Sub-Sahara African Academic Research Publications
March, 2023, Editions

JBER
Journal of Biodiversity and Environmental Research
Vol.27, No.4, ISSN 2211-8735

IMPACT OF THE APPLICATION OF GEOGRAPHIC INFORMATION SYSTEM ON LAND ADMINISTRATION IN THE FEDERAL CAPITAL TERRITORY, NIGERIA

AGBANA SAMUEL OLUFEMI; & KEMIKI OLUROTIMI ADEBOWALE
Department of Estate Management and Valuation, Federal University of Technology, Minna, Niger State, Nigeria

Abstract
Land plays an important role in the economy of nations and the manner in which land falling within their territories are being administered has been a matter for popular discourse in several fora globally. A major outcome of these discussions has been the need to automate Land Administration processes through the use of tools such as Geographic Information Systems (GIS). Nigeria is not left out in this global drive and a few states including the Federal Capital Territory (FCT) have adopted the use of GIS for its Land Administration. This paper examined the impact which GIS has on the land administration process within the FCT with particular reference to time taken transactions and the revenue generated from the process. The findings revealed that the application of GIS to Land Administration has greatly impacted on the time taken for transactions with the time taken for some processes reduced by over fifty percent and revenues have been largely improved even surpassing empirical projections such that the peak revenue after introducing GIS is about 718 percent above that of the pre GIS period. The study recommends that other state governments should consider adopting the GIS tools to Land Administration if not already in use, best practice standard should be inculcated, introducing online transactions should be strongly considered and Staff training, sanction and reward systems should be taken seriously.

Keywords: Land, Land Administration, Geographic Information System, Titleholder

INTRODUCTION
The Federal Capital Territory is a trail blazer in the adoption of GIS for Land Administration and much discussion has been raised regarding the effectiveness of the tool. There have been a number of studies on the application of GIS to Land

Administration in the FCT. Many of them including Adeoye (2006), Akeh & Mshelia (2016) and Jibril (2006) have dwelt on the benefits derived without giving much empirical data on the improvements or benefits derived.
This paper set out to put figures to the facts already known in examining the impact which GIS has produced on Land Administration practice within the FCT.

STATEMENT OF RESEARCH PROBLEM

The adoption of GIS for land administration purposes will undoubtedly bring a lot of benefits and promote sustainable national development in the country (Akeh & Mshelia, 2016).
A major problem which has confronted the administration of land all over Nigeria is the time taken for issuance of land titles or land registration processes which in some cases take a couple of years. The embracing of GIS for Land Administration is expected to improve the time taken for transactions. Several studies have been carried out on the effectiveness of GIS in improving land titling and good governance as expressed by Nuhu and Salau (2012) and Adeoye (2006) respectively. However, there is still a dearth of empirical statistics on the improvement brought about on the land administration processes and revenue.
A number of State Governments like Nasarawa, Niger, Kaduna, Imo and Cross River have now adopted the use of GIS for the management of its land resources in the light of current trends of E-Governance and ease of doing business being advocated worldwide. This study set out to evaluate the impact of GIS of Land Administration in the FCT in terms of; applications processed, time taken for transactions and revenue generated with empirical evidence.

OBJECTIVES OF THE STUDY

The aim of this study is to assess the impact of the application of Geographic Information System to Land Administration in the FCT with a view to highlighting the gains and challenges and then making recommendations geared at improving the existing system. In order to achieve this aim, the following objectives were formulated:

i. To examine the impact of GIS on the time taken for land titling and transaction processes in the FCT, Abuja.
ii. To determine the impact which GIS application has on land revenue generation.

RESEARCH QUESTIONS

The following research questions will be answered in the course of the study:

1. What is the impact of GIS application on the time taken for land titling and transaction processes in the FCT, Abuja?
2. Is there any significant impact on land revenue generated as a result of applying GIS to Land Administration in Abuja?

REVIEW OF RELATED LITERATURE

Land

Land as a basic natural resource means different things to different categories of people. It is both a physical commodity and an abstract concept as the rights to own or use it are as much a part of the land as the objects rooted in its soil (Dale and McLaughlin, 1988). Land is both a cultural and an economic asset. It remains a major factor of production and the effective administration of land impacts greatly on the economy of nations.

Land Administration

Land Administration is described as "the processes of recording and disseminating information about the ownership, value and use of land and its associated resources" (UN, 1996; p14).

Land administration is the process of regulating land and property development and the use and conservation of the land, the gathering of revenues from the land through sales, leasing and taxation, and the resolving of conflicts concerning the ownership and use of the land (Dale and McLaughlin 1999).

The Land Administration is defined by the United Nations Economic Commission for Europe (UNECE) as the process of recording and disseminating information about the ownership, value, and the use of land and its associated resources.

Functions of Land Administration

For Land Administration to be effective, there are certain functions that it must serve. Enemark (2009), identified four land administration functions as: land tenure, land valuation, land use and land development.

Professionals in Nigerian Land Administration

Several Professionals such as Land Surveyors, Town and Land use Planners, Estate Surveyors and Valuers.act as brokers between the land administration service providers and the beneficiaries of the services provided. These Professionals perform juridical functions during land registration when land

ownership disputes need to be resolved. They also assist landowners to register deeds, mortgages, and easements and to assign and convey land and property.

Automation of Land Administration

Williamson and Ting (2001) noted that Land Administration can no longer rely on manual processes, van der Molen and Tuladhar (2006) suggested computerisation as one of the measures which would curb corruption in Land Administration. Geographic Information Systems (GIS) has been recommended as a computerisation tool for Land Administration agencies (UN, 2005).

The Concept of Geographical Information System

A Geographical Information System is a computerised system for input, storage, management, display and analysis of data that can be precisely linked to a geographic location. Typically, GIS datasets come as layers there can be a layer for rivers, a layer for roads, and a layer for zip codes all within a particular geographical boundary. A layer may consist of one or more features, which include points, lines, or polygons.

Geographic Information System is an organised collection of computer hardware, software, geographic data, and personnel, that is been designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information. (Kanickaraj, 2018).

Components of Geographical Information System

It has been established by various authors including Dempsey (2012) that working GIS integrates five key components: hardware, software, data, people and method.

METHODOLOGY

The target population for the study included the beneficiaries of the land administration services comprising title holders and land professional and staff of the Department of Land Administration/Abuja Geographic Information Systems (AGIS). The study adopted a combination of the convenience or accidental sampling and quota sampling techniques to elicit responses from Title holders and Professionals/Agents respectively who were served different questionnaires. Both techniques are non-probability sampling techniques found suitable for the research as the Title holders are not readily available and the Professionals cut across various fields. Questionnaires with both close-ended and

open-ended questions were served on Title holders who came for transactions at the AGIS office and also through agents to their Principals. Quota sampling is a method of purposive sampling which recognises that good judgment and strategy has to be applied in picking samples (Umeh, 2018). The samples selected can be logically assumed to be representative of the sample frame as they are selected based on their specialist knowledge of the area of study. The questionnaires served on Professionals was in line with their proportion in the sample size.
Sample frame of 921 Professionals and 35,000 plus Title holders was obtained. Sample size was determined using Smith and Strattek (2010) formula resulting in 250 and 354 respondents adopted for the study from professionals and title holders respectively. After analysing data obtained using simple percentages, a five point Likert scale was used in analysis of data on time taken for processes to arrive at weighted mean and relative impact index of GIS on the processes, while exponential smoothing was used in analysing the times series data on revenue for thirty year period.

DISCUSSION OF RESULTS

IMPACT OF GIS ON TIME TAKEN FOR TRANSACTIONS

An outline of results from data obtained is highlighted below:

- Right of Occupancy (R of O) issuance could not be achieved earlier than 30 days in the years prior to the introduction of GIS. However, after the introduction of the GIS, a cumulative of 185 respondents accounting for 74% asserted that R of O could be issued averagely between 1-90 days. This is a marked improvement for this activity.
- 188 respondents amongst professionals elected that that issuance of bills could be done within 1 to 7 days after the introduction of GIS to about 64 respondents for elected for same time period before introduction of GIS.
- An increased number of Search reports (173) are issued within 1-7 days after introduction of the GIS than before its use where only 87 are issued.
- Issuance of C of O could not be done earlier than 31 days prior to the introduction of GIS. This is different with the situation after the introduction of GIS tools where 19 respondents (7.6%) have asserted that C of O issuance can be done within 1-7 days.
- 7 respondents (2.8%) affirmed that Power of Attorney could be registered in 1-7 days before the introduction of GIS, 18 respondents (7.2%) acknowledged that Power of Attorney could be processed within 1-7 days after the introduction of the GIS. 52.4% of the 250 respondents

posited that Power of Attorney was registered between 31-90 days before the advent of GIS as compared to 31.6% for the period after GIS.

- From Table 6 above, respondents propositioned that no assignment or mortgage could be registered between 1-7 days before the introduction of GIS. This has changed under the GIS regime where 7 respondents said you could register assignment and mortgage between 1-7 days.

Table 1: Relative Impact Index (RII) from responses by Professionals on the level of improvement experienced with GIS use
5 – Very High, 4 – High, 3 – Fair, 2 – Low, 1 – Very Low

Professionals	5	4	3	2	1	Total	Mean	Weighted Total	RII	Rank
Issuance of R of O	25	111	114	0	0	250	3.644	911	0.7288	3
Issuance of Bills	133	48	69	0	0	250	4.256	1064	0.8512	1
Issuance of Search reports	63	129	58	0	0	250	4.02	1005	0.804	2
Issuance of C of O	37	64	137	0	12	250	3.456	864	0.6912	6
Registration of Power of Attorney	26	104	100	20	0	250	3.544	886	0.7088	4
Registration of Assignment /Mortgages	13	110	114	13	0	250	3.492	873	0.6984	5

Source: Field Survey (2021)

The analysis of the responses of given by professionals on the impact that GIS has made on some land administration processes was carried out using a 5 – point Likert scale. Table 1 above shows weighted mean and Relative Impact Index (RII) calculated. Adopting a decision mean of 3.0, it is clear from the responses of the professionals that all the processes of land administration examined have been impacted positively with the introduction of GIS.
From the ranking results, the issuance of bills (having RII of 0.8512 and weighted mean of 4.256) is most impacted with the application of GIS, followed by the issuance of search reports, and then issuance of R of O. Registration of Power of Attorney is in 4th place, Registration of Assignments/Mortgages is ranked 5th in level of impact while the Issuance of C of O (RII of 0.5912 and weighed mean of 3.456) comes at the bottom being ranked 6th.

Table 2: Relative Impact Index (RII) from responses by Titleholders on the level of improvement experienced with GIS use

5 – Very High, 4 – High, 3 – Fair, 2 – Low, 1 – Very Low

Titleholders	5	4	3	2	1	Total	Mean	Weighted Total	RII	Rank
Issuance of R of O	86	89	124	41	14	354	3.542373	1254	0.708475	3
Issuance of Bills	139	184	17	0	14	354	4.225989	1496	0.845198	1
Issuance of Search reports	114	145	65	16	14	354	3.929379	1391	0.785876	2
Issuance of C of O	36	101	132	71	14	354	3.20904	1136	0.641808	6
Registration of Power of Attorney	24	187	101	28	14	354	3.50565	1241	0.70113	4
Registration of Assignment /Mortgages	12	139	137	52	14	354	3.234463	1145	0.646893	5

Source: Field Survey (2021)

The analysis of the responses given by titleholders on the impact that GIS have made on the listed land administration processes also using a 5 – point Likert scale was done. The result obtained as seen in Table 2 above is not much different from the results obtained for the professionals in table 1. While slight variations are observed in the weighted mean results and Relative Impact Index (RII) calculated, the ranking is exactly the same for the six processes. All the processes are similarly positively impacted by the introduction of GIS when a decision mean of 3.0 is adopted.

IMPACT OF GIS ON LAND REVENUE GENERATION

Exponential Smoothing

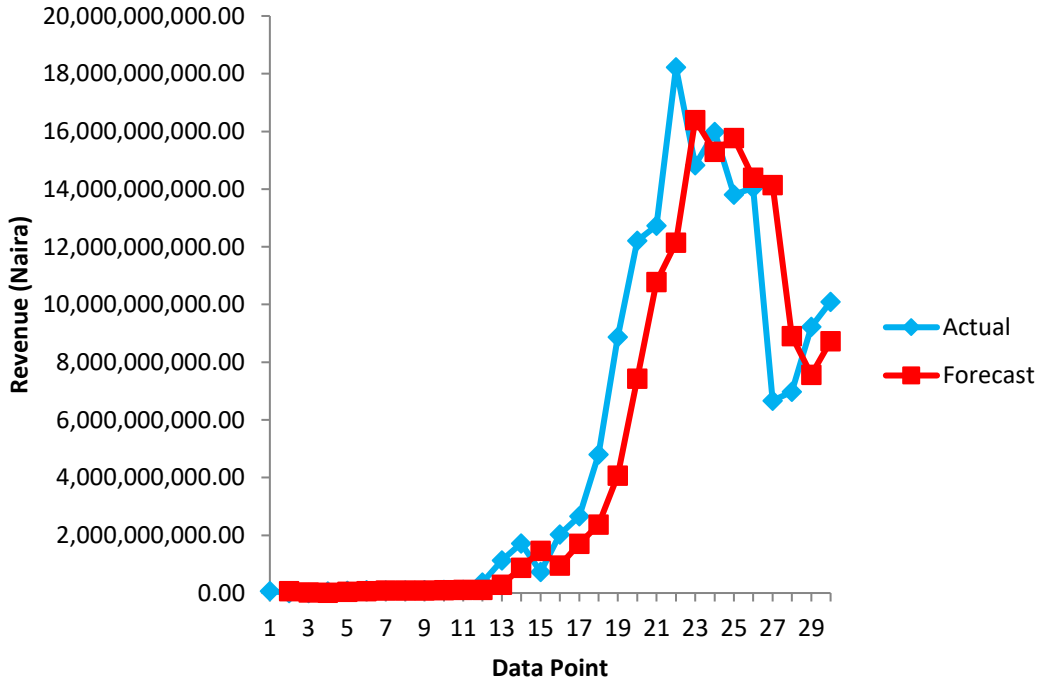
Smoothing provides a means for forecasting future values of a time series. Exponential smoothing is one type of weighted average that arraigns the arrangement of positive weight to past and present values only. A simple weight α is between 0 and 1. Then the exponential smooth series is calculated using SPSS From the record of the land revenue generated by the Department of Land Administration/AGIS for the period 1990 to 2019 (thirty years). It was indicated that from a sum of ₦69,996,361.04 generated as land revenue in 1990, the Department has been able to grow its revenue though having highs and lows which stood at ₦10,092,572,181.19 in 2019. The array of revenue generated over the thirty year period has not continually experienced only increases but there have been times when revenue drop was encountered. This is not uncommon with time series data because the components of time series include trend (which could have increase or decrease), seasonality, cyclicity and irregularity. An

important observation with the data set is that even when a decline is experienced, the succeeding year comes with an increase in revenue. There are no two successive years of decline and decrease in the succeeding year revenue was experienced only in seven instances. It is also observed that there is a continuous run of increases in revenue from 2005 to 2011 with the ₦2.034 billion revenue in 2005 rising to ₦18.219 billion in 2011. It was noted that 2005 is the bench mark year for the commencement of the GIS tool for land administration. There is no doubt that the jump in revenue of ₦0.735 billion in 2004 to ₦2.034 billion in 2005 is attributable to the introduction of GIS for the land administration process in the Federal Capital Territory.

The boom in revenue within this time is also attributable to the capacity of the system to handle larger number of transactions using GIS. Figure 1 below gives a visual appreciation of the trend in land revenue within the Federal Capital Territory for this period. It is important to note that, the peak revenue generated post GIS introduction of N14,039,923,899.50 is about 718% above the peak revenue of N1,715,473,812.56 generated before the introduction of GIS.

Figure 1

Land revenue trend and forecast for 1990-2019 using time series exponential smoothing



Source: Field Survey (2021)

Figure 1 above is a visual representation of the data set for a thirty year revenue record obtained from AGIS. The blue line is the plot of the actual revenue obtained in the years 1990 to 2019 while the red line is a plot of the weighted average adjusted through exponential smoothing to obtain a forecast of realistic revenue given the performance of actual revenue over the years. The data points from 1 to 13 (1990 to 2002) indicates that the gradient of the trend line for both actual revenue and forecast are similar. However, from that point to data point 22 (year 2011) the actual revenue trend is on a higher gradient than the forecast which translates to higher revenues (N1.134 billion compared to N0.293 billion on the lower bound of the gradient and N18.22 billion compared with N12.14 billion on the upper bound for that portion of the data set. However from point 25 to point 28, the forecast of revenue performs better than the actual revenue. The revenue increases occasioned by the introduction of LIS and GIS is evident in the presented chart.

CONCLUSION AND RECOMMENDATIONS

Conclusion

This study focused on the evaluation of the impact of applying GIS tools to Land Administration processes in the FCT and it was established that this has seriously impacted the system of Land Administration positively and it is welcomed by all stakeholders. This is demonstrated in the time that is now taken for certain transactions to be concluded. For example you can walk in and print your ground rent/statutory bills within an hour or less.

The number of transactions being treated has also improved alongside the revenue generated which has grown to double digit billions from double digit millions of naira.

Recommendations

The research having come up with the findings discussed in the work, the following recommendations are made:

1. The government investment in introducing GIS tools to land administration in the FCT should be sustained as the gains are enormous. Other states should consider also adopting the tools for land administration.
2. The issue of best practice should be inculcated into the land administration system and necessary infrastructure like uninterrupted power supply and stable internet facilities should be maintained to guarantee the improvement of service delivery to the public.

3. The introduction of online processing of land application, issuance of bills and search should be seriously considered so that people can transact from the comfort of their homes or offices.
   Staff training, sanction and reward system should be taken seriously.

REFERENCES

Adeoye, A. A. (2006) Abuja Geographic Information Systems (AGIS) as a tool for good governance in Nigeria, being a Paper presented presented at the 5th FIG Regional Conference, Accra, Ghana, March 8 – 11, 2006.

Akeh, G. I. and Mshelia, A. D. (2016) The role of geographic information system in urban land administration in Nigeria. MOJ Eco Environ Sci.; 1(1):16–20.

Alakirawa, U. T. (2018) Role of AGIS in Litigation on Land in FCT: being a paper presented at the in-house Retreat on Legal issues over the Administration of Land in the FCT organised by the FCTA Legal Services Secretariat.

Dale, P. and Mclaughlin, J. (1999) Land Administration, New York, Oxford University Press.

Dale, P. F. and McLaren, R. A. (2005) GIS in Land Administration. In P. A. Longley, M. F. Goodchild, D. J. Maguire, and D. W. Rhind (Eds.), *Geographical Information Systems: Principles, Techniques, Management and Applications, 2nd Edition* (pp. 859-875). Wiley Publications.

Ekrikpo, E. U. (2016) Legal regime of Land Administration under the Abuja Geographic Information System (AGIS). being a thesis submitted to the School of Postgraduate studies, Ahmadu Bello University, Zaria in partial fulfillment of the requirements for the award of the degree of Masters in Arts and Law – M.A. Law

Ghebru, H. and Okumo, A. (2003) Land Administration service delivery and its challenges in Nigeria, International Food Policy Research Institute, Working Paper 39.

Jibril, I. U. (2006) Computerisation of the Cadastral and Land Registry: The Abuja experience, being a Paper presented at the 5th FIG Regional Conference, Accra, Ghana, March 8-11, 2006.

Jibril, I. U. (2016) Thirty five years of Land Administration in the Federal Capital Territory (FCT) of Nigeria, being a Paper presented at the FIG working week, Christchurch, New Zealand, May 2–6, 2016.

Kanickaraj, L. (2018) Geographic Information Systems defined being an article published on the on the ARC Advisory Group blog available at https://www.arcweb.com/blog/geographic - information-systems-gis-defined

Kemiki, O.A, Odumosu, J.O, Ayoola, A.B & Popoola, N.I. (2015). Cadastral information System for M.I Wushishi Housing Estate. Journal of environment and Earth Science ISSN 22.24-3216/paper ISSN 225-0948/0nline 5(16).

Longley, P. A, Goodchild, M. F, Maguire, D. J. & Rhind, D. W. (2005). Geographic Information Systems and Science, 2nd Edition, Wiley.

Mabogunje, A. L. (2010). ICT and Land Reform in Nigeria: Progress, Problems and Prospects. In proceedings of the annual Conference on Land Policy and Administration; The World Bank April 26-27, 2010, Washington DC, USA. https://pdf4pro.com/amp/view/land-reform-in-nigeria-progress-problems-5b31bd.html.

McLaren, R. and Stanley, V. (2017), "ICT for Land Administration and Management". Module 14 pp. 343Soil Use and Management International Journal, 33(4), pp. 514-529. https://doi.org/10.1111/sum.12380

Nuhu, M. B. and Salau, T. L. (2012) Efficient Land titling through GIS and LIS Tools: A Panacea to Economic Transformation In Nigeria-Abuja, FCT experience. Being a Paper Presented at NIESV Annual Conference Held at Transcorp Hillton Hotels, Abuja, FCT 24th – 27th March, 2012.

Umeh, O. L. (2018) Research Methodology, Lagos, University of Lagos Press

Ralphs, M. and Wyatt, P. (1998), "The application of geographic and land information systems to the management of local authority property", Property Management, 16(2), pp. 83-91. https://doi.org/10.1108/02637479810214123

Williamson, I. P. (1994) The Role of Land and Geographic Information Systems In Economic and Environmental Management, 22(5), pp. 309-320.

Williamson, I. P. (2000) Best practices for Land Administration Systems in developing countries International Conference on Land policy reform Jakarta, 25-27 July 2000.