



EFFECTIVENESS OF GEOGRAPHICAL INFORMATION SYSTEM ON LAND ADMINISTRATION IN KADUNA GEOGRAPHIC INFORMATION SERVICE (KADGIS)

SHEKARAU, JOSHUA ASABE AND ALIYU, MUSA AMINA

Department of Estate Management and Valuation, Nuhu Bamalli Polytechnic, Zaria, Kaduna State

ABSTRACT

Geographical information system (GIS) is the technology that deals with the acquisition, storage, processing, presentation and dissemination of spatial information. It is an energetic and multipurpose technology that can be incorporated in managing both spatial and attribute data in text and graphic form thereby making it most apt for land administration purposes. This paper examines the effectiveness of geographical information system on land administration in Kaduna State. It maintains that the adoption of Geographical information system (GIS) technology in land administration will facilitate timely title registration, provide tenure security, ease land application processes and information sharing, facilitate land transactions, reduce corruption associated with land dealings, create efficient land markets and serve as a decision support system to government at all levels in formulating policies relating to land. The paper therefore advocates for the immediate computerization of all land records using Geographical information system (GIS) technology as imperative for efficient and effective urban land administration.

Keywords: *Geographical Information System, Geographic information service, Land Administration and Kaduna.*

INTRODUCTION

(GIS) have been used since at least the late 1960^s GIS can be define as computer mapping system of all types including those with line printer graphics, the forerunner of contemporary raster system are included. It is demonstrated that most of the early developments originated in northern America (Lawhead, 2015). In recent years, GIS is a field in which history is little more than anecdotal to rectify this search through the archives of government departments and agencies would certainly help GIS in the administration of land and land resources (Neale & May, 2018). Land is the means of life which our continued existence and progress depends on, it is in one way or the other, the basic source of most materials wealth land as a natural resources play a major

role in the livelihood of people and the growth of a nation since land is such a valuable asset in the society it plays central role in preserving the environment and optimum utilization of its resources (Zoomers, 2010). There is a better demand for a better means of securing land rights (Toulmin, 2009).

Nigeria occupies land area of approximately 923,768sq.km of which 20 percent of such land is in the urban area and 80 percent rural. Also only about 3 percent of the 20 percent in the urban area is mapped, titled and registered, while the remaining large portion is being operated in an informal system bringing virtually nothing to the coffers of the government (Teaford, 2006). This implies that sustained national assets of the country remain uncovered and tapped which is complete deviation from what is operation in other developed countries from formal real estate assets (Doling & Elsinga, 2012).

Kaduna is located on the southern end of the higher plains of northern Nigeria gridded by latitude $10^{\circ} 40'N$ and $10^{\circ} 60'N$ and longitude $7^{\circ} 10'E$ people who are seeking for accommodation and land for construction of building requires land, which hinders the necessitated the acquisition of land without title. Land title then was being clouded with delay due to bureaucratic process corruption and relatively expensive. The current law guiding land administration in Nigeria is the Land Use Act; Cap L.5 2004, originally promulgated in 1978, designed at solving the multiple land tenure system that existed in the country. The law was to regulate land administration and protect owner's rights, the process were faced with a lot of irregularities, as they were manually implemented. This gave rise to the need for automation of land administration utilizing GIS. Inferred from the above is the need for a sound and reliable information base that would enhance development and management activities by government. The efficient and effective administration of land as well as its associated resources is therefore hugely dependent on the availability of good land information system.

Consequently, much emphasis has been made in lack of computer literates among staffs under land administration, lack of adequate data and the shortage of the use of (GIS) technology, problem of data collection implementation and management, and legal problems that impeded (GIS) data sharing. Therefore much consideration has not been made on political will by government to tackle land administration problems through (GIS) which they consider other issues as more pressing. However, they ignore the fact that there is a correlation between land administration system and improved GDP of the country. It is against this background that this study tends to study the efficacy of geographical information system on land administration using Kaduna geographic information service (KADGIS) as a case study area in Kaduna State.

LITERATURE REVIEW

Meaning and Nature of GIS

The term geographic information system (GIS) has been defined in severally by different scholars with each definition tailored towards the perception and professional orientation of the person defining it. Hence, there is no universally accepted definition of GIS. Attempt been made in this paper to review some of those definitions to enable a deeper understanding of GIS to be made. Burrough (1983) defines GIS as a “set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes”. This definition clearly shows that GIS is a means to an end which is simply to achieve a “set of purposes”. Aronoff (1995) on the other hand defined GIS by looking at the major operational stages involved. According to him GIS is a “computer based system that provides four sets of capabilities to handle geo- referenced data: data input, data management (data storage and retrieval), manipulation and analysis and data output”.

Tomlin (1990) view GIS as a “configuration of computer hardware and software specifically designed for the acquisition, maintenance and use of cartographic data” This definition undoubtedly reveals one of the unique functions of GIS which is map making. Hence, GIS is perceived to be an advanced cartography. Conclusively, (Thontteh & Omirin, 2015) asserted that GIS is one of the modern methods that could be used in the computerization of land records as well as enhancing the process of land registration in Nigeria.

The need for geographic information system is real and immediate. (Coronel & Morris 2016) listed in order of important the four major components of GIS: institution, data, software and hardware each of these components has specific responsibilities and their interaction lead to the success and failure of GIS. There are key defining features that set GIS apart from other technology. (Wheatley & Gillings, 2013) maintains that “The unique features that distinguish GIS from other type of information system are data of entries and relationship management with a spatial framework, ability to perform spatial analysis”. such a wide range of use of GIS has become a powerful tool around the world for planning and decision-making. Internationally, GIS is one of the fastest growing industries with more than 170,000 people in the United State currently employ in the Geospatial information industry government academic and commercial sectors (Skelton, 2014).

From the analysis of the above definitions, it is obvious that GIS is a computer-based system that is used for mapping and analyzing spatial features on the earth’s surface. It is also indicative from the various definitions that GIS is an interdependent system consisting of the following components namely computer hardware, software, geographic data, expertise and procedures. No component can operate in isolation of

the other and a careful integration of all is vitally important for the successful functioning of GIS. Irrespective of the definition one is giving or adopting, it must be realized that GIS is a peculiar technology with the essential features of spatial references and data analysis. Hence, the true power of GIS lies in its ability to integrate information and help in making decisions.

Land Administration in Developing Countries

According to Cleaver (2017) land administration in developing countries is the process of reform and structures including institution of the land administration is necessary when these are deemed inefficient however, the focus of such endeavor is most often on achieving the desired goal through organization implementation of information and communication technology (ICT) land administration should be underpinned by the principle of good governance in developing country (Williamson, Enemark, Wallace & Rajabifard, 2010).

Kanayo, Kizito, and Udefuna (2013) reported that a modern land administration system should support the care policy sustainability and service increasing good governance and enhance quality of life. Despite growing influence in the west the level of poverty in the third world are improving the increasing gap between rich and poor has been well documented by data non agencies such as UNDP, 20% of the world population don't have access to clean water while twice as many (UNDP). Billions of people live on less than US\$1 per day.

The problem are often most accurate in urban area where there is an urgent need to improve service but also to formal and informal employment opportunities in which UNCHS and its partners will using the campaign do make it clear that it is not urbanization and itself that causes these problems, but rather, a failure to make better use of the economics opportunity and potentials offered by the urbanization process. Urbanization leads to the marginalization of the urban which increase their current cost of living and enormous future environmental and social costs for the next generation (Buhaug, & Urdal, 2013). Poverty tend to be associated with poor infrastructure in urban area with formal squatter settlement cost effective mechanism need to be developed in other to formalize the land tenure arrangement and ensure that resources are allocated efficiently for the upgrade of the infrastructure (Deininger, Selod, & Burns, 2011).

A tendency towards over regulation and a regulatory framework of standard regulation and administration procedures at its best different and more likely hostile to the need of the urban poor. All of these issues will have to be directly tackled in order to create the condition for rapid progress economic investment and growth (UNCHS 2000) part of this process must be improved to the local administration system and also the

development of an appropriate land information system (Toulmin, 2009). This is necessary but not sufficient to ensure a more equitable distribution of land property and ensure sustainable development but it is an essential component in the way forward (Williamson, *et al* 2010). Land market allows capital to be release and hence influence productivity and efficiency in agriculture (Woodhouse, 2012).

A successful market stimulated economic growth for individual land owner by releasing capital for investment in other field it can also benefit government by facilitating variety of form of taxation can also encourage changes in land use and stimulated moves towards to optional use of resources in theory market force should result in the highest and best use of the land although in practice other factors many present this outcome (Suzuki, Cervero, & Iuchi, 2013). Talks about using smart phone devices innovative location based service for mobile real's estate marketing using a smart phone according to (UNECE) good land administration create accurate accessible interoperable timely secure and completes information about land property in an affordable and efficiency way that promotes confidence between the public it commercial enterprises and government the records commonly held for land administration are also the foundation for integrated spatial information system that link.

According to (Toulmin, 2009) there should be a unified land system for both urban and rural area there should be one law and one set of procedure to accommodate the need of the region in a country including customary tenure in rural areas. Many rural communities which make up the agrarian sector in the land market in the country are geographically excluded from offices reducing level of registration in rural areas areas (Toulmin, 2009).

Role of GIS in Land Administration

Several countries such as Sweden (BRED 1995), Austria (BEV 1991) and great Britain (HM land Registry 1994) now provides on line access to a variety of land related data. The advent of computerized data based GIS technology provide an opportunity to develop a greater understanding of how land market work and how land may be more efficiently and effectively managed. However, more upon institutional than technical issues Obansa, 2009 enumerate the following as the role of geographical information system.

- To enhance up the process of registration
- Speed up the process of first registration of title.
- Decrease the cost and space required
- For storing demand records
- Prevent unnecessary duplication.

These benefits include:

- a. To support land property for credit
- b. To increase a sound data base that will be giving
- c. Signals to the property market
- d. To monitor development project and the impact they create on the environment
- e. To facilitate sustainable and standing land reform.
- f. To subsidize the initial creation cost of land administration system (Obansa, 2009). Earth and all chattel real, the legal conception of land goes further than this.

Land administration is a means by which government offers security of tenure regulate land market, implement land reforms, very taxes, sustain the environment and generally enhance the value of the land. Land administration serves as the instrument with which a society ensures equitable access to land to by stakeholders with the policy framework (Deininger, Selod, & Burns, 2011). The major law on land administration in Nigeria is the land use Act Cap L.5, 2004 promulgated in 1978. The problems of using manual method of data handing have dominated cadastral information management is a disappointing manner among various departments and parastatals within Nigeria. Hence the need for a well-coordinated approach to manage cadastral information which is Geographical Information System (GIS).

Vinh and Vinh (2005) applied GIS to district 5 Hochiminh City (HSMC) Vietnam when the district government agency encountered a lot of difficulty in activities of urban management the city is about 4.14 kilometer square and with 251,999 people. The study used Arc view GIS 3.2 software and the result showed that there have been really improved activities of district agencies in Hcmc to serve people better in the area of land management. Wang (2000) show that GIS was developed to assist in the real estate market in Austin area. The data base system assists realtors to located house for the customers and also assist real estate developers to determine the best location for housing development. This with the assistance of GIS technology, developers were able to combine information, perform analysis and display result in data base. This meant that GIS is very powerful in presenting data especially its ability to present data in map (Image) format.

Nigeria as a country is trying to adopt the using of (GIS) Geographical Information Service and its adoption to land management and its adoption would lead to the development of nationwide computerized open access property data based (Chukwuemeka,2012). GIS has been applied to real estate in several ways. Olawore, Babawale & Ajayi, (2011) shown that the key to any successful real estate transaction

is timely information about the property, market condition, and transaction terms. In Nigeria there are few known medium for providing such information. However, the fact remains that real estate transaction is by private treaty and there is no free flow of information to the real estate market. The consequence of this is that there is limited information about the transactions in housing market. Access to existing property market is in the hand of a privilege few. This forces buyers and seller to make decisions based on imperfect information.

GIS Implementation Barriers

For developing countries there must be great considerations given to utilizing GIS as the process can be laborious and complicated by barriers. GIS barriers include institutional inertia, resource constrains, technical constrain and lack of trained personnel referred to here as education (Gippet, 2016). In order to avoid these barriers of implementing GIS it is first necessary for an organization to become aware of GIS. Developing countries are beginning to recognize the potential of information and communication technologies (Ferguson, Huysman & Soekijad, 2010). This risk can be lessened through the creation of institutional inertia support by determining the appropriate role of GIS in an organization (Pinsonneault & Kraemer, 2002).

The appropriate role may be determined by applying the capabilities of GIS to a specific problem. Such a situation occurred in Cape Town; South Africa when it was hypothesized that a GIS could achieve a model based approach to up grading informal setting in a manner that was both structured and replicable (Sayer, Campbell, & Campbell, 2004). Utilizing GIS on a small scale project, researchers determined that the success of the pilot study could allow for a large investment and use of GIS technology on large scale project of similar themes organization are very difficult to change and they react very slowly and reluctant to pressure for change (Lientz, B., & Rea, 2016). If organization show willingness and capabilities to adjust to using GIS in clump of spatial data can be vital for economic development (Naseer, Bimal, & Kumar, 2015). Due to absence of adequate records that contain information such as land delineation or ownership. Land markets are prevented from reaching their full potential (Zahir and Shakir 2012). Previous Scholars reported that system of record keeping has created an administrative bottleneck in the development process as individuals and government struggle with record discrepancies and standards.

GIS can be standardized and maintained and assist with planning decision. The success of these and other GIS processes are contingent upon the availability of accurate data. Acquiring such data can be complex problem that creates barriers to successful implementation. Researcher recognized that accurate spatial data are

required for the successful use of geographic information system in developing countries however the acquisition of data can be prevent through a myriad of factors.

Land Administration Procedure in Kaduna State

- Ministry of land, survey and country planning has embarked on its mission to improve the service delivery to the public through the use of (GIS) for management of land in the ministry of land survey and country planning.
- KADLAPS which is Kaduna land and property is computerized solution that enable the ministry to service the public in the quickest and most acquired level of services available today word wide laps mean land and property information system is a computerized land record information with a geographical information system (GIS) capabilities the main goal of the system is better service delivering to the public and computerized the land management system of the state for its better utilization
- The evolution of land tenure system in the northern state is transfer and cadastral survey system in Kaduna state are considered each land was recorded in the register and entitlement for each former computer also in 2014 December 24th in most part of Nigeria Kaduna inclusive.

RESEARCH METHODOLOGY

The study area has a total land area of 46053KM² (17781 Square Meter) and a population of 6,066,552 (2006 census) which was accessed through the Kaduna state geographical information service (KADGIS).The target population for the study comprises the staff of (KADGIS) and property owners with certificate of occupancy. Simple Random sampling technique was adopted in selecting 40 staff and (60) sixty property owners with certificate of occupancy. Selection of (KADGIS) Staff was done according to the various activities of Kaduna geographical information system (KADGIS). Well-structured questionnaire were administered to property Owner and Staff of (KADGIS) so as to get an in-depth knowledge about effectiveness of geographical information system to land administration in the study area.

DATA ANALYSIS AND DISCUSSION OF RESULTS

Descriptive statistical technique using tables, figures and percentage were used to analyze the questionnaires designed on methods used in gathering data on land acquisition, benefits of GIS on land administration, effectiveness of GIS over the years, and Problem of GIS. Land owner perception on technological method of computing land data, perceived benefit and problem of GIS. The result obtained was

tabulated using frequency distribution tables with the use of Statistical Package for Social Sciences version 22.

Table 1: The table shows the method used by (KADGIS) in gathering data and information

Characteristics	Frequency	Percentage (%)
Manual method	0	0
Technological method	27	90
Both	3	10
Total	30	100

Source: Field survey 2018

The above table shows that 90% of the respondent in (KADGIS) indicate that technological method was used while 10% indicate that both method were used that is the table seek to know the current benefit of Geographical information system (GIS) in land administration in KADGIS. this implies that the technological method is used in gathering data and information in the Kaduna state geographic information service. This findings conforms with what Ferguson, Huysman, & Soekijad, (2010) noted that the adoption of GIS is coming on board now especially in developing countries.

Table 2: This table shows the current benefit of geographical information system on land administration

Characteristics	Frequency	Percentage (%)
Speedy operation	15	50
Security of data	2	6.7
More revenue to the Government	5	16.7
All of the above	8	26.6
Total	30	100

Source: Field survey 2018

The table above show that 50% of the respondent were on the opinion that the benefit of GIS is speedy operation, 6.7 are of opinion that it secure data, 16.7% are of the opinion that generate revenue to the government while 26.6% tick all of the above this implies that the benefit of geographical information system to land administration is speedy operation. This is in line with what Obansa, 2009 reported that GIS has tremendous benefits.

Table 3: The table shows how effective was (GIS) over the years

Characteristics	Frequency	Percentage (%)
Highly effective	18	60
Fairly effective	10	33.3
Poorly effective	2	6.7
Total	30	100

Source: Field survey 2018

The above table show that 60% of the respondent in the (KADGIS) are of the opinion that KADGIS is very highly effective while 33.4% are of the opinion that it is fairly effective 6.7% are of the opinion that it is poorly effective from the data collected and analyze it show that have been very effective over the years.

Table 4: This table shows the problem of GIS in land administration in Kaduna state

Characteristics	Frequency	Percentage (%)
Lack of awareness	10	33.3
Poor internet connectivity	5	16.7
Lack of proper funding	6	20
All of the above	9	30
Total	30	100

Source: Field survey 2018

The above table shows that 33.3% of respondents in (KADGIS) identified that the problems of GIS is lack of awareness 16.7 respondent want for poor internet connectivity, 20% of the respondent ticked lack of proper funding and 30% of the respondent tick all of the above. As highlighted by Gippet, (2016) that those afforewritten are factors hindering full implementation of GIS.

Table 5: This table seeks to know if the land owners agree with the technological method of land administration

Characteristic	Frequency	Percentage (%)
Strongly agreed	50	60
Agreed	10	20
Disagreed	10	40
Agreed	8	16

Total	50	100
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Source: Field survey 2018

The table above show that 60% of respondent strongly agreed with the technological method of land administration, 20% agreed, 20% disagreed with the system. This implies that the technological method is very effective in land administration.

Table 6: This table seek to know if the benefit of the (GIS) to land administration

Characteristic	Frequency	Percentage (%)
Speedy operation	25	50
Security of data	25	46
Decrease of data	2	4
Total	50	100

Source: Field survey 2018

The table above show that 50% of the respondent are of the opinion that (GIS and in speedy operation, 46% are of the opinion that it secure data 4% are of the opinion that it decrease cost this implies that GIS help in speedy operation. This is in line with what Obansa, 2009 reported that GIS has tremendous benefits.

Table 8: This table seek to know the problems of (GIS) application in land administration

Characteristic	Frequency	Percentage (%)
Lack of awareness	19	38
Poor internet connectivity	20	40
Lack of maintenance	11	22
Total	50	100

Source: Field survey 2018

The table above shows that 38% of the respondent are of the opinion that the problem of GIS application is lack of awareness, 40% are of the opinion that it is poor internet connectivity 22% of the respondent are of the opinion that it is lack of maintenance the implies that the major problem is lack of wariness and poor internet connection. As highlighted by Gippet, 2016 that those afformention are factors hindering full implementation of GIS.

CONCLUSION

Efficient and effective urban land administration depends on the availability of good, reliable and timely information. This information can be guaranteed through the computerization of land records using the GIS technology. Technological methods were used in documentation of land administration in Kaduna just like in any part of Nigeria. Both staff of the (KADGIS) Kaduna geographic information service and property owner upheld that the use of (GIS) geographical information system has many benefits to land administration such as, ensuring speedy operation and safeguarding data. More importantly, the staff of (KADGIS) Kaduna geographic information service asserted that (GIS) geographical information system enhance revenue generation to the government. Both staff of the (KADGIS) Kaduna geographic information service and property owner asserted that the use of (GIS) geographical information system has been very effective over the years. Nevertheless, they both noted that (GIS) geographical information system usage is not hitch free but have many problems hindering its success ranging from poor internet connectivity, lack of awareness to lack of maintenance.

RECOMMENDATION

This study assessed effectiveness of geographical information system on land administration using Kaduna geographic information service (KADGIS) as a case study area in Kaduna state, Nigeria. Based on the findings, it was discovered that the Kaduna state government has adopted the used of (GIS) technology in land administration and this has stopped all the discrepancy of land matters, the incidence of fraud has been reduced to the barest minimum. However, it is recommended that the problem of internet connectivity should be well address. Workshops should be organized in order to educate staffs on how to operate and work with (GIS). It is also recommended that there should be proper maintenance of device to ensure effective functionality of the device.

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