agency

ORLT: Office of the Registrar of Land Titles

PLR: Professional in charge of Land Registration

PKI: Public Key Infrastructure

RRA: Rwanda Revenue Authority

RNRA: Rwanda Naturel Resources Authority

RLMUA: Rwanda Land Management and Use Authority

SLO: Sector Land Office

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# **1. INTRODUCTION**

## **1.1 General Introduction**

To guarantee land management, land administration, and explicitly the support of land certificates gave to land to landholders during, land enlistment, land transaction, and Land Administration Information System (LAIS) has been developed. LAIS is a web-based land registration tool that is developed based on procedures and processes that are provided for by the Ministerial Order Determining Modalities of Land Registration. (BIRARO, February, 2014).

LAIS has been introduced as a way of moving from analog to digital way of dealing with various Land transactions but most importantly to create a more efficient, cost-effective, quick, and transparent Land process.

The research emphasizes on LAIS needs assessment for the improvement of the Transaction by Land sell service in the mainstream of e-government whereby the improvement needed is based on the use of ICTs in the activities related to the LAIS member's management at sector Level. A transformational act intends to come up with an automated working environment, where possible processes are treated online without physical visits of service beneficiaries. In this perspective, the main elements are people, process, technology, and information sharing through systems inter-connection and online authentication, if resources are shared many advantages are expected like cost-cutting, no duplication of efforts, quick, quality of service, and generally improved service delivery whereby these proposed technologies (PKI, fingerprint) will help to safely interact with the system used to have this service.

This study is directed to look at how Land Administration information system work on the perspective of the transaction by land sell at sector level; find out obstacles and why this service is not fully automated and design alternative solutions for making these service fully automated. Some necessities are characterized as dependent on recognized difficulties in the one process. To build a new workflow, the same necessities are used, which will be proposed to The Rwanda Land

Management and Use Authority (RLMUA) to improve its system. The workflow integrates transactions by land sell using some other ICT Solutions. The presented workflow in this study will be drawn using the Business Process Modelling Language (BPML).

The study will help Rwanda but also for other countries interested in using the new workflow of Transaction by land sell. It seems that customers will be helped by this new and simple workflow through Irembo; the improved workflow will be user friendly. This concept lies at the root of the problem of analysis, purpose, methodology and approach to design.

## **1.2 Problem Statement**

The idea of integrating the transfer of land titles via Irembo came up in 2015 (New Times, 2018) and it has since been on trial taking into account users' feedback with high involvement of RLMUA. RLMUA design when, how, and by whom the transfer was to be completed. The part of the correct holder was the signing of the sale agreement between parties and through the Irembo portal. He makes a declaration and pays for essential fees with the purpose of documenting the change in the land register, and then you have to notarize the agreement.

The current law says that both the seller and the buyer have to be there physically for the agreement to be notarized ( Government of Rwanda, 2013) and the sector land notary will carry the applications at the district land office and the DLO upload transaction in LAIS for further processing.

The applicant for the transfer of land title by sale service are complaining why all workflow can't be handled by Irembo portal as all required and asked documents are all recorded in the different system instead of wasting time by attending two or three days to Sector offices in pursuit for the transfer of land title because even Sector Land notary don't work every day, And the day given for that service is not proper for all customers who are asking for that service

After analyzing and describing the transaction by land sell process, additionally dependent on conversations, perceptions did during the fieldwork, the as-is workflows for the transaction by land

sell in Rwanda have obstacles that may depress right holders to buy and sell land due to all those difficulties. The recognized problems that establish the objective of this study are the following:

Notarization for agreement on land sale is presently done at the Sector Land office and sent to the Office of the Registrar of Land Titles at the district level to be managed. A sector may have at least 13833 parcels (Summary report for Kanombe sector from Rwanda Land Dashboard) in the different areas far from the sector office. It is a quite long distance for some Landholders, to get to the Sector Land Office; as they have to there more than one day. The discouraging point are the distance to get to the land office and how much the beneficiaries have to travel there.

Based on the described obstacles in the transaction by land sell procedure it may cause a serious problem in the economy of the country. Therefore, there is a necessity to have an easy workflow for Transaction by Land sell in Rwanda.

### **1.3 Study Objectives**

The land sell transaction has to be handled smartly and economically. This can be possible when Finger Print, PKI, and system inter-connection are used (RRA, NIDA, eMRS, and LAIS). This is the principal driving force for this study

#### **1.3.1 General Objective**

The objective of this research is to build a workflow for the Transaction by land sell service for minimizing the long time it takes to have a certificate when doing the transaction by land sell.

#### **1.3.2 Specific Objectives**

- Understand the existing workflow for improving the transaction by land sell service in Rwanda.
- Identify the use of ICT solution currently inland services at sector Level.
- Define the required systems inter-connection for sharing different needed data.

- Validate the new work processes for Transaction by land sell service in Rwanda.

To accomplish the above objectives, the accompanying inquiries must be replied to:

- How does the current workflow for the land sale Transaction service in Rwanda work?
- How ICT solutions are used for the transaction by land sell service at sector Level?
- How can the land sale transaction process be improved by sharing various information from various MIS?
- How valid are the newly designed workflows for Rwanda in handling the identified obstacles?

#### **1.4 Hypotheses**

At the end of this research project, it will be possible to improve and implement an efficient and effective Land administration and Information system to save time and to improve the quality of service offered by the Sector Land Office.

#### **1.5 Study Scope**

The focus of this Research project was to make a requirement analysis. On what Land Office has in place to facilitate the Transaction by Land sell at sector level in terms of ICT to effectively and efficiently deliver a better service and propose a new workflow to be used for Transaction by land sell service at sector level which is now semi-automated through Irembo Portal.

When selling Land property, the proposed workflow is restricted to remove the submitted hard copy document; removing the physical presence at the time of notification; and manual stamping. At the sector level, all processes for land transfer by sale in the Irembo platform will be fully automated to help provide a better and faster service. The identification will be authenticated with this working flow.

## **1.6 Significance of the Study**

Analyzing why all processes of land transfer by sell can't be fully automated and handled by Irembo portal as all required and asked document are all recorded in the different systems instead of wasting time by attending two or three days to Sector offices in pursuit for the transfer of land title. The study will propose an IT solution, which will be beneficial to all customers who are asking for that service and to the government who have the politic of implementation of ICT solution to facilitate its citizens to get services more efficient, cost-effective, quick, and transparent.

## **1.7 Organization of the Study**

### Chapter 1

Gives the introductory part of the study, it shows the background, and motivation justifies the problem statement. The study objectives, the hypothesis, and the scope of the study are provided.

### Chapter 2

Explains the literature of the current situation compared to related existing research of Transaction by land sell, information on land transfer relating to Land Administration information system.

### Chapter 3

Explains in detail the methods and techniques used in data collection and the process followed to design and model new workflow lead to a clear implementation plan

### Chapter 4

Discusses the current workflow for land transfer by sell and the requirements to design a new workflow proposed to Rwanda are defined.

### Chapter 5

Discusses the newly designed workflow and the validation assessment of this designed workflow is covered

## Chapter 6

Provides the conclusion on the research thesis and recommends other researchers and to the institution in charge of giving the service of land transfer by sale

### **1.8 Conclusion**

The chapter is a basic element that offers background and avocation of the research through the research problem. The research aims and research questions are given and connected to the research approaches.

## 2. LITERATURE REVIEW

The assessments on the existing movement of Land transaction in some of the developing countries as they take Land as a "tangible, lasting and inextensible good, and as a basis for economic development. The land can be state, community, or private property. Privately owned land is generally acquired through inheritance, formal or informal purchase, and community or state donation. As established " (UN HABITAT, 2010), the transfer of rights to land through purchase is often called a land market because it involves the exchange of good (land) for money between the provider (owner), the client (the buyer of land), respects the demand prices

The concept of land Transaction processes has a common agenda in these countries of looking at "*who, what services, and what proportion costs are covered*" (Chimhamhiwa, D., et al., 2009). Going by "who" these are the people insured or beneficiaries covered in the land transaction by sell scheme who are actually the topic in this study focusing on their better satisfaction using ICT solutions in regards to the quality of service delivery. Relatively in the current technology era, more initiatives are in place to strengthen the use of ICT solutions to enabler the improvement needed in land transactions like in 2008 the, Centre of Registers introduced the Electronic Service of Real Property Transactions (NETSVEP) (UN HABITAT, 2010), bringing its transactions into the digital age.

Lithuania executes a Latin Notary system, which requires mandatory notarization of all real property transactions. Historically, a notary directed the collection of documents necessary to conduct a transaction, decided whether a transaction would happen at all, and prepared the transaction agreement. The burden to collect necessary documents usually fell on the counterparts of a transaction. Nowadays NETSVEP provides a notary with all information and much of the data details required to execute a transaction. It maximizes the number of automatic procedures and minimizes human involvement to prevent errors and possible misconduct (UN HABITAT, 2010).

The electronic service automatically compiles an electronic transaction agreement or refuses to do so if any legal impediments are indicated that would make the deal illegal or invalid. Data for transaction agreements are compiled automatically from the state's registries. When it starts

preparing for a transaction, NETSVEP indicates if a deal is ongoing in the Real Property Cadastre and Register to prevent parallel transactions of the property. Those restrictions are lifted only after a deal is concluded or reversed. When a notary approves a property transaction by electronically signing an agreement, NETSVEP informs the registry about the conclusion of the deal and the change of real rights and provides information on the transaction value and the confidential information of the current owner. NETSVEP thus decreases the time requirements and increases the overall simplicity of property transactions thus dramatically improving their stability. (World Bank, 2013).

. In the following parts of this literature review, there is gathered information relevant to the situation of ICT inclusion in the land transaction sector and limitations in the current process.

## **2.1 Land Transaction**

Land transactions can assume a significant function by permitting the individual who are beneficial; however are either landless or own little land, to get to land. Land advertises likewise encourage the trading of land as the off-ranch economy creates and, where the conditions for doing so exist, give a premise to the utilization of land as security in credit markets. Capital market flaws and strategy mutilations have; notwithstanding, forestalled land deals markets from adding to expanded degrees of efficiency or diminished destitution in numerous cases. This has driven a few onlookers to take a negative position on a land market movement and to help government mediation, regardless of the significant extent of rental business sectors and the proof on the restricted viability of government intercession in such business sectors (World Bank, 2013).

## **2.2 Land Transfer information**

“According to the law managing land in Rwanda, Article 21, the land can be acquired through succession, gift, inheritance, ascending sharing, rent, sale/purchase, sublease, exchange, servitude, mortgage or any other transaction “ ( Government of Rwanda, 2013).

Research as of late done indicated that the prevalent method of land obtaining is through deal finished by gift umunani or inheritance (Biraro, et al, 2015a). Each land transfer must be officially registered and comprised of an official land register. To simplify the update of this activity, which infers the update of the land information system, the government has attempted a few activities. Initially, a Land Administration Procedure Manual is depicting how to enroll changes in land data utilized in the updating process.

“The document clarifies various sorts of changes in land data perceived in Rwanda; actors involved in the process and their roles; necessary documents; and forms to be used when applying for a change in registration” (RNRA, 2012). Secondly, there is LAIS, a web-based-land registration tool designed to support the maintenance of the land register. The system comprises a data store (spatial data and legal information) and a processing capacity held centrally where the users at the local offices can interface with the system using a web browser via the internet (RNRA, 2012).

When established, the system was accessible only at the province level, (Rwanda has four provinces and Kigali City) but now it exists in all the thirty districts within the country. Thirdly, the decentralization of land services from District to Sector level. According to the Land Administration Procedure Manual, the District Land Officer operating at the District level is responsible for preparing documents evidencing land transactions for submission to the Registrar of Land Titles at the province level, which in turn is responsible for issuing leasehold certificates, widely referred to as "titles".

The provision of these documents was brought at the sector level (there are 426 sectors). This was to facilitate the accessibility to the land services. Difficulties to access the land services were confirmed by the research done to assess the accessibility of ordinary citizens to the land administration system; it was found that citizens do around 12 km to go to the district to seek land services (Biraro et al, 2015a).

## **2.3 Transaction by land sell in Rwanda**

The assessments on the current services given by Land office on the land transfer where the owner of land who wants to sell his property he first deals with one who wants to buy, they agree on the price then they sign the agreement and the seller has to make a declaration on IREMBO so that to give information so that he could make a transfer and after he pays for the service electronically all about the e-service about the transfer is ended (Transparency International Rwanda, 2017).

Then the right holder compiles the required documents application form obtained at the irembo agent or Sector office; and the payment slips of all paid taxes on that land the landholder takes the application document to the sector. This one authenticates whether application is complete and documents needed are correct. After both parties have signed, the owner and the one who is buying, the land notary notifies the transfer agreement and the buyer receives a copy of the application letter received with a stamp of the date received. In addition, the land notary takes the documents of the application to the DLO; this should be possible around the same time or on an alternate day relying upon the availability of the land notary. At the District, The District LAIS Specialist shall pass the documents for processing to the Office of the Registrar of Land Titles (ORLT) (RWANDA NATURAL RESOURCES AUTHORITY, 2016).

As the application of transfer needs the physical presence at the sector Land Bureau and handled at the DLO. For a few, it is a very significant distance to arrive, as they need to go by public vehicle or stroll for quite a while. This turns out to be a more troublesome while, the customer have to go to the sector or district more than once and on different days during the process. As can be seen, a simple methodology is yet being used at certain means of the work process.

This research will help to improve this workflow by proposing a designed workflow to digitalize the whole workflow.

Hard procedures slow down the operation and leave customers depressed (Ali, Z., et al., 2013). In this respect, the Government of Rwanda has undertaken some action:

(i) “A Ministerial Order Deciding on Land Registry Modalities (2008) pursuant to the 2003 National Constitution and the 2005 Organic Law Deciding on Land Use and Executives in Rwanda. The Land Law of Rwanda repealed this natural law in 2013. The ministerial application involves the creation of a Land Title Register; procedures for the registration of titles and various land interests; and land transfer and related issues. “(MINIJUST, 2008).

(ii) A procedures manual detailing how changes in land details published in 2012 are registered and used in the updating process (RNRA, 2012). The document describes various types of land information changes recognized in Rwanda; stakeholders involved in the process and their roles; documentation required; and forms to be used when applying for registration of changes. The Unified Modeling Language is used to demonstrate the process of change registration using activity diagrams.

(iii) A Land Administration Information System (LAIS) was established to ensure proper land management and land administration as an electronic land registration tool; and specifically preserved the land certificates provided during registration to the right holders (RNRA, 2012). The system includes an information store and a centrally held processing power. Users can communicate with the device through the web using an internet browser at regional offices (RNRA, 2012).

The denomination of this system reflects, concurrently, The "Land Administration System" as an infrastructure for the implementation of land policies and sustainable development management (Williamson, I., et al, 2010); and the "Land Information System" as a system for the compilation, preservation, review, distribution and usage of information related to land (Dale, P. F., & McLaughlin, J.). This shows the dual role that LAIS has to play in Rwanda Land Administration.

## **2.4 The Requirement for the land transaction by sell**

A successful system design begins with the identification of customer satisfaction criteria (Todorovski, D., & Lemmen, C. H. J., 2007). Requirements are (1) what the system is intended to do, (2) what the system needs to perform its functions well and (3) what users want the system to do for them, according

To (Norman, R. J.) The first and second definitions refer to the functional and architectural specifications (Hackman-Antwi, R., et al, 2013) Defined while working on Point Cadastre requirements.

Four categories of requirements have been identified: (1) preparation requirements relating to context awareness prior to the start of the project; (2) functional requirements relating to the purpose of the point cadaster; (3) quality requirements relating to how easy, inexpensive or precise the point cadaster should be and (4) architectural requirements relating to the collection, storage and maintenance. These four categories are applicable to the development of a new land information system on the case of land sale transaction (as was the case for the point cadastre) (Hackman-Antwi, R., et al, 2013) and can be referred to as system specifications as a little has been said about the customer (right holder) mostly involved in the maintenance process.

As (Henssen, J., 2010) said: "Possible efforts should be made to get citizens' cooperation in the maintenance phase" unless no one from the land office is aware of the changes in land information. Then the criteria should be more customer-oriented for land transfer by land sale. To ensure that changes in land information are registered and documented, barriers that exist in the transfer process should be eliminated (Henssen, J., 2010). In this way, the maintenance process can add to the four categories defined by (Hackman-Antwi, R., et al, 2013): another category of requirements: customer requirements. Such conditions would lead to what the right owners want the device to do for them (Norman, R. J.).

Different authors ( (Hackman-Antwi, R., et al, 2013) (Enemark, S, 2013) (Henssen, J., 2010) (Larsson)) wrote about parameters or key points (described in the following paragraphs) to be considered in evaluating the quality and performance of a system of land information. Although these key points are proposed to see whether a system is well-performing, they can be taken as criteria that should be fulfilled by the same system to be enjoyable for its users. They will allow the customer to eliminate barriers during the transition process. They may also be used to define customer requirements in the transition of land information as a guide to what information to gather about the current situation.

(Larsson) and (Henssen, J., 2010) suggested that the reduced travel distance from the customer to the land office (or any other office was to acquire land services) to remove barriers to the right holder in the transfer process; the affordable transport fees should be reported in one office (e.g.: the sector office) to inform other concerned institutes of the change in land information, The sharing of information and integration of systems (registered changes in land information) should take place between institutions dealing with land issues.

Some of the aspects mentioned above were also affected (FIG, 2013). They argued that through decentralized land offices, a good land information system should be open to all users and run at a low cost in such a way that the recovery does not unduly burden the right holder. The FIG also suggested that through the quality of land information, the system should have protection given so that banks are certain of ownership when offering mortgages; Be simple and easy to understand and use as complex processes slow down the system and can deter its users; be timeless by providing updated land information, and be sustainable, meaning its maintenance over time.

Since the Land Information System is all about the procedures and techniques for gathering, preserving, evaluating and transmitting land information (Dale, P. F., & McLaughlin, J.); the requirements of the FIG are very much based on the consistency of the system in the line to satisfy its customers (right holders) among them. In their system, that demonstrates a well-performing business method in land administration, (Chimhamhiwa, D., et al., 2009); the reduced cost of the process that involves operation and process costs is again reduced. They addressed the increased

quality of the system's released documents and this is the product of the quality of the stored information (FIG, 2013).

The evaluation framework designers also added a shorter time that the entire process should take; continuous technological improvement in data management; greater customer satisfaction as they are the recipients of process output and greater dependence on social goals that are the functions of land administration (land valuation, land market, control of land use, land development (Enemark, S, 2013). Most of the authors cover the technical aspects of the transfer process, which are also very important for customer satisfaction. Enemark (2013) touched on the same aspects of cost, time and customer satisfaction, but with a great deal of emphasis on updating spatial land data, particularly in the developing world.

Simple administrative procedures to encourage and enable everyone to participate in the land market should be maintained by the government. The transfer of land should also be accessible to allow individuals to confirm the real holder of the right and thereby avoid transaction risks if anything is wrong. Some of the authors referred to above share a common understanding of certain aspects of the quality and performance assessment of the land information system. Accessibility to both land offices and land information; the expense of land services; and the accuracy of land information that contributes to the protection of both land information and transactions are performed several times as part of the time that the process takes. Other factors, such as the decentralization of land resources, may be added to the list as barriers for the right holders could be eliminated.

*Table 2.1 customer requirements*

<b>Aspect</b>	<b>Gap</b>	<b>Design Requirement</b>
Sector Land office Accessibility	Weak use of ICT solutions in service delivery. Which make citizen coming many times at Sector land office.	Citizens should have a convenient way to access land local offices using online information system
Process time	Long process for land transfer to get a new land certificate	The use of the physical presence of the landowner(seller) and buyer should be removed this will save customers time and resources for those who needs the service
Information Sharing	Many required hard copies of documents	The use of a hard copy document should be removed by the interconnection of systems

### 3. RESEARCH METHODOLOGY

#### 3.1 Introduction

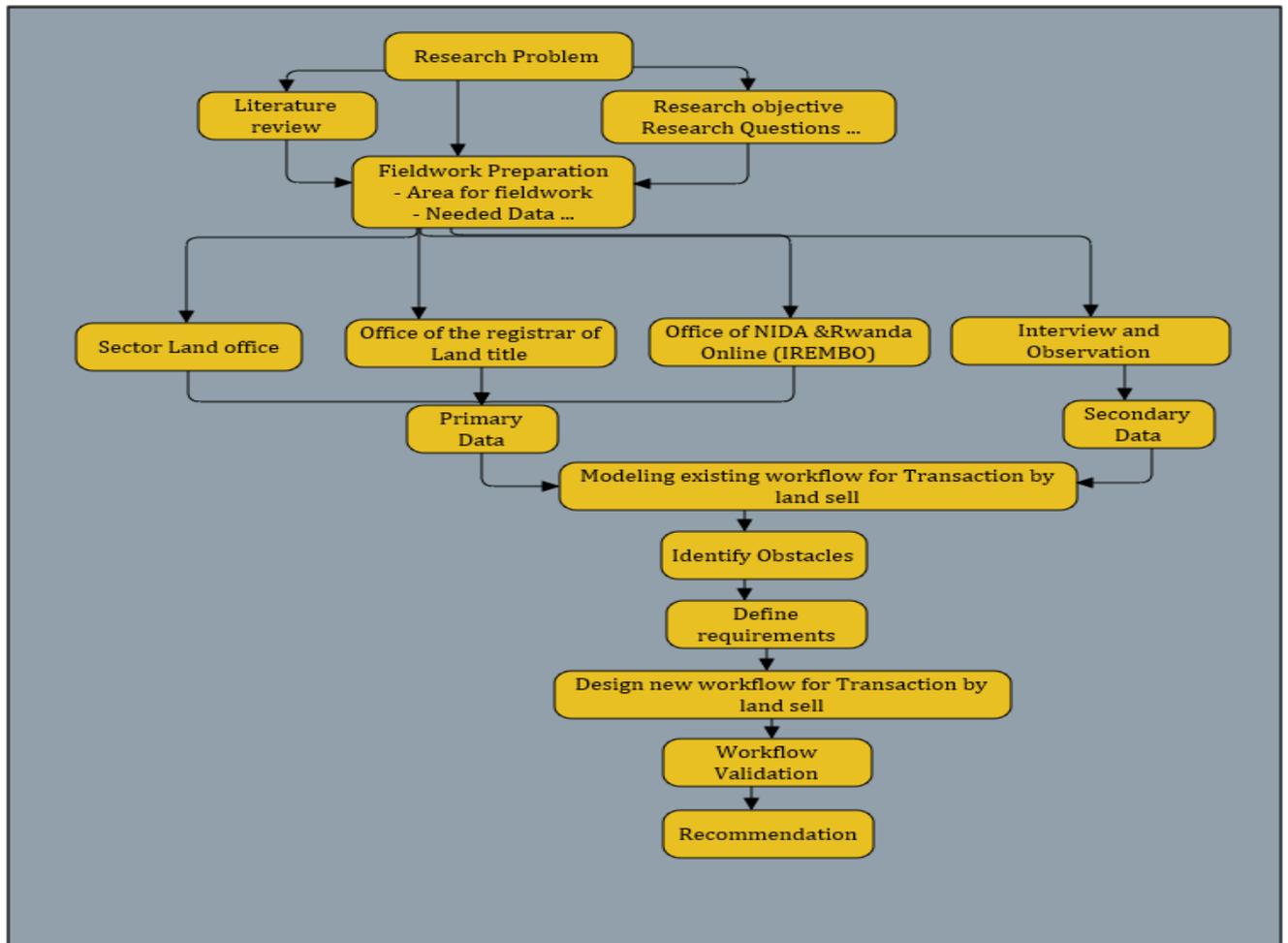
To realize the objectives of this study, which is qualitative research, we have used an interpretive research approach to the information collected from the institutions that are participants of Transaction by land sell. The core information gathering techniques used during this study are interview, literature review, and Article reviews (reports by the local and international organization, reviews on Rwanda land dashboard to see how many UPI we have in the country and revise how many transactions are done by sell, review of existing strategies). During data collection, the questionnaire was used with structured questions whereby we took time gathering information from institutions concerning the service of land Transfer.

To meet our objectives we used some methodology as follow:

*Table 3.1 Alignment of methodology to objectives*

<b>Objective</b>	<b>Methodology used</b>
Understand the existing workflow for improving the transaction by land sell service in Rwanda.	The interviews helped to model the current workflow process by allowing us to collect needed information.
Identify the use of ICT solution currently inland services	To accomplish this particular goal, an investigation was carried out in tandem with interviews and direct fieldwork observation
Define the required systems inter-connection for sharing different needed data.	To achieve the objective we used an interpretive research approach to the information collected from the institutions that are participants of Transaction by land sell.
Validation of new process for the transaction by land sell process in Rwanda.	This was achieved using Data analysis by analyzing the existing workflow and designed a new workflow.

The study is performed in three major phases: Pre-Field work, Fieldwork, and post fieldwork as presented in Figure: 3.1. The beginning of the study, where the issue of the study, the aims of the study and research questions are formulated. The fieldwork is carried out to gather primary and secondary data on the current situation. Process modeling of the transfer workflows is the last step.



*Figure 3.1 Research Design*

### **3.2 Consulted literature**

For the improvement of the Land Transfer by land sale at Sector level the ICT technology and tools have to be used for the system management of different stakeholders, we have consulted several documents. In general, these documents give a deep understanding of the implementation of Land transfer by sale in Rwanda, the encouragement, the importance of information sharing among systems, and the improved quality of service because of information sharing by using ICT tools.

Searching the articles in Google scholar and reports, we used the following keywords; Information system, Transaction by Land sell systems integration, and information sharing. Limiting the period from twenty years back from now, many results were not relevant to the study, and then the alternative was to also contact Land offices together with partner institutions for some annual reports, national and international conference reports, or global reports specifically on a Rwandan case study. On the other hand, RLMUA and partner institutions provided laws and regulatory frameworks on the Land Transfer scheme. The main criteria for choosing these articles and documents were simply because some are typically focused on the Rwandan context. Many articles, reports, laws, and regulatory frameworks are kept and we still consulting on this study, and Rwandan plan towards the promotion of ICT use in the land sector. Furthermore, the land transfer is a common practice in other countries there was a need to look at how some of those countries have implemented and the level of ICT use.

### **3.3 Study Population and Sampling**

We have used non-probability sampling which is associated with case study research design and qualitative research. Case studies tend to focus on small samples and are intended to examine a real-life phenomenon, (yin, 2003). The scope of the study covers some of the sectors situated in the City of Kigali. The study population was all service seekers of land-related services. The overall target sample size for this study was 200; the achieved sample size questionnaires well completed is 99 that is 49.5% of coverage. In some cases, some customers were found in the sector seeking the service, and in others, due to the COVID-19 pandemic the service was stopped and

other selected respondents were interviewed using the phone. This made it difficult to reach the initial sample size in the study timeframe.

### 3.4 Data collection

To design a workflow for improving the transaction by land sell, a concern of a lot of requirements permits eliminating difficulties in the process that may stop the delay The first stage in the concept of requirements is to collect data on the current situation in order to be able to understand the actual needs from which the requirements are to be created (Todorovski, D., & Lemmen, C. H. J., 2007) The information requested (Table: 3.2) was gathered on the basis of open interview questions (Annex 1).

Component that raises the issues came from the literature on criteria for land transfer. Those components were chosen on the basis on the difficulties recognized in the procedure manual on Transaction by land sale in Rwanda before the fieldwork. The recognized difficulties were: long travel distance to the SLO time taking; Needed hard copy documents by system integrations and the use of new technology will make the service efficient on both parties the government and to citizen too.

*Table 3.2 Description of needed data*

<b>Required Data</b>	<b>Component</b>	<b>Explanation</b>
Procedure	Involve Person	Any person who comes into contact with the application has been considered.
	Performed activity	Any action taken on the application is considered from the arrangement of the application to the issuance of a new land certificate.
	Bureau	For each office the application has to pass while doing land transfer was considered

	Physical Presence	Every office was the customer have to be physically present was considered
Transfer Registration Requirement	Required Documents	The required documentation that the applicant has to submit.
	Required payment	The money the applicant is expected to pay during the transfer of land <i>(Transport, service, making copies....)</i>
Information sharing	Access to the land information database	Persons included in the procedure of land transfer the ones that have the right to view the land data
	Conditions to have access	The needs to have admission to the land database
	Access level	Level on which a person can get entry to and use the records from the database
	Quality Checking	Before making modification in database, the verification is done.
	Actor who checks	The level of the person who checks the changes of data in the database

### 3.5 Interviews

We take into consideration different actors involved in land transfer by sell and those actors were consulted. The interview questionnaires are found in Annex 1. Those actors are the landowner met at some of the Sector Land offices coming for application of land transfer or to get changed new certificate. The interviewer was the person who comes for the application. Some customers did not respond because they were disappointed with what they received as answers to their applications. However, no matter the respondent the objective was to understand the existing workflows. Moreover, those who agreed to be interviewed provided ample details on the follow-

up process when asking for a transfer of Land title by sale. They are the ones who know the difficulties that they face when applying for land transfer.

Some of the actors taken into account are those working for departments involved in the transfer of land as shown in (Table 3.3). To understand the existing workflows, it is difficult to know what they do and how they do it. I interviewed those actors using the phone because of this disease of COVID-19 those actors are working out of the offices. The service offered to the applicant depends on how the internal workflow is organized. According to (Chimhamhiwa, D., et al, 2011) poor quality of application documents obtained upstream contain the downstream control activity in a cross-organizational workflow as incomplete applications are rejected and returned backward. That is why it also interviewed internal actors in the workflow of land sales transfer. Annex 2 shows the questionnaires used.

*Table 3.2 Internal Actors Interviewed*

<b>Office</b>	<b>Position</b>	<b>Role in Transfer</b>	<b>Number</b>
Sector Land Office(SLO)	Sector Land Officer (SLO)	-Heading the Sector Land Bureau; - Land notary	1
Land title Registry Office	Deputy Registrar of Land Titles (DRLT)	- Registrar of Land Titles - Approve change to land information	1
	Professional in charge of Land Registration (PLR)	-Verify the applications before processing - Adjust the applications.	1
	LAIS Professional		1

		<ul style="list-style-type: none"> <li>-Scan and upload application document into LAIS</li> <li>- Handling request on land information</li> <li>- Print and stamp new land certificate</li> </ul>	
IT Department	IT manager	Manage national land information database and its accessibility.	1

### 3.6 Modelling process

#### Step 1: Presentation of data

Primary and secondary data were observed together depending on the elements used in data gathering. As explained by the interviewees, it enables people to understand the current workflow for updating land information in Rwanda. Establishing a model through BPML (Business Process Modelling Language) and the workflow of transferring rights through the land sale is the focus of this research.

#### Step 2: Data analysis

The modeling workflow was analyzed, which shows the current situation in the land sale transaction in Rwanda. This analysis is supported by both interviews and direct observations. The mixture of this data enables us to identify the achievements of the transfer process so far and the remaining barriers that may interfere with the right holder when the land is transferred.

#### Step 3: Define the design requirement

Identifying difficulties and indicate areas for improvement. For each obstacle, many design requirements are defined. Construct requirements based on aspects to be taken into consideration when evaluating system performance.

#### Step 4: Design a new workflow

According to the defined design requirements, BPML (Business Process Modeling Language) will be used to design and demonstrate the workflow for the transfer of land through the sale. The design of the workflow should follow the defined requirement

#### Step 5: The new workflows Validation

As the last part of the process, the validation will be conducted in this way:

- Evaluating requirement: Compare the current situation with the new situation proposed by the new workflow. Evaluation is to check whether the design requirements are complied with and whether the main obstacles are eliminated.

## **4 SYSTEM ANALYSIS**

### **4.1 Workflow modeling technique**

(Heloisa, M. S., & Mitchell, M. T. ) Pointed out that workflow technology in a distributed environment has successfully defined, performed, controlled, and organized task flow while improving flexibility. A workflow management system can be used to do this, and can simplify processes between individuals and business processes (Aversano, L., et al, 2002). Task preparation and synchronization are some of the advantages of this technology; tracking task execution and completion; developing a recorded and tracked environment to facilitate the review of the activities, procedures, and ways in which organization manage their business (Heloisa, M. S., & Mitchell, M. T. ). However, technology reduces the contact between people, because everything is controlled remotely, and even when people feel controlled, it even leads to a lack of motivation (Aguilar-Savén, R. S., 2004).

Workflow management includes process modeling that describes the process of activities; process redesign to optimize the implementation and automation of processes and workflows, which requires technology to use information systems and personnel performance to perform, plan, execute, and control tasks described in the workflow (Mentzas, G., et al, 2001). In this study, process modeling is a technique used to describe the current situation in the transfer of land in Rwanda.

The modeling of the process requires the identification of elements of the workflow, such as tasks, participants, information systems, and personnel skills. For capturing abstract processes into the workflow, these elements are useful (Mentzas, G., et al, 2001). (Chimhamhiwa, D., et al., 2009). Also, (2011) when measuring the land management business process, this method assigns its activities to different organizations. Many requirements have been obtained from surveys, seminars, conference feedback, and different kinds of literature and used to evaluate current business processes. This allows us to identify areas for improvement and suggestions.

### **4.1.1 Other modeling techniques**

Other modeling techniques include (1) Data flow diagram; (2) Flow charts, (3) role interaction diagram, (4) Role activity diagram, (5) Gantt Chart, (6) Integrated Definition for Function Modeling, (7) Colored Petri-net and (8) Object Oriented methods. All these modeling approaches allow users to understand the process and make processor decisions to create a business process. (Aguilar-Savén, R. S., 2004).

All of these tasks can be implemented using different modeling languages symbols, or graphics which can represent the process by specifying the systematic activities required to perform system actions (Zur Muehlen, M., & Indulska, M., 2010). Since there is no specific workflow modeling annotation, this research uses BPML (Business Process Modelling language) to model the workflow to improve Rwanda's land transaction through the land Administration information system and Irembo Platform

### **4.1.2 Business Process Modeling Language**

Business Process Modeling Language (BPML) is a graphical representation that, while it was originally designed for an information system, can be used in process modeling (Glasse, O., 2008). It is a language that enables all business processes and software systems to be defined, visualized and recorded (Aguilar-Savén, R. S., 2004).

The BPML includes nine diagrams: In during this study, we used the activity diagram that defines the flows circulating between activities within a system; to model the structure of the transaction process. In-land administration, the BPML activity diagram is often used to model processes. For instance, (Zevenbergen, J. A., et al., 2007) to design real property transactions across European countries used it. One of the aims of the researchers was to provide a comprehensive and comparable description of real property transactions (Zevenbergen, J. A., et al., 2007).

## **4.2 Workflows to transfer land in Rwanda**

A procedures manual telling how the record of changes in land information is to be done (RNRA, 2012) supports the transfer of land title by sale in Rwanda. The manual describes the transfer workflow made up of actors through the use of activity diagrams; steps or tasks; and the needs to be accepted for the application. They also agreed, however when talking to some land employees in the sector, that further efforts are still needed to strengthen those offices in terms of equipment and human capacity building to enable them to maintain and sustain the system of land registration and transfer. Therefore, at the time of the fieldwork centered on the primary and secondary data obtained at that time, the workflow for land transfer is provided "as is". There is a table and an operation diagram for the demonstrated workflow that describes the process.

## **4.3 Transaction by land sell**

The workflow for recording the change in the land information system due to land sales is divided into three main stages where different actors perform different tasks.

(1) Application: To recognize the needed document, most of the landowner questioned said that they came to the SLO to request those documents or goes to the irembo Agent. After recognizing what to carry, the landowner compiles the required documents provided at different places: certificate of marital status provided by the Sector office (three months of validity); application form obtained at the irembo agent; and the Land revenues payment proofs.

The Landowner takes the application file to the sector land manager to confirm their legitimacy and fulfillment. He/she then formulates a transfer agreement that is checked and signed by the right holder with her/his spouse when applicable and the Receiver who is the buyer. After both parties have signed, the sector land manager who is the land notary notifies the transfer agreement and the buyer gets a copy of the application letter with a stamp of the date the application is received after the SLO takes the application documents to the District Land Officer (DLO). This can be done on the same day or a different day depending on the availability of the SLO.

(2) Processing: The Assistant of the Deputy Registrar of Land Titles (DRLT) who manually records, into a book of entries, the name of the applicant and the reason for application receives the application. This Assistant of the DRLT is the one also in charge of taking the application file from one desk to another and every time she records who has the application file to avoid that the documents may be lost. In addition, every person at the ORLT who receives an application puts, on the first page, a comment of what she/he did or what she/he wants the next actor to do and signs.

Therefore, the application is taken to the Professional in charge of Land Registration (PLR) who, once more, verify the fulfillment and the legitimacy of the received documents. As she has the right of entry to LAIS, she/he proves, in the land register, if the seller is the real and only Landowner. If the whole thing is exact, the PLR proceeds the application to the LAIS Professional (at the ORLT) for processing. If there is something that is mistaken in the application, she/he takes it to the DRLT who approves its rejection. The Assistant brings together the rejected applications from the DRLT and waits for the Sector Land officer to come and take them back to the SLO.

For the acknowledged applications, the LAIS Professional (at the ORLT) scans and uploads the application documents into LAIS and the application gets “accepted” status. She then updates the database with the name of the new landowner and the application is electronically sent to “processed” where the DRLT finds it for approval. The DRLT checks if the change was done according to the provided documents and approves the transfer. The status of the application becomes then “approved” and the change is saved in the database. The LAIS Professional prints and seals new land certificates for all approved transfers. The status of the application then becomes “printed”. She then takes the printed land certificates to the Assistant of the DRLT where the Sector Land Officer collects them together with the rejected applications and takes them back to the SLO. The Sector Land officer signs, in the recording book in front of each application that he takes back, as a way of confirming that the application is no longer at the ORLT.

(3) Issuance: all the collected files are taken from the ORLT to the Sector Archivist by the Sector Land Officer. The Archivist registers the obtained documents in the entry book. The new right holder (buyer) shall, after submission of the application papers, be given one month to return to the SLO to obtain feedback on the application. She/he comes to the SLO after the specified time and shows the Archivist a copy of the letter of application on which the date of submission is stamped. In the entry book. The archivist reviews it. If the new certificate is available, the new landowner will receive it and signs in the book that she/he takes it. The Sector Archivist then archives the application documents at the SLO. If the application was rejected and the documents are returned to the SLO, the new landowner receives an explanation of what to do so that the application can be processed.

The offices where the applicant receives the necessary documentation are listed in (Table 4-1); the times during the process that she/he has to go to the sector; and the conditions (documents and payments) for approving the application. It also defines the actors who access the database of information and what kind of rights they have. The application form, completed and signed by the right holder, is set out in Annex 2.

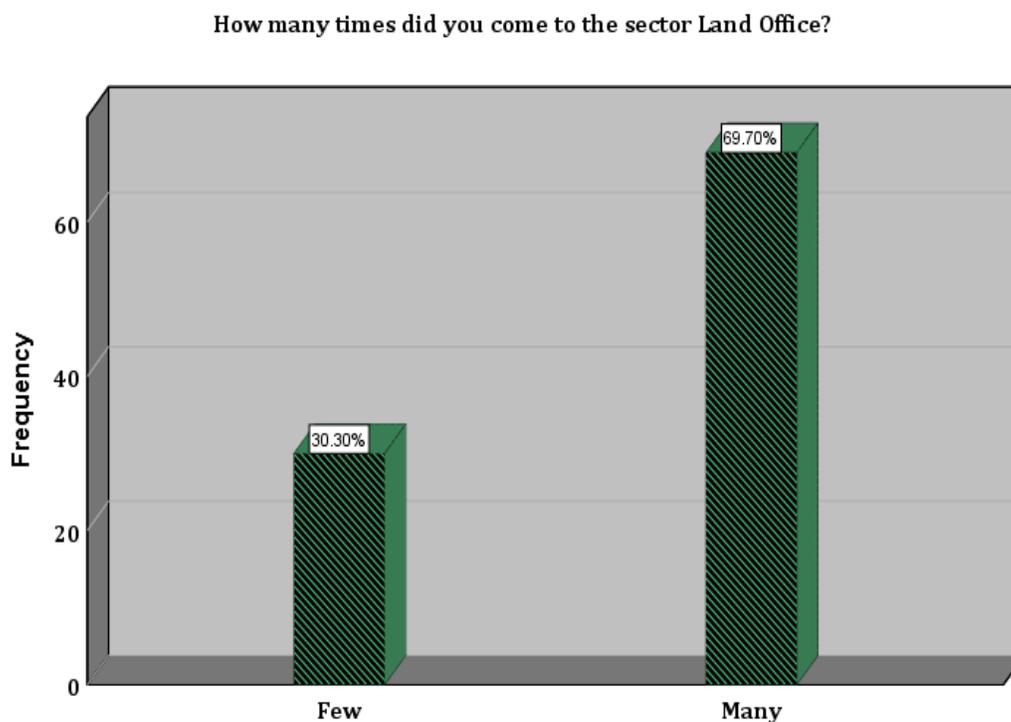
**Table 4.1 Data collection For the Existing workflow for the transaction by land sell**

<b>Data collected</b>	<b>Element</b>	<b>Existing situation</b>
Process	Actor and task involve	As shown in Figure 4.1
	Time to come to Sector office	<ul style="list-style-type: none"> <li>• Request details about what is required for the transfer of rights</li> <li>• Sign Sell agreement, send the application</li> <li>• Receive a new land certificate.</li> </ul>

Transfer requirements	Required documents	<ul style="list-style-type: none"> <li>• ID card copy of seller or power of attorney in case of an agent.</li> <li>• Copy of the buyer's identity card.</li> <li>• Seller is Marital Status Certificate.</li> <li>• Filled Application template for transaction</li> <li>• Original land certificate.</li> <li>• Payment slips or bill for land revenue</li> <li>• Notified Transaction agreement signed by both parties</li> </ul>
	Required Payment	<ul style="list-style-type: none"> <li>• 30,000 Rwf for transfer fees</li> <li>• 500 Rwf for a marital status certificate</li> </ul>
Information sharing	Access to and the extent of access to land information	Access to land information: Professional responsible for the registration of land ----- View LAIS Professional -----Edit Deputy Registrar of Land title -----Edit
	Conditions to have access	Permission was given by management to obtain from the database administrator a user account and password
	Quality check	Done due to the change being accepted
	Actors who checks	Deputy Registrar of Land Title

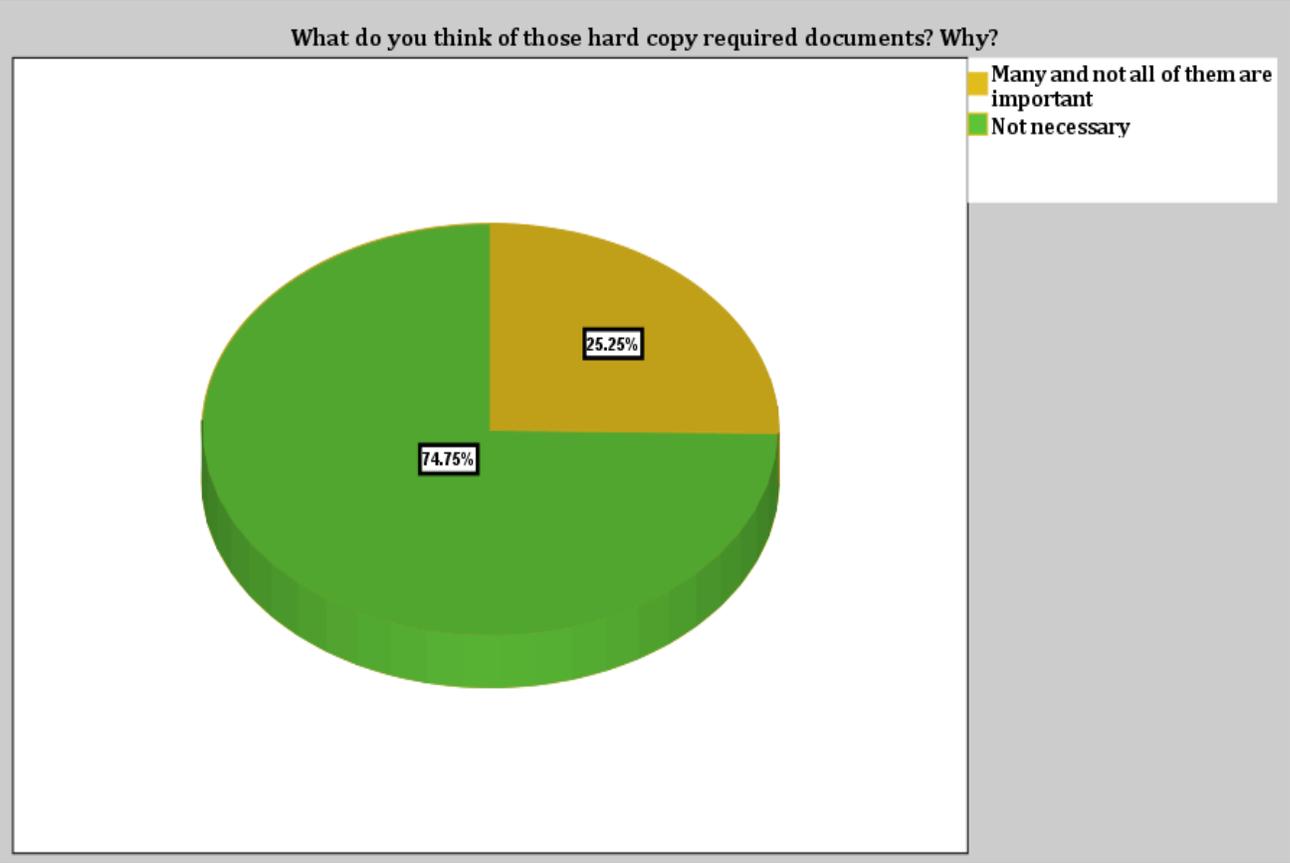
#### 4.4 Presentation of Finding

This section focus on major findings of the study by analyzing the response of service seekers on different aspects that were discussed during the research using SPSS (Statistical Package for the Social Sciences)



*Figure 4.1percentage Of Attended Time for Seeking for the Service at Sector Land Office*

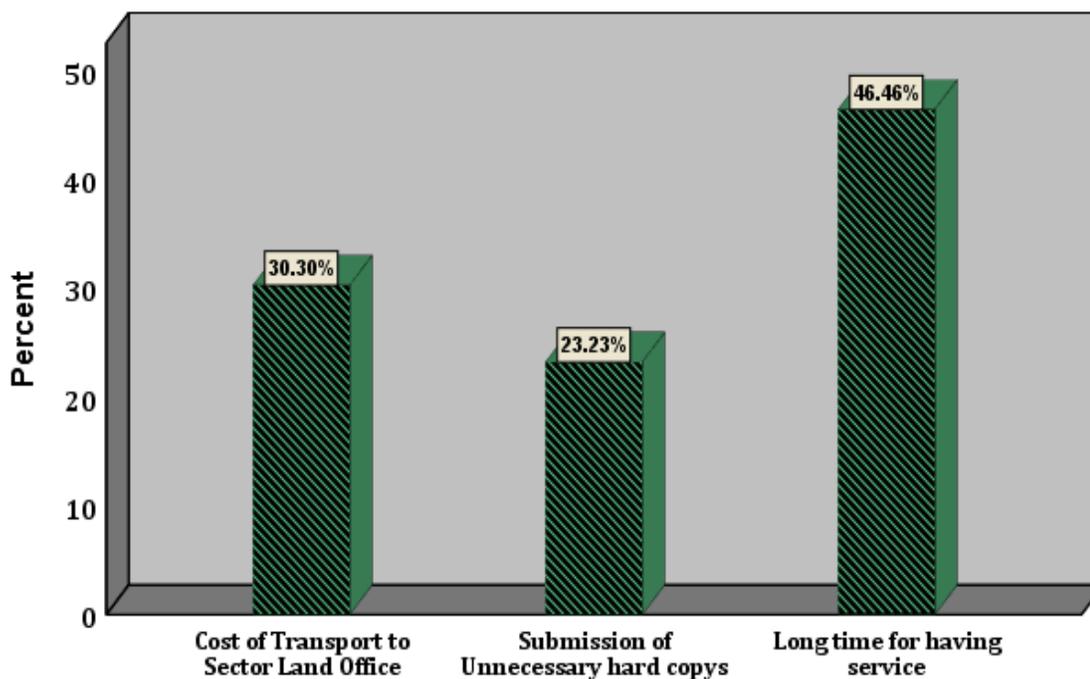
Obviously, the above finding is evidence that service seekers face obstacles as it shows that 69.70% of them attend many times at Sector Office for a different reason when doing the land Transfer. This calls us to propose some appropriate mechanisms to address this challenge in this research.



***Figure 4.2 Response percentage on the question of Satisfaction of submitted hard copy document for the service***

The above Graph examines the extent to which the submitted hard copies to be attached to the application are needed or not, cumulatively it shows that 25.25% shows that some of them are important but many of the respondent 74.75% say that those submitted hard copies are not necessary as it cost them by making a photocopy and they think that it is a duplicate because some of the other Government institutions have the records of that information.

### What obstacles do you think are in Transaction by Land sell service



*Figure 4.3 Static Percentage of the response of what obstacles faced when seeking the service*

In the same vein, for all respondent considered in this study, 46.46% say that getting a service of a land-service takes a long time and 30% of them had the problem of the cost that it takes them during the process like transport as some time they need to come at sector office more than one time and other 23% have the problem of the submitted hard documents which are supposed to be attached to the application form to complete the required file for Transaction by Land sell.

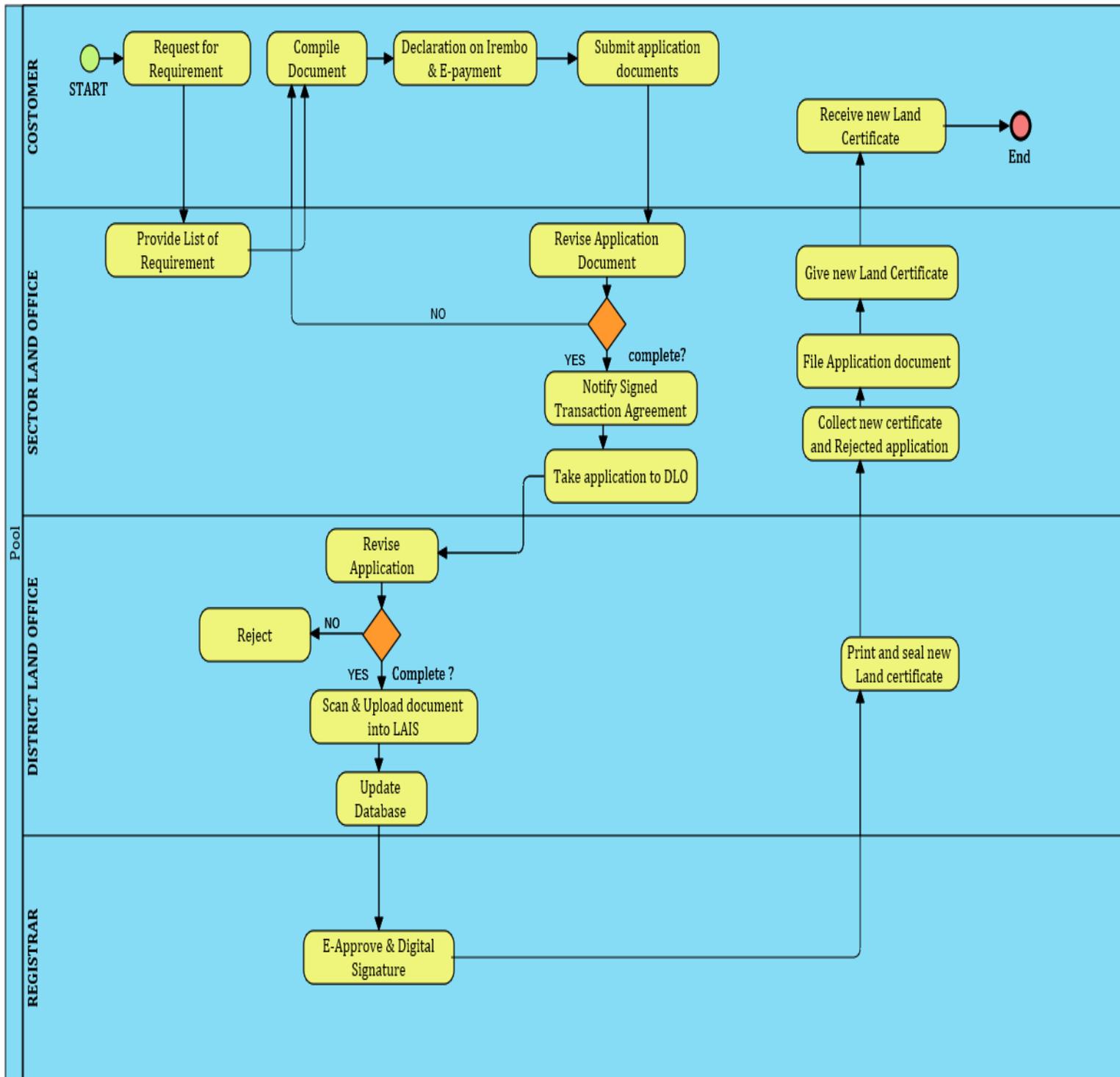


Figure 4-4 as-is workflow for the land transaction by land sell

## 5 RESULTS AND ANALYSIS

The chapters above define the current situation in Rwanda in the field of land transfer by sale. The design requirements are defined in a way that removes the barriers identified when the right holder sells his/her land and to meet the study goals. In this chapter, we present the new workflow to improve, the transaction by land sale propose to Rwanda Land Management and use Authority. The designed workflow is based on defined requirements and this chapter include the validation of the designed workflow

### 5.1 Proposed workflow for Transaction by Land Sell

The design of the proposed workflow is based on the stated demands. The strategy starts with an interconnection of systems for which databases are required in the land sale interconnection transaction, reducing the amount of documents submitted and saving the time and money spent by the right holder while looking for them. With this, we have met some of our objectives ” *Understand the existing workflow for improving the transaction by land sell service in Rwanda, Identify the use of ICT solution currently inland services Define required systems inter-connection for sharing different needed data.*”

The use of Fingerprint will help to retrieve needed data in those interconnected systems, as the NIDA had registered all Biometric data when giving the ID card all information will be connected to the Id card and

Personal identification using biometrics will enhance convenience by simply presenting his biometric features, a user can easily prove himself or herself instead of being physically at sector office in front of Notary then by using the fingerprint there is no trouble such that authorized users are denied access because of loss of a card or forgetting a password.

Using PKI can safely facilitate storage and sharing of electronic data; protection is assured by the use of public-key cryptography, as well as these underlying trust, authentication, and security issues over the network used by PKI. By facilitating trusted electronic communications and transactions, PKI brings the security and confidence of the physical world to the electronic world

(Suranjan Choudhury, 2002). With this, we come up with our last objective "*Validate the new workflows for Transaction by land sell service in Rwanda*" by simulating the Current workflow with the newly designed workflow.

The Following are Systems and Technology to be working with the land Administration Information System (LAIS) to enhance the service:

a. Rwanda Revenue Authority: government agency in charge of collecting taxes, it will provide information on the payment of land taxes. This will result in a safe transaction; the new owner will be aware of the tax situation in advance, helping to determine what the new owner will have to pay in the future.

b. The National Identification Project is the institution that maintains a National Population Registry (NPR) that issues a biometric National Identity Card (NID) for those 16 years and over, with a remarkable population coverage including children dependent on the NPR. Each person has a unique identification card number. The same database will contain details; about the marital status of those individuals as the official age for marriage in Rwanda is 21 years old and the marriage or celibacy certificate will not be needed for this information, as the marital status will be known from this database.

c. The Electronic Mortgage Registration System, which is already linked to the LAIS system, collects registered mortgaged information. As the new owner knows in advance if the parcel is mortgaged or not. It contributes to a secured transaction. At the same time, the bank providing the mortgage knows if there is some other mortgage on the parcel concerned. This Inter-connection mechanism can be used to collect information about the parcel on which the information is to be updated.

d. Fingerprint identification is one of the most popular and reliable personal biometric identification methods (Kuntal Barua, 2011) The biometric to be used in this propose workflow are already registered in NIDA databases because all citizen above 16 years old have to take ID and to have it the biometric data are taken to identify a person when needed, then the proposed new workflow for land sell the digital information to be compared are often in the different database all this database have to be interconnected and all information on the land property has

to be linked to the ID so that by using configured fingerprint devices people can retrieve all needed document and be attached to the application when selling his/her land property. This will prevent for the fraud and ensure the originality of the attached document as we what the whole workflow to be automated.

e. The PKI is closely linked to asymmetric key encryption, digital signatures, and encryption services (Imran Ijaz, 2012). Security services offered by PKI are:

1) Confidentiality: Keeping the private nature of the message is achieved by using encryption. Only the owner of the private key will be capable to decrypt the encrypted message.

2) Integrity: It is evident that the message has not been altered. It is obtained with the help of a digital signature. By verifying the signature successfully, it is ensured that message has not been changed after signing.

3) Authenticity: Confirming the identity of an individual or an application that transmits the message is done using a digital signature.

4) Non-Repudiation: Property providing security as the certainty that the message cannot deny it later passed.

As the proposed model the whole process would be done, online no physical application will be needed the PKI technology will help the sector land manager who is the notary to sign the application of transaction by land sell and approve for the next process. With the PKI exchange of electronic data in a secure way.

The Below figure named new proposed model is designed to improve the existing model of Transaction by land sell structure, and it addresses the raised gaps in the current business processes. Since the linkage is already established between all mentioned key stakeholders, the proposed model is based on information sharing for authentication purposes in existing systems of the key stakeholders. Depending on the available resources, the existing linkage between institutions is done by establishing site-to-site virtual private network tunnels and online authentication uses web services that are built on top of three cores XML specifications: Web Services Description Language (WSDL) Simple Object Access Protocol (SOAP) Universal Description, Discovery, and Integration (UDDI). The above-marked links are actually related to information exchange and

sharing, Description of the new integrated model for a Transaction by land sale are explained as follows:

Step1: Is the existing process where currently many of the government services are given throughout Irembo platform where a citizen can serve him or her self-depending on one capability of having skill and access to those infrastructures and check the requirement for the needed service depending on capability The right holder asks for an account as usual on Irembo to be able to apply online The IT gives the account and provisional password that may be changed by applicant.

Step2: The right holder Login and completes the application form and for retrieving the needed document after entering the (UPI) Unique Parcel Identifier of the parcel to sell the right holder will be asked to provide the fingerprint through the configured devices which are connected to all those interconnected systems throughout the irembo Platform to fulfill all requirement document and to retrieve information about parcel owner, to see if the parcel is not in mortgaged and if land taxes are not pending or unpaid in any legal case.

Step3: After both sides agreed, the owner uses e-payment to pay the necessary and everything is correct then applies to the sector Land manager who is a notary.

Step4: As every Sector Land manager (notarial) have the account he/she has to login for the application verification, make the notification using PKI digital Signature, and approve for the next process in LAIS

Step5: Then LAIS Professional, The District Land officer receives the request digitally with the notified transfer agreement, to add the update to the database. The LAIS Professional then sends the application to the Deputy Registrar of Land Titles so that the transfer can be accepted. The database is updated upon acceptance and new land certificates are ready for printing and issued to new owners.

Step6: When their owner arrives to retrieve them, SLO prints and issues the new land certificates

*Table 5.1 Contribution of the new Workflow*

<b>Current process workflow</b>	<b>Proposed workflow process</b>	<b>solution</b>
The submission of the hardcopy document	The needed document will be retrieved in inter-connected databases were all those needed information are stored	This will replace the cost that the customer give when making a photocopy of different documents, also remove forgery of documents because need information are stored in different DB which makes duplication of data which is not necessary
Submission of application needs physical presence of both landowner (seller) and buyer at SLO so that to approve their sell agreement and to notify their application.	Improve the current system by adding the use of Fingerprint and PKI. The fingerprint to authenticate the landowner online to replace the physical presence at SLO and PKI to help The notary to notify the application using a digital signature instead of using manual stamps and proceed with the application.	<p>The use of Fingerprint devices which are configured to LAIS system to authenticate the landowner as all biomedical record are stored in NIDA database and ID are connected to UPI this will help the landowner and buyer to approve their agreement and submitted the application online to the sector land office without going at SLO which cost the customers because may sector offices are far from where the parcel is located and the SLO will verify the application then use PKI to approve the application by digital signature then send it to DLO online to proceed the application</p> <p>This will reduce the time that takes the costumes when making the transfer of land, which sometimes discourage citizen.</p>

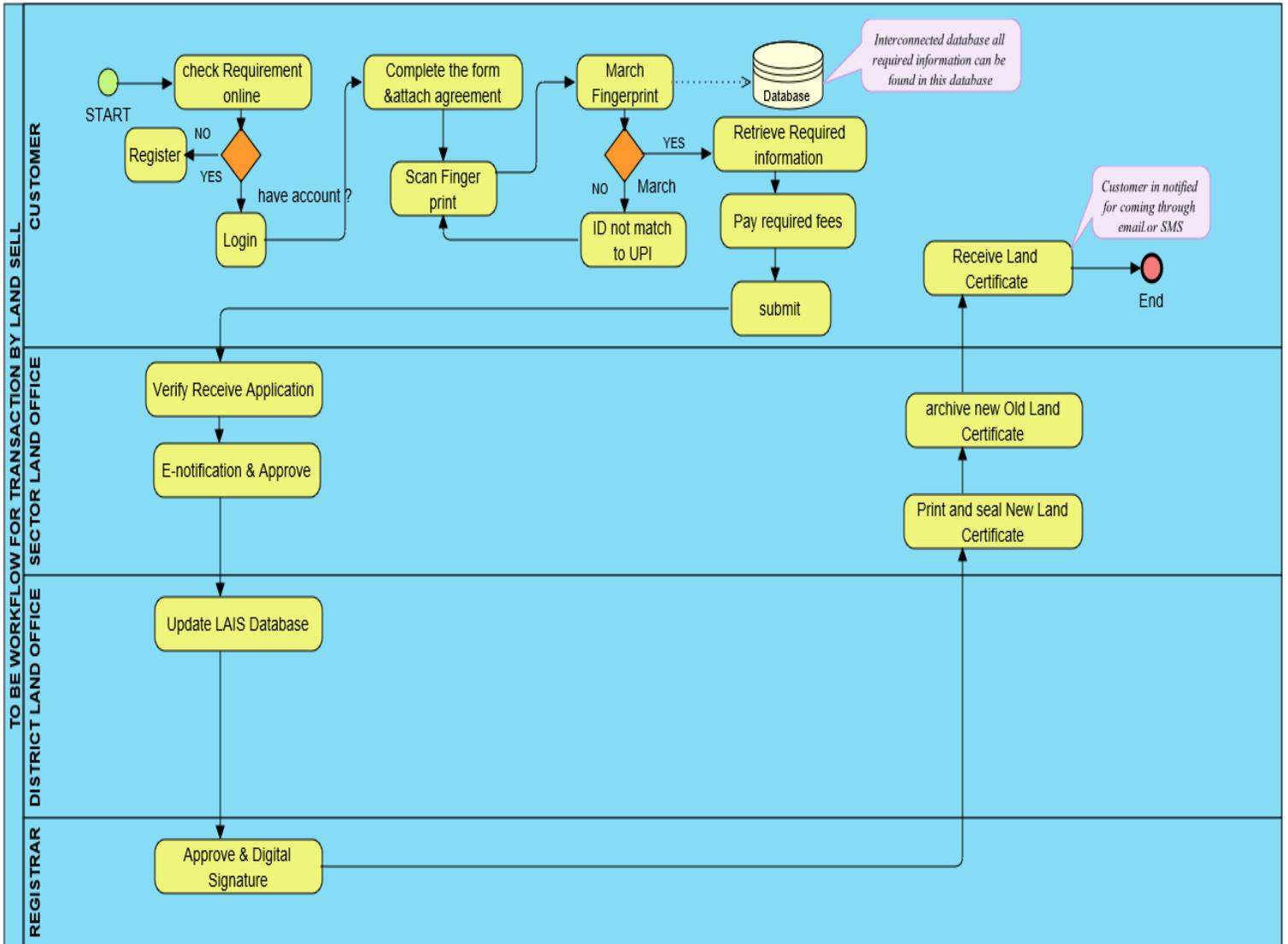


Figure 5.1 To be the workflow for Transaction by Land Sell

## **5.2 NEW DESIGNED WORKFLOW VALIDATION**

The aim of this presentation is to make a validation evaluation by checking whether the obstacles described in this study have been addressed and to evaluate whether the proposed workflow can enhance the current process by providing a real image of how to face those obstacles.

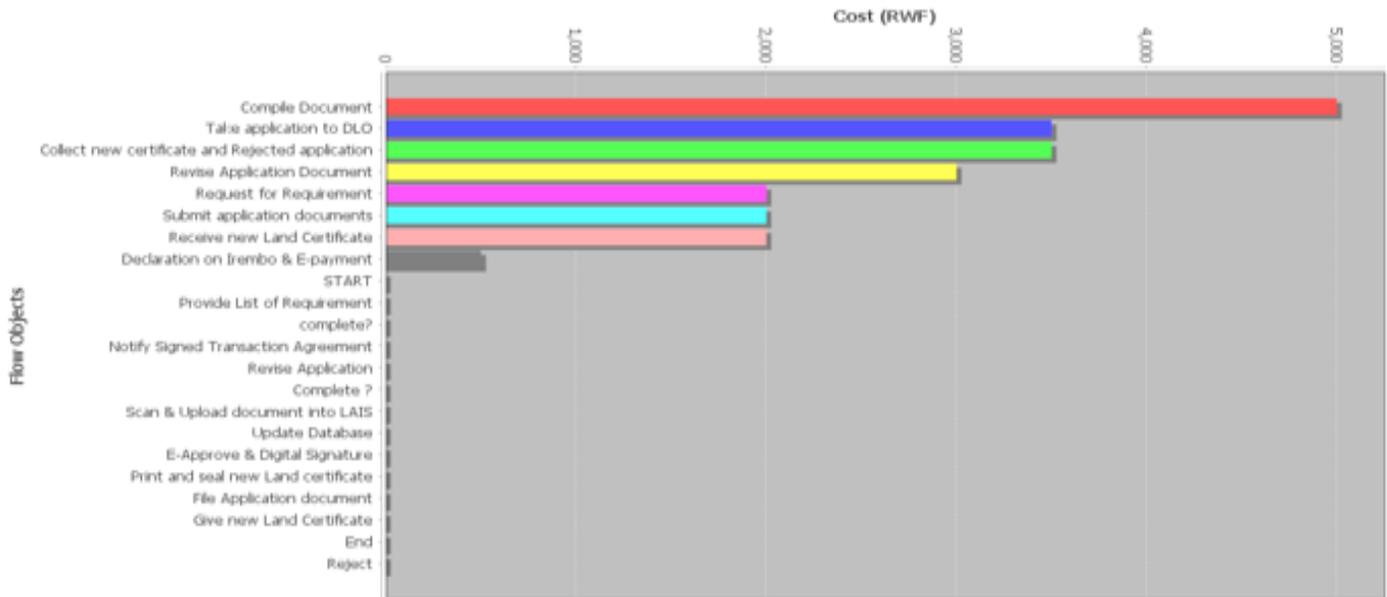
With the use of simulation Software Visual Paradigm by taking a full channel for one custom from the start of the process up to the end, we come up with a real assessment on how the designed workflow will improve the service of Transaction in terms of Cost and Time. In as process, all process takes 7 days (figure 5.3) and it cost 21500 Frw (figure5.2) this cost does not include the service Price that is (30000Frw) the cost is only for Transports and other needs to fulfill the required document.

Using the simulator the to be Process will be taking 40 min (figure 5.5) and Cost 3500 (figure 5.4) Frw you can see that this is totally different compared to the current situation which can help on the part of the customer and also to the Government in its perspective to enhance operational efficiency and the quality of service delivery to citizens, business and to establish effective communication channels to enable and power both rural and urban communities the mean to increase citizen participation in governance using ICTs and focus on national digital transformation(GoR,2015). The simulation result is shown below:

### Cost Per Scenario

Scenario Name	Number Of Instance	Cost Per Instance (RWF)	Total (RWF)
1 complete	1	21,500	21,500

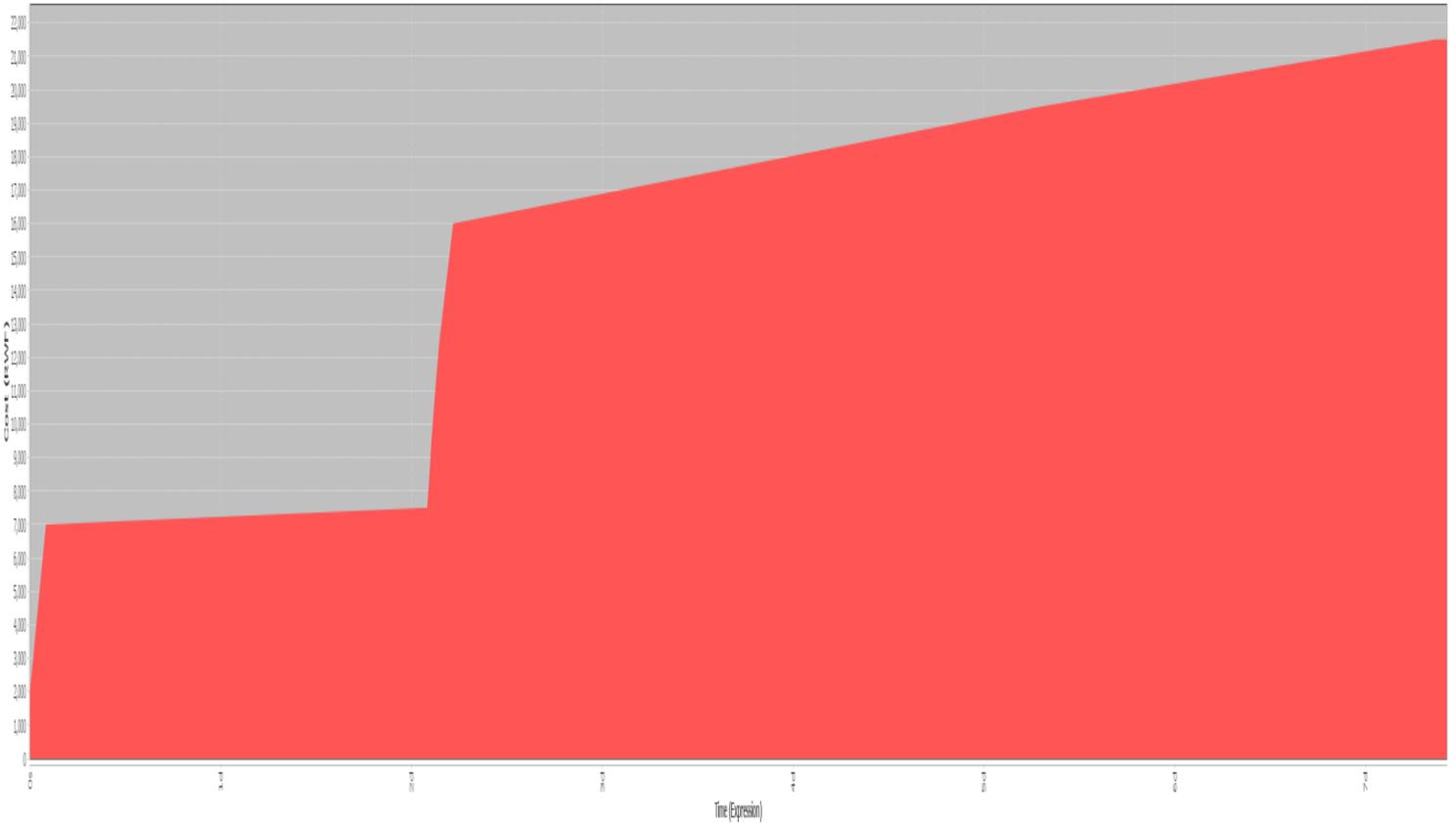
### Cost Per Flow Object



*Figure 5. 1 Cost For, as is workflow*

The diagram shows the cost for each flow object to make the transaction by land sell complete cost in current workflow, which is 21,500 Frw

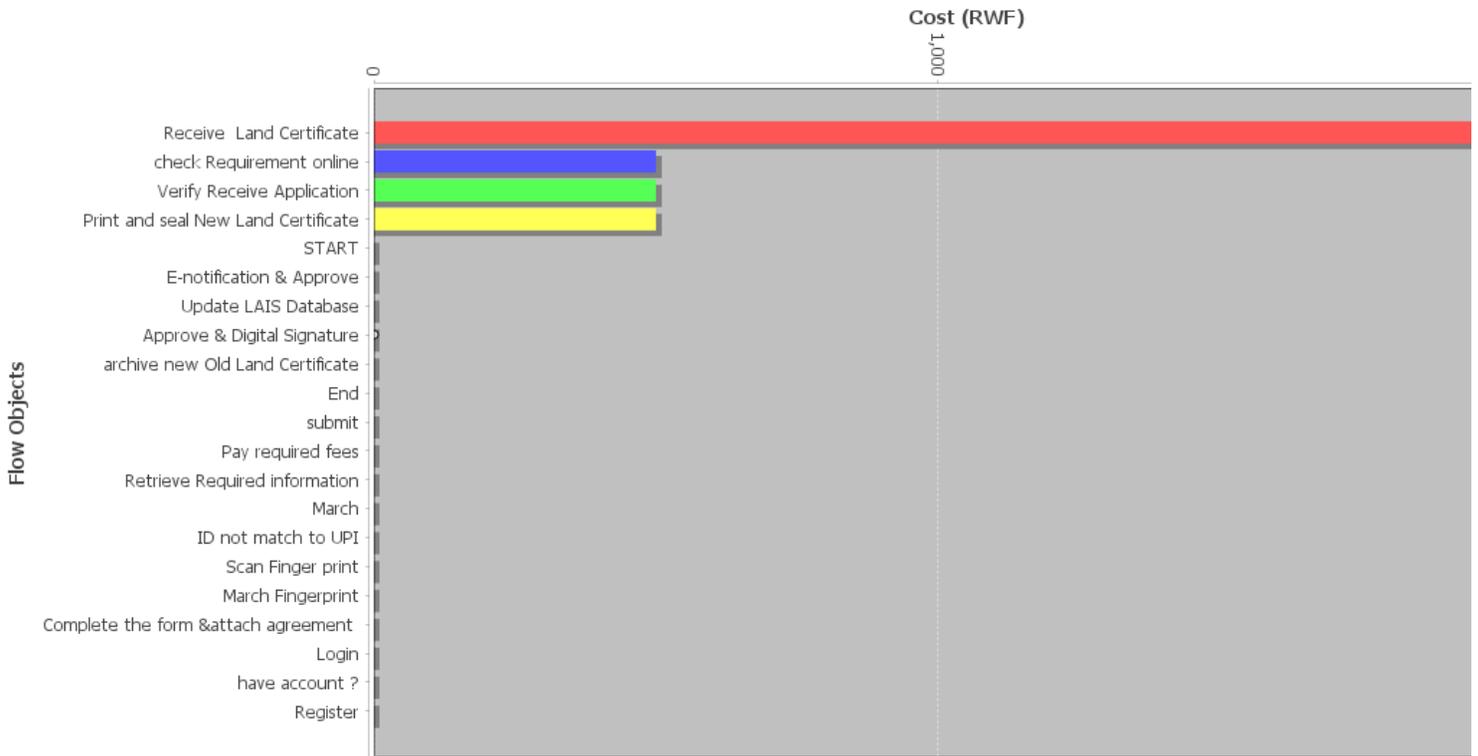
Time Cost



**Figure 5. 2 As is time for workflow**

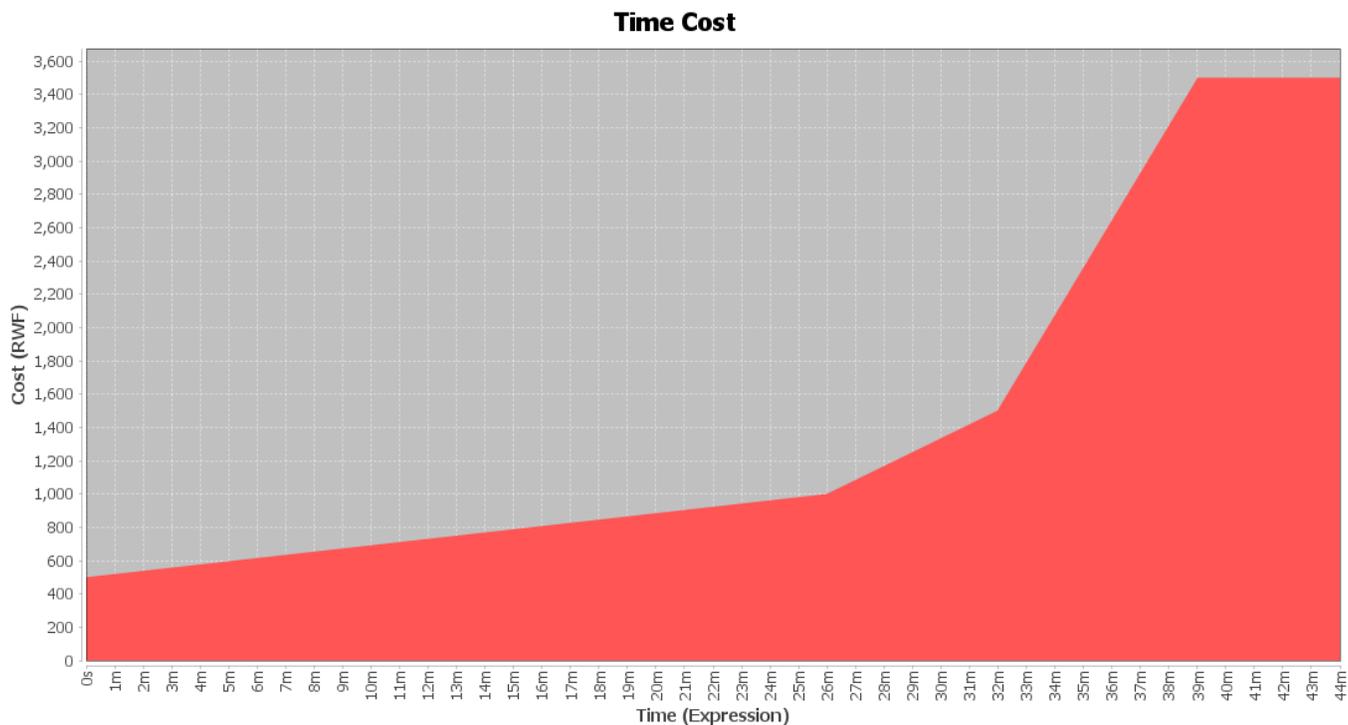
The above diagram shows the time it takes to complete the process in the current workflow it is taking 7 days so that the transfer by land sell can be complete.

### Cost Per Flow Object



**Figure 5. 3 Cost for the “to be” Process**

The diagram shows the cost for each flow object to make the transaction by land sell complete cost in Designed proposed workflow, which is 3500 Frw



**Figure 5.4 Time to be a process**

The above diagram shows the time it takes to complete the process in the current workflow it is taking 44min so that the transfer by land sell can be complete.

The assessment shows the difference between the current situation in the transaction by land sell in Rwanda and the proposed workflow, which shows that some obstacle will be, handled The Table below compares the existing workflow of Land transfer against the new workflow.

**Table 5.2 Validation Assessments**

<b>Design requirement</b>	<b>Existing workflow</b>	<b>New workflow</b>	<b>Validation</b>	<b>Comment</b>
An easy way of getting information on the required document	The customer has to go to the sector office for gathering or needed document	The customer based on her/his level of using the computer he	based on time and cost by the simulator for as-is and to process the	For the existing workflow, the customer has to go to the

		can get or needed information online	step is validated	sector office for asking required document which some time cost money for transport and other needs figure:5.2 with this proposed workflow the information will be gathered online There are no other expenses except for the cost of internet only
Remove physical presence for notification	The application is submitted physically so that the sector notary can confirm and notify that they are no fraud and the landowner is the one who is selling.	Using fingerprint and PKI it's will help to authenticate the landowner and help the land notary to use a digital	based simulator for as-is and to process the step is validated because this step is online no need of	the recorded biomedical data by NIDA will be used using a fingerprint to authenticate landowner when making

		signature to notify the online application	physical presence which remove transport costs and time	application and notary can notify application using digital signature when receive the request notification of an online application This not cost anything for transport the only internet is needed
Reduce the time that the buyer goes to sector office	A Customer comes for asking required information then comeback for submission and will came to take the new certificate	All processes are done online	based simulator for as-is and to process the step is validated because this step is online	All process should be done online and the customer comes at the sector once when he's informed that the new certificate is already issued so he came to pick the new

				and submit the original old certificate
Remove submission of hard copy document	Your submitted application file should contain much hard copy document <i>(Copy of ID card of buyer, Marital status certificate of the seller, Filled Application template for the transaction, Original land certificate, Payment slips or recite for land revenues, Notified Transaction agreement signed by both parties)</i>	By the inter-connection of MIS databases, all information on landowner will be linked to his/her ID card and using the fingerprint all need the information to fill the application will be retrieved if no missing document you submit the application	based simulator for as-is and to process the step is validated because this step is online	Because of the interconnection of MIS databases which are involved in the land transaction by selling almost all needed document are already registered their no need of making duplications of data by bringing had copy documents and cost for photocopy or other charges as you can see I figure:5.4 are removed

<p>After verifying that the requested service is possible, the appropriate payment should be made</p>	<p>As the current workflow is semi-automated after filling a given form by Irembo agents you have to pay a certain amount for the application and the agent print out the completed form which is among the hard copy document which is submitted by the seller</p>	<p>As the all process is done online after fulfilling all requirement and there is no problem you should be asked to pay the required amount to submit your application</p>	<p>based simulator for as-is and to process the step is validated because this step is online</p>	<p>Sometimes customer pay for the application and when he/she go for the submission at the land office at sector level he/she is told that he is application is not complete or any other issues, when he/she has already paid for the service, is to be processed you have to pay after the requirement, are fulfilled</p>
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## 6 CONCLUSION AND RECOMMENDATION

### 6.1 Conclusion

This research was conducted to make a requirement analysis on how the transaction by land sell is presently being conducted in Rwanda, discover potential obstacles for the landowner when doing transfer after voluntary sell, and suggest solutions to overcome them. The primary target of the research was to design a workflow for Transaction by land sell service in Rwanda that will resolve the long time it takes to have a certificate when doing the transaction by land sell in Rwanda that will resolve the recognized obstacles. This was accomplished using sub-objectives that have a specific research question to be answered.

#### **Sub Objective 1: Understand the existing workflow for improving the transaction by land sell service in Rwanda.**

The sub-objective one has been achieved through the data collection which helped to understand the current situation. The Question to be addressed was:” *How does the current workflow for the land sale Transaction service in Rwanda work?*” For this, the interviews helped to model the current workflow process by allowing us to collect needed information. The designed requirement on both side customer and system sides were used to design the new proposed workflow. Those requirements helped to know what customers want the system to do for them and what the system needs to respond to customer needs to make easy the title land transfer.

#### **Sub Objective 2: Identify the use of the ICT solution currently inland services.**

The purpose behind this sub-objective was to get and to know the technology that is used in this service so that it can be improved or changed to full automate the service of Transaction by land sell. The Research Question to be addressed was” *How does ICT solution are used for the transaction by land sell service at sector Level?*”. To achieve this sub-objective and analysis combined with the interviews and direct observation from fieldwork was done.

The main obstacle is that the only step that is used the ICT solution is making the declaration on Irembo Platform so that the customer can have a way of paying for the application all other process is done manually

by filling a form getting from any agent of Irembo or get from Sector Office and other required the remaining problem for the customer where the long travel distance to Sector Land office coming several times at SLO due to a weak use of ICT in service delivery. Those remaining obstacles suggested that the opportunity for improvement and these were proposed with the use of Fingerprint and PKI technology solution where the service can be fully automated as shown in the figure. the fingerprint which will help to retrieve some needed information to fulfill the application and to authenticated the application so that all process could be done online without physical presence at SLO and the use of PKI to help the Land Manager who is the land notary to notify the application using the digital signature instead of using manual stamps. The proposed new workflow has been presented using Business Process Modelling Language (BPML).

**Sub Objective 3: Define required systems inter-connection for sharing different needed data.**

The definitions of system requirements were achieved based on the obstacle of submission of many hard copy documents. The research question to be addressed was *“How can the land sale transaction process can be improved by sharing various information from various MIS”*. To design a new workflow, we have started by the proposal of inter-connection of the needed database for the required document when doing title land transfer

Recently RLMA latched the land information Inquiry Portal that will help to know the ownership of the parcel if the parcel has a caveat or restriction if the parcel is under the transaction and the planned land use this combination will remove some of the obstacles of submitting some hard copy document. To interact with those interconnected databases to help the customer (right holder) to remove the time spent on the Process and to remove submitted physical document at SLO we have proposed the use of an ICT solution:

**Sub Objective 4: Validate the new workflows for Transaction by land sell service in Rwanda.**

The validation aim was to assess if the proposed Workflow met the designed requirement and if the identified obstacles were removed, the question to be addressed was *“How valid are the newly designed workflows for Rwanda in handling the identified obstacles?”* The proposed ICT solution will remove the time taken by the citizen for the process and time of attending to SLO, the cost for travel to the SLO for the service, remove submitted hard copy document and the physical presence is no longer needed at SLO as the

propose ICT solution is used to provide the required information for the all application process to be done online. This will prevent fraud and ensure the originality of the attached document, as we want the whole workflow to be automated and with the PKI exchange of electronic data in a secure way.

## **6.2 Recommendations**

Recommendation to the RLMUA is the decentralization of the service so that those changes of transfer should be obtained at the cell level instead of sector level and they should found Irembo agent at the cell level who will be helping those customers who are not able to interact with the online application. This is very helpful for rural areas because of scattered villages; the sector officer can be far away from residents. To offer further explanations and to assist on the move, they should be a front desk officer. Further and future studies can come up with a concrete assessment on the side of customer satisfaction of the improved and enhanced system.

We recommend the Institution in charge of land service for evaluating the modality and implementation of the proposed workflow-based on designed requirements.

The recommendation for future researchers who will be interested in this study is making the implementation of the proposed workflow by the use of different techniques to automate the process. This will allow the identification of more requirements that were not discovered in the designed workflow.

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## Annex1: Questionnaires for interview

### 1. Questions for a Customer interview

Interviewee Number...

Date:../2/2020 Start time:....

End Time: ...

I am NSHUTI Arielle and I am researching Transaction by Land sell: Assessment and option for Rwanda.

The purpose of this 10 minutes discussion with you; is to help me to understand the process that you followed when you want to make a Transaction by Land sell

This interview is only for academic purposes and the information that you will give is confidential.

Do you allow me to record this discussion?

Interviewee address: District:.....

Sector:.....

Cell: .....

Village:.....

Q/N	Question	Notes
1	For what purpose are you coming to the sector Land Office?	<ul style="list-style-type: none"> <li>• <i>To do the transfer by land sell</i> <input type="checkbox"/></li> <li>• <i>Collect the new land certificate</i> <input type="checkbox"/></li> <li>• <i>Other</i> <input type="checkbox"/></li> </ul>
2	How many times did you come to the sector Land Office?	<ul style="list-style-type: none"> <li>• <i>Few</i> <input type="checkbox"/></li> <li>• <i>Many</i> <input type="checkbox"/></li> </ul>
3	How do you travel from your home to the sector Land Office	<ul style="list-style-type: none"> <li>• <i>Walking</i> <input type="checkbox"/></li> <li>• <i>Public transport</i> <input type="checkbox"/></li> <li>• <i>Own transport</i> <input type="checkbox"/></li> </ul>
4	How long does it take to get to the sector Land Office	<ul style="list-style-type: none"> <li>• <i>Small-time</i> <input type="checkbox"/></li> <li>• <i>Long Time</i> <input type="checkbox"/></li> </ul>
5	If long, where do you wish the land services on Transaction by Land sell should be delivered?	<ul style="list-style-type: none"> <li>• <i>Village</i> <input type="checkbox"/></li> <li>• <i>Cell level</i> <input type="checkbox"/></li> <li>• <i>Sector level</i> <input type="checkbox"/></li> </ul>
6	What do you think of those hard copy required documents? Why?	<ul style="list-style-type: none"> <li>• <i>Many and not all of them are important</i> <input type="checkbox"/></li> <li>• <i>Many but important</i> <input type="checkbox"/></li> <li>• <i>Not necessary</i> <input type="checkbox"/></li> </ul>

7	If many and not all of them are important, which one do you find important ( <i>or how do you want them to find those documents</i> )?	
8	Where do you submit your application for Transfer by Land sell?	<i>On Irembo Portal</i> <input type="checkbox"/> <i>At sector Land office</i> <input type="checkbox"/>
9	What obstacles do you think are in Transaction by Land sell service	
10	What are your suggestions to improve the Transaction by Land sell service Using ICT Solution?	

## 2. Sector Land Officer interview

Date:...../2/2020

Start time:.....

End Time: .....

I am NSHUTI Arielle and I am researching Transaction by Land sell: Assessment and option for Rwanda. The purpose of this 10 minutes discussion with you; is to help me to understand the process that you followed when you want to make a Transaction by Land sell.

This interview is only for academic purposes and the information that you will give is confidential.

Do you allow me to record this discussion?

Q/N	Question	Notes
1	What are the steps in the Transaction by Land Sell process?	
2	Which step do you participate in?	
3	What is your task in that step?	
4	What required documents to accept an application for Transaction by Land sell	
5	Why are those documents required?	
6	What do you check in the application?	
7	When do you check?	<ul style="list-style-type: none"> <li>• Before the application is received <input type="checkbox"/></li> <li>• After the application is received <input type="checkbox"/></li> </ul>
8	How do you perform on the application?	<ul style="list-style-type: none"> <li>• manually <input type="checkbox"/></li> <li>• Digitally <input type="checkbox"/></li> </ul>
9	From whom do you receive the application?	
10	To whom do you submit the processed application?	
11	How do you submit the processed application?	<ul style="list-style-type: none"> <li>• Digitally <input type="checkbox"/></li> <li>• Physically <input type="checkbox"/></li> </ul>
12	How does the applicant get feedback?	
13	After how long does he get the feedback?	
14	What obstacles do you think are in the Transaction process?	

15	What obstacles are in the Land Administration Information System and Irembo Portal to give a full-automated service?	
16	What are your suggestions to improve both systems?	

**Annex 2: Application form for Transfer of rights by Sell**

**FORM 4**

Edition May 2018



**APPLICATION FORM FOR TRANSFER OF RIGHTS ON A PARCEL BY VOLUNTARY SALE**

Person information

I/We:.....  
 Status:.....  
 ID/Passport:.....  
 Address:.....District.....Sector.....Cell.....Village Telephone  
 number: ..... E--mail: .....

OR

Company/NGO/Professional association/Church/Cooperative/Other:.....  
 I (authorized representative): .....  
 ID/Passport:.....  
 Address:.....District.....Sector.....Cell.....Village  
 Telephone number: ..... E--mail: .....

Kindly request for transfer of rights on a parcel by sale

Parcel information

UPI: .....  
 City of Kigali/Province: .....  
 District: .....  
 Sector: .....  
 Cell: .....  
 Percentage rights to be transferred:.....%

The motivation for the request .....  
 .....  
 .....

Required documents for the transaction

Proof of identity of the Buyer (Transferee)	
The notarised sale agreement, signed by registered parties	
Land documents for the parcel to be sold	
Notarized Memorandum of Association indicating shares of every shareholder, in case among persons to be registered there are foreigners and Rwandans co-owning land or a company business company, an organization or association with legal personality in which foreigners are shareholders	

.....  
 Date of Application

.....  
 Signature of the applicant(s)

Received and verified by: .....

Function: .....

Date..... Stamp

Signature.....

**FORM 4**

Edition May 2018