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International Journal of Real Estate Studies

INTREST

Technological Innovations in Land Administration System (LAS): Concern on Level of Awareness in Nigeria

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Article history: Received: *26 July 2020* Received in revised form: *20 September 2020*
Accepted: *17 November 2020* Published online: *31 December 2020*

Abstract

The study examined the level of awareness of technological innovations in land administration among stakeholders comprising academics and officials charged with the responsibility of administering and managing land in the Federal Capital Territory, Abuja, Nigeria. The study sampled 114 land experts and employed multi-layer non-probabilistic sampling, i.e. cluster, convenience and snowballing techniques. Descriptive statistics of mean score of weighted options (5-point Likert scale), cross tabulation and Kruskal-Wallis test were deployed to analyse the data. The mean score (MS) showed a very low level of awareness of technological innovations among the respondents. The result revealed that, the respondents have a fair knowledge of Geodata Cadastral Database and Land Resource Manager. The compare mean score analysis of the level of awareness against the respondents' background information revealed that field personnel, GIS experts, HND holders and experienced land administrators were relatively familiar with the technologies in their categories. Kruskal-Wallis was used to test if there is a significant difference in the opinions of the respondents considering variation in their background profiles. The test result showed that there is no statistical significant difference in the opinions of the land experts. The findings signaled that the operation of land administration in the country is still at a basic level, manual and labour intensive. The study therefore advocated for scaling up of sensitisation and awareness campaigns on the technological innovations, synergy between field and academic land experts, training and re-training of personnel and adoption of strong institutional framework that will enhance LAS in the country.

Keywords: Land administration, system, technologies, innovations, awareness

1.0 INTRODUCTION

Land and its resources play an essential role in every sphere of human endeavour. The desire to own, develop and control land and its resources has always been on the increase leading to greater competition among individuals, groups and public agencies. This points at the high demand for land especially in urban environments. Therefore, the approach that will ensure fair allocation, distribution and redistribution of land in an efficient and effective way is becoming so complex; it poses a challenge to land administration and management system especially in developing countries like Nigeria. Jacobs (2015) posited that land administration projects have been failing for the past fifty years in Sub-Saharan Africa due to adoption of wrong technological approaches.

The usage of nascent technologies in land administration is far more embraced in developed countries than in the developing ones. The paradigm shifts from conventional approach to tech-driven land administration system is linked to dynamism in emerging land related matters, to curb increasing rate of land crisis and the need to harness opportunities in technology advancement in solving land related problems. In developed countries such as United States, United Kingdom and fast developing ones such as Japan, China, Malaysia and Singapore, studies have shown the high level of adoption and attendant benefits (Atazadeh, 2017; UN-GGIM, 2019; United Nations, 2015). McLaren and Stanley (2011) highlighted the benefits of modern land administration to include improvement in housing delivery, security of tenure, land resource management, public confidence, land market monitoring, spatial land use planning, service delivery and public safety. Others are facilitation of land reforms, reduction in land disputes, credit security, increased revenue generation and enhancement in environment stewardship.

In the local context, scholars and practitioners have carried out a number of studies on LAS and noted deficiencies in its operations (Akpoyoware 2010; Didigwu & Olakanmi, 2016; Djiré, 2007; Babalola et al., 2015; Oboli & Mabogunje, 2002; Odum & Ibem, 2011; Thontteh & Omirin, 2015). The authors attributed the inefficiencies in the LAS in Nigeria to inadequate funding, ineffective LAS models, poor database management, weak policy framework and inconsistencies in the land administrative strategies. Accordingly, Ibuoye (2007) noted that a major goal of land administration is to optimize the use and allocation of land. Improvement of land through installation of infrastructural services, some of which may be computer based commodifies it by making it tradable.

However, the inefficiencies in the LAS signal the inability of the existing land administration system to address the current issues relating to land management in the country. This suggests the need for alternative LAS approaches especially those that are technology driven in order to enhance the efficiencies in land allocation and its resources control. Atilola (2010) and Mahmud (2013) have strongly advocated the adoption of intensive technology driven LAS as the way out of poor land management to an efficient one that conforms to global best practice. Recently, the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) advocated for increased level of awareness and adoption of geospatial information technologies to ensure sustainable land administration (UN-GGIM, 2019). The committee argued that, the raising level of awareness on the benefits of adopting appropriate framework for effective and efficient land administration is key to achieving 2030 Agenda for Sustainable Development Goals (SDGs).

Thus, the level of awareness of the administrators of LAS on trending technologies is relevant to be examined. The usage of the technological tools is corresponding to the knowledge about the innovations which could in turn enhance its level of adoption. Local studies on LAS have largely focused on the operational efficiency of LAS and attendant challenges in Nigeria. A few local studies on technologies in LAS did not consider the level of awareness and adoption especially among the land experts. Study awareness of LAS technologies is necessary for the following three reasons. Firstly, it will expose trending innovations in LAS technologies. Secondly, it will enhance the knowledge of the frontline personnel on the benefits of technological innovations in LAS and thirdly, it will also encourage and enhance the adoption of the technologies and provide relevant information for restructuring of the country land policy.

■2.0 LITERATURE REVIEW

2.1 An Overview of the Concept and Dynamism of Land Administration

The meaning and definitions of land administration have been explained from different views, contexts and fields but geared towards similar ideas. Some authors describe it as a *process* while some explain it in form of a *system*, while others see it as an instrument to ensure equitable access to land by stakeholders within the policy framework of a country. As a process, the United Nations Economic Commission for Europe defined land administration as a process that is concerned with the 'determining, recording and disseminating of information about the tenure, value and use of land when implementing land management policies' (UNECE, 1996). In the work of Dale and McLaughlin (1999), land administration is explained in a broader view as regulatory processes on land and landed property, its use and conservation, revenue generation, authentication of sales, leases, taxation and also land conflict resolution and to determine land ownership structure. The authors summarised the process into three revolving attributes namely ownership, values and use (see Figure 1).

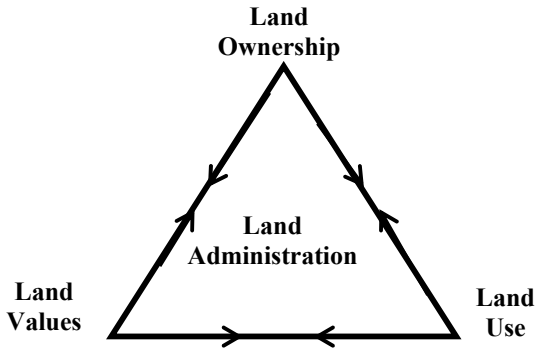

Figure 1 Three key attributes of land
(Source: Dale and McLaughlin, 1999)

Thontteh and Omirin (2015) describe land administration as a system of establishing land ownership through the issuance of certificates of right in property. Riddell (2000) and Joireman (2006) posited that LAS helps the individuals or groups in whom the right is vested to defend their interest against infringement by counter claimants. Dale (2007) noted that a good quality land administration system should be targeted towards achieving primary objectives such as secured and transparent land dealings, low transaction cost, accessible credit facilities, even distribution/redistribution of land and its resources to enhance environmental sustainability. Atilola (2010) posited that those fundamental goals of effective and efficient land administrative system could be achieved through the use of reliable geo-information, efficient cadastre survey and effective information and communication technology (ICT).

Mitchell et al. (2015) and Reynolds et al. (2017) added that, the use of technology in land tenure system can take the form of either identifying the extant land ownership structure or formalizing the customary right of occupancy. The United Nations Economic Commission for Europe (UNECE) identified sections in LAS such as land tenure system, land registrations, the cadastre comprising fiscal, juridical, land-use and multipurpose. Others are land valuation and taxation, land management control and location information infrastructure (Williamson et al., 2010). Allen (2014) opined that, the use of technologies in land management could be to facilitate land registration, titling and record management; save time and cost land titling processing and administration. Further, Ukaejiofo (2007) noted that land administration is an equitable instrument for accessing land and a policy framework to redefine the state of land use, allocation and its resources control.

Implicit in these statements is that land administration is a means by which government offers security of tenure, regulate land markets, implement land reforms, levy taxes, sustain the environment and generally enhance the value of land. To achieve effective and efficient land administration across the nationals and sub-nationals, the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) noted the need to advocate for raising awareness on the adoption of appropriate land policy framework that are driven by social, economy and information and communication technology.

2.2 Evolution of Land Administration System in Nigeria

Historically, the formal recording of land instruments in Nigeria was pioneered during the British colonial rule in 1888. In Nigeria, the history of land recording activities can be traced back to the pre-colonial era. Land administration system was fairly well established during the period after the amalgamation in 1914; where the Northern and the southern protectorates were merged for easy administration by the British colonialists. After independence in 1960, Nigeria operated different land policies in her geopolitical regions. In the northern region, the public land ownership system prevailed based on the provisions of the Land Native Rights Ordinance while in the southern and western regions, a dichotomous system prevailed with customary and statutory land holdings systems operating together until 1978 when the Land Use Act (now Land Use Act, Cap L.5, 2004) was introduced which abolished the extant land governing system. The Act unifies the land tenure systems and serves as a guide for land administration in the country (Adedeji, 2008; Atilola, 2010; Fajemirokun & Atilola, 1979; Mabogunje, 1978).

Ibuoye (2007) observed some general advancement in land administration which appeared to be technological in nature. The author noted that Nigeria land registry was initially bogged down with bottle necks but its witnessed technological growth with the introduction of e-registration in 2003. In the Federal Capital Territory (FCT), Abuja, the technological age commenced with the title recertification exercise under a GIS based system, popularly known as Abuja Geographical Information System (AGIS). Similarly, some states have commenced the use of information system such as Lagos, Kaduna, Niger while at the federal level, we had Federal Land Information System (FELIS). Ukaejiofo (2007) maintains that if land administration is a vehicle to implement national land policy, it must be tackled from the perspective of system modernization (Figure 2: Evolution of ICT in LAS).

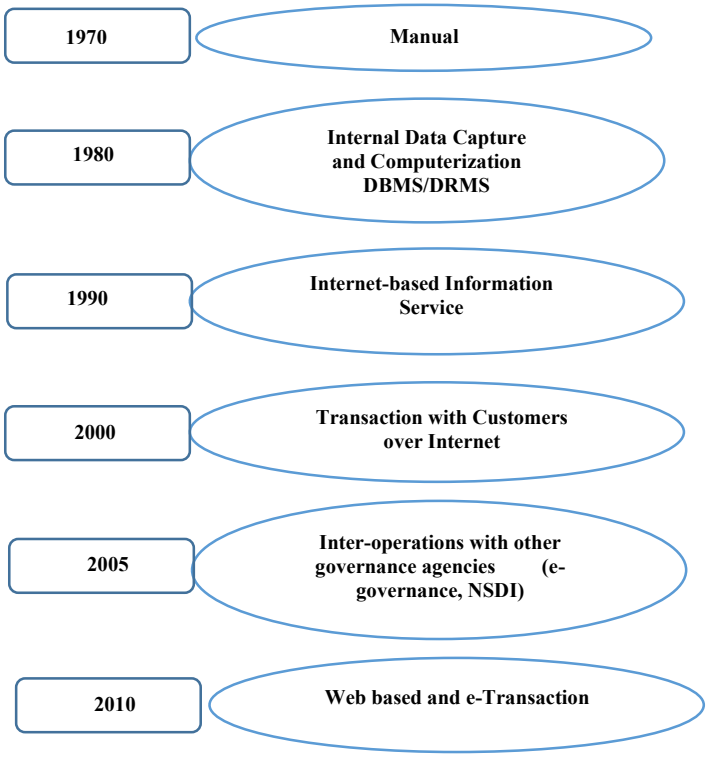

Figure 2 Evolution of ICT in land administration
(Source: McLaren and Stanley, 2017)

2.3 Challenges of Land Administration System in Nigeria

A number of literature have documented the problems associated with poor land management in both developed and developing countries although with different peculiarities. For example, in developing countries like Nigeria, Odum and Ibem (2011) identified some of the problems to include land accessibility and uneven distribution of land and its resources. Ademiluyi and Raji (2008) observed problems of emerging slum and settlement. Faye (2008) noted the increasing rate of fraud in land transactions, fake titles, land disputes and unhealthy property market conditions. Djiré (2007) argued that the primary causes of the mayhem in land management system could be attributed to population explosion, instability of land policies and inconsistent land administrative strategies.

Babalola et al. (2015) noted the absence of land administration model that could foster sustainable development in land management. Didigwu and Olakanmi (2016) added that the problem is associated with spatial data recording and database management. Abolade et al. (2018) investigate digitalization of land administration in Kaduna state; the study noted the problem of infrastructure decay, internet connectivity and shortage in the trained manpower. Similar studies on digitalizing land administration and management have been carried out across Nigerian states – for instance, Adeniyi et al. (2018) investigated Ekiti, Kebbi and Niger states experiences, while Ghebru and Okumo (2016) assessed eight states (Cross River, Benue, Bauchi, Ekiti, Enugu, Kaduna, Lagos and FCT Abuja).

However, in spite of the relevance of technology in land administration system as documented in literature, it appears that, the impact of ICT in the administration of the use, control and management of land have not been fully tapped into especially in developing countries including Nigeria. This shortfall may be attributed to under-utilization of ICT due to some issues and challenges peculiar to different countries. In Bangladesh, for example, Nahrin and Rahman (2009) raised issues associated with legal framework, political will, financial constraint and technicalities involved in its application. Augustinus (2015) reported the issues related to ICT aid land administration system in Bulgaria to include identification of land use pattern, data recording and proper capturing of users' land use requirements. Lee (2006) opined the need to work on institutional framework of land policies in South Korea.

Local studies have also investigated Nigeria experiences with respect to use and application of technology-aid land administration system. Aribigbola (2008) investigated how urban land use planning and management can be improved using Akure as a case study. The study identified weak implementation and inadequate monitoring. The author suggested reorganisation of land planning process and institutionalization of concerned agencies and local authorities. The study did not examine the usage of technologies in aiding improvement in land use planning and management.

2.4 Previous Works on Technologies in Land Administration System

Research into prospects and problems of digitalising land recording and administration system has been on the increase in recent time and gaining global attention. For instance, Ting and Williamson (1999) explored the nexus among land administration; information technology and society. The study deploys a theoretical approach and stressed that, the land administration system is becoming more and more complex; owing to the evolving dimensions of land/man relationship and the rising demand for land for use in the society. The study however noted that, the adoption of ICT will enhance sustainable development and aid decision makers in the formulation of effective and efficient land policies.

Rahman and Talukder (2016) examined the cost and benefit of digitisation of land records in Bangladesh. The study analysed the associated cost involved in a non-digitalised land administration i.e. cost concerning administration, transaction, opportunity, operation, development and travel costs. This was to justify the need to adopt digitization approach to enhance cost effectiveness. The study found that digitization of land records save cost. The authors concluded that land administration system driven by technology will enhance easy enforcement of contract on land and ensure high rate of property development.

In Uganda, Luyombya and Obbo (2013) probed the state of digitisation of land registry. The primary aim of the study was to ascertain the level of usage of technology in land registration process. The study adopted case study approach and the opinions of 207 land registry clients and some top-ranked officers of land ministry were surveyed. The study found that Uganda land registration system still operates at manual (through paperwork) level, but efforts are seriously being put in place to upgrade the manual approach to digitisation system. A similar study by Jacobs (2015) critically reviewed the usage of technology in land administration system for sustainable development in Uganda and Ghana. The study established the adoption of technology in the administration of land in both countries. The author expressed that, the use of digitalised land administration system in those countries had led to improvement in ownership structure, strengthening the institutional land policy and had enhanced effective communication among concerned organs and agencies. The author identified the problem of upgrading the extant land information system to include sustainability of the system, financial constraint, political will and policy inconsistencies among others.

The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM, 2019) modelled framework for effective land administration. The primary objective of the study is to provide information for developing, reforming, strengthening or modernizing land administration and management systems across the globe. The study noted the importance of effective and efficient land administration and management system towards achieving Sustainable Development Goals. The committee listed 'advocacy and awareness' as one of the tools in the framework for effective land administration.

Reynolds et al. (2017) reviewed literature on land tenure technologies. The study identified three areas in which technology could be used to aid land administration system. The study categorised them into Type I, II and III. The authors also named Type I as *Support for Land Tenure Enabling Environment,* Type II – *Land tenure Data Collection and Aggregation* and Type III – *Formal land Titling.* In the first category (Type - I) activities involved providing accessible information on land ownership structure, institutional, government and regulatory framework. The second category (Type II) entailed the use of maps and database for collection, dissemination and aggregation of data concerning land titling and ownership related matters. While the third category (Type III) comprised of the use of technologies to facilitate the land titling, transaction and dealing process among individual landowners, corporate bodies and the regulatory body i.e. government. The study noted 38 technologies being applied to land administration globally, 27 of them is used for Type II (enabling) and Type III (Titling) activities (see Table 1).

Table 1 Technology in land administration system
(Source: Reynolds et al., 2017)

Technology	Platform	Intended Users	Land Tenure Activities
Aumentum Cadastre	Computer - desktop	Governments	Types II, III
Aumentum OpenTitle*	Computer - desktop; computer - internet	Governments and their implementing	Types II, III
Aumentum Registry	Computer - desktop/application	Government agencies	Type III
Blockchain (BitFury)*	Internet accessible database	National governments	Type III
Cadasta Platform*	Computer - desktop; computer - internet	Organizations and communities	Type II
Focus on Land in Africa (FOLA)	Computer - desktop; mobile phone - smart	Not specified	Type I
Gender and Land Rights Database	Computer - desktop; mobile phone - smart	Government agencies	Type I
Geodata Cadastral Database	Computer - desktop	Governments and private business	Type II
Global Forest Watch: Land Rights	Computer - desktop	Indigenous groups	Type II
Innola Solutions	Computer - desktop	Not specified	Type II III
Its4Land	Computer - internet	Urban and rural smallholders; Pastoralists; Rural landowners	Type II
Land Matrix	Computer - desktop	Not specified	Type II
Land Portal	Computer - desktop; mobile phone - smart	Not specified	Types I, II
Land Registration as a Solution	Computer - desktop	Government agencies	Types II, III
Land Resource Manager	Computer - desktop	Businesses with land assets	Type II
Land Rights Platform	Computer - desktop; mobile phone - smart	Cambodian youth	Type I
Land Use Planning for Tenure Security	Computer - desktop/application; mobile - smart	Rural and urban poor	Type I
Landfolio Software	Computer - desktop	Compliance monitoring agencies for natural resources	Type III
Landmapp*	Mobile phone - smart	Rural smallholder farmers	Types II, III
LandMark	Computer - desktop	Indigenous groups	Type II
Landwise	Computer - desktop; mobile phone - smart	Lawyers, researchers, and development practitioners	Type I
Mapping for Rights*	Internet accessible database; mobile app – smart phone	Indigenous and forest-dependent people	Types I, II
Mobile Application to Secure Tenure (MAST)*	Computer - desktop; mobile phone - smart	Rural land claimants	Types II, III
mLocGov	Computer - desktop/application; computer - internet	Governments and small holder farmers	Type III
Mobile DHIS2 Tool	Mobile phone - feature	Not specified	Types II, III
Mobineo	Computer - desktop	Governments	Type II
One Map Initiative*	Computer - internet	Indigenous or rural groups	Type II
Open Development Initiative	Computer - desktop; mobile phone - smart	NGOs (e.g., universities)	Type I
RAISG	Computer - desktop	Indigenous peoples	Type II
Red Tierras*	Computer - desktop	Rural, low-income communities	Types II, III
Sarawak Geoportal	Computer - desktop	Indigenous Sarawak peoples	Type II
Sistema de información sobre comunidades nativas de la amazonía peruana (SICNA)	Computer - desktop	Indigenous Amazonians	Type II
Social Tenure Domain Model (STDM)*	Computer - desktop/application	Land insecure poor	Type II
SOLA Community Server	Computer - desktop	Not specified	Type III
SOLA Open Tenure	Computer - desktop	Not specified	Type II
SOLA Registry	Computer - desktop	Government agencies	Type III
SOLA Systematic Registration	Computer - desktop/application; computer - internet	Not specified	Types II, III
Suyo*	Mobile phone - smart	Low-income families in informal settings	Types II, III
Talking Titler	Computer - desktop/application	Governments	Type II
The Tropical Forest Community Mapping Initiative (TFCMI)/Mapping for Rights	Computer - desktop	Indigenous and forest-dependent peoples	Types I, II

3.0 METHODOLOGY

The study was conducted in the Federal Capital Territory (FCT), Abuja, Nigeria. The choice of the study area is linked to the fact that, FCT is the federal constituency of the country, and the style of land administration system is structured to be replicated in all the 36 states of the federation. Also, the territory tends to be the almighty in the area of income, expenditure, capital and human resource; therefore, technologies especially in the area of land administration, seem to be more familiar among land personnel compared to the states level. Sometimes, when some states are faced with the challenge of either acute shortage of man power or technological devices in combatting unique problems inclining towards land related matters, FCT tends to be the bailout agent. The choice of conducting the subject matter of the research in FCT is due to the highlighted reasons among others.

The study is descriptive and non-probabilistic in nature. This is considered appropriate because the study focuses on frontline land experts that engage in land administration both in practice and academic environment. A total of 150 questionnaires were administered; 100 for practitioners and 50 for academics. The difference in the number of questionnaire administered is attributed to the higher number of personnel in the Ministries, Departments and Agencies (MDAs) than in the tertiary institutions. The relevant MDAs that were considered for sampling include Ministry of Works and Housing, geo-information units. Their contemporaries in academics were drawn from University of Abuja, Ahmadu Bello University, Kaduna State University and University of Jos. The selected academics are those that have their teaching and carrier advancement in physical planning, design, geo-information and land management related fields. The inclusion of the academic in the study population is to know whether the trainers (lecturers) in land related disciplines are aware of those technological innovations which reflect the knowledge impacted on their students.

Non-probabilistic multilayer sampling techniques were employed by the study. First, cluster sampling was used to get the attention of the land personnel at their ministries, department and agencies (MDGs). Convenience sampling techniques was deployed to identify specifically those respondents among workers of MDGs that are directly involved in land management and administrations in their various units/sections/departments. In addition to these, referring sampling was also adopted to categorically get to other personnel who could provide relevant information through the recommendations of their colleagues in the MDGs.

The study deployed descriptive statistical model i.e. Mean Score (MS) of weighted options. The submissions of the respondents on their level of awareness of technological innovations in LAS were measured on 5-point Likert scale which ranged from Not Aware-1; Not Sure-2; Fairly Aware-; Moderately Aware-4; to Fully Aware-5. The mean score (MS) of weighted options is expressed in mathematical terms as follows:

$$MS = \sum \frac{TWF}{N}$$

where,
MS = Mean Score
W = Assigned weight to the scale (1-lowest to 5-Highest)
TWF = Total Weighted Frequency
N = Total number of sample

To clearly identify the boundaries for each category of the weighted options, the study adapted and modified the relative index (RI) scale recommended in the work of Akadiri (2011) and Rooshdi et al. (2018). The authors used ratio 0.2 as the interval for each successive options on the 5-Likert scale i.e. $0 \leq RI \leq 0.2$ (least scale) and $0.8 \leq RI \leq 1.0$ (highest scale). The authors RI specifications and the modification to suit the study analysis is presented in Table 2.

Table 2 Scale for weighted options

Likert Scale	Authors Specification for RI		Modifications by the study	
	Scale Range	Remarks	Scale Range	Remarks
5	$0.8 \leq RI \leq 1.0$	High	$4.1 \leq MS \leq 5.0$	Fully Aware
4	$0.6 \leq RI \leq 0.8$	High-Medium	$3.1 \leq MS \leq 4.0$	Moderately Aware
3	$0.4 \leq RI \leq 0.6$	Medium	$2.1 \leq MS \leq 3.0$	Fairly Aware
2	$0.2 \leq RI \leq 0.4$	Medium-Low	$1.1 \leq MS \leq 2.0$	Note Sure
1	$0 \leq RI \leq 0.2$	Low	$0 \leq MS \leq 1.0$	Not Aware

In addition, cross tabulation descriptive statistics was deployed to examine how the awareness level vary with the background information of the respondents such as institution working with, specialization, educational status and years to relevant experience. The results of the study were presented in tables and bar charts.

4.0 RESULTS OF THE ANALYSES

Table 3 presents the background information on the respondents' institution, specialization, education and years of relevant experience. As indicated on the Table, the sample were more from the personnel in government offices (68.5%) compared with the respondents in the academia (31.5%). 31.6% of them work with government agencies, 26.3% were working in geography field with higher number being lecturers, geo information system experts account for 15.8%, while personnel in housing/valuation unit and the town planning officers constitute 21.1% and 5.3% respectively. The analysis on the educational qualification showed that, 15.8% had Higher National Diploma (HND) and Bachelor of Science (BSc) degrees each, 10.5% had Postgraduate Diploma (PGD), and respondents with Master of Science

(MSc) degree accounts for 47.4% and 10.5% of them had obtained PhD. For years of relevant experiences, 15.8% of them have less than 5 years' relevant experience while approximately 84.2% indicated to have been working for 6years and above in land administrative related field.

Table 3 Background information of respondents

Response Category	Parameter	Frequency	Percentage (%)
Institution	Public	78	68.5
	Academics	36	31.5
	Total	***114***	***100.0***
Specialisation/Units	Land Administration	36	31.6
	Geo Information System	18	15.8
	Geography	30	26.3
	Town Planning	6	5.3
	Housing/Valuation	24	21.1
	Total	***114***	***100.0***
Educational Qualification	HND	18	15.8
	BSc	18	15.8
	PGD	12	10.5
	MSc	54	47.4
	PhD	12	10.5
	Total	***114***	***100.0***
Years of Relevant Experience	5yrs n less	18	15.8
	6-10yrs	42	36.8
	11-15yrs	24	21.1
	16-20yrs	12	10.5
	21-25yrs	18	15.8
	Above 25yrs	-	-
	Total	***114***	***100.0***

Table 4 presents the result of summary descriptive statistics on the extent to which the land experts are aware of the trending innovations in technology-aid land administration tools. The study conducted by EPAR (2017) identified forty (40) tools and categorised them into three, based on their area of applications i.e. Type I (Support for Land Tenure Enabling Environment), Type II (Land Tenure Data Collection and Aggregation) and Type III (Formal land Titling). This study thereby adapts those that are directly concerned with land management system (35 tools) and tests the level of awareness of land experts on the technologies.

The result of mean score (MS) showed that the level of awareness varies across the technologies. A larger number of them were not familiar with the technologies, while some were not sure of their existence. For instance, the respondents were fairly knowledgeable, (MS>3.00<3.50) of technologies such as Geodata Cadastral Database (item 1: 3.2105) and Land Resource Manager (item 2: 3.0526). The report of the negative skewed frequency distribution of -.241and -.238 for the item 1 and 2 respectively indicated the sample recorded higher score above its means. By effect, it implies that larger number of the sample expressed their higher level of awareness to the items above average in the sample.

Other technologies especially in items Nos. 3 to 9, the respondents showed some level of familiarity (MS>2.00<3.00) compared to other tools on item No. 10 to No. 35 (MS<2.00). Among the itemized technologies, item No. 3 (Land Registration as a Solution) and item No. 4 (Land Use Planning for Tenure Security) with relative mean score MS>2.50<3.00 seem to be a little bit familiar with the respondents among the technologies in the categories. They are also used in Land Tenure Data Collection and Aggregation (Type II) including Formal land Titling (Type III). The partially noticeable usage of the tools in public land administration signals the substantial use of manual means (paper work) and intensive labour approach to land registration and land use planning control in the country. Surprisingly, land experts express that they are either not aware or sure of the innovative land-tech tools of technologies from item No. 10 to item No. 35 on the Table. However, for a thorough examination, the selected technologies on item No. 1 to 9 were subjected for further analysis. For more clarification, the result is further illustrated in Figure 3 and the area of applications in LAS was presented Table 5.

Table 4 Awareness on technologies in land administrative system

Item	Technologies in Land Administrations	Mean	Std. Dev.	Min.	Max.	Skewness
1	Geodata Cadastral Database	3.2105	1.24427	1.00	5.00	-.241
2	Land Resource Manager	3.0526	1.32266	1.00	5.00	-.238
3	Land Registration as a Solution	2.8421	1.18679	1.00	5.00	-.076
4	Land Use Planning for Tenure Security	2.6842	1.53032	1.00	5.00	.277
5	Land Rights Platform	2.4737	1.57531	1.00	5.00	.423
6	Land Portal	2.4211	1.43221	1.00	5.00	.438
7	Global Forest Watch	2.3684	1.22845	1.00	5.00	.485
8	Gender and Land Rights Database	2.1579	1.46692	1.00	5.00	.749
9	SOLA Systematic Registration	2.0000	1.49335	1.00	5.00	1.168
10	SOLA Community Server	1.8421	1.31418	1.00	5.00	1.440
11	Aumentum Cadastre	1.8421	.93675	1.00	3.00	.322
12	LandMar	1.7895	1.28624	1.00	5.00	1.622
13	Landfolio Software	1.7895	1.28624	1.00	5.00	1.317
14	Social Tenure Domain Model (STDM)	1.7895	1.00858	1.00	4.00	.752
15	Land Matrix	1.7368	1.25545	1.00	5.00	1.496
16	SOLA Open Tenure	1.7368	1.21242	1.00	5.00	1.431
17	Landfolio Software	1.7368	1.25545	1.00	5.00	1.496
18	SOLA Registry	1.7368	1.29705	1.00	5.00	1.396
19	Mapping for Rights	1.7368	1.21242	1.00	5.00	1.431
20	Landmapp	1.7368	1.16780	1.00	5.00	1.548
21	One Map Initiative	1.7368	1.16780	1.00	4.00	1.141
22	Blockchain	1.6842	1.08339	1.00	4.00	1.171
23	Landwise	1.6842	1.08339	1.00	4.00	1.171
24	Innola Solutions	1.6842	.92474	1.00	4.00	1.084
25	Mobineo	1.5789	.88142	1.00	3.00	.939
26	Suyo	1.5263	.82237	1.00	3.00	1.081
27	Its4Land	1.5263	.94270	1.00	4.00	1.471
28	Red Tierras	1.5263	1.04932	1.00	5.00	2.175
29	Mobile Application to Secure Tenure (MAST)	1.5263	1.09876	1.00	5.00	2.010
30	Talking Titler	1.4737	.88458	1.00	4.00	1.721
31	Sarawak Geoportal	1.4211	.75134	1.00	3.00	1.421
32	Mobile DHIS2 Tool	1.4211	.75134	1.00	3.00	1.421
33	The Tropical Forest Community Mapping Initiative (TFCMI)/Mapping for Rights	1.3158	.73250	1.00	3.00	1.902
34	RAISG	1.3158	.65602	1.00	3.00	1.861
35	Open Development Initiative	1.2105	.61649	1.00	3.00	2.607

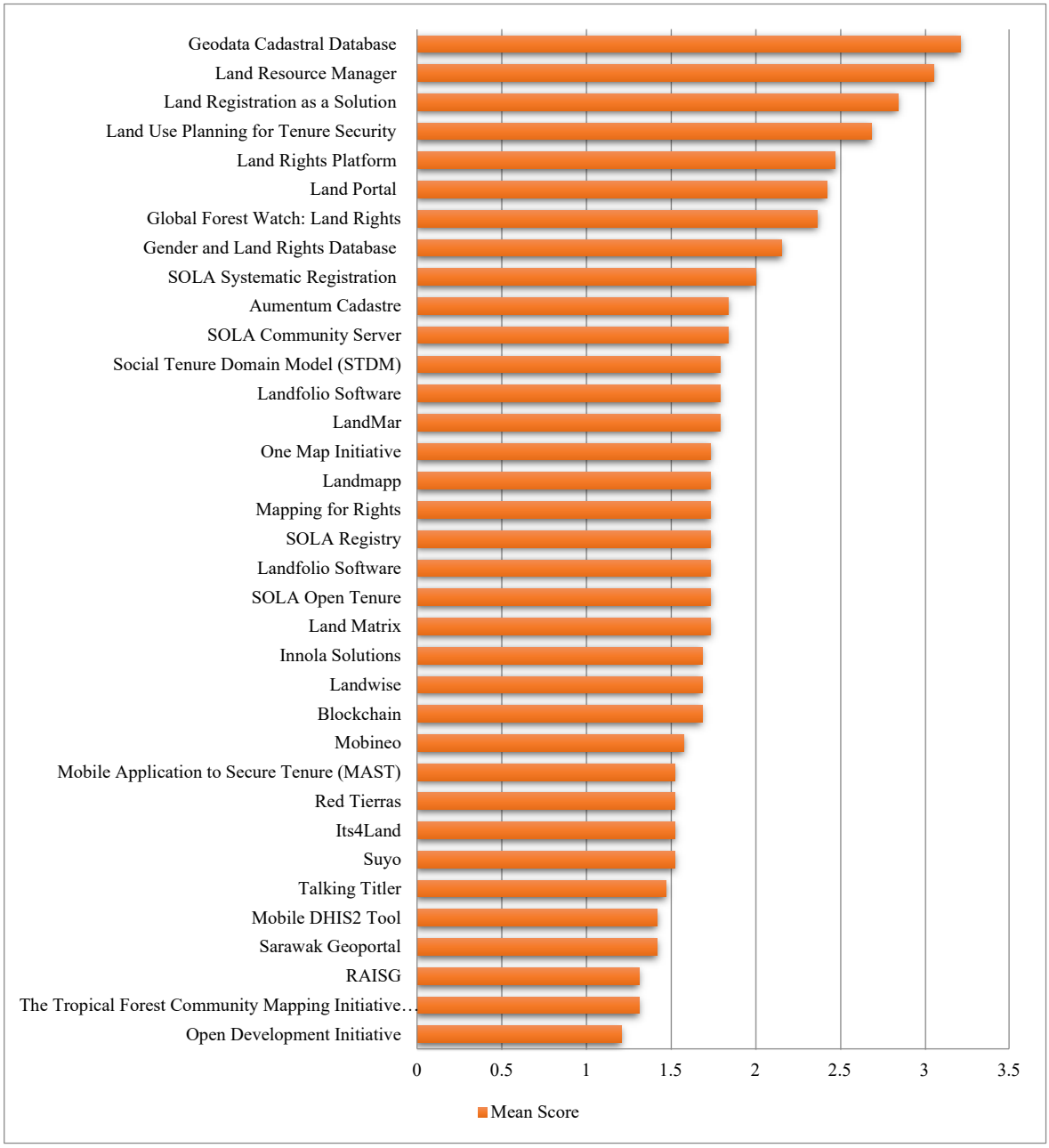

Figure 3 Awareness on technologies in land administration system

Table 5 Area of usage of selected technologies in land administration system

Area of Application	Technologies (Item No. 1 - 9)
Support for Land Tenure Enabling Environment (Type I)	Land Use Planning for Tenure Security Gender and Land Rights Platform Land Portal Land Rights Database
Land Tenure Data Collection and Aggregation (Type II)	Geodata Cadastral Database Land Resource Manager (TII) Land Registration as a Solution Land Portal Global Forest Watch: Land Rights SOLA Systematic Registration
Formal Land Titling (Type III)	Land Registration as a Solution SOLA Systematic Registration

To reveal more knowledge on how the level of awareness varies among the land experts, the study probed further the awareness of technologies in land management across some background information (such as the respondents' institution, specialization, education and relevant years) that could probably influence the respondents' level of awareness. To achieve this, the study deployed cross-tabulation descriptive model to examine the extent to which respondents with varying background information were familiar with the selected technologies in their various categories and whether the differences in the background information co-vary with their level of awareness. The results of crosstab analyses were illustrated with bar chart in Figure 4a for Institution, 4b for specialization, 4c for education and 4d for years of relevant experience.

During the field survey exercise, the questionnaires were administered to the academic members in the tertiary institutions and public servants in the concerned government agencies. Two categories of respondents' institutions i.e. academics (lecturers) and public servants were identified and their mean score were compared on the level of awareness on the technologies. The result showed that, respondents working with the government agencies showed a higher level of awareness compared to their counterpart in academics. As indicated in the bar chart (Figure 4a), the public servants displayed a fair knowledge on some technologies including *Land Right Platform, Geodata Cadastral Database, Land Resource Manager, Land Registration as a Solution and Land Use Planning for Tenure Security* (MS>3.00).

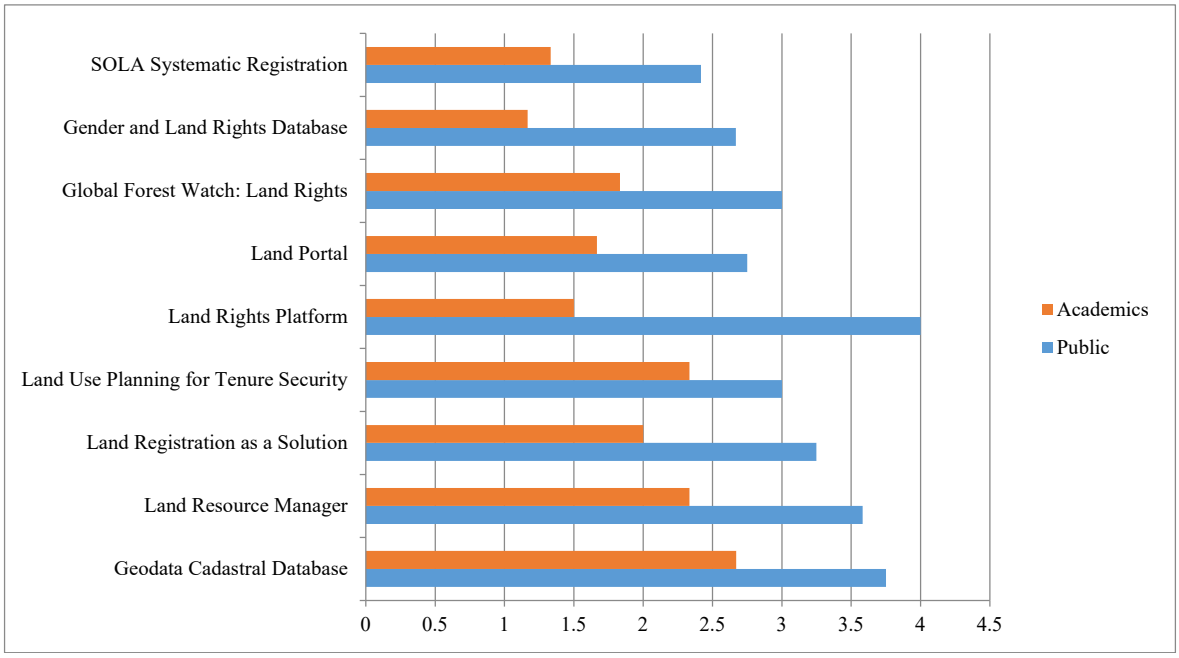

Figure 4a Crosstab of awareness of selected technologies against the respondents' institutions

In Figure 4b, the level of awareness was crosstab against the respondents' area of specialisation i.e. Land Administration (Land Admin.), Geo Information System (GIS), Geography (Geo), Town Planning (Planners), and Housing and Valuation Experts (Housing/Valuation). None of them was familiar with technologies such as Sola Systematic Registration, Gender and land Right Database and Global forest watch (MS<3.00). Specialist in Housing and Valuation showed a fairly knowledge of Land Registration and Geodata Cadastral Database technologies (MS>3<4).

Town Planners expressed the good knowledge in Land Portal, Land Right Platform, Land Use Planning for Tenure Security and Land Resource Manager technologies (MS>4<5) while they showed fair familiarity with Land Registration and Geodata Cadastral Database (MS>3<4). Respondents in Geo Information System sections expressed their fairly knowledgeable level of awareness of technologies such as Global Forest Watch, Land Portal, Land Registration and Land Managers (MS>3<4), while they showed a good knowledge of Geodata Cadastral Database (MS>3<4). For Land Administrative Experts, they only expressed their fair level of awareness on technologies such as Land Rights Platform, Land Registration, Land Resources Manager and Geodata Cadastral Database (MS>3<4).

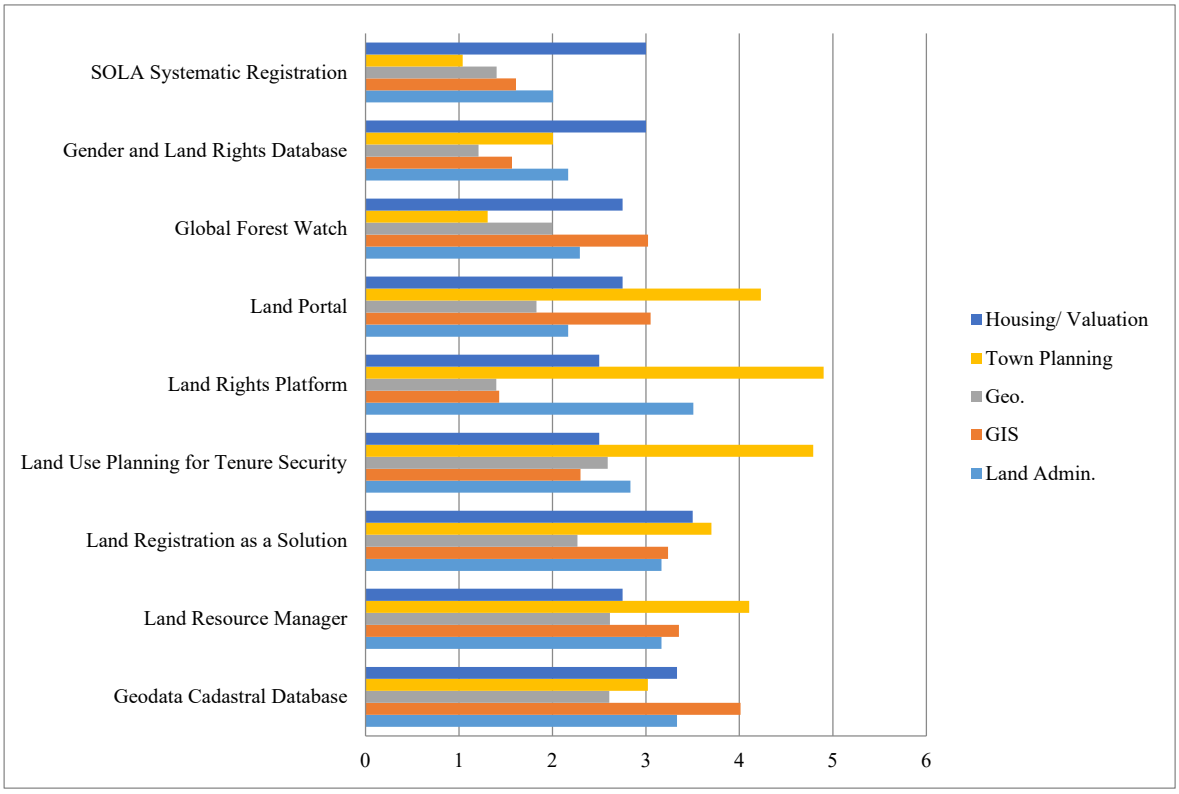

Figure 4b Crosstab of awareness of selected technologies against the respondents' specialization

In Figure 4c, the crosstab on educational background information of the respondents against their awareness level was presented. The HND holders expressed their moderately awareness level of Geodata Cadastral Database (MS>4<5) and fair knowledge of Land Right Platform, Land Use Planning for Tenure security and Land Resource Manager (MS>3<4). Their BSc. degree counterpart has fair knowledge of Geodata Cadastral Database (MS>3<4) and good knowledge of Land Registration technologies. PGD holders identified fairly with Land Registration and Gender and Right Database and indicated to be more aware of Land Resource Manager (MS>4<5). The MSc and PhD degree holders were observed to be in the least categories of respondents that were either not aware or sure about those new technologies in land administration relation matters (MS<3.00). Those respondents with MSc and PhD degrees seemed to be largely lecturers because of their level of non-awareness correspondents with the crosstab in Figure 4a that revealed non-awareness of the respondents in academic line. However, the polytechnic degree holders (HND) showed relatively higher level of awareness over the university degree holders (BSc).

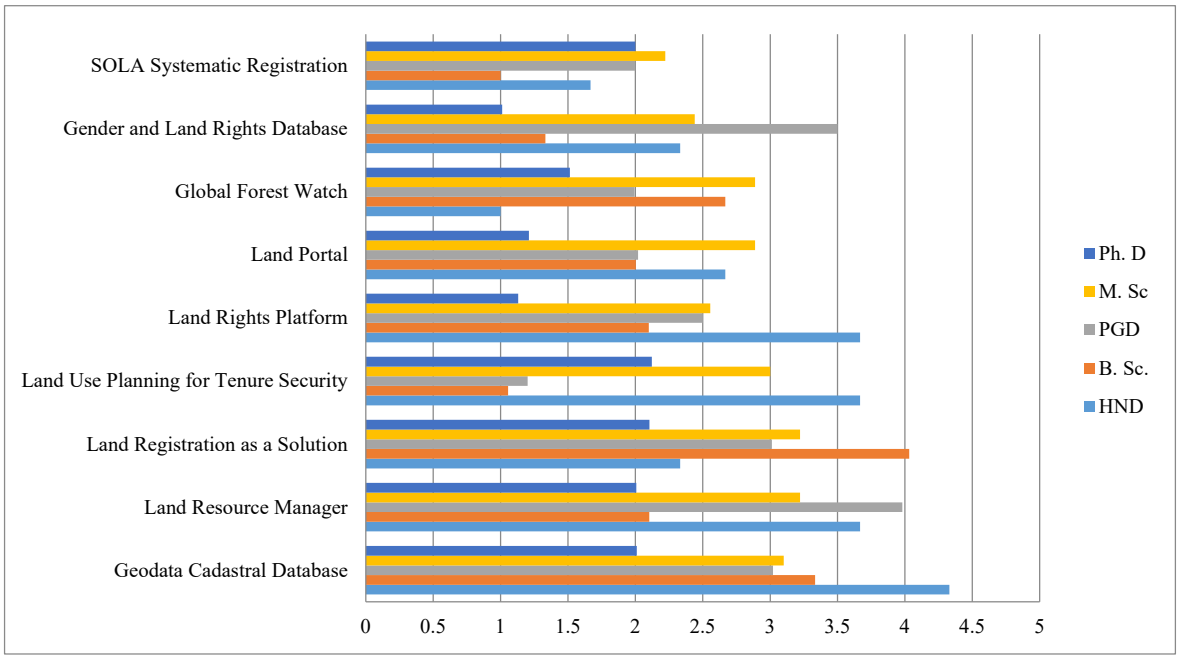

Figure 4c Crosstab of awareness of selected technologies against the respondents' educational background

On respondents' year of experience against level of awareness, the analysis showed that Respondents' that started work less than 5 years ago only expressed that they were well informed about Geodata Cadastral Database technologies (MS>4<5), with a fair knowledge in Land Right Platform and Gender and Land Right Database (MS>3<4). For those that have years of experience for 11 to 15 years, they indicated that they were fairly familiar with Land Resource Manager, Land Registration and Land Use Planning for Tenure Security technologies (MS>3<4). The 16 to 20 years experienced personnel fairly identified with technologies such as Geodata Cadastral Database, Land Resource Manager, Land Registration, Land Portal and SOLA Systematic Registration (MS>3<4), while those that had experience above 20 years displayed a relatively good knowledge about Geodata Cadastral Database, Global Watch Forest, and Gender and Rights Database (MS>4<5) and were fairly informed about Land Resource Manager, Land Registration, Land Portal and SOLA Systematic Registration (MS>3<4) as shown in Figure 4d.

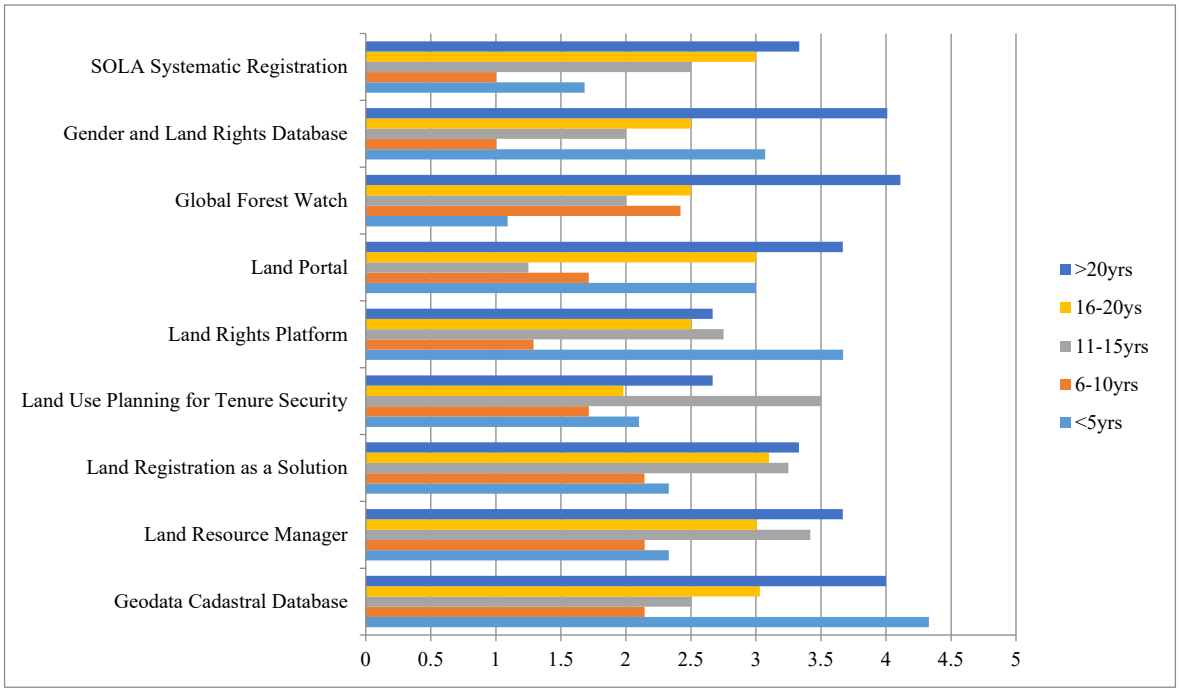

Figure 4d Crosstab of awareness of selected technologies against the respondents' years of relevant experience

All bar chart analyses (i.e. the Figures 4a-d) showed respondents' awareness (in categories) on individual selected technologies. However, through Figure 5a to 5d, the study goes further to investigate the general level of awareness of the technologies of respondents in the categories. The analysis helped to further reveal which of the respondents (in categories) have some familiarity with the technologies. They discovered that the public servants (institution category), Town Planning experts (specialization) and respondents with years of experience more than 20years (>20years) were noted to display a fair knowledge of selected technologies in land administration system.

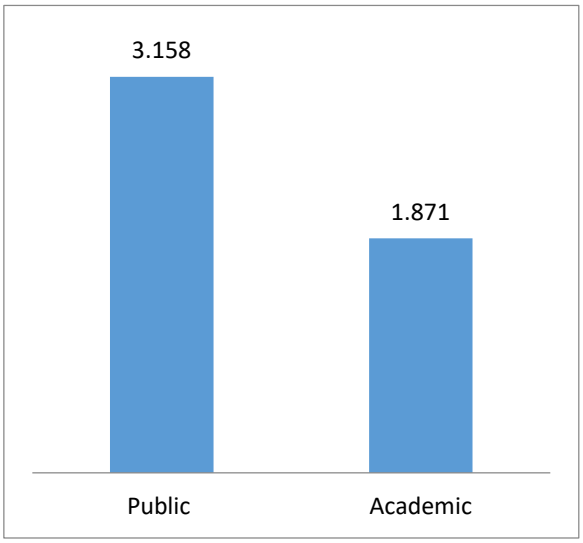

Figure 5a Average mean score of public and academic institutions

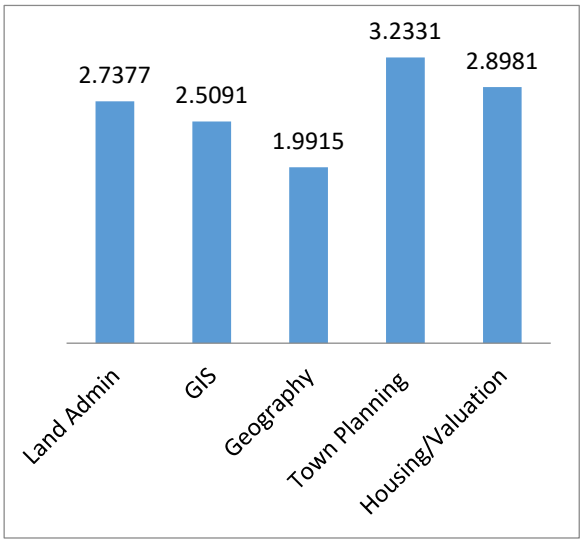

Figure 5b Average mean score of respondents' specialisation

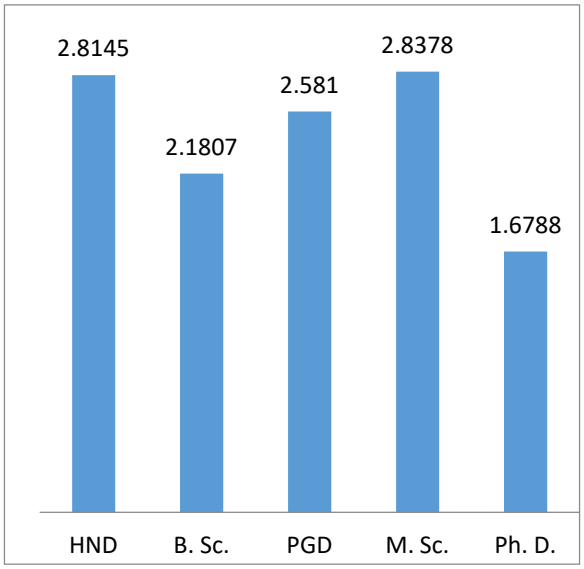

Figure 5c Average mean score of respondents' education

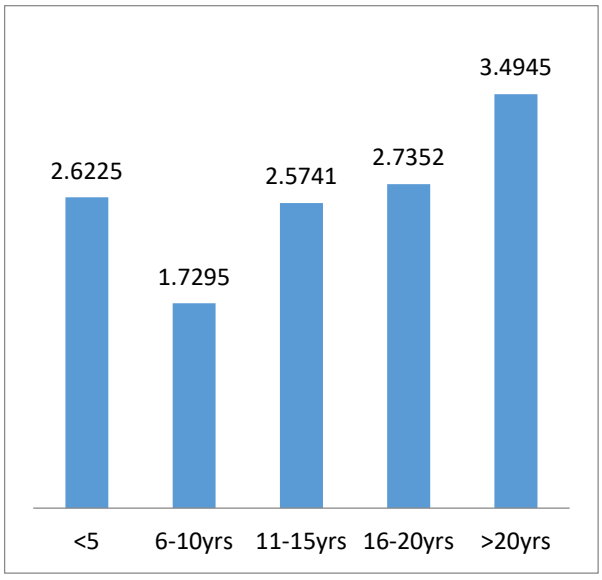

Figure 5d Average mean score of respondents' years of relevant experience

Further probe was done to understand if there was a significant difference in the opinions of the land experts considering differences in their background information such as institution, specialisation, education and years of relevant experience. The study deployed Kruskal-Wallis test and the result was presented in Table 6 The analysis of the test showed that there was no significant difference in the submissions of the respondents as indicated by the Asymp. value which was more that 5% level of significance (p>.05). The result signalled that, the land experts shared similar opinions on the low level of awareness on the technological innovations for land administrative system in the country irrespective of the differences in their background information.

Table 6 Kruskal-Wallis test of LAS technologies and background profile of land expert

Technologies	Institution		Specialisation		Education		Years of Experience	
	Chi-Square	KWT (A.Sig)	Chi-Square	KWT (A.Sig)	Chi-Square	KWT (A.Sig)	Chi-Square	KWT (A.Sig)
Geodata Cadastral Database	4.835	.089	3.903	.419	4.193	.380	5.411	.248
Land Resource Manager	5.941	.051	3.146	.534	4.092	.394	.996	.910
Land Registration as a Solution	4.066	.131	3.395	.494	2.166	.705	1.568	.814
Land Use Planning for Tenure Security	1.871	.392	2.629	.622	5.609	.230	3.058	.548
Land Rights Platform	6.375	.041	8.171	.085	3.587	.465	3.364	.499
Land Portal	2.352	.308	2.631	.621	3.304	.508	5.772	.217
Global Forest Watch	1.514	.469	2.421	.659	7.787	.100	9.135	.058
Gender and Land Rights Database	1.883	.390	1.680	.794	3.763	.439	8.662	.070
SOLA Systematic Registration	2.537	.281	2.344	.673	2.299	.681	8.151	.086

Kruskal-Wallis Test (KWT); Asymp. significance level @ 5% (*)

■5.0 DISCUSSION

Geodata Cadastral Database and Land Resource Manager are noted to be well known in the study area (see Table 4). The tools are used in Land Tenure Data Collection and Aggregation (Type II; Table 5). The fair level of awareness for this category of technologies could be attributed to the fact that, most developing economies like Nigeria are witnessing a strong wave of physical development majorly in housing and road infrastructure. This situation has led to massive public land acquisition, high risk in private land ownership, land disputes, fraud, community land clashes and other land related social crisis. To curtail the ugly situation, there is the need for good data management system. Therefore, the use of technologies such as Geodata Cadastral Database and Land Resource Manager have been strongly advocated for; this has in turn boosted its level of awareness at various echelons of land administration sections.

Generally, the level of awareness on technological innovations in land control and management is very low. This suggests that the operation of land administration is at basic level and largely depend on labour intensity rather than technologies. Thus the manual and human approaches directed towards land management and its resource control in the country have yielded little or no result compared to what is obtainable in other climes, especially the developed and fast developing ones. This inference can be supported with the work of Mabogunje (2002) and Thontteh and Omirin (2015). These studies strongly argued that the extant operation of land administration system in the country is yet to be categorised as being effective and efficient when compared to global best practice. Among the possible attributable factors, Djiré (2007) highlighted instability in policy and inconsistence in land administration strategies as one of the major mitigating factors. This explains the weakened institutional framework (policy) that may further strengthen the low adoption of those technologies.

However, authors including Adeoye and Mensah (2008), Acharya (2009), Atilola (2010), and Mahmud (2013) have substantially advocated the need for the country to look beyond the conventional approaches to land management and keep abreast with the global trend. For instance, Mahmud (2013) opined for digitalized land management system to aid accuracy in surveying boundaries, enhance land databank and quality of tenure system. Atilola (2010) pointed out that the adoption of tech-aid land administration system improves land accessibility, real time and appropriateness in dissemination of land information. Therefore, there is urgent need not only to increase the awareness of innovation technologies in land administration system but also encourage its usage. The increasing awareness of the tech-tools could guarantee to some extent its level of usage, as strongly noted by previous studies. This paradigm shift could aid effective and efficient operations in the country land administrative system.

Figure 4a-d investigated the background information of the personnel (institution, specialization, education and relevant years) against their awareness level. In Figure 4a, the study noticed that, while public servants showed relatively fair knowledge, a large number of the academia (lecturers) were unaware of the new technologies. The fair knowledge of the public workers (in land sections) was attributable to their level of exposure, training and capacity development programmes they had undergone in the course of carrying out their duties. However, the non-awareness of the technologies among the academic staff could be adduced to many reasons. Some of these could be the conventional teaching methods that were largely based on theory with little practical work, poor equipment of technical laboratories with new technologies for learning and level of exposure on the part of lecturers among others. The wide gap in the level of awareness between the academic and the practitioners (public) signalled the weak synergy and equally suggested the need for policy that would enhance their high level of collaboration. Similarly, respondents with HND background (education), specialists in GIS complemented with personnel having relevant work experience of 20 years and above were observed to have higher level of familiarity with the technological tools in there categories. This suggested that the background information of the respondents possessed great influence of their awareness level.

For instance, experts in Geo Information System field tend to relatively show higher level of familiarity with the technologies compared to other specialisations in the categories (Figure 4b). This calls for sensitization and training programme that will cut across all the concerned professions in land administration for holistic development of the land and a management system that fosters the physical

growth and social economic development at the local, national and international levels. Similarly, the noticeable awareness of polytechnic graduates is in consonance with the common saying that polytechnic education gives practical oriented training; which may be due to the nature of their job line (technical officer/technologist). This type of training contributes to their level of exposure. Hence this suggests the need to review the university curriculum to give training that will improve the practical knowledge of students. Also, it clearly shows that the length of experience is prominent to the level of awareness i.e. the length in years of experience, especially in practice the higher likelihood of being informed about trending innovation in technologies. This means that, higher the experience could signify higher level of exposure especially the practical ones.

■6.0 CONCLUSION

The study investigated the level of awareness among land experts on trending technologies that could aid land administration system in Nigeria with the major focus on Federal Capital Territory (FCT), Abuja. The study set out to know the extent to which personnel in land management were familiar with trending innovative technologies in the management of land and its resources. The study discovered that the level of awareness was drastically low, where majority were either not aware or sure. However, the personnel with over 20years wealth of practical related experience especially in the land section of public ministries, department and agencies showed a general fair knowledge. The findings implied that the operation of land administration in the country is still basic, manual and labour intensive. This could likely result in ineffective, inefficient and inequitable land management and resource control. Previous studies (Mabogunje, 2002; Thontteh & Omirin, 2015) have shown lapses in the efficiency of conventional land administrative approach and some scholars including Djiré (2007), Adeoye and Mensah (2008), Acharya (2009), Atilola (2010), Nuhu (2008) and Mahmud (2013) have strongly advocated the urgent need to harness technologies that could aid the country's administrative system. Conclusively, the findings signal that the operation of land administration in the country is still at a basic level, manual and labour intensive. The study therefore recommends the need for scaling up of sensitization and awareness campaigns on the technological innovations, synergy between field and academic land experts, training and re-training of personnel and adoption of strong institutional framework that will enhance LAS in the country.

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