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INFORMATION SYSTEM USAGE AND LAND MANAGEMENT: A CASE STUDY OF NYANZA DISTRICT, RWANDA

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ABSTRACT

The purpose of this study was to assess the correlation between information system usage and land Management within Department of Land Titles and Mapping Office of the Registrar General, in Nyanza District, Rwanda with the following objectives; to examine how land management is carried out, in Nyanza District; Rwanda, to determine how an information system is used in Nyanza District; Rwanda and to determine how information system usage affects Land management, in Nyanza District, Rwanda. Descriptive case study research design was used. The target population for the study was 200 employees including staff, GIS officers and data entry personnel of land titling and mapping registrar general within Nyanza, southern, Rwanda. A sample size of 132 was calculated using Slovin's formula. Interview guide and questionnaires were used to collect data. Pilot study was done at Huye District within the land administration officer with a target population of 6. Quantitative analysis method has been used including frequencies, percentages, weighted means, standard deviation, and multiple regressions to describe the relationships between variables. Statistical Package for Social Sciences (SPSS) version 16.0 was used as a tool for quantitative analysis while interview guides and open-ended questions have been analyzed qualitatively using content analysis. The resulting indicators were presented in tables. Findings revealed that the information system is used at a high level where the grand mean value of 1.84 shows that the respondents agreed on the usage of the Information system; internet connection was strongly confirmed by the land administration office staffs via the content analysis. The finding also showed that the connectivity of GIS and GPS, as well as LAIS in general, was good; this was strongly confirmed by the land

administration staffs through the content analysis. The performances of other functionalities were established, tasks done by staffs and data entry personnel using IS were measured where findings showed that not all of the respondents were together on the respective issues concerned. Additionally, findings revealed r =0.82 multiple correlation coefficients which shows that there was a very strong positive correlation between independent variables (Information system) and the dependent variable (land management). The findings were also emphasized by R-squared equal to 66%, this reveals that the applied information system have effect on land management whereas the remaining total variation of 34. % was due to unexplained factors. Recommendations were to strengthen the policy of information dissemination in order to assess quickly information on land management. This process should be processed via the website to facilitate people to assess information related to land using a mobile telephone.

KEYWORDS: *Information, Information System, Information System usage, Land Administration Information System (LAIS), Management Information System (MIS), Usage.*

1. INTRODUCTION

This chapter describes the background of the study, the problem statement and research objectives as well.

All over the world, the Information and Communication Technology (ICT) revolution has driven global development in a good way. Technological progress, infrastructure deployment, and falling prices have brought unexpected growth in Information and Communication Technology access and connectivity to billions of people around the world. Information and Communication Technology help the world in achieving future sustainable development goals as the world moves faster and faster towards a digital society (Ceron& Dubois,2003).

In both the private and public sectors, land information is a prime requisite for marking decisions related to land investment, development, and management. Information reduces uncertainty by helping to identify and analyses problems. Strategies to overcome them may then be prepared and implemented. The value of information and the effectiveness of the decision-making process are directly related to the quality of the information and the manner in which it is made available. The transfer of land records to the computer-based system provides the key for the development of a modern land information system. Information in this form can easily be recalled, updated and selectively manipulated. With the development

of data exchange standards, information from a number of agencies can be readily combined to generate a wide variety of outputs. Complex data analysis and efficient data administration is only practical using the automated system (Hadjiraftis, 1991).

According to Kasphia & Rahman (2009), in Bangladesh, Land Information System usage result to the good efficiency, accurate and timely Information concerning to land administration and management. Land Information System (LIS) is considered to be the most accountable and feasible systematic approach for developing an up-to-date land administration and management.

Karikari, Stillwell& Carver (2005) analyzed the application of Geographical Information System (GIS) in the land management of Ghana, and found that nearly all cadastral and land registration systems focused on record management, rather than information exploitation. The lands commission secretariat, the leading agency in LA in Accra only used GIG for static map displays and had not used GIS for any analytical purposes. This signifies at best a mixed outcome.

Most countries are developing initiatives to widen access to and use of land information system, but their maturity and success vary across the regions. In Latin America, for example, Chile, El Salvador, and Honduras are more advanced than others. A good example of this type of initiative is Australia and New Zealand's land Information Council, which is responsible for coordinating the collection and transfer of land-related information between the different levels of government; and promoting the use of that information system in decision making. National Spatial Data Infrastructures involve the cooperation of public and private organizations to implement interoperable technologies, data standards, and business approaches within a policy framework that facilitates the sharing and reuse of land information (Enemark, Williamson&Wallace,2005).

Information, Communication, and Technology (ICT) in land administration generate statistics to determine many of the Land Governance Indicators, land administration computerization projects need to be guided by the role of ICT in the Land Governance Assessment Framework. Indonesia is one example of a country that had taken this approach. In this Online access to information services related to land, the administration is expanding with the expansion of broadband infrastructure and the use of mobile phones to deliver Internet and SMS-based services (Tinget al, 1999).

Babawuro (2010), in Nigeria, confirmed that the lack of adequate functional, coordinated land administration information system (LAIS) and networks weak the system of managing land in the country. In this article, it was demonstrated that the role of information system usage was important on Cadastre. Chan& Williamson (1999), in this study on Fundamentals of Geographical Information Systems; Land administration and management, land use control, provision of utility services and other services can be pursued by computerized LAIS. This system would serve in unified services related to land management by marginal labor, time and money.

Biraro (2014) confirmed the use of Information System (IS) on Land management in Rwanda. However, it was demonstrated that there is still considerable effort to make, in order to update the Land Information to get the benefits of improving Land Information System. The information system (IS) functionalities should be performing well to successfully fulfill information system (IS) objectives. According to Balaban&Platiša (2009), argued that the necessity of information system functionality has emerged from the importance of information technology in effectiveness and efficiency of work processes in an organization. However, it has been utilized to manage and process complex data and services related to land transactions such as registration, land titling, cadastral plan services and land transfer that caused improvement in land resources management.

Rwanda started to put in place the use of Information Communication and Technology (ICT) on Land management where recording and updating the spatial and non-spatial data concerning Land was done through the program called Land Tenure Regulation (Enemark, Williamson &Wallace, 2010). The program was undertaken in 2005 with trials, which was a nationwide systematic land registration. The aim was to provide legally valid land documents to all rightful landholders (Ministry of Natural Resources, 2012). The program was completed in 2013. The Land Tenure Regulation program used the general boundary approach: grassroots surveyors were used to demarcating land parcels on high resolution enlarged satellite images the surveying was done by the grassroots surveyors and claims were assessed in the field in a highly participatory manner. During the systematic land registration, spatial and non- spatial land information was recorded using two different computer system (Ministry of Natural Resources,2012). The two systems were connected by Unique Parcel Identifier linking the parcel information to its owner. So far, the non- spatial land information stored in the Land Tenure Regularization Support System was migrated into a web-based

land registration tool known as Land Administration Information System (LAIS) designed to support the maintenance phase. The spatial component has also to be added to this system to form a complete Digital National Land Register (Ministry of Natural Resources, 2012).

The process of recording and disseminating Land related Information in Rwanda starts from the District Land Bureau, located in each District, and is completed at the national level where the entire land information database is electronically managed. The process is led by a manual which gives guidelines on how to update land information. The document was published in 2012 by the department of lands and Mapping. Comparatively speaking, Rwanda made a positive progress in land administration in registering all its land. Now it is on the list of countries in the world with a complete and digital land register. However, considerable efforts are still needed to update the land information in order to get the benefits from this improved Land Information system (Biraro, 2014).

Byamugisha (2013) argued that, the systematic land registration in Rwanda was carried out by using the participatory approach with a high involvement of the State. The State planed when, how and by who the registration was to be done. The role of the right holder was to show the boundaries of her /his parcel and pays, in the average of 10 US dollars of registration fees. The land registration and the issuances of land certificates were handled by the state at the cell office (a cell was the unit of registration). This was quite simple for the right holder. To change the land information; a manual approach is still used. The right holder initiates the process of change reporting. During the land information update, the right holder follows designed workflows, looks for required documents, at different places, and pays required fees so that the change can be recorded within the land register. If the workflows for updating land information are not simple, not all the right holders will report changes in land information.

1.2 Problem Statement

In Rwanda, the National Land Bureau improved the land information system in order to solve many problems related to land management issues. This improvement includes moving from manual system to digital automated system named Land Tenure Regularization (LTR) in 2005 to provide legally suitable land documents to all rightful landholders; In 2013 LTR evolved into the web-based land Registration Information system (LAIS). The changes were followed also by improving the network system, network security, communication means and recruitment of new IT staff (Ministry of Natural Resources, 2012). However, system users

(Land administration staff, GIS staff, and data entry personnel) at Nyanza District were still increasing complaints which include information provision (there are some cases where the system provides data which are different from the entered ones). Internet connection (internet connection which is some time down) and reports generation, as a result, some data were manually produced, staffs were required to work extra time when sending and receiving the needed information and customizing reports. Meanwhile, studies related to the information system and land management in Rwanda continue to be very scanty. Therefore, the research sought to assess how information system usage affects land management in Nyanza District, Rwanda.

Objectives of the Study

The study has both general and specific objectives.

The general objective of this study was to assess the relationship between Information System usage and land Management within Department of Land Titles and Mapping Office of the Registrar General, in Nyanza District, Rwanda.

Specific objectives were as follows

- To examine how land management is carried out, in Nyanza District, Rwanda.
- To determine how an information system is used in Nyanza District, Rwanda.
- To determine how information system usage affects Land management, in Nyanza District, Rwanda.

2. REVIEW OF RELATED LITERATURE

This study was based on aristotle's Holism and Technology Acceptance Model (TAM) of Fred Davis. The rapid development of information technology has helped to firmly establish the general attitude that Information Systems (IS) are a powerful instrument for organizational problem-solving. Mele, Pels&Polese (2010) observed that since Aristotle claimed that knowledge is derived from the understanding of the whole and not that of the single parts (Aristotle's Holism), researchers have been struggling with systems and parts in terms of their contents and their relative dynamics and systems thinking come from the shift in attention from the part to the whole.

The Information System (IS) collects, processes, stores, analyses and disseminates information with a particular objective through inputs (data, instructions), processing and

outputs (reports, calculations). The entry data are processed in a usable format and sent to specific users, such as the managers, accountants, or a specific department (e.g. sales), or another IS which will use these data for another treatment depuration and change of focus for the use of this information. The IS uses a physical part (hardware), another part composed of application programs, a databank and mainly people who work directly in the information system, and other people who use the information generated by the system, (Alter,2008).

Technology Acceptance Model (TAM) was developed by Davis to predict user acceptance of technology and was based on Theory of Reasoned Action (TRA).This model was subject of Davis dissertation. TAM indicates the relationship between external variables, perceived usefulness, perceived ease of use, attitude toward use and actual usage. TAM provides information on how the design choices influence user acceptance of technology. According to Davis, if the system appears useful to the users then they are more willing to use it.

Venkatesh & Davis (2000), Technology Acceptance Model (TAM) was adapted from Azjen and Fishbein's Theory of Reasoned Action (TRA) to model user acceptance of information technology systems. As introduced by Davis (1986) in adaptation of TRA, they confirmed that TAM model is focused on analyzing technology, concentrating on two key constructs: perceived usefulness (PU) and perceived ease of use (PEOU).

In TAM model both perceived usefulness and ease of use lead to attitude toward use. Ease of use also influences perceived usefulness of the technology. Attitude towards using technology influences an individual's intention to use information technology, and this, in turn, influences actual use. In the original TAM model, perceived usefulness refers to the degree to which the user believes that using technology will improve work performance within an organizational context. Perceived ease of use is defined as the degree to which a person believes that using a particular system would be free of effort with an organization.

2.1 Information System and Land Management

Shim *et al*, (2002) defined information system as a combination of human and technical resources, together with a set of organizing procedures that produce information in support of some managerial requirements. Data relating to land may be acquired and held in alphanumeric form, for example, written in notebooks and surveyors' field books, or graphically for example, as maps or aerial photographs, or digitally (for example, using electronic methods).

To become information, the raw data must be processed so that it can be understood by a decision maker. A land information system gives support to land management by providing information about the land, the resources upon it and the improvements made to it. The operation of land information system includes the acquisition and assembly of data; their processing, storage, and maintenance; and their retrieval, analysis, and dissemination. The usefulness of such a system will depend upon the degree to which it can be updated, accuracy, completeness, accessibility, and also upon the extent to which the system is designed for the benefit of the user rather than for the producer of the information.

According to Olumoye (2013), Information System have become an integral part of every corporate organization; including the land management and land administration in facilitating decision-making, planning process and the prospect of achieving organizational goals and objectives. The researcher argued that business firms and other organizations rely on information systems to carry out and manage their operations, interact with their customers and suppliers, and compete in the marketplace. As major and new technologies for recording and processing information have been invented over the millennia new capabilities have appeared. To shade light on this, the introduction of the internet without any doubt has enabled access to information and other resources; this has facilitated forming relationships among people and organizations at an unprecedented scale.

(Kasphia&Rahman, 2009), confirmed land information system (LIS) as an important tool to facilitate quick capturing, retrieval and querying of different cartographic information. Land administration and management, land use control, provision of utility services and other services can be pursued by computerized LIS. This system would serve unified services related to land management by marginal labor, time and money. Use of LIS for recording and maintaining the original volume of land records could minimize the chances of tampering with records. If any change in the ownership is updated in real time through the computer-based system, agencies can manage the ownership ledgers in a unified fashion and allow anyone to check the current ownership information any time they want. Once an accurate geodetic framework and a cadastral system have been developed, many analysis of land-tenure change could be performed with the guarantee of the high degree of measurement accuracy. This will help arrive at compatible multiple land uses within selected parcel of land.

Theobald et al (2000). Asserted land information system (LIS) as a division of Geographic Information System, which is most often based on the ownership, management, and analysis of a portion of the earth, LIS application combines both traditional survey methods and Global Positioning System (GPS), a sophisticated satellite system for acquiring the local information on land. The Cadastral Survey (CS) and Mapping methodology based on ground survey or aerial survey supplemented by the ground survey is to be adopted. Completion of these operations would provide digital maps. Using Satellite navigation systems or (GPS), surveyors collect field data using a portable backpack or hand-held devices. In this process, they use signals from GPS satellites to work out the exact location on the earth's surface. Most GPS receiver's store, collected co-ordinates and associated attribute information in their internal memory, so they can be downloaded directly into a GIS database.

LIS could introduce a unified cadaster that is a broader concept to incorporate information related to positioning of land, land size and orientation, land ownership, land use etc. This is a large scale, community-oriented land information system to serve both public and private organizations concerned to land administration and management, land development and service provision. Despite the huge installation and recurring cost of new technologies, once the land record is completely computerized, various space-specific parameters could be hooked-up to the land record (Abbas, Yayork&Muhammad, 2014). The same record could be utilized for various purposes such as taxation, subdivision planning and other tasks in urban, rural and regional level. For this Purpose, demand responsive step-by-step approach within a timeframe would bring the effective results for land administration and management through LIS.

Geographic Information System (GIS) is defined as a collection of data, storage, and analysis in relation to their spatial distribution at various stages of information handling. LIS is a division of GIS. When data in the GIS is related to various quantitative and qualitative aspects of land resource, it is termed as Land Information System (LIS). LIS is most often based on the ownership, management, and analysis of a portion of the earth most frequently of interest to human (Kasphia&Rahman, 2009).

LIS is further subdivided into parcel and non-parcel based. Non-parcel based LIS include natural resources information system. Activities within the non-parcel based LIS could include habitat, evaluation, conservation easement procurement, wildlife evaluation, earthquake and landslide prediction, flood hazard abatement, chemical contamination

evaluation, forest and range management, and scientific investigation. Parcel-based LIS application is generally focused on land ownership and other cadastral investigations (Bennett, Wallace& Williamson, 2008).

Fundamental applications of the earlier mentioned types are highly accurate geodetic framework upon which the percales can be precisely described. LIS application involves traditional survey methods and Global Positioning System (GPS), a sophisticated satellite system for acquiring the local information. The Cadastral Survey (CS) and Mapping methodology based on ground survey or aerial survey supplemented by the ground survey is to be adopted. Completion of these operations would provide digital maps (Kasphia&Rahman, 2009).

Satellite navigation systems or Global Positioning System (GPS) could be used for field data collection. For this, the surveyors use a portable backpack or hand-held devices. They use signals from GPS satellites to work out this exact location on the earth's surface in the terms of (x, y, z) co-ordinates using trigonometry at the push of a button of the GPS receiver. Most GPS receivers store collected co-ordinates and associated attribute information in their internal memory, so they can be downloaded directly into a GIS database (Heywood, Cornelius, & Carver,2002).

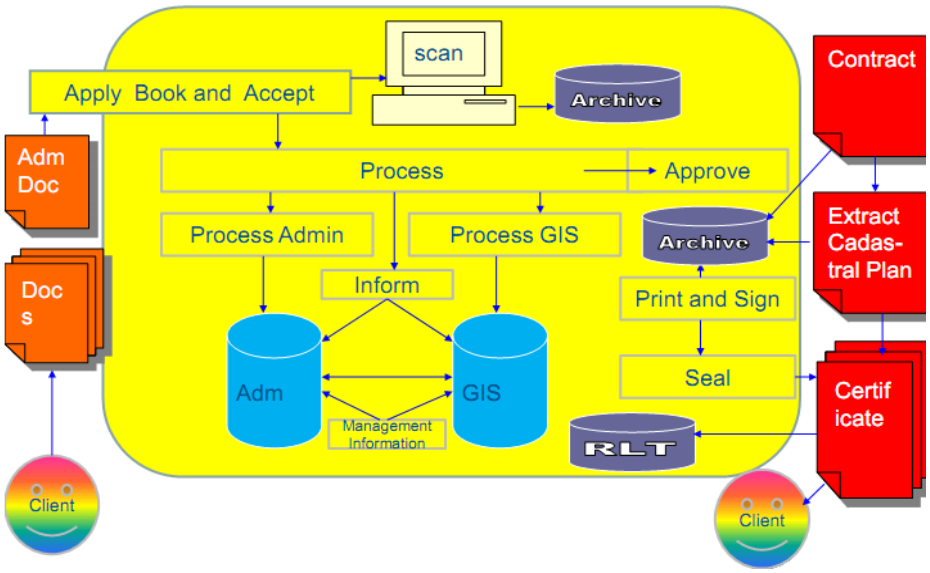

Figure 2.1: Land Administration Information Systems (LAIS).

Source: (Ministry of Natural Resources, 2012).

Figure 2.1 shows interrelated components making the land administration information system.

Client: The client in this diagram is the applicant who needs a service related to land transaction.

Document: The administrative officer advises the applicant and verifies, notarise and file the documents received for an application for a land transaction.

Administrative document: An administrative document is offered to the Registrar Land Title (RLT) with the aim to register formal facts into the registration. An administrative document is a formal document from outside or from inside as an internal Document (e.g. to make corrections). The changes in the registration are based on administrative documents, for later justification.

Apply book and accept: An administrative officer also books and accepts the documents from the client for transaction.

Scan: To scan a document in land registration service refers to convert hard document copies into soft copies in order to be stored in the archive.

Process: The land registration officer books, accepts and processes the documents. The land transaction can be processed in the LAIS. The process can be done in LAIS administrative as well as in LAIS GIS, depending on the kind of transaction.

Approve: The approval of the transaction is done by the Deputy Registrar who checks that the changes in the LAIS have been done in accordance with the documents presented for transaction; if yes, the status approved is given to the transaction; if not, the transaction will be refused by the Deputy Registrar and the changes in the LAIS are reversed and returned to the accepted status. Then, either the LAIS professional will re-do the changes in the right way this time or a request for rectification sent to the Applicant (via the District Land Office or authorized staff).

Sign and print: This is done automatically by the system after the information needed to prepare the certificate has been approved by the Deputy Registrar; it's printed to PDF.It should be noted that only a limited number of transactions will lead to the generation of the certificate (e.g. sale, donation, inheritance, exchange, division of a parcel, merge of parcels), other transactions will only lead to a change in the LAIS database (e.g. servitude, caveat, and seizure).

Contract: At the end of the land transaction process, the land registrar officer ensures that the certificate is generated with electronic signature and seal of the Deputy Registrar and make sure that the applicant will receive the certificate or the contract.

Seal: The certificate has to be sealed and the sealing to be confirmed by the Deputy Registrar; from that moment on, the certificate is the official document for the object of transaction. The original of the certificate is stored at the Office of the (Deputy) Land Registrar.

Extract cadastral: A Cadastral Register (parcel map/spatial component of the system), is the plan that shows the location of parcels (where), their size (how much) and their land use and value (what).

2.2 Conceptual Framework

The Conceptual Framework represents the relationship between the independent variable and dependent variables of this study. The framework further explains the intervening factors that might interact to influence the relationship.

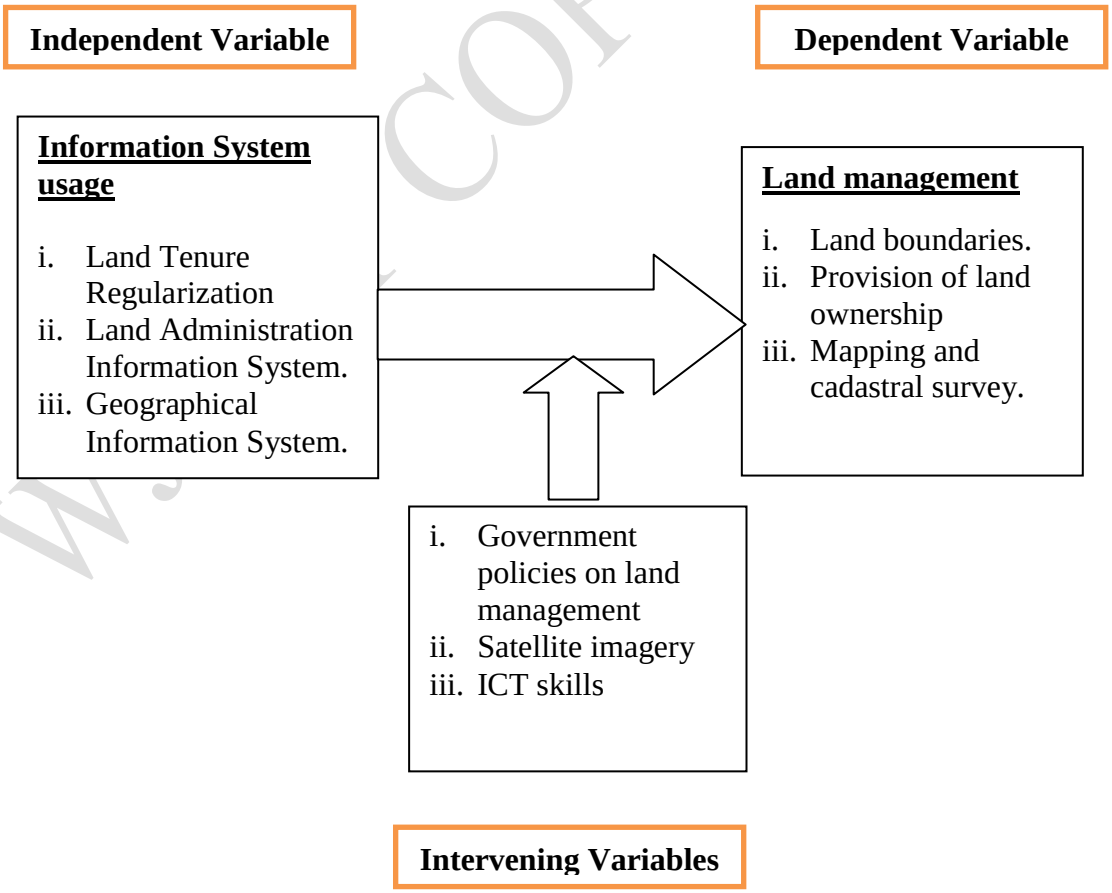

Figure 2.2: Conceptual Framework. Source: (Personal interpretation).

3. RESEARCH METHODOLOGY

Methodological approach, the techniques and instruments used in conducting the research. The research methodology various methods were used in research design, design, target population, sample size, sampling technique, data collection methods, data collection instruments, administration of data collection instruments and data analysis procedure.

3.1 Research Design

A descriptive case study research design was chosen because it is most suitable to clarify the information system functionality performances, the tasks for which information system are used by GIS officer staffs, Land administration and Land notary staff and data entry personnel. It helped to explain how the information system affects the land management within the department of Land Title and Mapping office of the Registrar General within Nyanza District, Rwanda.

3.2 Target Population

The participant staffs GIS office and data entry personnel for this study were taken as target population from the office of the Registrar of land titles within the department of Land Title and Mapping, Nyanza District, Rwanda, Southern Province employees, for the year 2016.The target population consisted of staff (land administration staff),GIS officer and data entry personnel, respectively from the Land Titling and Land Registrar from which GIS office 2, Land administration staff 48 and data entry personnel 150.

3.3 Sample Design and Sampling Technique

Sample design referred to the method used to choose the sample from the population of 200 staffs, GIS offices and data entry personnel and includes. Slovin's (1993) formula was used for obtaining the sample size. Given by:

$$n = \frac{N}{1 + N \times e^2}$$

Where

N= the population size

n= the sample size, e=1-confidence level =1-0.95=0.05

$n=198/ (1+198*(0.05)^2) =132$

The sample size of 132 respondents was drawn from a target population of 200 staff and data entry personnel within the department of Land Title and Mapping office of the Registrar

General within Nyanza District, Rwanda has been used. Stratification was used to group proportionally the population into three strata, including staff (Land Administration, Land notary), GIS officers and data entry personnel. Strata proportions were simply being calculated as it follows:

Strata 1 (Land administration staff) = (48/200)*132= 31

Strata 2 (GIS officers) = 2

Strata 3 (Data entry personnel) = (150/200)*132= 99

The three strata comprised staff, GIS officers and data entry personnel. Then, individuals have been selected from staff and data entry personnel's strata using simple random sampling technique. Purposive sampling technique used to select the GIS officers. The unit of analysis under this study was those who use information system in their daily activities.

3.4 Data Collection and Analysis

Questionnaires were as tool to collect information in this study and the questionnaires were emphasized mainly on the objectives of the study. Alongside the questionnaires, personal interviews were administrated for selected respondents. Closed and open ended questions were formulated according to the objectives of the study. Interviews were conducted among staff in their own offices. The questionnaires were administrated to the data entry personnel and collected upon completion. Data entry personnel were required to choose answers from lists. Each respondent completed the questionnaire which involved closed ended and open ended questions. In the closed ended questions, Likert scale of 5 to 1where 5 = strongly agree, 4 = Agree, 3 = Not sure, 2 = Disagree, and 1 = strongly disagree was been used. Quantitative analysis method has been used including frequencies, percentages, weighted means, standard deviation, and multiple regressions to describe the relationships between variables. Statistical Package for Social Sciences (SPSS) version 16.0 was used as a tool for quantitative analysis while interview guides and open-ended questions have been analyzed qualitatively using content analysis.

3. RESEARCH FINDINGS AND DISCUSSION

Questionnaires were distributed within the Department of Land Titles and Mapping office of the Registrar General in Nyanza District. Data were collected during working hours of land transaction activities and based on the usage of information system to affect the land management. Furthermore, the interviews guides were administrated to land administration staff and GIS officer.

Interviews guides were used to understand further information on information system usage, tasks which were achieved using information system and land. Questions involving Likert Scale were analyzed by calculating weighted means where the weights were as follows: 5= Strongly Agree; 4=Agree; 3=Not sure; 2= Disagree; 1= Strongly Disagree.

$$\text{Weighted mean} = \frac{\sum(weights * observered\ frequences)}{\sum observed\ frequencies}$$

Table 4.1: Distributions of respondents by their attitude on how land management is carried out.

Items	Mean	Standard deviation	Interpretation
1. Parcell titling	3.33	0.43	Agree
2. Award of title certification	3.84	0.43	Agree
3. Parcel demarcation	3.72	0.42	Agree
4. Land information update	4.53	0.35	Strongly Agree
5. Satellite imagery	3.95	0.43	Agreed
Grand mean	3.87	0.41	Agree

Source: Primary data

The results from, table 4.1 was by using weighted means and standard deviation. Concerning on the parcel titling, respondents agreed at rate of mean value of 3.33 and standard deviation of 0.43. This means that respondent agreed on the issue concerned with the same understanding.

About award of title certification, respondent agreed at mean value of 3.84 and standard deviation of 0.43. This means that, respondent agreed award of title certification as the yield or result of land management with same understanding.

Concerning on the parcel demarcation, respondent agreed at mean value of 3.72 and standard deviation of 0.42. This means that respondents agreed with same understanding on parcel demarcation as the product of land management.

About land information update, respondent's responses at rate of mean value of 4.53 and standard deviation of 0.35 which means that respondent strongly agreed with common understanding.

Concerning on the satellite imagery, respondent's respondents confirmed the issue concerned at rate of 3.95 and standard deviation of 0.45 where this means that respondents agreed and

have same understanding on the statement where satellite imagery confirmed as the product or result of land management. In general, grand mean of 3.87 and standard deviation of 0.41 show that, respondents agreed with common understanding on the statement of how land management is carried out.

Table 4.2: Information System usage in staff, GIS office and data entry personnel.

Items	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree	Weighed Mean	Stand Deviation
1. Staff and data entry Personnel possess basic ICT skills	18 (14.63%)	105 (85.37%)	0 (0%)	0 (0%)	0 (0%)	3.85	0.35
2. The quality of training received by the staff on the use of system is relevant	17 (13.82%)	105 (85.37%)	1 (0.81%)	0 (0%)	0 (0%)	3.87	0.36
3. Respondents master the functionality of land tenure Regularization	25 (20.33%)	97 (78.86%)	0 (0%)	1 (0.81%)	0 (0%)	3.81	0.45

Source: primary data

(Standard Deviation <0.5 or close to zero -respondent's responses are crowded around the weighted mean), (σ >0.5 or high -respondent's responses are dispersed on issue concerned). The results from Table 4.2 show how Land administration staffs, GIS officers and data entry personnel possess skills that allow them to perform in IS in three strata, whereby the respondents agreed at rate of eighty-five point thirty-seven percent (85.37%) which means that Staffs and data entry Personnel possess basic ICT skills, and strongly agreed at rate of fourteen point sixty-three (14.63%).

About the quality of training received by the staff if it is relevant to the system or not, the respondents agreed at rate of eighty five point thirty seven percent (85.37%) and strongly agreed at rate of fifteen point eighty two (13.82%), and zero point eighty one (0.81%) of the respondents were not sure. Concerning the functionality of land tenure regularization, a total of ninety- nine point nineteen (99.19 %) percent of respondents agreed and strongly agreed that the users mastering the functionality, and zero point eighty one (0.81%) percent disagreed.

In general, the results show that the respondents appreciated the IS usage in staff, GIS offices and data entry personnel strata at rate of more than ninety- nine (99%) percent. The results were also supported by the three weighted mean values of three statements, 3.85, 3.87, and 3.81 which mean that the respondents agreed the statement. The interview administered responses from land administration and GIS officer confirmed the usage of information system in their daily activities of land transaction and delivering printed cadastral plane of parcel and certificates to the land owners as the output of Land Information System. The interviewees added that the usage of IS helps to save time of working and provide the reliable information and strengthening the usage of information system at high level.

Table 4.3: Land Administration Information System (LAIS) Usage.

Items	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree	Weighed Mean	Stand Deviation
1.The use of LAIS can lead to the Efficiency of land management	18 (14.63%)	104 (84.55%)	1 (0.81%)	0 (0%)	0 (0%)	3.89	0.36
2. Use of LAIS for controlling Land use and development	31 (25.20 %)	89 (72.36%)	2 (1.63%)	1 (0.81%)	0 (0%)	3.78	0.50
3. The sharing of data between LAIS users (staff)	21 (17.07%)	102 (82.93%)	0 (0%)	0 (0%)	0 (0%)	3.89	0.37
4.The LAIS system is user friendly	17 (13.82%)	104 (84.55%)	2 (1.63%)	0 (0%)	0 (0%)	3.88	0.37

Source: primary data

(Standard Deviation ((σ)) <0.5 or close to zero -respondents responses are crowded around the weighted mean (μ)), (σ >0.5 or high -respondents responses are dispersed on issue concerned).

Table 4.3 shows how LAIS is used as IS, the majority of respondents agreed that there is a high efficiency within the institution due to the use of LAIS in order to administer land management at rate of eighty-four point fifty-five (84.55%) percent, while fourteen point sixty-three (14.63%) percent of respondents strongly agreed. The weighted mean value of 3.89 shows that the respondent agreed the statement.

About the land use and development, the majority of respondents agreed that the LAIS use for controlling the land use and development within Nyanza District at rate of seventy-two point thirty-six (72.36%) percent, while twenty-five point twenty (25.20%) percent strongly agreed on this. The remains totalize two point forty-four (2.44%) percent were not sure, disagree and strongly disagree concerning on the use of LAIS for controlling the land use and development within the institution, here the majority of respondents confirmed the use of LAIS for controlling the land use and development within the institution, also the weighted mean value of 3.78 shows that the respondent strongly agreed the statement.

About the data sharing, the majority of respondents agreed that sharing of data between staff and data entry personnel is sufficient at rate of eighty-two point ninety-three (82.93%) percent versus seventy-seven point zero seven (17.07%) percent of respondents who strongly agreed. On this point, the majority of respondents agreed that the LAIS is highly used as IS; this also is supported by the weighted mean of 3.89. Concerning usability of LAIS system, the majority of respondents at rate of eighty-four point fifty-five (84.55%) percent agreed, and thirteen point eighty-two (13.82%) percent strongly agreed on the statement, while the rest of respondents who represent one point sixty-three were undecided. Its weighted mean of 3.89 also emphasizes that the respondents agreed that LAIS system is user friendly.

In general, the grand mean for the weighted means is 3.86 which show that the respondent agreed the usage of LAIS in Nyanza District.

Table 4.4: IS usage levels and interpretations.

Items	Mean	Standard deviation	Interpretation
1. GIS usage	3.52	0.387	Agree
2.LAIS usage	3.85	0.425	Agree
3. Hardware usage	3.46	0.340	Agree
4.Software usage	3.57	0.465	Agree
5.Data usage	4.58	0.425	Strongly Agree
Grand mean	3.79	0.408	Agree

Source: primary data

Table 4.4 interprets the mean value of different items that contribute on how Information system is used within the Department of Land Titles and Mapping office of the Registrar General in Nyanza District. The results show that the respondents agreed on IS usage in staff, GIS usage with mean value of 3.52, LAIS usage at mean value of 3.85, hardware usage with mean value of 3.46, software usage with mean value of 3.57, while strongly agreed on data

usage at mean value 4.58. In general, the grand mean 3.79 and overall standard deviation show that the respondents agreed with the same understanding on that Information system is used at high level within the Department of Land Titles and Mapping office of the Registrar General in Nyanza District.

4.2.2 Effect between information system usage and land management

To examine how information system usage affects land management within Department of Land Titles and Mapping office of the Registrar General in Nyanza District, the researcher based on regression model of this association:

Land management = b_0+ b_1LAIS+ b_2GIS+ b_3LTR+ ε Where LAIS, GIS and LTR represents independent variable, b_0, b_1, b_2 and b_3 represents coefficients, ε represents unknown factor, and land management represents dependent variable.

Table 4.5: Information system and land management.

Model		B	Std. Error	Beta	T	Sig.
1.	(Constant)	-.214	.291		-.736	.463
	LAIS	.079	.077	.076	1.164	.247
	GIS	.054	.055	.062	1.006	.316
	LTR	.188	.060	.203	3.277	.001

From result of table 4.5, the regression model to support the research objective was developed.

Land management =-0.214+0.79LAIS+0.54GIS+0.188 LTR+0.59.

Constant, land tenure regularization (LTR), land administration information system (LAIS) and geographical information system (GIS).

Dependent variable: (land management).

5. SUMMARY OF FINDINGS

Findings shown that the majority of respondents agreed and with same understanding on the issue concerned where information system is managing land by producing parcel titling, award of title certificate, parcel demarcation, land information update and satellite imagery.

The finding represented by the grand mean value of 3.7 shown that, respondents agreed on usage of Information system at high level within the Department of Land Titles and Mapping

office of the Registrar General in Nyanza District. These information systems seemed to complement one another.

The findings were also emphasized by R-squared =66%. This reveals that the applied information systems, land tenure regularization, land administration information system, geographical information system, have positive effect on land management. From this, 34 % reveal that there are other factors behind independent variables of researcher which affect land management.

6. CONCLUSION

From this study, with main objective: to assess the relationship between Information System usage and land management within department of land titles and mapping office of the Registrar General, in Nyanza District, Rwanda. The relationship was measured using both coefficient of correlation and R-squared values. The results shown that there were high correlations between the independent variable (Information systems) and dependent variable (land management) and the level of usage was very high .The value of R-square were good, to highlight the effectiveness of information system usage on land management.

7. Recommendations

The recommendation derived from findings to land office; to use information systems on high level because they contribute more in land management. To decentralize the offices for decreasing long queue purposive. This has to go with the increasing of internet connectivity in diverse corners of country.

The user should be trained in information systems usage; this would enhance the level of services delivery, look after the technology tools, and being updated to new version. The information users must be also qualified in information systems to maintain and guarantee the land management security and stable.

The policy of information dissemination should be strengthening in order to access quickly information on land management. This process must be processed via website, to facilitate people to access information using mobile telephone.

8. Areas for further Research

For this study, the factors that used to assess effectiveness of information systems on land management represented 66%, i.e., there were other factors that represent 34 %. Further

research should assess other factors that affect land management. Those factors should be included in the regression model(s) for future studies, in addition to the factors identified in this research. Similar studies need to be carried out in other districts of Rwanda in order to have a broad-based view of the situation concerning information system usage and land management in Rwanda.

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