Assessment of the Procedures for Land Registration and Documentations on the Geographic Information System (Gis) in Abuja, Nigeria

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Abstract*— Geographic Information Systems (GIS) play a critical role in effective urban planning. Access to reliable and adequate geo-information constitutes a fundamental driver of economic growth and sustainable development in any nation. This study assesses the procedures for land registration and documentation within the Geographic Information System framework in Abuja, Nigeria. The study adopted simple descriptive statistical techniques, including frequency analysis, percentage distribution, and content analysis. Data were collected through questionnaires administered using a simple random sampling technique, ensuring that a reasonable proportion of the population had an equal opportunity of being selected for the sample. The findings reveal that functional land tenure systems exist within the Abuja Geographic Information System (AGIS). Specifically, the land tenure systems in the area are well defined and easy to understand, promote equitable access to land, and indicate that traditional land tenure systems are perceived to be more effective than statutory systems in resolving land-related disputes. Furthermore, the land information system operated through GIS was found to be reliable and relatively up to date. The study also established that clearly defined procedures for land registration and documentation are in place, with evidence that government agencies provide adequate institutional support during the land documentation process. Based on these findings, the study recommends the need to enhance public awareness and simplify existing procedures. Regular community sensitization programs should be organized to educate stakeholders on the structure, clarity, and benefits of land tenure systems. In addition, land registration procedures should be streamlined to accommodate varying literacy levels and encourage wider participation. Improving the accessibility and reliability of the Land Information System (LIS) is also essential and can be achieved through sustained investment in system infrastructure to enhance reliability and user access. Expanding targeted training programs for diverse user groups will further build capacity, increase system utilization, and address identified technical and financial challenges. Finally, addressing corruption and promoting affordability are crucial; this requires the implementation of robust anti-corruption measures within land management agencies, transparent fee structures, strong accountability mechanisms, and the subsidization of land registration fees for vulnerable groups to ensure equitable access to land registration services.

Keywords*— Assessment Procedures, Land Registration, Documentations, Geographic Information System (GIS), Abuja, Nigeria.

I. INTRODUCTION

Nigeria operates a notably weak land administration system (Ukaejiofo, 2020). Several scholars have observed that, despite Nigeria's vast landmass of approximately 924,768 square kilometres, the country lacks the requisite institutional and technological infrastructure to derive optimal benefits from effective land administration. Although the nation is richly endowed with land resources, the potential of land as a catalyst for sustainable development remains largely underutilized. Mabogunje (2016) contended that effective land administration in Nigeria is severely constrained because over 70% of land has not been surveyed or registered with State Ministries, and only about 3% of the estimated 20% of urban land has been properly mapped. Consequently, comprehensive land administration remains elusive. Similarly, Ukaejiofo (2019) reported that between 2010 and 2015, less than 10% of Nigeria's total land area could be linked to well-documented records of land use and ownership. This situation reflects the absence of comprehensive cadastral maps for most cities and towns, leaving a significant proportion of land use outside the effective control and management of government institutions. Open and transparent land administration systems, however, have been shown to reduce reliance on court-based dispute resolution by enabling simple, evidence-based administrative mechanisms for resolving land disputes (Streudler, 2014). Geographic Information Systems (GIS) are indispensable tools for modern urban planning. Access to reliable, accurate, and sufficient geo-information serves as the driving force behind

economic growth and sustainable development in any nation. In most developed countries, over 80% of rational planning, resource allocation, and environmental management decisions are informed by high-quality spatial data. Achard et al. (2015) emphasized that the application of GIS in monitoring environmental changes such as deforestation and urban expansion significantly saves time and financial resources. They further highlighted that GIS enables environmental changes to be measured consistently across multiple spatial and temporal scales. Anastasio and Bodzin (2006) reinforced this position by describing GIS as a valuable tool for understanding environmental processes and supporting responsible decision-making. They concluded that, in the absence of GIS, the measurement and assessment of forest cover and land use would be less accurate and considerably more time-consuming. Wilkie and Finn (2016) further noted that Remote Sensing and GIS constitute powerful tools for analyzing land use and land cover changes, as well as terrain characteristics. Unlike traditional approaches, GIS allows for the analysis of spatial relationships between land use and forest geography across extensive areas using single image captures. Additionally, GIS facilitates the derivation of critical spatial data products such as elevation, slope, and aspect from digital terrain models (DTMs). Remotely sensed data also enable synoptic analyses of Earth system functions, patterns, and changes at local, regional, and global scales, thereby bridging the gap between localized ecological studies and broader conservation and biodiversity management initiatives.

From a geographical perspective, the twentieth century is widely regarded as the century of urbanization. Although urban growth began earlier in certain regions, it evolved into a global phenomenon during this period. Urban populations have expanded at nearly twice the rate of overall population growth, with approximately half of the world's population residing in urban areas by 2010, compared to less than 5% in the 1800s. This transformation has been driven by several factors, most notably the shift from agrarian economies to service- and market-based systems (Knox et al., 2023). Toward the latter half of the twentieth century, urbanization trends shifted significantly from developed to developing countries. Indeed, many developing nations are experiencing the fastest rates of urban growth ever recorded. In the 1950s, 20 of the world's 30 most populous cities were located in developed countries (Knox et al., 2023); by 2010, however, 18 of these cities were situated in developing regions (Demographia World Urban Areas & Population Projections, 2010). Projections indicate that global urban populations will continue to increase, nearly doubling between 2010 and 2050, when approximately 6.4 billion people are expected to reside in urban areas. Notably, this growth is projected to occur predominantly in developing countries (World Urbanization Prospects, 2017).

Statement of the Problem

The persistent underdevelopment of many third-world countries, including Nigeria, can be attributed to a combination of factors such as poor-quality data collection, inadequate data organization and management practices, and limited technical capacity for sustainable environmental management. The consequences of these deficiencies are evident in widespread air and water pollution, environmental degradation, increased disease prevalence, and premature mortality. These challenges underscore the critical weaknesses in land information and data management systems in Nigeria. In response to these issues, this study seeks to examine the role of Geographic Information Systems (GIS) in land information management and assess their implications for land administration efficiency.

Rapid urban expansion has rendered manual recordkeeping systems inefficient, time-consuming, and susceptible to abuse. Although several attempts have been made in the past to address these challenges, many failed due to the underestimation of the problem's complexity and poorly defined project scopes. A major obstacle to the computerization of cadastral and land registry records has been the absence of strong political commitment from relevant authorities.

Effective land information management systems are expected to provide timely, accurate, and accessible land title and ownership information to stakeholders. However, land administration practices in most Nigerian states, as well as within the Federal Ministry of Works, Land and Housing, remain largely analogue. These systems are characterized by bureaucratic bottlenecks and human-induced inefficiencies that delay land title processing and perfection. Consequently, they discourage potential investors and impede national economic

development. Although some states and federal institutions have initiated efforts to computerize cadastral records, these initiatives fall significantly short of the standards required for a comprehensive land information management system.

Ifeanyichukwu et al. (2022) lamented that despite the well-documented benefits of land information computerization, only about 20% of Nigerian states have adopted ICT-based land administration systems. The urgency of improving land information management systems cannot be overstated, particularly in an era dominated by information and communication technology (ICT). Computerized land administration systems can facilitate faster title registration, prevent duplication of records, enhance access to land-related information, and incorporate built-in quality control mechanisms. Nevertheless, land title acquisition in Nigeria remains opaque, discouraging both domestic and foreign investors. Access to land information is limited, leading to substantial revenue losses for government. Even in states that have implemented partial computerization, only a fraction of land administration processes has been automated, resulting in continued delays and inefficiencies (Zevenbergen & Ploeger, 2019). There is, therefore, an urgent need to reduce land title processing time and improve documentation efficiency in Nigeria. Given that Ministries of Lands and Urban Development operate through multiple interdependent departments, enhancing interdepartmental coordination is essential for improved service delivery. However, achieving this requires a comprehensive review of existing processes to identify gaps and areas for improvement. Against this backdrop, this study assesses the GIS-based land information system for efficient land administration in Abuja.

Research Questions

This study seeks to address the following questions:

i. What are the existing land tenure systems?
ii. What are the procedures for land registration and documentation?

Objectives of the Study

The objectives of this study are to:

i. identify and examine the existing land tenure systems; and
ii. examine the procedures for land registration and documentation.

II. RELATED WORK

Conceptual Framework

Significant advancements have been recorded over time in the study and development of Cadastral Information Systems. In many countries, various initiatives have been undertaken to extend traditional cadastral systems to address emerging needs. These initiatives include the automation of administrative tasks, the development of applications for managing cadastral registers, the creation of analytical tools for producing digital cadastral maps and plans, the automation of land management processes for land consolidation, and the implementation of comprehensive land information systems. Elayachin and El-Hassane (2015) explained that the design and implementation of a digital cadastral system require an integrated approach that links cadastral operations with GIS platforms and supports multipurpose land administration systems. They proposed a three-level framework. At the first level, existing cadastral applications are thoroughly examined, and all modernization projects are critically analyzed. The second level focuses on identifying and evaluating various methods for linking cadastral data models with GIS software, highlighting the strengths and limitations of each method. The third level addresses the actual implementation strategy of the proposed system. Buragohain et al. (2012) developed a land information system for Guwahati City, India, using integrated Remote Sensing and GIS technologies. Their objective was to establish an advanced database management system for the city. The methodology involved digitizing maps of Guwahati and its surrounding areas, while industrial and infrastructural data included drainage networks, road and railway systems, and other urban facilities. Satellite imagery was processed and classified using supervised classification techniques to generate land use and land cover maps. Spatial and temporal changes in urban growth patterns were identified from the digital data. Subsequently, a plot-wise urban land use map was produced, with comprehensive ownership attributes assigned to each plot. The study culminated in the development of a decision support system that provided detailed information on individual plots and their attributes. The database was converted into a web-enabled format, allowing

customized queries and real-time access to land information through online platforms.

In Turkey, the cadastral system established in 1925 underwent several legal and organizational modifications that resulted in inconsistencies and a lack of standardization, particularly in the geometric aspects of cadastral data. Many cadastral maps lacked coordinate systems or used incompatible reference frameworks. Challenges associated with data quality, inconsistency, slow service delivery, and inadequate digital archiving necessitated reforms toward a computer-based cadastral information system. In response, researchers analyzed cadastral database requirements and designed a spatiotemporal database capable of supporting spatial, temporal, and spatiotemporal queries. The system adopted a Spatiotemporal Entity-Relationship (STEP) model combined with the Enhanced Entity-Relationship (EER) model. Oracle 8i Spatial was selected due to its spatial data handling capabilities, while MapInfo 6.0 GIS software was employed for graphical editing, display, manipulation, and analysis of cadastral data. The study resulted in a functional cadastral database into which land registry and cadastral data were successfully loaded.

Tella and Rably (2021) conducted a study that integrated historical and contemporary cadastral records to create a robust cadastral database known as the Virtual Multipurpose Data System (VMDS). The VMDS incorporated both geo-referenced spatial data and corresponding attribute information. Similarly, Reghavendran (2022) demonstrated how an automated cadastral mapping and land information system could be established. He identified two critical components of a cadastral information system: the spatial component, which describes parcel boundaries and spatial distribution, and the non-spatial component, which includes ownership details, tax values, and related attributes. Spatial data were managed using a spatial database engine (SDE), while non-spatial data were handled using MicroStation Geographic software. Oracle databases were employed for customized queries and report generation. The resulting cadastral information system enabled extensive analytical capabilities, subject to data availability and user requirements.

In Nigeria, Shuaibu (2008), in his study titled *"Cadastral Land Information System for Sustainable Land Conveyance in Bauchi State,"* converted existing analogue maps into digital formats using a digitizing tablet within an ILWIS environment. An automated attribute database was created in an ArcView environment, enabling spatial queries and analyses. The study successfully demonstrated the mapping of plots covered by certificates of occupancy, as well as residential, recreational, and commercial land uses. Similarly, in 1996, the Government of New Zealand mandated Land Information New Zealand (LINZ) to automate the nation's survey and title systems, integrate survey and title processes, digitize records, reduce compliance costs, adopt emerging technologies, and meet increasing public demand for improved cadastral services (Bevin, 2019). In Nigeria, the establishment of the Abuja Geographic Information System (AGIS) marked a significant transformation in land administration practices within the Federal Capital Territory. The analogue cadastre was digitized, and new certificates of occupancy were issued to existing land title holders. Prior to AGIS, land transactions in Abuja were plagued by duplicated titles, prolonged search processes, and poorly documented conveyances.

Land Administration

Despite the absence of formal recognition for customary land administration under the Land Use Act of 1978 (LUA) and the 1999 Constitution of the Federal Republic of Nigeria, customary land administration systems remain deeply entrenched and resilient. While the LUA provides a framework for land administration in urban areas (Babalola & Hull, 2019a; 2019b), its applicability in rural and peri-urban areas is limited. In these areas, land access and use are governed predominantly by African customary law, which encompasses long-standing, reasonable, and widely observed customs (Ndulo, 2011). Communities in rural and peri-urban settings depend largely on traditional authorities for land allocation and management. From a legal standpoint, customary law occupies an informal space, as it is not explicitly recognized by the Constitution. Consequently, customary and statutory land administration systems operate as a hybrid arrangement with minimal coordination or mutual recognition. Effective and efficient land administration systems supported by appropriate legal frameworks are essential for ensuring tenure security (Subedi, 2016; Ghebru & Okumo, 2016; 2017; Otubu, 2018). To guide land reform initiatives, researchers emphasize the importance of

understanding country-specific land administration contexts through conceptual frameworks. Hull and Whittal (2019) proposed the 3S conceptual framework—success, sustainability, and significance—which emphasizes human rights, pro-poor policies, and good governance in cadastral system development, particularly in relation to customary land rights.

Nigeria's land administration system has evolved over time, shaped by diverse stakeholder perspectives, including service providers, beneficiaries, and professionals. However, policy and institutional choices made over the years have created persistent gaps in service delivery. These challenges are exacerbated by dynamic social, cultural, political, legal, and economic environments. Land administration institutions face numerous constraints, including outdated hierarchical structures, bureaucratic inefficiencies, and high service costs. As a result, only a small proportion of the population participates in the formal land sector. Due to lengthy and expensive registration processes, only about 3% of land in Nigeria is formally titled. This situation disproportionately affects women and low-income groups, undermines the business environment, restricts access to finance through collateralization, and limits government knowledge of land ownership and use. Several studies, including those by the World Bank, rank Nigeria among the most difficult and costly countries for property registration. Many of these challenges stem from poor interpretation and implementation of the Land Use Act of 1978. In response, the Presidential Technical Committee on Land Reforms (PTCLR) was inaugurated in 2009 to reform land administration policies. Its mandate includes harmonizing land laws, supporting nationwide land registration, identifying possessory rights using modern technologies, establishing dispute resolution mechanisms, creating a national land title depository, standardizing land valuation systems, and promoting efficient and sustainable land administration.

Following pilot land titling programs in Ondo and Kano States, the PTCLR commissioned a nationwide study across 12 states and the Federal Capital Territory to assess land administration practices. The study involved stakeholder interviews and evaluated public engagement processes, land valuation and taxation, dispute resolution mechanisms, land rights recording systems, and land transaction procedures. A strategic review of land administration practices identified gaps between legal provisions and actual practices, assessed revenue generation mechanisms, examined existing technologies, and explored opportunities for developing a unified national land administration platform.

The Concept of Geographic Information System (GIS)

Geographic Information System (GIS) refers to a computer-based system designed to capture, store, manage, analyze, and display geographically referenced data related to features on the Earth's surface (James, 2014). GIS enables the acquisition and processing of spatial data such as roads, utilities, and land features, supports real-time monitoring of events, facilitates spatial data retrieval and visualization, and enhances mapping capabilities. GIS relies heavily on remote sensing technologies, which use aerial and satellite sensors to detect and classify objects on the Earth's surface through transmitted signals (Ahmed & Salihu, 2013). It also incorporates geographic profiling techniques, where spatial locations are digitally analyzed to produce probability surfaces indicating likely target locations (Rossmo, 2018). With the advancement of computer technologies, GIS has emerged as a powerful tool for addressing complex social, economic, and environmental challenges. It is now widely applied in earth sciences, environmental management, urban planning, and crime analysis (Radoff, 2023). Today, GIS constitutes a rapidly expanding global industry with increasing demand for skilled professionals, data, and software solutions. Many contemporary challenges—such as pollution, deforestation, overpopulation, natural hazards, and disease distribution—have strong spatial dimensions that can be effectively analyzed using GIS technology (Kabiru, 2021).

GIS is defined as a specialized information system that integrates hardware, software, data, and procedures for collecting, storing, retrieving, analyzing, and presenting spatial and non-spatial data. It functions as a database system, a cartographic tool, and a comprehensive spatial analysis platform (Jebur, 2022). Compared to conventional methods, GIS enables faster, more accurate map production and spatial analysis, thereby enhancing decision-making processes.

Applications of Geographic Information Systems

GIS enables the overlay and integration of multiple data layers for a given area, supporting informed decision-making processes such as site selection, environmental impact simulation, emergency response planning, and hazard analysis (Kabiru, 2022). In land management, GIS facilitates efficient data generation, storage, retrieval, and updating of land records, zoning plans, cadastral maps, and tax information. It supports land registration, land-use planning, and administrative boundary delineation (Jebur, 2021). GIS technologies are also widely applied in public utility planning and management, including water supply, electricity, gas, telecommunications, transportation networks, sewer systems, and emergency services. Environmental applications of GIS include forest modeling, air and water quality assessment, environmental zoning, and climate-related analyses. In archaeology, GIS supports spatial data management, site prediction modeling, landscape reconstruction, and cultural heritage management (Ahmed, 2019).

Furthermore, GIS plays a critical role in disaster risk assessment by identifying areas vulnerable to floods, earthquakes, landslides, droughts, and other hazards. It supports defense operations through integrated spatial intelligence and enables monitoring of sea-level changes, marine ecosystems, and groundwater resources. In agriculture, GIS and GPS technologies underpin precision agriculture by assisting farmers in making data-driven decisions based on spatial variability within farmlands, thereby improving productivity and resource efficiency. Overall, GIS remains a transformative technology with extensive applications across land administration, environmental management, urban planning, agriculture, and national development.

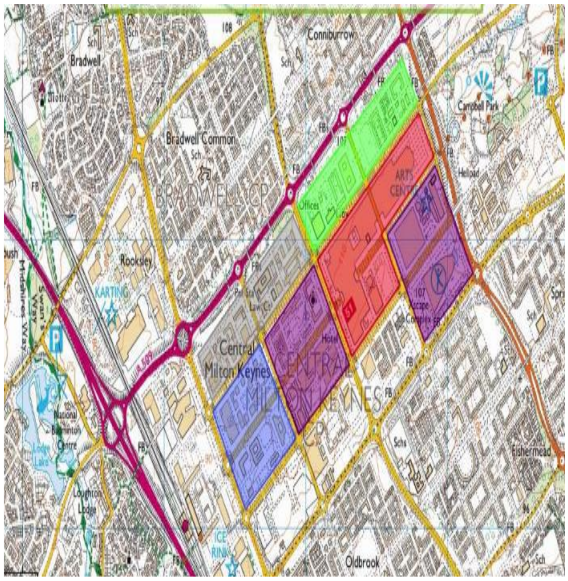

Fig. 1: A plan of land-use and cadastral mapping
Source: Abuja Geographic Information System (AGIS, 2024).

Technologies of geographic information systems are widely used for the planning and management of public services (as shown in the figure below). The typical uses of geographic information systems involve the management of the following utilities: gas, electric, water, telecommunication, roads, sewering network (as shown in the figure below), facilities of TV/FM, analysis of hazards, dispatch, and services emergency. Typical data that input involves a street network, demographic data topographic data, and boundary of the local government (Jebur, 2021).

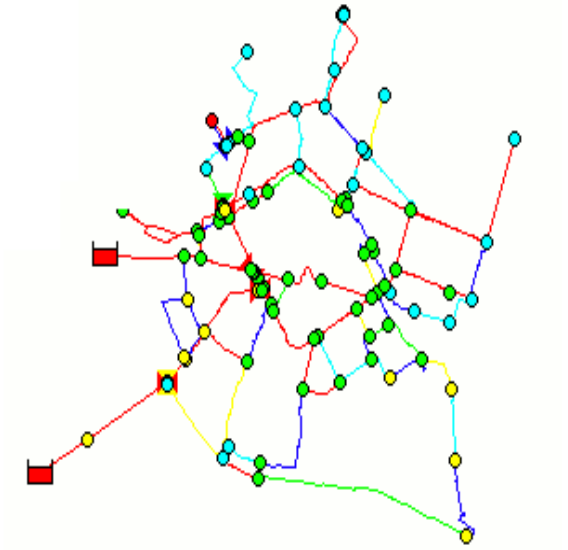

Fig. 2: A plan of sewering network.
Source: Abuja Geographic Information System (AGIS, 2024).

The geographic information systems have the ability for applying a variety of applications of the environmental field that extend from the simple query, inventory, analysis of map and overlay, to decision-making systems that be complex. Include such as modeling of the forest, monitoring, air/water quality modeling, mapping of the environmental zones, analysis of the interaction economic, change geological & hydrological, and meteorological. The data environmental that must be input into geographic information systems involve elevation, the cover of the forest, hydrogeology coverage, and soil quality (Jebur, 2021).

Archaeology has used geographic information systems in a variety of ways as a spatial system, where, use the applications of geographic information systems as database management for records archaeological, with the added advantage of being handy to design instant maps in the simplest level, It has been performed in the management of cultural contexts, where sites of archaeological are foretold using statistical models based on-site locations that previously identified. Also, it has been used as a tool in intra-site analysis and to simulate changes in past landscapes (as shown in the figure below) (Ahmed, 2019).

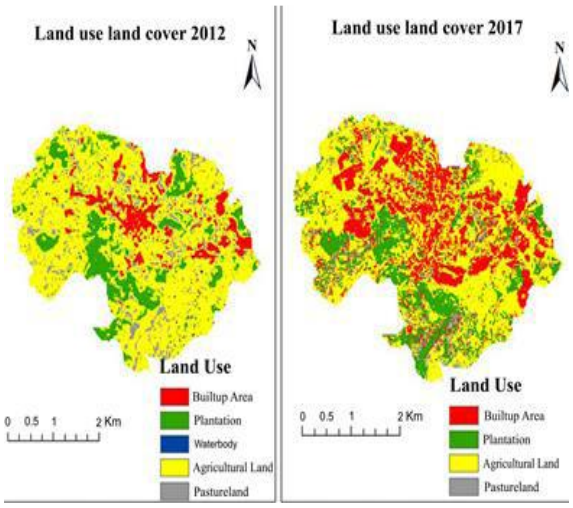

Fig. 3: Changes in past landscapes for five years
Source: Abuja Geographic Information System (AGIS, 2024).

The geographic information systems can study areas exposed to floods (as shown in the figure below), earthquakes, storms, cyclones, fire, drought, volcano, soil erosion, and landslides, therefore, it can accurately predict future accidents.

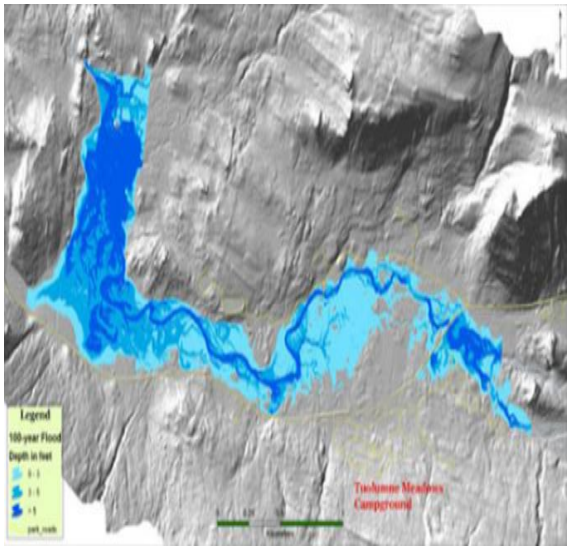

Fig. 4: Areas exposed to floods
Source: National Emergency Management Agency (NEMA, 2024).

Geographic information systems offer a practically unique ability to combined geographical data and analyze them, which further enhances and develops the intelligence base for operations of defense.

Geographic information systems enable the study of the change of sea-level (as shown in the figure below), the temperature of the sea surface, marine population, and coral reef ecosystem.

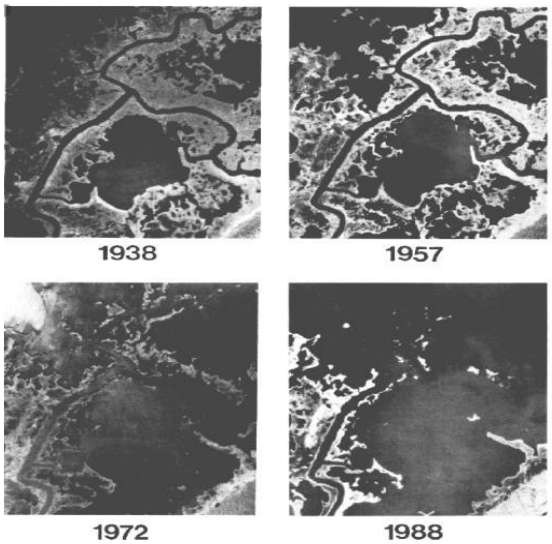

Fig. 5: Sea-level for deference years
Source: Global Sea Level Change Map (1938-1988).

Geographic information systems enable the spatial representation of resources of groundwater, quality of waste, management of the watershed, water pollution, and surface water management (Jebur, 2021).

The use of geographic information systems and GPS in the production of agriculture. Exactness agriculture is a catch-all expression that describes using technologies of geographic information systems and GPS to manage specific field areas. Technologies of exactness agriculture use information from various sources to aid farmers in decisions making about crop production and management based on the variability of the potential of production inside fields.

III. THEORY/CALCULATION

Modernization Theory

Modernization theory posits that urbanization in developing countries occurs as a result of industrialization, economic growth, and technological innovation that typically originate from urban centers and gradually diffuse to surrounding areas (Pacione, 2015). This theory emphasizes the importance of economic development, social progress, and the adoption of new technologies as key drivers of societal transformation. In the context of Geographic Information Systems (GIS), modernization theory provides a useful framework for understanding how spatial technologies can support development initiatives. GIS facilitates urban planning, infrastructure development, and resource allocation through precise spatial analysis, mapping, and visualization tools. By leveraging GIS, governments and planners can make data-driven decisions that enhance efficiency and effectiveness across multiple sectors.

Modernization theory focuses on social and economic progress. GIS supports this by tracking socio-economic indicators such as health, education, poverty, and income distribution, enabling policymakers to assess and promote societal development. Additionally, the theory highlights technological advancement as a major catalyst for progress. GIS represents a significant technological innovation in the collection, analysis, and visualization of spatial data, thus aligning with the theory's emphasis on modern tools for development.

Key principles of modernization theory, when applied to GIS, include:

Efficient Resource Allocation: GIS enables optimized spatial planning and resource management, ensuring effective use of land, water, energy, and other critical resources.

Data-Driven Decision Making: GIS provides platforms for the analysis and visualization of complex spatial data, supporting evidence-based policies and strategic urban development.

Technological Advancement: GIS is a state-of-the-art tool for spatial data management, facilitating modern approaches to land administration, planning, and governance.

Applications of Modernization Theory in GIS, Urban Planning, and Development:

1. Urban Planning and Infrastructure Development: GIS aids in designing efficient urban infrastructure, transportation networks, and public service systems. Planners can model and simulate urban growth, optimize land use, and identify priority development areas.
2. Resource Management: GIS supports the monitoring, analysis, and management of natural resources, including water supply, agriculture, forestry, and energy distribution, promoting sustainable utilization.
3. Disaster Management: GIS is instrumental in risk assessment, emergency response planning, and post-disaster damage evaluation, enabling timely interventions and improved resilience.
4. Environmental Sustainability: GIS facilitates environmental monitoring, conservation planning, and the implementation of sustainable development initiatives, such as tracking deforestation, soil erosion, and pollution.
5. Economic Development: GIS enhances business and investment planning by supporting market analysis, site selection, and infrastructure assessment, fostering economic growth and informed decision-making.

By integrating GIS within the framework of modernization theory, developing countries can harness spatial technologies to accelerate urbanization, improve governance, and promote sustainable socio-economic development.

IV. EXPERIMENTAL METHOD/PROCEDURE/DESIGN

Study Area Location and Size

Abuja is the Federal Capital Territory (FCT) of Nigeria, covering a total land area of approximately 7,315 sq. km. The Federal Capital City (FCC) itself is planned to occupy about 250 sq. km, while the

remaining area of the territory spans roughly 7,065 sq. km (AGIS, 2024). Geographically, Abuja lies between latitudes 8°50' and 9°10' N and longitudes 7°15' and 7°32' E. As a planned city, Abuja serves as the administrative and political center of Nigeria, having been constructed in the 1980s and officially designated the nation's capital on 12 December 1991, replacing Lagos (Wikipedia, 2018). The FCT was formed from parts of Niger, Plateau, and Kwara states.

Geologically, the territory is predominantly underlain by high-grade metamorphic and igneous rocks of Precambrian age, trending roughly NNE–SSW. These formations include gneiss, migmatites, granites, and schist belts along the eastern margin. The lowest elevation in the FCT is approximately 10 m above sea level in the extreme southwest along the Guraja River floodplain. The terrain rises irregularly toward the east, north, and northwest, with the highest elevations found in the northeast, where peaks exceed 760 m above sea level. Land administration in Abuja encompasses land registration, cadastre, valuation, and land inventory (AGIS, 2024). While traditional approaches to land administration often involve lengthy processes, the adoption of Geographic Information Systems (GIS) has provided innovative solutions that streamline operations and unlock previously untapped opportunities in the FCT.

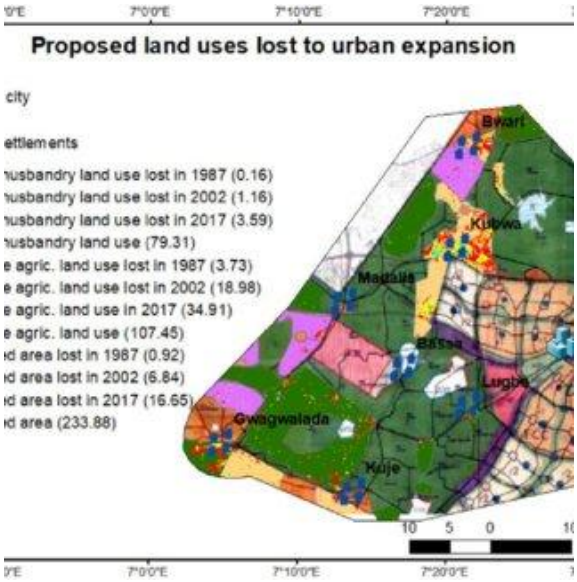

Fig. 6: Map of the Study Area
Source: Abuja Geographic Information System (AGIS, 2024).

Climate and Rainfall

Abuja experiences three distinct seasons. The hot and rainy season lasts from April to October, followed by a dry season from October to April, with a brief Harmattan season in between, characterized by dry, dusty winds from the Sahara and lower temperatures. During the rainy season, average daytime temperatures reach around 30°C (86°F), with relatively warm nights. In the dry season, temperatures can soar to 40°C (104°F) during the day and drop to as low as 12°C (54°F) at night. According to the Köppen climate classification, Abuja has a tropical wet and dry climate (Aw) (tripreport.com, 2024). Dense cloud cover during the rainy season can reduce temperatures significantly, particularly between July and August. Relative humidity in the dry season averages around 20% in higher elevations and northern areas and about 30% in the southern parts of the FCT.

Soil and Vegetation

The FCT is largely underlain by crystalline rocks, mainly granites and gneisses, and its vegetation is predominantly savanna, with pockets of forested areas (Pop, 2016). Soils are generally shallow and sandy across major plains, including Iku-Gurara, Roboes, and Roubochi, making them highly erodible. Some areas, such as the Gwagwa plains, have deep, clayey soils derived from gabbro and biotite granite, making them highly fertile and suitable for urban development. The FCT falls within Nigeria's Guinea Savanna vegetation zone. According to the 2012 National Population Commission estimate, the population of the Federal Capital City Area Council is 979,876 (NPC, 2012).

Research Design

This study employed a descriptive cross-sectional survey design to ensure the collection of reliable and comprehensive data. The research primarily relied on primary data obtained through structured questionnaires administered to legal landowners, as well as staff from GIS-related ministries and agencies.

Types of Data Sources

Both qualitative and quantitative data collection methods were used. The qualitative approach allowed for flexible interaction with respondents, enabling them to express their perspectives freely. The quantitative approach provided measurable data that facilitated clear analysis and comparison.

Data Collection Method
Data were collected using structured questionnaires. A descriptive cross-sectional approach was adopted, and data were subsequently analyzed using charts, graphs, and measures of central tendency.

Population of the Study
The estimated population of Abuja is 3,840,000 (Macrotrend, 2024). The study focused on legal landowners and personnel from land administration ministries and agencies.

Table 1: Population of Study

Serial Number	Name of Target	Number of Questionnaires Allocated
1	Federal Ministries associated with GIS and Land Administration	80
2	Legal Landowners	160
3	Licensed Land Consultants and Agents	60
Total		400

Sample Size and Sample Technique
Taro Yemeni's formula is been used to draw the sample. The derivation goes thus:
N= n/(1+n(e)2)
Where; N= Sample size, n= population under study, e= margin of error (0.05).
Therefore:
N= 3,840,000/(1+3,840,000(0.05)2)
= 3,840,000/9600.0025
= 399.999998
= 400
Four hundred (400) questionnaires were administered to the respondents and all were retrieved. On this note the researcher decides to distribute the questionnaires as scheduled below:
Serial Number Name of Target Number of Questionnaires Allocated
Federal Ministries Associated with GIS and Land administration. 80
Legal Land Owners 160
Licensed Land Consultants and Agents 60
TOTAL 400

Method of Data Processing
Data collected through the structured questionnaires were organized and processed systematically to obtain relevant information from various stakeholders related to the research topic.

Method of Data Analysis
Descriptive statistics were used to analyze the data. This approach is appropriate for non-experimental survey research and provides an effective way to summarize, present, and interpret the information collected from respondents.

V. RESULTS AND DISCUSSION

The Existing Land Tenure Systems

Table 2: Responses on the Existing Land Tenure Systems

S/N	Statement	Percentage (%)
1	Existing land tenure systems are well-defined and easy to understand	22
2	Current land tenure systems ensure equal access to land for all	16

S/N	Statement	Percentage (%)
3	Traditional land tenure systems are more effective than statutory systems	22
4	Government provides adequate support for land tenure systems	16
5	Existing land tenure systems protect vulnerable groups (women and youths)	24

Source: Author's Survey (2024)

The study examined the existing land tenure systems and their influence on Geographic Information Systems (GIS) based land administration, as reflected in responses from stakeholders involved in land management. The findings show that 22% of respondents perceive the existing land tenure systems as well-defined and easy to understand, suggesting moderate clarity in current practices. Furthermore, 16% of respondents indicated that the current land tenure systems ensure equitable access to land for all citizens. Interestingly, 22% of respondents reported that traditional land tenure systems are more effective than statutory systems in managing land-related conflicts. Additionally, 16% of respondents believe that the government provides sufficient support for the implementation of land tenure systems. Importantly, 24% highlighted that the current land tenure systems adequately protect vulnerable groups, such as women and youths, indicating partial inclusivity in land governance.

These results are consistent with the findings of Adeniyi (2023), who emphasized that communities informed about existing land tenure systems and acquisition processes can better ensure equal land access for women and youths, thereby promoting equity in land distribution.

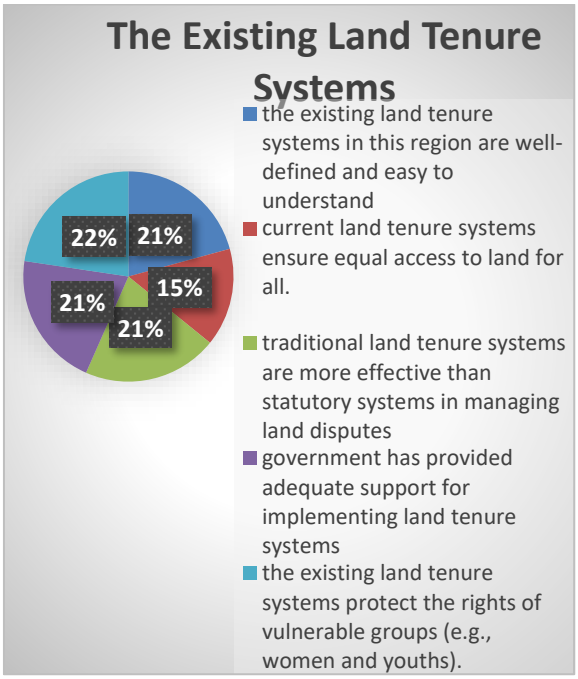

Fig. 7: The Existing Land Tenure Systems
Source: Author's Survey (2024)

The Procedures for Land Registration and Documentation

Table 4: Responses on Procedures for Land Registration and Documentation

S/N	Statement	Percentage (%)
1	Procedures for land registration are clear and straightforward	55
2	Corruption is a major challenge in land registration and documentation	61
3	Land registration procedures are affordable to the average citizen	52
4	Digitization has improved efficiency of land registration	50

S/N	Statement	Percentage (%)
5	Government agencies provide adequate support during documentation	40

Source: Author's Survey (2024)

The findings provide important insights into land registration and documentation practices in Abuja. A majority of respondents (55%) indicated that the procedures for land registration are clear and straightforward, suggesting a reasonably structured system. However, 61% of respondents identified corruption as a major challenge, indicating that unethical practices continue to compromise the efficiency and fairness of the registration process. Affordability remains a concern, as only 52% of respondents found the registration process reasonably priced, implying that nearly half of the population may face financial barriers to formal land registration. On a positive note, 50% of respondents acknowledged that digitization has improved the efficiency of land registration and documentation, highlighting the benefits of technological integration. Despite this, only 40% of respondents felt that government agencies provide adequate support during land documentation, signaling a need for capacity building, improved service delivery, and enhanced citizen support mechanisms.

Overall, the results underscore that while modernization and GIS integration are beginning to streamline land administration processes, significant challenges—including corruption, affordability, and inadequate institutional support—must be addressed to create a more effective and inclusive land registration system.

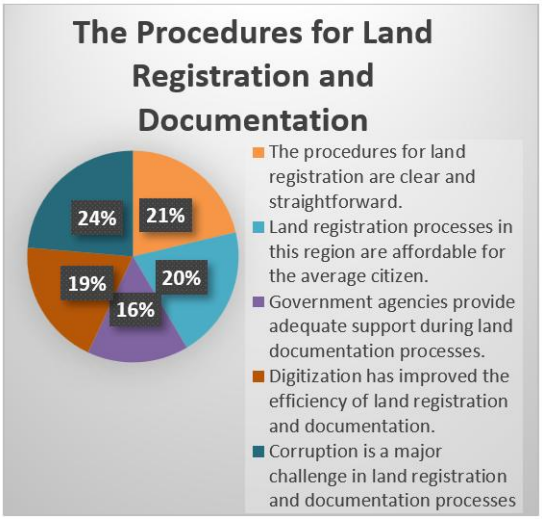

Fig. 9: The Procedures for Land Registration and Documentation

Source: Author's Survey (2024).

VI. CONCLUSION AND FUTURE SCOPE

Conclusion

Based on the findings of this study, it can be concluded that the existing land tenure systems in Abuja are generally well-defined and relatively easy to understand. However, a notable portion of the population still perceives these systems as complex or unclear, indicating a need for further simplification and clarification. Equal access to land under the current land tenure arrangements remains a concern. While some respondents acknowledged progress, the significant proportion of undecided or negative responses highlights persistent inequalities and challenges in the practical implementation of these systems.

Traditional land tenure systems were identified as more effective than statutory systems in resolving disputes, emphasizing the continued relevance of customary practices in regional land management. Although some respondents recognized government support for land tenure systems and the protection of vulnerable groups, overall feedback suggests that these areas require substantial improvement. The prevalence of undecided responses points to gaps in public awareness and inconsistent experiences with government interventions. Consequently, addressing these gaps through enhanced public engagement, awareness campaigns, and improved support mechanisms is crucial for strengthening the effectiveness of land tenure systems.

VII. RECOMMENDATIONS

Based on the findings of this research, the following recommendations are proposed:

Enhance Public Awareness and Simplify Procedures: Conduct regular community sensitization and educational campaigns to inform stakeholders about land tenure systems and their benefits.

Further simplify land registration and documentation procedures to accommodate individuals with varying literacy levels and encourage broader participation.

Improve Accessibility and Reliability of Land Information Systems (LIS):
Invest in upgrading LIS infrastructure to improve reliability, functionality, and stakeholder accessibility.
Implement training programs tailored to diverse user groups to build capacity and promote effective system utilization, while addressing identified technical and financial barriers.
Tackle Corruption and Promote Affordable Processes:
Introduce stringent anti-corruption measures within land management agencies, including transparent fee structures and accountability frameworks.
Provide subsidies or reduced registration fees for vulnerable groups to enhance affordability and equitable access to land registration services.

Contribution to Knowledge
This study contributes significantly to understanding stakeholder perceptions of land tenure systems. With 55% of respondents indicating that the systems are clear and accessible, the research highlights the relative success of current frameworks while identifying gaps, as evidenced by the 25% of respondents who find them complicated.
The findings underscore the effectiveness of traditional land tenure systems in dispute resolution, suggesting that customary practices could be integrated into formal land management frameworks to improve efficiency and inclusivity. Additionally, the study reveals inadequacies in ensuring equal access and protecting the rights of vulnerable groups, highlighting areas for policy intervention focused on women and youth.

The research also identifies gaps in institutional support for implementing land tenure systems. The significant proportion of undecided respondents reflects a lack of awareness or understanding of land tenure processes, pointing to the need for educational programs and public sensitization initiatives to enhance stakeholder engagement and participation.

VIII. SUGGESTIONS FOR FURTHER STUDIES

Comparative Analysis of Traditional and Statutory Systems:
Future research could investigate the strengths, weaknesses, and potential synergies between traditional and statutory land tenure systems. Such studies could explore cultural, legal, and socio-economic factors that influence their effectiveness, particularly in dispute resolution and equitable access to land.

Government Support and Policy Implementation:
Research could examine the role of government in the implementation and enhancement of land tenure systems, assessing the adequacy of resources, training programs, and infrastructure provided to ensure that land tenure systems protect the rights of all stakeholders, particularly vulnerable groups.

Public Awareness and Accessibility:
Further studies could focus on levels of public awareness and understanding of land tenure systems, identifying barriers to knowledge dissemination.

Research could also explore ways to improve accessibility, both in procedural simplicity and comprehensibility, to address challenges faced by undecided or dissatisfied stakeholders.

Author's Statements – Disclosures
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All authors contributed equally to the completion of this research paper. Each author reviewed and approved the final version of the manuscript.

Conflict of Interest:
This manuscript is not under consideration for publication elsewhere and has not been previously disseminated. There are no conflicts of interest to disclose.

Data Availability:
Data for this study were collected using structured questionnaires. The methodology employed a descriptive cross-sectional approach, with data analyzed using charts, graphs, and measures of central tendency.

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