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# Level of Use of GIS for Land Registration, Lagos State, Nigeria

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***ABSTRACT (Cambria 10, UPPERCASE, ITALIC)***

**Context and background**

The population in Lagos state, Nigeria is not only rapid but alarming. This has increased the pressure on land use. In Lagos State, the ministry responsible for land policy and land matters is the Lands Bureau.

**Goal and Objectives:**

This study examined the level of use of Geographic Information System for land registration in Lagos State, Nigeria. Qualitative and Quantitative approaches were employed to achieve the objectives of the study.

**Methodology:**

Primary data was sourced from the principal officials of professional directorates at Lands Bureau who were involved in land registration process of the State using both structured interview and questionnaire multi-modes.

**Results:**

Findings revealed that there is a distributed organization model with department level authority in place, wherein each department has control over the process. The study also shows that the level of use of GIS is still decentralized with each department focusing on its GIS tasks at a time

***Keywords :***

*Land Reform, Land Registration, Lands Bureau, GIS, Professional Directorates*

## 1. INTRODUCTION

A driving force for environmental problems is population growth. According to United Nations (2019), "the world's population is expected to increase by 2 billion persons in the next 30 years, from 7.7 billion currently to 9.7 billion in 2050 and could peak at nearly 11 billion around 2100". This has far reaching implications particularly on future generations. But as the total world population experiences increase growth, the growth will not be rapid because of dynamics of population especially in developed countries. Several countries are expected to see their populations decline by more than 15 per cent by 2050.

In contradistinction, Africa's population is rapidly growing and sub-Saharan Africa's population is expected to double by 2050. This will add 1.2 billion people to Africa's 2019 population of 1.3 billion people (Feyissa and Ezeh, 2019). The main reasons for this rapid growth of population as indicated by Garg (2017) include natality, mortality, immigration and migration. It is anticipated that regardless of the decline in fertility rate in Africa, the transition of the young into grown adults having their own children would shape the population distribution across the world in decades to come.

The Nigerian State is driving the boom for this rapid population in Africa. At present, the country is the most populous in Africa with an estimated population of about 207,386,989 (Worldpouplation review, 2020). By 2100, the country's population is estimated to be around 790.7 million (Kazeem, 2020). This poses huge challenge for the Nigerian Government because as population becomes larger, it becomes very hard for the government to reduce poverty, hunger and provide basic amenities for good standard of living for its populace

Lagos State constitutes one of the thirty-six (36) States of the Federal Republic of Nigeria. It is the smallest in area of Nigeria's 36 States with an area of about 358,861 hectares. This represents only 0.4 percent of the entire area of the country. Opoko and Oluwatayo (2014) revealed that "despite the controversies that surrounds population figures in Lagos State, there is a general consensus that the population growth in the state has been rapid".

The population of the state is growing at an alarming rate. The urban population in Lagos State grew from 267,400 in 1952 to 665,246 in 1963 at a rate of over 8.6% per annum. In her periodic report, the statistics of United Nations also revealed that in 1995, Lagos became one of the largest urban conglomerations occupying the 29$^{th}$ position in the world with 6.5 million inhabitants and steadily moved up to the 23rd position in 2000 and later to 8.8 million by 2002 Lagos is a megacity with over 17 million population (Lawanson, 2007) and it has a population of 20,000 in every square meter and an annual population increase of 275,000 persons.

With the rapid population growth in the state, there is increased pressure on land. Influence of human activities on land is accelerating daily because of the population growth. As noted by Garg (2017), "the rapid increase of human population is putting extraordinary pressure on our natural resources available particularly land". Land is required for diverse economic purposes all over the world. It is an ultimate resource without which life cannot be sustained (Orekan, 2014). It has been identified as perhaps the single most important natural resource of any nation on which human and economic activities take place. In order to support economic, political and administrative activities and also to promote efficiency in land markets, land has to be properly administered and managed.

In Lagos State, the issue of land registration poses a serious challenge to the government because of the increasing population and limited land area coverage. There has to be a system that will support efficient land registration system. Computerisng manual ways of handling land registration Systems can improve efficiency in land transactions (Ahene, 2008).

The Lagos State government is aware of its urban expansion and how land is being used for diverse economic purposes in the state. This has led to the increased need to embrace technological tools such as GIS in order to ensure accurate and timely information for sustainable development of the state. As part of the Land reform exercises being embarked by Lagos State Government, Digital Mapping and GIS project was started in 2009 as part of measures to complement the Electronic Database management System at the Land Registry, Lagos State

This study is borne out of the need to investigate the level of use of GIS technology for land registration in Lagos state where the population is growing at an alarming rate. Understanding the level of use of GIS in the state for efficient land registration systems by the adoption of GIS technology can help determine whether it yields desired outcomes or otherwise.

## 2. LAND REGISTRATION IN LAGOS STATE

The Lagos state government had been taken steps to be at the forefront of improving land registration processes in the Country. The Lagos State Lands Bureau had been modernizing her operations in order to make information readily and promptly available to customers (Arnot & Meadows, 2006). Lagos state had experienced challenges before the deployment of the Integrated Land Administration and Automation System. Some of the challenges experienced include:

a. Existing system was paper based, not open, time consuming, cumbersome and filled with a lot of malpractices. Information was difficult to locate and search.

b. Customer service delivery was very poor. There were inadequate storage facilities for file storage. Files split to the floor heavily which makes the staff knee deep.

c. The time for processing the title documents were unnecessary lengthy. Processing of title documents took several months before the deployment of new technology. Certificate of Occupancy (C of O) takes up to a year before being processed while other titles like Deed of Sublease, Deed of Mortgage takes more than six months

Due to the bottlenecks in the manual approach of processing title documents at the land registry, target revenues expected were not actualized hence contribution to the growth of the state's Gross Domestic Product (GDP) was not high when compared to the new technology introduced.

In 2004, Lagos State government continued embarking on the establishment of land reforms for the state. This led to the creation of the Electronic Document Management System (EDMS) that can be used for the archiving of all land related data. In 2009, the state government the Lagos State Government commenced a N3 billion naira mapping and GIS project of the state (kufoniy 2013b). This was done so as to increase the awareness for the use of Geoinformation for decision making in the state especially in the area of land administration. Consequently, an enterprise GIS Database was created as a result of a comprehensive surveying and mapping exercise of the entire state. The Lagos State Geoinformation Infrastructure Policy (LAGIS) was also created.

## 3. GEOSPATIAL TECHNOLOGIES

For several decades now, geospatial technologies have assumed increasing relevance in use in organizations. The technologies include GIS, Remote Sensing of the environment, Surveying techniques, and GPS. These technologies have been used to administer, keep, store, manage land records, locate facilities, manage transportation systems, and environmental problems, and also to promote and protect human health"

The potentials of these technologies is so enormous that the geospatial industry has been identified as a major growth industries in the future by the United States Government. The technology is very effective and can yield new information that can impart positively on decision making processes. It requires people who are trained in theory and applications to acquire, determine the quality of spatial data and process it with the required infrastructure

According to Taylor (2004), Africa is still very weak in the adoption of geospatial technologies. There are no building capacities in the area to support its full implementation. Most of the projects embarked upon in the African context is single targeted projects. On the completion of the project, the capacity building effort is also over. Academic institutions do not have adequate teaching and research laboratories even when there are trained personnel.

Mabogunje (1981) revealed that "urban system within major African countries is predominant with primate cities. These cities siphon investment projects, population mostly from the periphery, and vast amounts of budgets meant for infrastructure and services to the detriment of all the other parts of the country"

Its high time African countries repositioned themselves by embracing Geospatial technologies because they consist of powerful tools that can help in the acquisition, mapping, processing the data for information dissemination.

### 3.1 The role of GIS in land registration

When events are to be mapped and analyzed, one veritable tool that can assist is GIS. GIS is a computer-based tool for capturing, storing, checking, manipulating, analyzing and displaying data which are referenced to the earth (Department of Environmental 1987). This kind of definitions are posed on the assumption that institutional and behavioral dimensions that can make GIS implementation to succeed or fail are ignored. In the several definitions of GIS, it can be found that GIS is generic and also includes dimensions such as financial and organizational contexts that can have influence its adoption especially in the context of developing economies.

As advancement in technology grows and mature and data also becomes more handy in computersed forms, the use of GIS as a base for uniting land related information increases. GIS is providing administrators with better ways of doing things than before. Different datasets could be integrated into one and analyzed to yield new and more accurate information. Major features of GIS technology that is making it a reliable technology for land related information include support of Spatial database, available digital maps and higher network speed bandwidth. When GIS is introduced into land registration, there are a lot of benefits that are derived. These include provision of security of tenure, wealth generation, increased developments in housing, provision of more opportunities for investment purposes, and faster processing of titles in land, It also ensures that rights are guaranteed

to be valid and transactions regarding them to be legal in the recording process (Ekemode, Adegoke and Aderibigbe, 2017).

## 4. LEVEL OF GIS INTRODUCED INTO ORGANIZATIONS

GIS is gaining importance and increasingly becoming an important tool all over the world. GIS operations are supported by a large number of infrastructural components. According to Burrough (1986), the basic components that define a GIS are Hardware, Software, Database, People and Procedure. These components are put in place toward achieving a certain goal.

GIS has heavily impacted on the geoinformation scene through the development of land administration systems. Land administration systems provide information on land record, land ownership, land values, land use and other land-related data. To achieve sustainable management of land resources in multi-functional organization, enterprise land information is vital and essential for managing information on current land use, monitoring changes in land use, efficient functioning for a market economy, tenure security, land use planning and valuation, sustainable management of land resources.

One major land administration service before the introduction of GIS in Lagos State was granting of statutory right of occupancy by the governor to a citizen for land situated in urban areas. This is usually evidenced by the issuance of Certificate of Occupancy (C of O) as specified in the Land Use Act. Another land administration service operating before the introduction of GIS in the state is the processing of consent to alienate land. This involves seeking the consent of the Governor to alienate land. The stipulation of the Land Use Act is that a land holder will continue to have absolute possession of all improvements on his land. But the transfer or alienation of the improvements of the land to another party has to be approved by the Governor.

With GIS, there are so many operations that can be carried out. These include Scanning, Georeferencing, Vectorization, Attribute Data Management, Coordinate transformation, Measurement Computations, Classifications etc. In an attempt to overhaul its processes, the state has scanned many of the documents in archives

Longley et al. (2001) highlighted three levels of operational GIS. These are project, departmental, and enterprise GIS. The project operational level of GIS sees the introduction of GIS into organizations for a fixed term usually the project is for a fixed duration. In this case reuse of data human knowledge and software is not considered again. The project requires assembling the technical components required for a GIS. The project can span across several months or few years..

The departmental GIS is another level of operational GIS (Sugarbaker, 1999). The management is within the department that supports it. At this level, there is usually a central information system where the department GIS receives information resources such as database, network. This approach is best suited when the organization using GIS functions is needed only in one department. It is only the department within the organization that experiences the costs and benefits of the technology.

Sugarbaker (1999) mentioned enterprise GIS as the third level of operational GIS. This is used in big organizations where several projects may be running concurrently. Several departments within the organization are amalgamated to share resources and save money. This leads to adoption of common

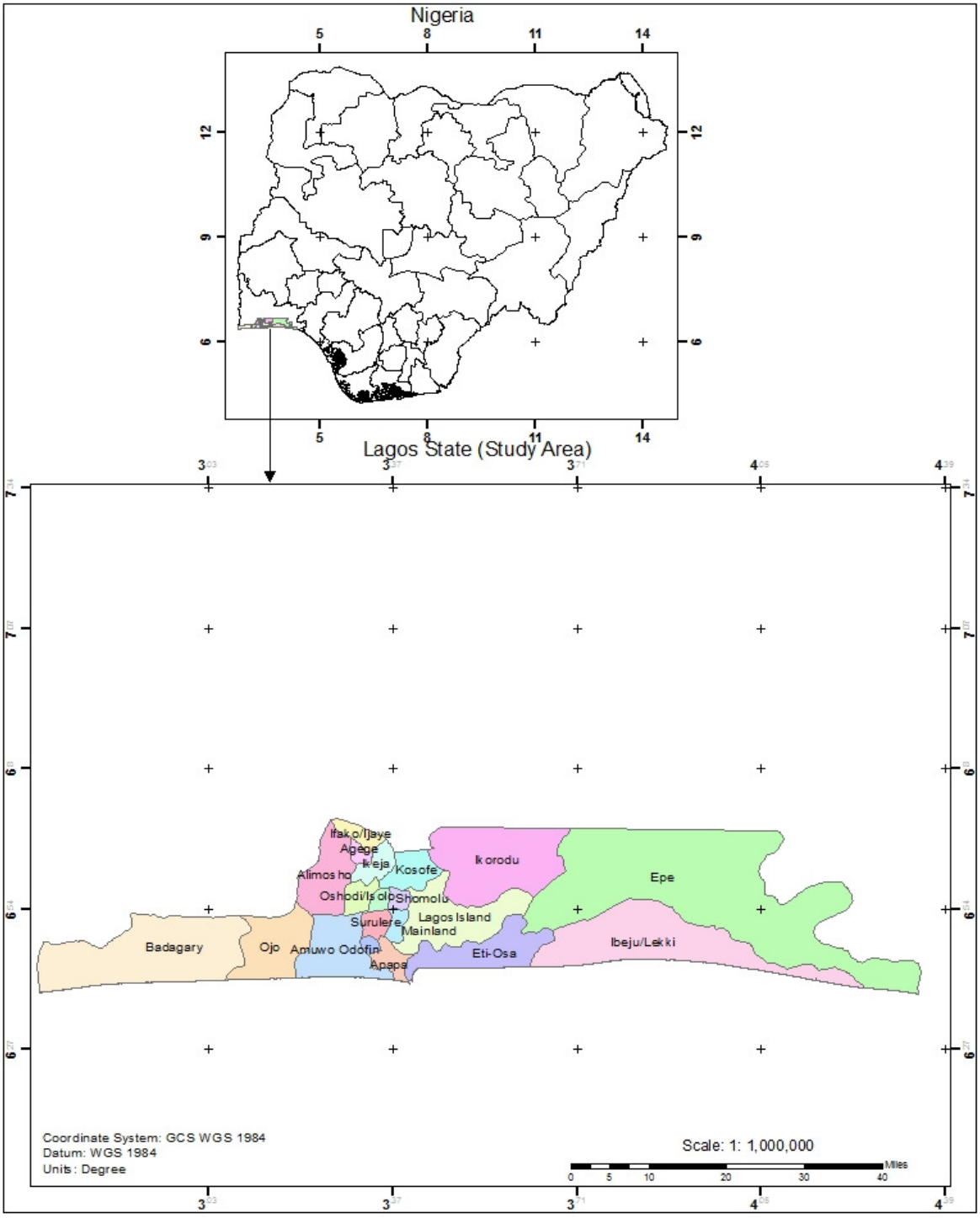
standards, a focused team and enhanced GIS capabilities. Hence an Enterprise Wide Information System is created. The system is centrally funded and managed by the leadership of the organization.

The need for effective land registration systems in Lagos state is increasing due to the high rate of population growth in the state. To meet these needs, the level of operational GIS in the state matters. Thus, this is a function of the organizational structure, goal and management direction of the state government.

## 5. MATERIALS AND METHODS

The ministry saddled with land policy and land matters in Lagos State is the Lands Bureau. Both primary and secondary data were used for the study. Primary data was sourced from the officials of the Lands Bureau who were involved in land registration process of the State. There were five (5) main professional directorates within the Lands Bureau and these were: Land Services, Land Regularization, Land Registry, Land Use and Allocation, Office of the Surveyor General. Information and Communication Technology (ICT) Unit also plays major role in the services. Data were collected from five of the principal officers of the professional directorates. Data collected included GIS implementation stage, GIS Infrastructure, GIS Organizational model, and hindrances to the use of GIS. Secondary data, such as the revenue generation information from Lands Bureau, were also obtained. Both qualitative and quantitative approaches were used for this study. With the qualitative approach, semi-structured interview was used in assessing the procedural and functional activities at the lands Bureau while quantitative approach gave an understanding of the workflow and architecture of the system that supports the land registration at the Lands bureau. Data collected were analysed using simple frequency distribution and percentages.

**Figure 1: Map of the study area**




## 6. RESULTS AND DISCUSSIONS

This study examined the level of use of Geographic Information System for land registration with a view to providing information on the use of GIS and also to equally provide information that will enhance land registration through the use of GIS in the study area. With respect to the level of GIS in use; GIS implementation stage, GIS Infrastructure, GIS Organizational model, and hindrances to the use of GIS the GIS Application Software, DBMS, Operating System, GIS Implementation stage, GIS Organizational model and GIS tasks available revealed that the level of GIS use at the Lands Bureau is at the Departmental level. Findings also revealed that there is a distributed organization model at the Lands Bureau with department level authority in place, wherein each department has control over the

process. Table 1 indicated that 80% of the respondents from the Lands Bureau had been using GIS between 5 – 10 years and 20% for over 5 years. The respondents at the Lands Bureau were quite familiar with the technology of GIS.

| Years | Frequency | Percentage |
|---|---|---|
| Less than 5yrs | 1 | 20 |
| Between 5 – 10 | 4 | 80 |
| More than 10yrs | - | - |
| Not known | - | - |
| **Total** | **5** | **100** |

**Table 1: Description of Respondents by how long they have been using GIS**

Table 2 indicates their responses. 80% of the respondents indicated that GIS has extensive use but few users. 20% indicated that GIS at the lands Bureau is at the initial stage of Implementation. GIS is introduced into organizations in phases (Project, Departmental and Enterprise).

| GIS Implementation | Frequency | Percentage (%) |
|---|---|---|
| Being Considered | - | - |
| Initial Stages of Development | 1 | 20.0 |
| Few users and Applications | - | - |
| Extensive use, few users | 4 | 80.0 |
| Extensive use, many users | - | - |
| **Total** | **5** | **100** |

**Table 2. Stage of implementation of GIS at the lands**

The initial stage of Development of GIS is majorly Project based with very few users. When the users are growing and the organization sees GIS as technological solution for their services then it goes to the stage of departmental. When GIS is extensively used for virtually all operations with many users then we have enterprise GIS.

| GIS Tools | Frequency | Percentage (%) |
|---|---|---|
| Arc GIS Desktop | 5 | 100.0 |
| Auto CAD | 5 | 100.0 |
| ArcGIS Server | - | - |
| Online GIS | - | - |
| Mobile GIS | - | - |
| Google Earth | 1 | 20.0 |
| Total | 5 | 100.0 |

**Table 3. Types of GIS software applications in use**

There are various software applications that aid the use and production of GIS maps and models. Findings revealed that all the (100%) respondents had familiar use with ArcGIS Desktop. (100%) respondents use AutoCAD being a third-party software. This indicates that ArcGIS Desktop and AutoCAD are the predominant GIS software applications in use at the Lands Bureau. The absence of ArcGIS server, Online GIS and Mobile GIS suggests that most of the resources of the professional directorates within the lands Bureau are not centralized hence they operate a disjointed system.

The organizational model employed by the respondents at the Lands Bureau in carrying out their activities were examined. In Table 4, findings revealed that (100.0%) respondents who are in the

majority opined that they have a distributed organization model with department level authority in place, wherein each department has control over the process. This also supports the reason why they have operationalized a Desktop GIS setup.

| Organizational Model | Frequency | Percentage (%) |
|---|---|---|
| Centralized | - | - |
| Decentralized | 5 | 100 |
| **Total** | **5** | **100.0** |

**Table 4. GIS Organizational Model**

Table 5 revealed the major hardware components within the GIS Unit at the Lands Bureau. A major component of a GIS is the hardware. Hence respondents gave the following hardware components available at the GIS unit of the Lands Bureau as Desktop Computer, Plotter, Scanner, Printer, Rolls of Paper, and replaceable inks. This is an indication that the GIS Unit is also operational for the purpose of data acquisition, data processing and information presentation.

| Hardware | Frequency | Percentage (%) |
|---|---|---|
| Server Computer | - | - |
| Desktop Computer | 5 | 100.0 |
| Plotter (for large wall amps) | 5 | 100.0 |
| Scanner | 4 | 80.0 |
| Rolls of paper for the Plotter | 4 | 80.0 |
| Replacement Ink for the Plotter | - | - |
| Printer | 5 | 100.0 |
| Replacement Inks for Printer | - | - |
| GPS Units | 5 | 100.0 |

**Table 5. Types of GIS Hardware components in use**

Database Management Software (DBMS) are software that enables users to store, modify and analyze a database. Land information are stored on databases that are routinely analyzed, classified and assessed from time to time, the DBMS in use at the Lands Bureau were examined in Table 6, findings through multiple responses revealed that 3(60%) respondents made use of Microsoft Access software. Microsoft Access software is good for simple database applications and it is readily available because it is a Microsoft product is readily used in this part of the world. This indicate that Data Storage within the lands Bureau is gradually growing in size however Document Management System (EDMS) is readily being used at the lands registry directorate for data storage

| Applications | Frequency | Percentage (%) |
|---|---|---|
| Oracle | - | - |
| Microsoft SQL | - | - |
| My SQL | - | - |
| Oracle Spatial | - | - |
| Microsoft Access | 3 | 60% |
| EDMS | 1 | 20% |

**Table 6 DBMS Applications in Use**

Table 7 examined the various tasks the GIS software was being used for in land registration. Multiple responses were provided by the respondents, all the respondents indicated that the GIS software

they are using could be used for scanning, which involves the copying of images or copies of a document into a digital format, georeferencing, which has to do with locating particular points on the earth surface with their specific locational information. Database administration, data overlay, computation of distances and measurement, and vectorisation are other tasks the GIS software is being used. Hence it is revealed that the basic operations of GIS are being done at the Lands Bureau indicating that GIS is a main part of the operational processes at the lands Bureau.

| Tasks | Frequency | Percentage (%) |
|---|---|---|
| Scanning | 4 | 80.0 |
| Georeferencing | 4 | 80.0 |
| Database | 3 | 60.0 |
| Data Overlay | 3 | 60.0 |
| Computation of Distances and Measurement | 2 | 40.0 |
| Vectorization | 4 | 80.0 |
| Others | 2 | 40.0 |

**Table 7. GIS Software Tasks**

In Table 8 respondents were asked to indicate the hindrances to the use of GIS at the Lands Bureau. Top on the respondent list was lack of funds, followed by cost of hardware and software and lack of trained people. Investment in GIS involves a lot of cost in setting up and continued maintenance hence the reason why lack of funds top the list. Most states in Nigeria are experiencing dwindling funds and poor revenue generation. Also, when the GIS Infrastructure is there, people have to be trained and retrained and more staff have to be employed and salaries have to be paid consequently. These have cost implications to the state Government

| Hindrances to GIS Use | Frequency | Percentage (%) |
|---|---|---|
| Lack of Understanding of what GIS can provide | - | - |
| Lack of trained people | 3 | 60.0 |
| Hard to track and train personnel | - | - |
| Don't know best methods or best practices for GIS/Mapping | - | - |
| Cost of Software ad Hardware | 5 | - |
| Printer | - | - |
| Hard to obtain technical support | - | - |
| Lack of funding | 5 | 100.0 |
| Not enough work to support a GIS office | - | - |
| Someone is outside currently providing services | - | - |

**Table 8. Hindrances to the use of GIS**

## 7. CONCLUSION

In this study, GIS system architecture and its functional capabilities at the Lands Bureau were examined. Findings revealed that at the Lands Bureau, there is a distributed organization model with department level authority in place, wherein each department has control over the process.. Decentralized model informs that each department has its own focused GIS team but their information register is not linked with other departments. It is noted that there is huge pressure on the Lagos State Government to reduce cost and at the same time provide better services that is more efficient and effective for land registration in the State. The growing population in the state had

increased the demand for land and had led to increase in land and land related problems. This has necessitated the Lagos State Government towards embarking on several land reform exercises in the state. With the implementation of the Lagos State Digital Mapping and GIS Project in 2009, the Electronic Database Management System within the Lagos State Land Registry had been complemented. This has enhanced the rate at which accurate and timely information is been provided for the growing populace of the state. However, GIS potentials is still yet to be fully utilized for land registration activities of the state. The adoption is still on-going and basically at the departmental level. GIS technologies are appropriate for building robust, efficient and effective land registration system for sustainable development. Lagos state Government should ensure that necessary infrastructure are put in place for effective and efficient service delivery. Staff of the Lands Bureau should be periodically trained on the best practices for land registration using technology and Government should sensitize and educate people on the benefits of Land title registration using modern day technological solutions like Geographic Information system.

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## 10. ROLE OF THE AUTHORS

The authors worked together in getting the whole research paper packaged. The lead author initiated the research topic and was supported by the other. Data gathering was done by the lead author while processing, write-up and compilation were done together

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## 13. KEY TERMS AND DEFINITIONS

**Land Administration**: It is the process whereby land and the information about land may be effectively managed to meet the needs of a modern society. It may also refer to the process of recording and disseminating information about the ownership, value and use of land and its associated resources.

**Land Registration**: defined as the process of creating and managing land tenure information officially. It is also the "process of official record of rights in the land.

**Geospatial Technologies**: are powerful tools that can help in the acquisition, mapping, processing data for information dissemination.

**Enterprise GIS**: This is the third level of operational GIS that is used in big organizations where several departments within the organization are amalgamated to share resources and save money which eventually leads to adoption of common standards, a focused team and enhanced GIS capabilities.