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SYSTEM MODERNIZATION, PROCESS OPTIMIZATION AND PERFORMANCE OF THE NATIONAL LAND INFORMATION MANAGEMENT SYSTEM IN KENYA

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ABSTRACT

The Land Information Management System, sometimes referred to as the 'Ardhisasa System.' Ardhisasa offers a comprehensive platform for land transactions, enabling users to do various online activities like land registration, valuation, surveying, adjudication, planning, and allocation. The creation and execution of Ardhisasa in Kenya has encountered several hurdles. This research will evaluate the impact of system modernisation and process optimisation on the performance of the National Land Information Management System in Kenya, specifically targeting the Ardhisasa System.The research was informed by the Information Systems Success Model and the Technology Acceptance Model. The research used a descriptive design. The target demographic would consist of the personnel employed at the National Land Commission Nairobi Office and the Ministry of Land, Housing and Urban Development, together with their customers in Nairobi County. The multiple regression analysis reveals a robust positive correlation (R = 0.599) between critical system modernisation, process optimisation, and system performance, underscoring their combined significance. The modified R Square value of 0.342 indicates that these parameters explain around 34.2% of the variation in system performance, underscoring their importance in enhancing effectiveness. Increases in system modernisation and process optimisation correspond with respective performance gains of 0.496 and 0.178 units. The results underscore the need for stakeholders to design and execute comprehensive process optimisation and system performance strategies to improve the overall efficacy of the National Land Information Management System in Kenya. The findings demonstrate that enhancing process optimisation and system performance components can substantially improve overall system efficacy, aligning it with user requirements and expectations.

KEYWORDS: *system modernization; process optimization; Land Information Management System; Kenya*

1.1 INTRODUCTION

Land is a fundamental asset for every nation. It is a component of production that encompasses labour and capital. It is essential for the economic, social, and political advancement of a nation. A link exists between effective land use and a nation's economic progress, which can only be realised via the availability of information about that land. The prevailing trend of globalisation necessitates the creation of an integrated land information management system to meet the need for efficient and effective land services. Land information exists in both spatial and attribute formats (Mwangi, 2018). A Land Information Management System (LIMS) is a digital platform used for the management of land-related data, including ownership, usage, valuation, and geographic location (World Bank, 2022). It is a geographic information system (GIS) that consolidates several modules and functions to effectively gather, store, retrieve, analyse, and communicate land information.

The land sector is essential to the economy of African nations. It is interconnected with several sectors and is essential for food security and the socio-cultural requirements of people in Africa (UN-Habitat, 2018). The administration of the land sector is deemed a priority to enhance the overall performance of national economies (World Bank, 2019). In South Africa, land management profoundly influences water supplies. Alterations in land cover impact the volume and quality of water supplies, resulting in difficulties in residential water provision. Initiatives are underway to regulate land use patterns and preserve soil quality to alleviate the effects on water resources (Roux et al., 2019). Nigeria is striving to integrate many independent systems to enhance service delivery and facilitate data harmonisation and cooperation. A comprehensive and broad perspective on LIMS is essential for ensuring effective operation and service

delivery (Oluwagbemi et al., 2019). Ghana has acknowledged the significance of LIMS in land management and has undertaken initiatives to digitise land data and optimise land administration procedures. The nation is striving to enhance land governance, transparency, and accessibility to land-related services (Amartey et al., 2017). Liberia has been focused on ensuring land tenure and enhancing land management systems. Initiatives are underway to modernise governance protocols and enhance land ownership and management to foster shared prosperity and change developmental opportunities (World Bank, 2017). Ethiopia has been using LIMS to enhance land administration and management. The nation acknowledges the significance of sustainable land management in combating climate change and attaining developmental objectives. Initiatives are underway to sequester and retain carbon in flora and soil using sustainable land management techniques (Oyana et al., 2019).

Kenya has instituted the National Land Information Management System (Ardhisasa System) to transform land administration and registration procedures. Ardhisasa serves as a comprehensive platform for land transactions, enabling users to do various online activities like land registration, valuation, surveying, adjudication, planning, and allocation (Mwenda, 2019). The creation and execution of Ardhisasa in Kenya have encountered several hurdles. Initial results from a research suggest that the implementation of Ardhisasa has been intricate and disorganised, with several issues yet unresolved (Mwenda, 2019).

1.1 System Modernization

System modernisation in management information systems include the implementation of new systems or the enhancement of existing ones to augment efficiency, functionality, and alignment with contemporary business requirements (Boehm & Jain, 2019). It entails the modification of processes, rules, and standards to use new technology, improve performance, and meet changing needs (Boehm & Jain, 2019). The modernisation of management information systems is propelled by the need to align with technological progress, enhance operational efficiency, and address evolving business requirements (Boehm & Jain, 2019). It often involves substituting obsolete technology, transitioning to cloud-based solutions, or incorporating new features into current systems (Boehm & Jain, 2019). The modernisation process include evaluating the existing IT landscape, pinpointing areas necessitating improvement, and formulating a plan for efficient implementation of changes (Fitzgerald et al., 2014). It may include re-architecting, reconstructing, or substituting old systems according to the organization's unique requirements and objectives (Fitzgerald et al., 2014).

Change management is essential in system modernisation, since it entails substantial modifications to processes, systems, and workflows (Fitzgerald et al., 2020). Addressing possible opposition from workers and stakeholders is crucial by offering training, communication, and support throughout the modernisation process (Fitzgerald et al., 2020). Organisations may get greater efficiency, enhanced data management, expanded scalability, and superior integration with upcoming technologies by modernising their systems (Boehm & Jain, 2019). It allows organisations to use sophisticated analytics, automation, and digital transformation to foster innovation and achieve a competitive advantage (Boehm & Jain, 2019).

System modernisation in management information systems include the implementation of new systems or the enhancement of existing ones to augment efficiency, functionality, and alignment with contemporary business requirements. It entails modifying processes, regulations, and standards to use new technology and meet changing needs. Modernising systems allows organisations to improve performance, use new technology, and foster creativity.

1.2 Process Optimization

Process optimisation within Management Information Systems (MIS) entails enhancing and refining the workflows, rules, and standards associated with the system's operation and administration. Its objective is to improve efficiency, effectiveness, and production by eradicating redundancies, minimising mistakes, and optimising the system's capabilities (Hammer & Champy, 2017). Process optimisation entails the analysis of current processes, the identification of improvement opportunities, and the implementation of modifications to attain superior outcomes (Dumas et al., 2018). Its objective is to eradicate superfluous procedures, mitigate bottlenecks, and enhance the overall quality of outputs and results (Dumas et al., 2018).

Organisations may boost efficiency, decrease expenses, promote interdepartmental communication, and elevate overall operational performance by optimising procedures (Dumas et al., 2018). Process optimisation often

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necessitates the use of tools and technology, including workflow management systems, process mining tools, robotic process automation (RPA) software, and low-code platforms (Dumas et al., 2018). These instruments allow organisations to automate manual operations, optimise processes, and enhance precision and uniformity (Dumas et al., 2018).

The process of optimisation is ongoing and iterative, since there is always potential for improvement. It necessitates meticulous organisation, analysis, and monitoring to discern areas for improvement and treat them efficiently (Dumas et al., 2018). Through the ongoing optimisation of processes, organisations may adjust to evolving business requirements, enhance resource management, and attain superior business outcomes (Dumas et al., 2018). Process optimisation in management information systems include the revision of workflows, rules, and standards to enhance efficiency, minimise mistakes, and optimise results. It is a perpetual and iterative process designed to optimise processes, improve cooperation, and attain superior business outcomes via the use of tools and technology (Dumas et al., 2018).

1.3 Performance of National Land Information Management Systems in Kenya

The National Land Information Management System, referred to as the Ardhisasa System, is a digital platform created by the Ministry of Lands and Physical Planning in Kenya (Government of Kenya, 2019). It seeks to transform land administration and registration procedures by offering a modernised and automated system for handling land records (Government of Kenya, 2019).

The Ardhisasa System functions as a comprehensive platform for diverse land transactions, including registration, valuation, surveying, adjudication, planning, and allocation. It supersedes the manual method of land administration, registration, and management, consolidating all ministries of the Ministry of Lands (Government of Kenya, 2019). The system enables users to establish individual or business accounts, which undergo verification and approval by the Registrar of Persons and the Companies Registry. It offers access to information pertaining to land, including land parcels, survey data, and geographical coordinates. Users are able to conduct searches, monitor land ownership, and visualise land use (Government of Kenya, 2019).

The adoption of the Ardhisasa System corresponds with the government's initiatives to enhance governance, transparency, and service delivery in land management. Its objective is to improve efficiency, reduce bureaucracy, and facilitate safe and dependable property transactions. The technology facilitates the digitisation of land records, therefore obviating the need for paper-based paperwork susceptible to corruption and fraud (Government of Kenya, 2019). Notwithstanding the accomplishments of the Ardhisasa System, obstacles have arisen in its execution. The obstacles include the intricacies of the implementation process, insufficient public knowledge and engagement, inadequate data and validation procedures, restricted accessibility for foreigners, system delays and congestion, and security issues (Government of Kenya, 2019). Initiatives are underway to tackle these difficulties and enhance the functioning, accessibility, and user experience of the Ardhisasa System.

1.2 Problem Statement

Land is a fundamental facilitator of Kenya's Vision 2030. Land is seen as a fundamental factor in social, economic, and political development. The State Department for Lands and Physical Planning is tasked with enhancing the livelihoods of Kenyans via effective land administration, fair access, secure tenure, and sustainable land resource management. Land investment may provide substantial profits when executed correctly, making it a profitable prospect for several investors. In Kenya, land records have historically been maintained using a paper-based system, which is susceptible to loss, deterioration, compromise, and inadequate use (Kwanya, 2019). The paper-based method has adversely impacted land administration operations, rendering them inefficient, time-consuming, unreliable, expensive, and ineffective over time. In Kenya, the paper-based land records include certificates of title, certificates of lease, survey plans, valuation reports, maps, mutations, land transaction receipts, and land sale agreements, among others. In 2007, the Kenyan government decided to automate all land records and transactions by creating and implementing a land information management system using big data technologies capable of storing extensive and varied land ownership and transaction data. This policy choice was reflected in the National Land Policy of 2009, which mandated the automation of land records and transactions (Wala, 2024).

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The push to digitise was informed by the government's desire to solve land administration-related problems such as land grabbing, followed by double allocation, poor filing system, absentee landowners, illegal land conversion, untitled lands, squatting, sale of government land, ethnic conflict, and compulsory land acquisition (Nyangweso & Gede, 2022). One of the key achievements of the land digitalization program in Kenya was the establishment of the National Land Information Management System also known as 'Ardhisasa System'. Ardhisasa provides a one-stop-shop for land transactions, where users can undertake several online land transactions such as land registration, valuation, surveying, adjudication, planning, and allocation. The development and implementation of Ardhisasa in Kenya has been fraught with challenges. A study by Muthama and Gateri (2024) indicate that the process of implementing Ardhisasa has been a complex and messy affair, with several challenges yet to be addressed. The study identified several issues, such as a lack of standardization in the country's existing land records, low digital literacy levels among elderly staff and landowners, inadequate planning to integrate existing manual records into the new digital system, corruption, fraud, and a lack of transparency (Muthama & Gateri, 2024).
In order to effectively solve these concerns, it is necessary to implement digital transformation interventions that include technical, procedural, data governance, and human-centred approaches within a comprehensive strategy. The implementation of System modernization and Process optimization intervention approaches aims to address several challenges concurrently in a more holistic manner.

1.3. General Objective
This study will assess the effect of system modernization and process optimization on the performance of the National Land Information Management System in Kenya with a focus on the Ardhisasa System.

1.4Research Study Questions
i. What is the effect of System modernization on the performance of the National Land Information Management System in Kenya?
ii. How does process optimization affect the performance of the National Land Information Management System in Kenya?

2.0 LITERATURE REVIEW
2.1 Theoretical Literature
2.1.1 Information Systems Success Model (ISSM)
The Information Systems Success Model (ISSM), formulated by Delone and McLean, originated in the early 1990s. The model was first developed to address the increasing need for a thorough framework to evaluate the effectiveness of information systems (IS). Delone and McLean sought to rectify the shortcomings of current models by integrating a wider array of success characteristics and examining their interrelationships (Delone & McLean, 1992).

The ISSM encompasses six elements of information systems success: information quality, system quality, service quality, system use intents, user happiness, and net benefits. Information quality pertains to the precision, pertinence, and promptness of the information supplied by the system. System quality pertains to the technical characteristics of the system, including dependability, usability, and adaptability. Service quality emphasises the help and assistance offered by the information systems staff. System use intentions indicate the degree to which users plan to utilise the system. User satisfaction denotes the subjective assessment of the system by users, while net benefits cover the advantageous results and advantages obtained from system utilisation. In the context of a research evaluating the impact of digital transformation on the performance of national land information management systems in Kenya, the ISSM would be very relevant. The model offers a thorough framework for assessing the efficacy of such systems by examining many variables of success. Utilising the ISSM, researchers may evaluate the quality of the information supplied by the system, the system's technological attributes, and user satisfaction (Kameri-Mbote & Kamau, 2019).
Furthermore, the ISSM facilitates an analysis of the interconnections among many elements of success. The model indicates that information quality, system quality, and service quality directly affect user satisfaction and use intentions, which subsequently influence the net benefits obtained from the system. Investigating these links enables researchers to get a more profound comprehension of the impact of digital transformation and the efficacy of the 'Ardhisasa System' on several aspects of success (Kameri-Mbote, & Kamau, 2019). Moreover, the ISSM offers a theoretical framework for evaluating the influence of digital transformation on the efficacy of information systems. As National Land Information Management Systems experience digital transformation, it is essential to comprehend how this change affects information quality, system usability, and user satisfaction. The ISSM provides a framework

to assess these elements and ascertain the degree to which the 'Ardhisasa System' has effectively met its intended goals.

2.1.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model, proposed by Davis (1989), elucidates the factors influencing user acceptance and utilisation of technology. The model indicates that consumers will evaluate perceived utility and perceived ease of use when determining the application and timing of a new technology. Perceived usefulness refers to the degree to which an individual feels that using a certain system improves their work performance and productivity, whereas perceived ease of use denotes the amount to which a person believes that employing a particular system requires little effort (Davis, 1989).The notion posits that people will embrace technology if it performs the required work successfully and efficiently. The limitation of TAM is its failure to account for factors like as cost, structural imperatives, and environmental influences that compel users to embrace technology. Park (2009) asserts that the Technology Acceptance Model (TAM) is an effective theoretical framework for elucidating and interpreting behavioural intentions around technology utilisation.

The Technology Acceptance Model (TAM) is a well recognised theoretical framework for comprehending the processes of IT adoption and use. It elucidates a significant portion of the variability in users' behavioural intentions about IT adoption and utilisation across diverse settings (Hong et al., 2006). It forecasts a user's acceptance of information technology and its use in the workplace (Au & Zafar, 2008) and elucidates the factors influencing user acceptance of various end-user computer technologies (Davis, 1986). The Technology acceptability Model (TAM) aims to elucidate the correlation between technological acceptability and adoption, and therefore, the behavioural intention to use it (Autry et al., 2010). It positions perceived usefulness (PU) and perceived ease of use (PEOU) as fundamental factors influencing system utilisation (Chen & Tan, 2004; Au & Zafar, 2008).

2.2 Empirical Literature Review

2.2.1 System modernization and Performance of National Land Information Management System

Kusmiarto, Aditya, Djurdjani, and Subaryono (2021) performed a research evaluating the digital transformation of land services in Indonesia, emphasising preparedness for this shift. They used the Digital Governance Assessment Framework (DGRA), particularly tailored for the land service sector, including nine fundamental indicators for assessment. The study included desk studies to identify relevant laws and technical specifications, with direct observations and comprehensive interviews with stakeholders to ascertain user requirements and assess the execution of current rules in land service procedures. An evaluation of land registration data from the Land Office of Yogyakarta City identified deficiencies in completeness, compliance, consistency, correctness, duplication, and integrity. The survey determined that overall preparedness for digital transformation need improvement, especially in Cyber Security, Privacy, and Resilience, which received low scores (1.0). Although Leadership and Governance, User-centred Design, and Public Administration Reforms attained relatively high scores (≥2.0), other essential domains, including Technology Infrastructure (1.7), Legislation and Regulation (1.4), and Data Infrastructure, Strategies, and Governance (1.8), were considered mediocre and require improvement. This study and the present research seek to enhance land information management systems via modernisation initiatives. This research examines the impact of system modernisation on the performance of the National Land Information Management System in Kenya, while Kusmiarto et al. (2021) investigate the preparedness for digital transformation of land services in Indonesia.

Todoruţ and Tselentis (2018) examined the influence of information and communication technologies (ICT) on public administration, emphasising the fast and varied transformations induced by digitalisation. The main emphasis of their article was to highlight the significance of digitalisation as a catalyst for generating public value in governance processes. The notion of e-government was adopted to modernise central and local public administrations, facilitating the provision of integrated, transparent, and secure public services to residents and enterprises. The researchers evaluated the E-Governance development Index (EDGI) at the European Union level, observing that Romania's performance falls below the EU average, indicating an urgent need to expedite the digitisation process for sustainable development. The Digital Economy and Society Index (DESI) was also cited, which assesses EU member states in five critical domains: connectivity, human capital, internet utilisation, digital technology integration, and the delivery of digital public services. Their research methodology included a documentary and comparative study of data from EU papers and statistics pertaining to the function of ICT. The research advised the Greek government to strategically improve public services via e-government implementation, foster the use of e-government services, and optimise the

use of ICT in governmental operations. The research largely focusses on the European setting but does not directly address the unique issues encountered by Kenya in modernising its National Land Information Management System. The present study seeks to assess the impact of system modernisation on its performance in Kenya, but Todoruţ and Tselentis (2018) do not explore the actual execution of e-government efforts or the particular challenges faced by poor nations.

2.2.2 Process optimization and Performance of National Land Information Management System

A research by Mwangi (2018) investigated the establishment of an integrated land information management system in Kenya, crucial for the efficient collection, administration, and dissemination of data about land ownership, use, and valuation. The system is structured to tackle four fundamental components: land tenure, land value, land usage, and land development. The development process adheres to a structured System Development Life Cycle, including planning, analysis, design, and implementation stages. Diverse techniques were examined, including the Waterfall Model, Prototype Model, Spiral Model, and Unified Process Model, among others. The Unified Process Model was selected because of its iterative, incremental, and architecture-focused attributes. Factors impacting this decision were ambiguous user needs, technological familiarity, complexity, dependability, and project timelines. The study used a survey approach including customers and personnel from eleven districts with land offices, indicating a pronounced need for a comprehensive system that integrates all essential Ministry functions. A web-based prototype was subsequently created and executed for designated regions in Nairobi County. The development faced challenges such as obtaining political support, ensuring departmental dedication, forming a project management team, managing change, dealing with extensive land records, complying with legal and institutional mandates, safeguarding land information security, and adapting to swiftly changing technology and costs. The research yielded a prototype suitable for implementation by the Ministry of Lands. Mwangi's research focusses on developing an integrated system, while the present study evaluates the impact of modernisation on an existing National Land Information Management System.

A research conducted by Mutsune (2023) examined the impact of monitoring and evaluation (M&E) methodologies on the implementation of National Lands Commission projects in Nairobi City County, Kenya. The study used institutional, stakeholder, and realistic assessment theories and implemented a descriptive research technique with 66 participants, including project managers and team members. Data was gathered with standardised questionnaires and analysed through qualitative and quantitative methodologies, including theme analysis and descriptive statistics. The results demonstrated that monitoring and evaluation planning, stakeholder involvement, staff competence, and budget distribution substantially enhanced project implementation. The research highlighted that efficient monitoring and planning improve decision-making by elucidating goals and fostering cooperation with M&E partners, hence reducing dependence on external specialists. Project managers are advised to delineate project limits and goals, explain necessary actions, and evaluate stakeholder requirements to comprehend their impact. Furthermore, delineating a precise budget for monitoring and evaluation is crucial for effective project execution. Mutsune's research seeks to enhance procedures within the Kenyan National Lands Commission, concentrating especially on projects in Nairobi City County, hence limiting its applicability to the wider context of the National Land Information Management System modernisation in Kenya. It also fails to address the specific issues associated with developing monitoring and evaluation processes for technology initiatives.

Mucheke (2017) undertook a research to examine the factors contributing to the ineffective implementation of e-conveyancing in Kenya and to evaluate the adequacy of the current legislative framework in supporting it. The study used case study and descriptive methodologies, collecting qualitative data via library and field research. Data was gathered from workers of the Ministry of Lands and Physical Planning, the National Land Commission, consumers, and members of the public using self-administered questionnaires designed for various respondent categories. The literature study examined many theories about the adoption of information and communication technology (ICT) and e-government, including the Unified Theory of Acceptance and Use of Technology, to ascertain elements that promote the acceptance of new technologies. Critical results identified substantial obstacles, such as inadequate stakeholder engagement, insufficient user training, deficient legal frameworks for e-conveyancing, conflicts of interest, and inadequate system security. The research determined that the main impediments to e-conveyancing are an insufficient legal framework and conflicts of interest, which lead to ineffective project management and user opposition. The report advised the Law Reform Commission and the Legislature to revise land and contract laws in Kenya to enable the use of digital signatures and electronic contracts for transactions involving immovable property. Mucheke's

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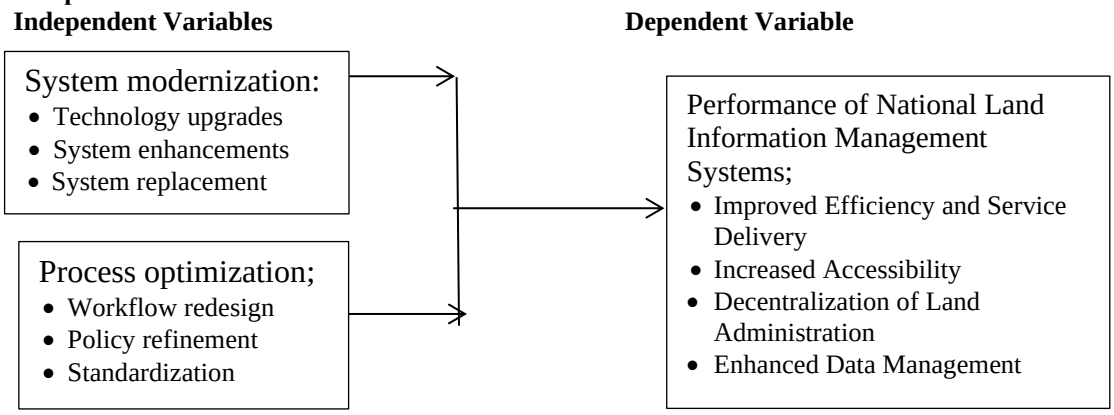
research concentrates on the legal and user-related problems of e-conveyancing, while the present study investigates the larger idea of system modernisation for the National Land Information Management System, addressing several topics beyond e-conveyancing alone.

2.3 Conceptual Framework



3.0 RESEARCH METHODOLOGY

3.1 Research Design

Kombo and Tromp (2006) define research design as the structured framework that outlines the methodical approach for conducting the investigation. Malhotra (2004) asserts that a research design offers a comprehensive framework that delineates the structure of the study to fulfil its goals. This research employs a descriptive design. The descriptive research approach was deemed suitable since it offers a precise representation of the features of a specific event or real-life scenario (Kothari, 2014). Descriptive design is pertinent when a researcher aims to formulate a theory, discover issues with existing practices, defend present practices, make evaluations, or ascertain the actions of others in comparable circumstances (Ordo, 2009). This study aims to gather data demonstrating the impact of Digital Transformation on the Performance of National Land Information Management Systems in Kenya and to depict the current state of affairs; hence, a descriptive research methodology has been used (Ordo, 2009).

3.2 Target population

The target population or universe denotes the comprehensive enumeration of all products or persons sharing at least one common characteristic within any academic discipline (Kothari, 2011). Consequently, the population constitutes the biggest group from which the research samples are derived (Sekaran & Bougie, 2013; Ordo, 2009). The subjects of examination in this paper are the National Land Commission and the Ministry of Land, Housing, and Urban Development. The subjects of observation will be the clientele and personnel employed at these two institutions. Consequently, the target demographic would include all personnel employed at the National Land Commission Nairobi Office and the Ministry of Land, Housing and Urban Development, together with their customers in Nairobi County. The National Land Commission (2022) data indicates that an average of 21 persons visit each country land office daily. The National Land Commission now employs 549 personnel in 11 departments (National Land Commission 2022). The Ministry of Lands and Physical Planning employs 1,431 personnel across five directorates. The entire target population was 1980.

3.3 Sample and Sampling Technique

A sample constitutes a collection of observations extracted from a population using a specified methodology. Cooper and Schindler (2014) define a sample as a portion of the population that accurately represents the full population under investigation. Sampling is the methodical selection of a representative subset of items from a defined target population (Kothari, 2011; Cooper & Schindler, 2014). Sampling is the process of choosing an appropriate sample, or a representative segment of a population, to ascertain the parameters or characteristics of the whole population (Creswell, 2009). The sample size was determined using the formula by Cochran and Snedecor (1989) and the sample size determined as:

$n = N / (1 + Ne^2)$

$n = 1980 / (1+1980(0.1)^2) = 96$ sample size

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Where:
n = sample size,
N = is the population size and,
e = is the level of precision which is 10%; at 95% confidence level and p is assumed to be = .5
The research will use stratified random selection to obtain a sample of 96 participants. Stratified random sampling is a probability sampling method that minimises bias by assuring proportionate representation of all subgroups within the population. Stratified random sampling entails dividing the research population into several groups (strata). The strata in this research consisted of many departmental categories within the National Land Commission Office and the Ministry of Land, Housing, and Urban Development.

Data stratification or categorisation is often conducted based on the shared characteristics of individuals within a research group (Russell, 2013). The sampling technique reduced selection bias. Stratification of sample size ensures that the sample accurately reflects the research population. To arrive at a representative sample per category the following formula was used:
*Total population per category / Total population * Total sample size*.
*For example: Directorate of Land Administration =333 / 2,001*95 = 15.81 =* ***16***
The proportion of each departmental category was used to determine their share of the sample size and due to rounding off of sample size per categories, the total sample size for the study was 101.

Table 1: Sample Size

Institution	Category	Study population	Sample Size
National Land Commission	Audit & Risk Management	44	2
	Finance & Administration	34	2
	Human Resource Management	32	2
	Information and Communication Technology	54	3
	Land Administration	62	3
	Land Information Management System	53	3
	Land Use Planning	59	3
	Legal Affairs & Enforcement	29	2
	Natural Resource	54	3
	Research	34	2
	County Coordinators and Assistants	94	5
Ministry of Land, Housing and Urban Development	Directorate of Land Administration	333	16
	Directorate of Physical Planning	332	16
	Directorate of Survey	306	15
	Land Registration	228	11
	Land Adjudication and Settlement	232	11
Total		**1980**	**101**

3.4 Pilot Study

Sekeran (2003) asserts that a pilot research is essential for evaluating the reliability of the questionnaire. Cooper and Schindler (2003) assert that a pilot test is performed to identify deficiencies in design and equipment and to provide proxy data for the selection of a probability sample. This pilot study allowed the researcher to assess the instrument's reliability and validity. Connelly (2008) said that an adequate study sample for a pilot research should include a minimum of 10% of the anticipated sample size. Consequently, this research will do a pilot study using 10% of the sample population. The participants in the pilot research will be excluded from the final study. A pilot research assists

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in identifying questions that may be unclear to respondents; if unaddressed, these ambiguities may result in unexpected responses.

3.5 Data Analysis and Presentation

The data preparation will occur prior to processing the replies from the completely completed surveys, including editing, coding, data entry, and cleaning. The research generates both quantitative and qualitative data. Quantitative data will be coded and recorded using the Statistical Package for the Social Sciences (SPSS Version 25) and analysed using descriptive statistics. The statistical methods used will aid the researcher in delineating the data and assessing the respondents' degree of agreement with the various assertions associated with each constituent. Descriptive statistics will be used, including absolute and relative percentages with indicators of central tendency. Tables and figures will be used to analyse the quantitative data, which will thereafter be presented in continuous prose. The researcher will do a multiple regression analysis to determine the strength of the association between the dependent and independent variables. The regression model that will be used is:

$\mathbf{Y}=\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \alpha$

Where **Y** = Performance of National Land Information Management System

β_0 = beta constant; ($\beta_1 - \beta_4$) = The coefficient for the various independent variables

X_i representing: X_1, X_2, X_3, X_4

X_1 = System modernization; X_2= Process optimization;mX_3 = People development; X_4 = Data management; α =error term

4.0 DATA ANALYSIS AND RESEARCH RESULTS

4.1 Demographic Characteristics

The study sought information on respondent's demographic characteristics as enumerated in Table 2.

Demographic Profile		Frequency	%
Gender Distribution	Male	38	47.5
	Female	42	52.5
Age Distribution	26-35 years	16	20%
	36-45 years	21	26.3%
	46-55 years	31	38.7%
	Over 55 years	12	15%
Work Experience	1-5 years	12	15%
	6-10 years	38	47.5%
	11-15 years	22	27.5%
	Above 16 years	8	10%

The results show that the sample is fairly balanced in terms of gender, with 47.5% of the respondents being male and 52.5% being female. This suggests that the study has a reasonably representative sample of both genders. The gender balance of the sample has implications for the generalizability of the findings. If the sample were heavily skewed towards one gender, it would be difficult to draw conclusions about the population as a whole. However, with a fairly balanced sample, the findings are more likely to be representative of the population. The results show that the majority of employees are between the ages of 36 and 55, with 38.7% of employees in the 46-55 age range and 26.3% in the 36-45 age range. This suggests that the workforce in these organizations is relatively mature. The age distribution of the employees has implications for the experience level and knowledge base of the workforce. Older employees are likely to have more experience and institutional knowledge, while younger employees may be more up-to-date on the latest trends and technologies. The results show that the respondents with work experience between 1 and 5 years were 15%, those with 6 and 1 years of work experience, were 47.5%, while those with 11-15 year category were 27.5% and finally those with work experience above 16 years were 10%. This suggests that the workforce in these

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organizations is relatively experienced, with a good mix of employees with mid-level and senior-level experience. The work experience of the respondents has implications for their knowledge and skills, as well as their potential for career advancement. Employees with more experience are likely to have a better understanding of the organization's operations and procedures, and they may also have developed specialized skills that are valuable to the organization.

4.2 Correlation Analysis

The study first determined the relationships among the study variables. The association between the independent variable and the performance of the National Land Information Management System in Kenya were determined through correlation coefficient. The relevant results are presented in Table3

Table 3: Correlation of Study Variables

Variable		System modernization	Process optimization
System modernization	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	80	
Process optimization	Pearson Correlation	.430**	1
	Sig. (2-tailed)	.000	
	N	80	80
Performance	Pearson Correlation	.575**	.399**
	Sig. (2-tailed)	.000	.000
	N	80	80

The results in Table 3 show that the association between System modernization, Process optimization and Performance of National Land Information Management Systems. The correlation coefficient between system modernization and performance is 0.575, which is statistically significant ($p < 0.01$). This indicates a strong positive relationship, suggesting that improvements in system modernization are associated with enhanced performance of the 'Ardhisasa System'. As the system becomes more modernized, it likely provides better services and functionalities, leading to improved outcomes. The correlation coefficient for process optimization and performance is 0.399, also statistically significant ($p < 0.01$). This indicates a moderate positive relationship, suggesting that optimizing processes within the system contributes to better performance. Efficient processes can reduce delays and improve service delivery, which is crucial for the effectiveness of land management.

The correlational analysis results are in-line with Opondo (2021) who conducted research that aimed to examine the impact of leading and managing change on the performance of land administration function in Kenya. The research found that the act of leading and managing change has a positive and statistically significant impact on the performance of the Land Administration and management function in Kenya. The research suggests that the senior executives in both organisations should develop and execute initiatives with the goal of inspiring, incentivizing, and fostering innovation and creativity among the staff. Furthermore, the report suggests that both the Ministry and the NLC should endeavour to augment the funding allocated for staff training. This training will provide personnel with the necessary skills to effectively perform their tasks, hence enhancing service delivery. The study suggested that there should be a holistic approach to digital transformation that encompasses system modernization, process optimization, people development, and data management is essential for enhancing the performance of land administration function in Kenya.

4.5.2 Multiple Regression Analysis

The purpose of this study was to examine the influence assess the effect of System modernization and Process optimization on the performance of the National Land Information Management System in Kenya with a focus on the Ardhisasa System.

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Table 4: Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
				R Square Change	F Change	df1	df2	Sig. F Change
.599[a]	.359	.342	.53559	.359	21.524	2	77	.000

a. Predictors: (Constant), System modernization, Process optimization

The value of R = 0.599 indicates a strong positive correlation between the independent variables (system modernization, process optimization) and the performance of the system. This suggests that as these System modernization and Process optimization factors improve, the performance of the National Land Information Management System is likely to enhance as well. Adjusted R Square: The Adjusted R Square value of 0.342 adjusts the R Square value for the number of predictors in the model. This value is slightly lower than R Square, reflecting the model's ability to explain the variance while accounting for the number of predictors. An adjusted R Square of 0.342 indicates a strong model fit, suggesting that the System modernization and Process optimization (independent variables) collectively contribute significantly to explaining performance. The coefficient of determination adjusted R^2= 0.342 which implies that digital transformation explains 34.2% of the variance in performance of the National Land Information Management System in Kenya with a focus on the Ardhisasa System. This result shows a strong influence of System modernization and Process optimization on performance of the National Land Information Management System in Kenya with a focus on the Ardhisasa System. By understanding these relationships, stakeholders can make informed decisions to enhance the system's effectiveness and ensure it meets the needs of its users.

Table 5: ANOVA Results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	12.349	2	6.174	21.524	.000[b]
Residual	22.088	77	.287		
Total	34.437	79			

a. Dependent Variable: Performance of National Land Information Management Systems
b. Predictors: (Constant), System modernization, Process optimization

The ANOVA (Analysis of Variance) results presented in Table 5 provide insights into the overall significance of the regression model used to assess the impact of System modernization and Process optimization on the performance of the National Land Information Management System in Kenya. The F statistic is a ratio of the mean square of the regression to the mean square of the residual. The statistically significant F statistic (22.458) and the associated p-value (0.000) indicate that the regression model is effective in explaining the variance in performance. This suggests that the independent variables collectively have a meaningful impact on the performance of the system. The ANOVA results provide strong evidence that System modernization and Process optimization variables significantly impact the performance of the National Land Information Management System in Kenya.

Table 6: Regression Coefficients for Performance

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	**Std. Error**	**Beta**		
(Constant)	.986	.411		2.399	.019
System modernization	.496	.101	.495	4.891	.000
Process optimization	.178	.096	.186	1.843	.069

a. Dependent Variable: Performance of National Land Information Management Systems

Table 6 shows the multiple regression Coefficients results for each of the System modernization and Process optimization on the performance of the National Land Information Management System in Kenya with a focus on the Ardhisasa System. From Table 6, the overall regression model considering the coefficient is as shown below:

Performance of National Land Information Management Systems =0.986+ 0.496X_1 + 0.178X_2

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The study found that the System modernization (X_1), Process optimization (X_2) were positively related to the performance of the National Land Information Management System in Kenya with a focus on the Ardhisasa System. Analysing the regression coefficients as shown in Table 6, it becomes apparent that holding all factors constant, the performance of the National Land Information Management System would be .986. This signifies that a one-unit change in System modernization is linked to a 0.496-unit rise in performance of the National Land Information Management System, while a one-unit change in Process optimization is linked to a 0.178-unit rise in performance of the National Land Information Management System.

These study results concur with Kuria, Ngigi, Gikwa, Mundia, and Macharia, (2016) who assessed A web-based pilot implementation of the africanized land administration domain model for Kenya—a case study of Nyeri County. The key outputs of this work were the Africanized Land Administration Domain Model (A-LADM) and pilot Land Administration System (LAS). The pilot solution uses a web centric solution, with the data stored and managed centrally from a PostGIS database backend, using the Python Django framework to implement the server side and client-side frontend. This solution demonstrates the importance of automating processes and supporting standards based software development. The strong significant correlation suggest that automating processes and supporting standards based software development are all important factors that contribute to the performance of the system. Stakeholders should prioritize these areas to enhance overall system effectiveness. Further stakeholder participation is key when implementing systems and 2 workshops are held to capture requirements and validate the developed solution.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This study assessed the effect of System modernization and Process optimization on the performance of the National Land Information Management System in Kenya with a focus on the Ardhisasa System. In conclusion, the modernization of the 'Ardhisasa System' has effectively improved user satisfaction, system reliability, and overall performance, reflecting a successful upgrade. Nonetheless, the variability in user responses, especially concerning productivity, suggests that there are specific areas needing further enhancement. Positive feedback on the user-friendly interface indicates that additional training and support could further elevate user experience and satisfaction levels. Furthermore, the observed lower mean and higher variability in productivity responses highlight the necessity for the management team to explore barriers that hinder users from achieving optimal productivity. Collecting qualitative feedback will be crucial in identifying these challenges more clearly. However, to fully capitalize on the benefits of modernization efforts, targeted attention to identified areas for improvement is essential. Continuous efforts to enhance the system will ultimately lead to greater user satisfaction and productivity.

In conclusion, this study successfully investigates the impact of System modernization and Process optimization on the performance of the National Land Information Management System in Kenya, specifically focusing on the Ardhisasa System. The multiple regression analysis demonstrates a strong positive correlation (R = 0.599) between key System modernization and Process optimization and system performance, indicating their collective importance. The adjusted R Square value of 0.342 reveals that these factors account for approximately 34.2% of the variance in system performance, highlighting their significance in driving effectiveness. Increases in system modernization and process optimization, correlate with respective rises in performance of 0.496 and 0.178 units. These findings emphasize the critical need for stakeholders to adopt and implement robust process optimization and system performance strategies to enhance the overall effectiveness of the National Land Information Management System in Kenya. Ultimately, the results provide compelling evidence that improving these process optimization and system performance elements will significantly elevate system performance, ensuring it effectively meets user needs and expectations.

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