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Information and Communication Technology (ICT) Use and Research Productivity of Middle-level Lecturers in Nigerian Universities

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Abstract

This article examines the influence of the availability and use of information and communications technology (ICT) on the research outputs of middle-level lecturers in Nigerian universities. The influence of specific variables such as the availability of a functional research laboratory, swift internet connectivity, functional laptop computers, functional e-library and data analysis/simulation software was investigated. Performance in research output was operationalised to mean the number and quality of publications. The study utilised a non-experimental research design involving the triangulation of a cross-sectional survey and in-depth interview research methods. The cross-sectional survey method was used to elicit quantitative data from 1,325 respondents drawn from 12 universities in South-west Nigeria, while in-depth interviews with administrators, unit managers, heads of departments, lecturers and students were conducted to generate qualitative data for the study. The results show that while ICT facilities were largely available, ownership was mostly personal; and that although access to ICT impacts research output, productivity of middle-level lecturers in this regard is impaired by inadequate underlying infrastructure and poor funding support for publication and higher education more generally. The article recognises the role of middle-level academics in the domestication of ICT-based higher education in Nigeria and calls for improved funding and more aggressive integration of ICT in higher education in the country.

Keywords: ICT, utilisation, research outputs, Nigerian universities

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Résumé

Cette article examine les effets de la disponibilité et de l'utilisation des technologies de l'information et de la communication (TIC) sur les résultats de recherche d'enseignants de niveau intermédiaire dans les universités nigérianes. L'influence de variables spécifiques telles que la disponibilité d'un laboratoire de recherche fonctionnel, une connectivité Internet rapide, des ordinateurs portables et une bibliothèque électronique fonctionnels, et un logiciel d'analyse/simulation de données a été étudiée. Dans le présent travail, la performance dans les résultats de recherche a été opérationnalisée pour signifier le nombre et la qualité des publications. L'étude est basée sur une conception de recherche non expérimentale impliquant la triangulation de méthodes d'enquêtes transversales et d'entretiens approfondis. La méthode d'enquête transversale a été utilisée pour obtenir des données quantitatives auprès de 1 325 répondants issus de 12 universités du sud-ouest du Nigéria. Les entretiens approfondis avec des administrateurs, des responsables d'unité, des chefs de département, des professeurs et des étudiants ont été menés pour générer les données qualitatives de l'étude. Les résultats montrent que les installations TIC sont largement disponibles, mais sont, principalement, des propriétés personnelles ; et que, malgré l'impact de l'accès aux TIC sur les résultats de la recherche, la productivité des enseignants de niveau intermédiaire est entravée par l'inadéquation de l'infrastructure sous-jacente et l'insuffisance du soutien financier alloué à la publication et l'enseignement supérieur en général. L'étude reconnaît le rôle des universitaires de niveau intermédiaire dans la domestication de l'enseignement supérieur basée sur les TIC au Nigéria et appelle à un meilleur financement et à une intégration plus proactive des TIC dans l'enseignement supérieur du pays.

Mots-clés : TIC, utilisation, résultats de recherche, universités nigérianes.

Introduction

This article discusses the outcome of a study that was conducted to examine the availability and use of ICT in 12 universities in Nigeria's South-west region. The study also sought to determine how and the extent to which ICT facilities such as functional research laboratory, swift internet connectivity, functional laptop computers, functional e-library and data analysis/simulation software affected the performance of middle-level academics. The study was spurred by the growing utility and relevance of ICT in research, especially in higher education, and by the need to establish if and the extent to which middle-level academics in Nigeria are leveraging the humongous possibilities offered by ICT to improve the quality and quantity of their research, and to enhance their visibility in the global epistemic village. Extant

literature seem to suggest that efforts at both governmental and institutional levels to adopt and integrate ICT in higher education institutions across Africa has remained largely sluggish and uneven (Hennessy et al. 2010; Nja and Idiege 2019) and that ICT facilities in most of universities are plagued by poor quality and low speed of connectivity, inadequate underlying infrastructure and low levels of awareness and commitment by higher education administrators (Idowu and Esere 2013; Nwankwoala 2015). Yet, in ICT driven global world, prioritising ICT adoption and integration, especially by higher educational institutions, has become non-negotiable if these institutions are to attain optimum global visibility and competitive advantage in the discharge of their core mandate of knowledge production through teaching and research.

Statement of Problem

The centrality of ICT in today's globalising world has been acknowledged. Its positive and pervasive influence permeates every facet of human endeavour. Kpolovie and Awusaku (2016) describe it as a revolution with an abiding capacity to positively transform every aspect of our social, economic, and cultural life. For the education sector, the adoption of ICT has redefined activities in all aspects of the provision and administration of higher education (Egoeze et al. 2018). Maitra et al. (2017) add that, for the researcher specifically, ICT also facilitates access to and exchange of intellectual properties among colleagues across geographical divides, improves the quality of research and publications through the use of information and quality materials from the internet, facilitates record-keeping and enhances overall job efficiency.

However, despite the promises of ICT for research, data on whether and how academics in Nigerian higher education, particularly middle-level academics, are using ICT to improve their research are still scanty, narrow and mostly focus on limited aspects of ICT such as the internet (Ajegbelen 2016). In addition, literature suggests that ICT has had greater impact on administrative services such as admissions, registration, fee payment and purchasing and that these financial services are conducted online. Conversely, there is little or no online visibility of much of the works of Nigerian academics, thus raising questions about their exploitation and the revolutionising power of the ICT (Ezema 2011). This study sought to fill this gap in knowledge by interrogating the influence of ICT availability and utilisation on the research performance of middle-level academics across the three categories of universities – federal government-owned, state government-owned and private sector-owned – in Nigeria.

Literature Review

This section of the article attempts to provide a thematic review of literature on ICT availability in higher education, ICT accessibility and utilisation in higher education and ICT and research outputs of academics in higher education.

ICT in Higher Education

Since the start of the twenty-first century, there has been a considerable expansion of ICTs in higher education systems around the world (Saikia 2017). This is connected with the enormous opportunities and ease of life that ICT presents to all players in the sector (Tedla 2012). Egoeze et al. (2018) hold that the adoption of ICT in higher education institutions especially has redefined activities in the teaching and learning process, research and information sourcing, administrative services/management of students' records, as well as communication among teachers, students, researchers and others in these institutions and beyond. It is in this context that Punie (2007) and Wang (2008) contend that ICT has become a desideratum for any university or institution that aspires to reduce costs, deliver on mandates of promoting teaching and research, achieve global visibility and truly compete in our fast-growing digital world.

However, the use of ICT to improve higher education has remained uneven across regions, countries and even institutions within same countries (https://www.iau-aiu.net/technology). While most of Europe is maximising the full benefits of ICT in higher education, most of Africa appears to lag (Hamidi and Chavoshi (2018); Alden Rivers et al. 2015). Latin America and Asia also rank ahead of Africa in ICT integration in higher education whether for teaching, learning or research (World Bank 2016). Within Africa, variations also exist, with studies putting South African universities ahead of Eqypt, Algeria, Bostwana, Kenya, Senegal, Uganda, Ghana, and Nigeria (in that order) (World Bank 2016). This is expected given the ranking of Africa as the worst region in the world in the International Telecommunication Union (ITU) Information and Communication Technology Global Development Index 2015 (International Association of Universities, n.d.). In Africa, Nigeria is ranked among the very worst five countries, in 134th position with a very low score of 2.61 in the ICT Development Index by ITU (2015). The ITU Information and Communication Technology Global Development Index is a key indicator of national advancement (ITU 2015) Underscoring the importance of this ranking, Kpolovie and Awusaku (2016) note that ICT has become a key factor in distinguishing between

developed and developing countries. They add that ICT has since become the core basis for national survival and development and that the growth of a nation can correctly be defined based on the number of its citizens who effectively and efficiently employ ICT to meet human needs productively.

Different surveys blame the sluggish penetration of ICT use in higher education in different parts of Africa, including Nigeria, on diverse factors including weak infrastructure either in terms of low broadband width or lack of access to reliable source of electricity; unequal access to these resources between urban and rural areas; high costs of using such a technology; the poor perception of ICT by some African governments, at least at the current stage of development; and poor ICT skills, among others (Hennessy et al. 2010; Wilson et al. 2014).

Availability of ICT in Higher Education in Nigeria

After years of apathy, the Nigerian government introduced the Nigerian National Policy on IT in the year 2001. The aim of the policy was to revitalise the country in general and its educational sector in particular, in keeping with the acknowledged role of ICT. Yushau and Nannim (2018) note that one-third of the objectives of the policy dwelt on the need to integrate IT into the mainstream of education and training, to establish new multi-faceted IT institutions as centres of excellence to ensure Nigeria's competitiveness in international markets, and to develop human capital with emphasis on creating and supporting a knowledge-based society. Some of the implementation strategies of the policy included the restructuring of the education system at all levels to respond effectively to the challenges and emerging impact of the information age and particularly, the allocation of a special IT development fund to education at all levels. An ICT department was also created at the Federal Ministry of Education to collaborate with government agencies and other stakeholders in the private sector to initiate ICT-driven projects and programmes to impact all levels of the education sector (Ekpo 2012).

Despite the above efforts and initiatives, the application of ICT to higher education in Nigeria, as in the rest of Africa, has remained far from satisfactory. Nigerian universities are yet to appreciably integrate ICT into its curricula to have a better direct impact on economic growth in the current world of e-commerce, e-governance, e-learning and e-everything (Kpolovie, Iderma & Ololube 2014). There is also little evidence of ICT integration and use in the teaching, learning and research in Nigerian universities (Bello and Aderibigbe 2014). This may not be unconnected with an earlier

observation by Achimugu et al. (2010) that tertiary institutions in Nigeria lack adequate ICT infrastructure to effectively tap into the opportunities offered by the cyberspace. Ekpo (2012) reinforces this point when she argued that, although the National Universities Commission (NUC) prescribes that there should be at least one computer to every four students and one PC to every two lecturers below the grade of lecturer I, one PC per senior lecturer and one notebook per reader/professor, the majority of Nigerian universities have not achieved this recommended system ratio for their faculties. Instead, many university lecturers and students must go to commercial cyber cafés in town before they have access to a computer that is internet connected or at best buy private modems with which they are able to connect to the internet. For the private universities, the situation was better off in terms of availability of ICT facilities because many of them have 24-hour internet connectivity in their campuses, and there are comparatively fewer lecturers and students than in public universities.

In a study on ICT availability and utilisation in tertiary institutions in Cross River State, Egomo et al. (2012) found that the three institutions that were covered by the study did not have the necessary ICT facilities for instruction and research, and neither did the lecturers possess skills in ICT for effective classroom interactions. This approximates an earlier study by *Gambari and Chike-Okoli* (2007), which found specifically that only 20 per cent, 52 per cent and 48 per cent respectively of the respondents agreed to the availability of ICT facilities at universities, polytechnics and colleges of education *in Niger State*. About 56 per cent of all respondents agreed that ICT facilities were available at all levels of tertiary institutions in the state. In another study on the ICT services available in educational and research institutions in Nigeria, Osofisan and Osunde (2007) observed that there were computer systems in many of these institutions, but that their use was limited to only word processing and that they were often plagued by one problem or another, including low access speed, poor power supply and poor maintenance culture. They also found that most of the institutes and universities had ICT equipment and services such as printers, scanners, local area network (LAN), email, the internet, intranet and telephone, but there was no wide area network (WAN) connectivity between any two educational or research institutes in Nigeria, that not all the institutes had websites, that those that did were not updated regularly and that the content of most of the websites were not useful to researchers. Their position was corroborated by the works of Jumare et al. (2017) and Nkoyo and Egbe (2016), indicating that there are inadequate ICT facilities in the universities and that, where facilities are available, they are dormant and underutilised

(Egoeze et al. 2014; Hamilton-Ekeke and Mbachu 2015). Yushau and Nannim (2018) add that internet connectivity in most tertiary institutions in Nigeria was poor because the bandwidth subscribed is too small to support any meaningful activity during peak periods and that, where ICT infrastructures like multimedia projectors are available, other infrastructures like interactive whiteboards are lacking. In sum, therefore, ICT availability in higher education in Nigeria is still a challenge.

Accessibility and Utilisation of ICT in Higher Education in Nigeria

Access to ICT infrastructure and resources are necessary preconditions for the effective adoption and integration of ICT hardware and software facilities into teaching, learning and research in universities and other tertiary educational institutions (Ololube et al. 2015). Access here is used to refer to the ability and the actual frequent application of that ability in utilising the functionality and benefits of ICT tools, facilities, systems, or entities (Kpolovie and Iderima 2016). The term also describes the degree to which ICT is accessible to key stakeholders in the universities. ICT utilisation is the actual appropriate use of ICT facilities and services or taking advantage of the services made possible by ICT facilities for teaching, learning and research. Access and utilisation are both aided by availability and much more by the competence and appropriate attitude of people towards technology; availability or simply having ICT in schools will not guarantee their effective use either for teaching or for research unless there is access, competence and the right attitude (Kpolovie and Awusaku 2016).

Compared with developed countries, and even parts of Africa, access to ICT in most of Nigeria's higher institutions is not as widespread as would be optimal, and utilisation of e-learning or ICTs in higher education institutions in Nigeria is low (Beebe 2013). This is corroborated by Egoeze et al. (2014) who investigated the extent and level of ICT application in Nigerian universities and found that the usage of following were all at the lowest level: scanners, webcams, digital cameras, WAN interconnecting the university to other institutions or linking various campuses, LAN, controller area network (CAN) connected to the internet for private internet access by the university, e-library for online access to the university library resources, use of teleconferencing for interactive communication for lectures, seminars, meetings, and radio/television broadcast lecture delivery. *Egomo et al. (2012)* had earlier found that although lecturers in tertiary institutions in Nigeria recognise the importance of ICT in teaching, learning and research, their competence and usage of the available ICT facilities is below expectation. Gambari and Chike-Okoli (2007) similarly note that although most Nigerian

tertiary institutions already incorporate computer study as part of their academic programmes, most of them are still theoretical in nature and so are unlikely to meaningfully impact society; they also found that ICT has had more impact on administrative services such as admissions, registration, fee payment and purchasing than on the fundamentals of classroom teaching, learning and research. This view is reinforced by Kpolovie and Awusaku (2016), who observed that financial dealings are more or less online in most Nigerian universities, but the areas of data assessment such as semester results, grades, lecture timetables and lecture notes are still not being attended to with the use of ICT, even when fees have been charged for the requisite ICT facilities. This raises concerns about lecturers' access, competence, and attitudes to ICT, especially given that many lecturers have only very few publications that are readily available on the World Wide Web.

Existing literature indicates a positive relationship between university lecturers' computer competence and their attitudes toward, as well as their utilisation of, ICT for teaching and research. Most teachers who showed negative or neutral attitudes towards the use of ICTs in education lacked knowledge and skills that would enable them to make informed decisions (Al-Oteawi 2002; Jimoyiannisa and Komis 2007). Research has demonstrated a correlation between computer access and teachers' attitudes toward technology (Kpolovie and Awusaku 2016), as well as between access to ICT resources and their utilisation (Emmanuel et al. 2014). Lecturers' successful utilisation of ICT for teaching and research is hampered by a myriad of problems. Among these are low levels of ICT literacy, a dearth of technical staff, low levels of funding, irregular power supply, prohibitive costs of ICT facilities and lack of relevant ICT infrastructures (Ololube et al. 2014). Others include resistance to change (Cuban et al. 2001; Idowu and Esere 2013) and cultural perceptions (Albirini 2006).

ICT and Research Output Among Academics in Higher Education

Research is one of the core duties for which the university lecturer is engaged. Not only is research output – measured in terms of the number and quality of publications (journals, books, chapters in books, conference papers, reviews, reports, research proposals etc.) – the key determinant of academic career advancement, it is indeed a major indicator of their quality (Kpolovie and Awusaku 2016) and productivity (Popoola 2008). Research output enables academic staff to demonstrate scholarship, gain recognition for creative thinking and develop a reputation for expertise in a specialty area; it also partly determines both local and international recognition and

respect for academic staff and academic institutions more generally (Popoola 2008). In any field of specialisation, it provides current information for growth, progress, and improved society.

This explains the burden on the academic to either publish or perish and underscores the seeming celebration of the advent of ICT among most researchers in view of its potential to facilitate the efficient and effective performance of their research tasks (Akpan 2014). Colwell (2000) also suggested that the widespread use of ICTs will inevitably influence every area of research. Kpolovie and Awusaku (2016) add more specifically that ICT is quite relevant in research designs and execution of experiments, descriptive studies, statistical analysis, data production and storage and dissemination of research information, Ehikahamenor (2002) notes that ICTs are altering the ways in which academics hunt for information, communicate with each other, conduct research and dispense research results. ICT can assist research in any discipline as it provides faster and easier access to most comprehensive and up-do-date information through digital libraries that provide digitised full-text resources to learners and researchers.

Despite the acknowledged importance of ICT to research, however, empirical studies on the influence of ICT on research outputs especially in Nigeria are still scarce (Nwagwu and Agarin 2007) and mostly focus on limited aspects. Kpolovie and Awusaku (2016) also add that lecturers' attitudes towards the adoption of ICT in the execution of research and teaching/learning activities have not been duly investigated.

In one of the few existing studies on the impact of utilisation of internet services on teaching and research outputs in two private universities in South-western Nigeria, Okafor et al. (2011) found a remarkable difference in the percentages of research output of respondents three years before they began to access and utilise internet services and after they began to access internet services. Specifically, they found that the utilisation of internet services aided the respondents to publish their works (54.3 %), to attend conferences (61.6 %) and to improve both the quality of their teaching (74.2 %) and the quality of their research output (79.1 %). Furthermore, respondents recorded an improved research output in terms of books, chapters in books, monographs, and journal articles, from when they began to use internet services compared to their research output prior to the implementation of computers and internet services at their institutions. The study, however, recognised that a number of other variables such as lack of funds, unfavourable university policies/guidelines on promotion and publications, individual traits of academics, environmental factors, differences in perspectives and other social constraints could mediate between internet use and research publications. These factors also influenced

the extent of utilisation of internet services, for which purpose and the type of research output respondents concentrated on (books, chapters in books, monographs, journal articles or conference attendance). For instance, while senior academics did not prioritise the internet because they were under less pressure to publish having already reached the peak of their career, junior and middle ranked academic staff were found to be more motivated in browsing for materials on the internet for promotional advantages than for scholarship purposes. These choices were based on how they perceived their situations and goals within the university system.

A related study by Khan and Dominic (2009) on the influence of internet use on research output by 50 faculty members of the Engineering College of Moradabad, India, also found that while 50 per cent of the respondents claimed it had great influence, 30 per cent reported partial influence and 20 per cent reported no influence at all, suggesting the possible influence of other undetermined variables. Zainab and Meadows (1999) investigated the impact of the use of computers on research productivity in two Malaysian universities – University of Malaya and National University of Malaysia – using eighty-three academic engineers and 239 academic scientists. They found that although more than half of the academic engineers used computers for research purposes, it did not significantly influence their publication output. On the other hand, they found that the highly published academic scientists were those who made frequent use of computers. This may also suggest that while ICT use is a predictor of research output, other intervening variables may mediate between use of computers and publication outputs.

For instance, in their analysis of ICT utilisation and the research outputs of Kenyan scientists, Schaefer et al. (2016) found that institutional affiliation (institutional context), level of education and type of research activity engaged in will predict their use of ICT in research. The study established that scientists in Kenyan Universities utilised ICTs for research more than those in the Kenyan Agricultural Research Institute (KARI) and that the level of education of a scientist was related to the extent to which they utilised ICTs to enhance research outputs. Also, while KARI scientists appeared more prominent in the use of ICTs to present their data at conferences, university lecturers were more proficient in simulation and data analysis and review and publication of journal articles (Schaefer et al. 2016). A similar study by Akpan (2014) on the relationship between ICT competence and lecturers' job efficacy in selected universities in Cross River State, Nigeria, revealed that the higher the skills of a lecturer on ICT utilisation, the more likely they will deploy ICT for research and teaching in the university.

Most studies agree that ICT affects lecturers' research output, though other factors may also contribute. This study sought to examine these factors within an as-yet unstudied group – that of middle-level lecturers in Nigerian universities – to ascertain the links between ICT utilisation and research outputs.

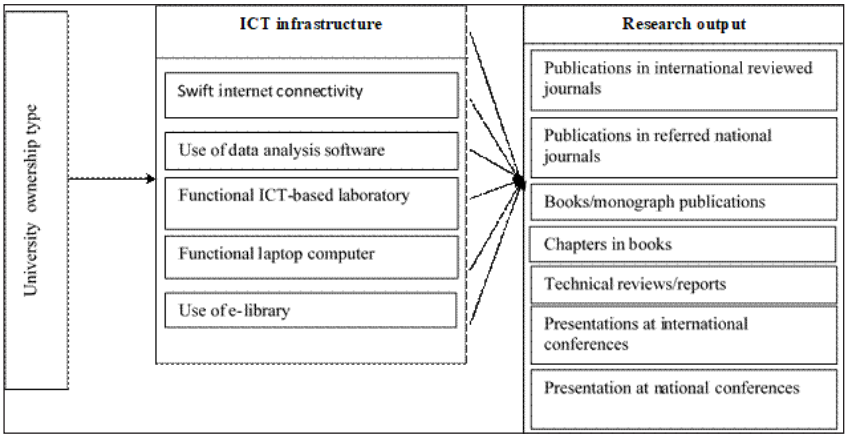

Figure 1: Research model

Source: Adapted from Jabbouri et al. (2016)

Proposed Research Model

This research builds upon the conceptual model for measuring the efficiency of ICT infrastructure on education as sourced from literature. It considers ICT infrastructure availability and utilisation as the independent variable whilst seeing research outputs of academics as the dependent variable. Oyerinde and Bankole (2019) as well as Jabbouri et al. provide support for the model through their research, which demonstrate links between various forms of ICT infrastructure to performance. The model posits that ICT infrastructure – hardware, software, networking and communications, databases and, in our case here, swift internet connectivity, use of data analysis software, functional ICT-based laboratories, functional laptop computers and e-libraries – are predictors of productivity measured in terms of research output of academics (see Mitchell et al. 2012). Where these infrastructures are available, functional, and utilised, they will predict high research output and vice versa. Also, given literature evidence that availability and functionality of ICT infrastructure in the Nigerian higher education is sometimes influenced by type of university ownership, this paper further posits that research outputs of academics will vary based on the ownership of their universities – whether public or private.

Methods and Data

Research Design

The study adopted the non-experimental research design involving the triangulation of a cross-sectional survey, in-depth interview research methods, and a checklist of available ICT materials in the selected institutions. A cross-sectional survey collected quantitative data from 1,325 participants across 12 universities in South-west Nigeria. Additionally, in-depth interviews with administrators, unit managers, department heads, lecturers, and students provided qualitative insights for the study. The adoption of the mixed research design derives from its acknowledged benefits, one of which is that it enhances the validity and reliability of data obtained because of the high likelihood that information that are missed out by one method are captured by the other (Caracelli and Greene 1993; Olsen 2004). The non-experimental research design was also adopted because it is the most preferred in studies where experimentation is not desired to investigate the study variables (Reio 2016).

Study Population and Sample Size

The population for this study consisted of all middle-level academics operationalised in the study to refer to academics who are designated as lecturers II, lecturers I and senior lecturers (using the standard lecturing grades in Nigeria) in 12 selected universities across the six states of South-western Nigeria. An equal number (4) of universities was sampled based on ownership type, namely: federal government, state governments and private operators to allow for comparison. A sample of 1,500 middle-level academics was drawn from the selected universities for the cross-sectional survey based on populations and in a manner that ensured that all the faculties, schools and colleges in each university were sampled in order to guarantee fair representation. Only 1,325 questionnaires were filled out correctly and sent back. (Refer to Table 1 for details about the universities and sample sizes.) For the qualitative data, six lecturers, one library staff and one ICT personnel were purposively selected in each university. The library and ICT staff were selected to provide information on the status of availability and functionality of the ICT facilities under investigation. The study was a one-time study conducted between June and October 2018, and the individual lecturer is the unit of analysis.

Table 1: List of sample universities and sample size

State	Schools	Ownership	Proposed sample size	Achieved sample size
Ekiti State	AfeBabalola University, Ado-Ekiti	Privately owned	75	86
	Ekiti State University, Ado-Ekiti	State government	175	140
Lagos State	University of Lagos, Akoka	Federal government	150	122
	Lagos State University, Ojo	State government	100	86
Ogun State	Covenant University, Ota	Privately owned	75	60
	Federal University of Agriculture, Abeokuta	Federal government	175	156
Ondo State	AdekunleAjasin University, Akungba	State government	175	162
	Joseph Ayo Babalola, University, Ikeji-Arakeji	Privately owned	75	74
Osun State	ObafemiAwolowo University, Ile-Ife	Federal government	175	156
	Redeemers University, Ede	Privately owned	75	64
Oyo State	University of Ibadan, Ibadan	Federal government	150	184
	LadokeAkintola University, Ogbomoso	State government	100	35
Total			1,500	1,325

Research Instruments and Operationalisation of Variables

A structured questionnaire was used to elicit quantitative data from respondents. The questionnaire contained closed ended questions for the nominal and binary variables except for ratio variables that require input of actual numbers. The questionnaire contained ten sections and eighty-one questions. The section on socio-demographic characteristics had questions on sex, age, ethnicity, marital status, religion, education, position, nature of employment, among others. Regarding ICT facilities, the study interrogated access to five core items, namely: functional research laboratory, swift university internet connectivity, functional laptop computers, functional e-library and data analysis/simulation software. The questions were designed to gather suitable responses related to this topic. Research outputs were similarly measured on the basis of six indicators, namely: number of articles in peer reviewed international journals, number of articles in referred local

journals, number of books/monographs, number of book chapters, number of presentations at international conferences, number of presentations at national conferences, number of technical reports and number of written research proposals. The respondents' claims were verified through direct examination of the publications.

An in-depth interview guide was used to collect qualitative data. In the guide for lecturers, respondents were asked about availability and functionality of different forms of ICT facilities in their university, and how these affect their research outputs and publications. However, the interview guides for library and IT personnel required the respondents to describe access and use of available ICT facilities by middle-level lecturers.

Data Analysis

Quantitative data were entered and analyzed using version 22 of the Statistical Package for Social Sciences. Frequencies, means and percentages were used for descriptive univariate analysis while T-Test (for independent variables with two attributes), analysis of variance (for independent variables with three attributes) and binary logistic regression were used to test six different hypotheses, namely: the relationship between swiftness of university internet connectivity research output; the association between use of data analysis and simulation software and research outputs; whether access to functional research laboratory would increase research outputs; the association between availability of functional laptop computer and research output; the association between use of e-library and research output; and whether private universities perform better in research output than government universities. The interviews were transcribed in Microsoft Word and content analysed along major themes.

Ethical Considerations

Letters of notification were written to the Vice-Chancellors of the twelve universities to inform them about the study prior to commencement. The questionnaire also contained a brief introduction and a letter of consent. Additionally, respondents received a verbal explanation of the study prior to taking part. No participant was coerced into participating in the study.

Results

Results indicated that 46.6 per cent of the respondents were drawn from federal universities, 31.9 per cent were from state universities, while 21.4 per cent were from private universities (see Table 2). About 68 per cent of the

respondents were male and 32 per cent were female. Also, 45 per cent of respondents were 40–9 years old, followed by those in the age bracket of 30–9, who constituted 35.5 per cent. The mean age was 42.5 with a standard deviation of 7.23. Lecturers II constituted 35.3 per cent of the total sample, lecturers I 35.9 per cent while senior lecturers constituted 28.8 per cent of the sample. About 95 per cent of the lecturers were full-time staff.

Table 2: Demographic characteristics of respondents

Nature of ownership	**Frequency**	**Per cent**
Federal	618	46.6
State	423	31.9
Private	284	21.4
Total	1,325	100.0
Sex	Frequency	Per cent
Male	897	67.7
Female	428	32.3
Total	1,325	100.0
Age	Frequency	Per cent
Below 30 years	48	3.6
30–9 years	471	35.5
40–9 years	596	45.0
50 years and above	210	15.8
Total	1,325	100.0
Mean: 42.5		S.D: 7.23
Rank/position	Frequency	Per cent
Lecturer II	468	35.3
Lecturer I	476	35.9
Senior lecturer	381	28.8
Total	**1,325**	**100.0**

Availability and Functionality of Selected ICT Facilities

As indicated earlier, the study investigated the availability of specific ICT facilities considered critical to research output especially, such as functional research laboratory, swift internet connectivity, functional laptop computers, functional e-library and data analysis/simulation software. It turned out that none of the sampled universities had up to 90 per cent availability of any

of these basic ICT facilities. Functionality was also observed to decrease, compared to availability, in all items examined. The most available item was a laptop computer at 88.0 per cent. However, most of available laptop computers were personally owned as opposed to official ownership, as shown in Table 3 and demonstrated in Figure 2. The functionality of laptop computers when compared to availability is 9.5 per cent short. Internet facilities, university email services, and websites recorded shortfalls of 27.1 per cent, 31.5 per cent and 29.8 per cent respectively in functionality. The least available facility is e-library (37.7 %), which recorded only 24.3 per cent functionality. Private universities recorded the highest level of availability of desktop computers at 78.4 per cent. However, state universities recorded the highest level of functionality of laptop computers with 94.8 per cent followed by federal universities at 91.5 per cent. Printers, scanners, and digital photocopying machines were more available and functional in private universities than government-owned institutions. Most of the lecturers purchased the laptops they use with their own money. While university email services, websites and e-libraries were one hundred per cent officially owned and provided by the universities, only 53.7 per cent of respondents had access to official internet facilities. A much lower proportion had access to provision of other ICT facilities including desktop computers, laptop computers, printers, scanners, and digital photocopying machines. Lecturers in private universities enjoyed official ownership of ICT facilities more than their colleagues in public universities. Purchase of these facilities with personal money was common across all the items in public universities than in private ones.

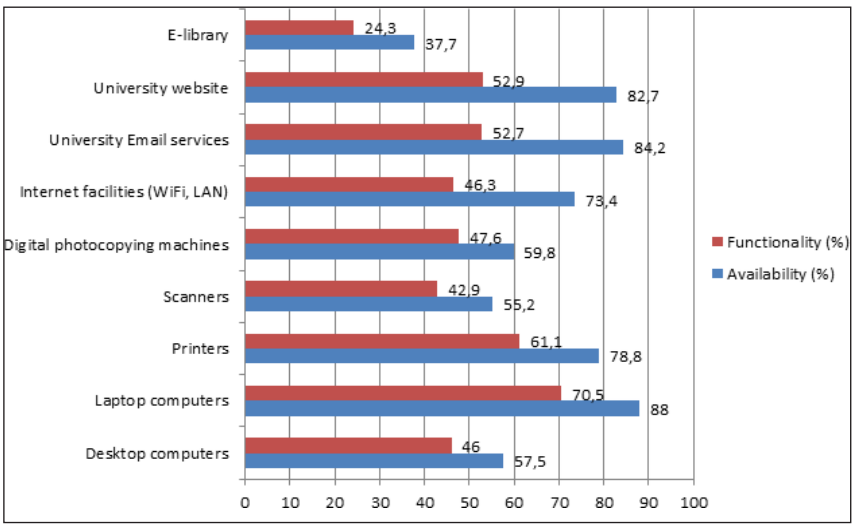

Figure 2: Chart showing the availability and functionality of ICT

An analysis of the data from the in-depth interviews (IDIs) also reflects the findings from the quantitative data. Bemoaning the non-functionality of most ICT facilities in some universities, a respondent reported thus:

> The facilities are not available; even when they are available, they are usually malfunctioning. Most of these facilities are outdated…Some of the facilities that are presently available on campus are not up to date with the current technological advancement…One of the problems is inadequate training, a lot of people would have loved to make use of these facilities. Even if they were available, how many people have acquired the training on how to use them? Skype is available, for instance, but how many people are aware that there is networking platform called Skype. We have a lot of old lecturers who cannot search through their mail. They must employ assistants to check their mail, and to send their mail to them. Rigidity and resistance to change is a problem among our colleagues. In addition, most of these facilities are never prioritised by the University. Many of what you see are provided for by units/departments using internally generated revenue (IDI, male lecturer).

Access to and Utilisation of Research-related ICT Facilities

This study found that 45.1 per cent of the respondents had access to functional ICT-based research laboratory, 49.1 per cent reported that internet connectivity in their universities was quite slow, while barely 8.3 per cent of the respondents reported that they had very fast internet connectivity in their universities. Also, only 42.5 per cent of the respondents reported that they had access to the university e-library always while another 18.9 per cent had no access to the e-library at all. While 43.5 per cent of respondents could only use data analysis software well, another 24.9 per cent could not use any data analysis or simulation software at all, as shown in Table 3.

Table 3: Access to and utilisation of research-related ICT facilities

Access to functional ICT research laboratory	**Frequency**	**Per cent**
No	727	54.9
Yes	598	45.1
Total	1,325	100.0
Swiftness of internet connectivity	Frequency	Per cent
Very fast	110	8.3
Fast	564	42.6
Slow	651	49.1
Total	**1,325**	**100.0**

Frequency of access to university e-library	**Frequency**	**Per cent**
Always	563	42.5
Sometimes	512	38.6
Never	250	18.9
Total	**1,325**	**100.0**
Use of data analysis and simulation software	**Frequency**	**Per cent**
Very well	419	31.6
Fairly well	576	43.5
Not at all	330	24.9
Total	**1,325**	**100.0**

Results from the qualitative data revealed that the internet and electricity supply were central to the functionality of other ICT facilities. Unfortunately, these were mostly unavailable. As a respondent put it:

> The very first thing when talking about ICT is the internet, so when internet is not present, every other component of ICT is not going to work. Currently, we are having issues with the university internet. If there is no internet, how do you check your mail, how do you link up with other researchers? How do you use the E-library? How do you conduct research in the laboratory? (IDI, female lecturer).

It was discovered that resources in e-libraries were not being fully used, as many lecturers either were unaware of their availability or chose not to use them. As a respondent put it:

> That is part of the challenges we are having…We spend a lot of money to subscribe to these e-library databases and they send the usage statistics to us…sometimes, I want to cry when I think of the amount we are spending and people are not using it…sometimes they [the service providers] send us messages and ask if anything is wrong with the service because people are not using it…we keep informing people that we have this, we have that… During NUC accreditation, supervisors are usually amazed about what we have in this library…Many lecturers do not know what shelves to get book for their own courses in the library…If I want to be generous, I will score lecturers 40 per cent in terms of usage; if I don't want to be generous, I will give them 20 per cent (IDI, male lecturer).

Yet another respondent said:

> Yes, they use it but not as much as we expect…it is a bit under-utilised… what we normally do in order to sensitise them to make them aware of these resources…we normally organise college to college training on the

use of these resources; if you were to come tomorrow when the training of academic staff will take place, we are going to give training to them (IDI, male administrator).

Table 4: Performance in research outputs

Research outputs	Percentage of respondents who had published	Mean number of articles published
Article(s) in peer reviewed international journal	74.7	8.5
Article(s) in local journal	69.8	5.8
Book(s)	36.1	1.7
Book chapters	29.4	2.6
Presentations at international conference	42.5	2.9
Presentations at national conference	48.3	3.4
Technical reports	26.6	2.5
Presentation of written research proposal	45.9	2.3

Performance in Research Outputs

The study found that 74.7 per cent of the respondents had published articles in international journals, making this the highest in terms of output with a mean number of 8.5 per cent. The second highest in terms of outputs were articles in local journals where 69.8 per cent of respondents had an average of 5.8 per cent publications. Books were the least usual form of research publications with only 36.1 per cent of the respondents having authored an average of 1.7 books, as shown in Table 4 and Figure 3. This could be because books take more time to write than other forms of publications. The relationship between the various independent variables in this study (availability of functional research laboratory, swift internet connectivity, functional laptop computers, functional e-library and data analysis/simulation software) on research outputs are fully demonstrated in the testing of hypotheses later in this article.

Hypotheses Testing

This study did not set out to establish causality between ICT and research outputs of academics. This is because of the clear understanding of the possibility of other variables beyond ICT availability and use that could impact the research outputs of academics. However, there are indications in the relevant literature that ICT can and does have an influence on the quality and quantity of research output of academics. With this in mind, he study examined six hypotheses, and their results are outlined below.

Figure 3: Mean number of research publications

Hypothesis 1: Swiftness of university internet connectivity is associated with research output

Results show that swiftness of internet connectivity is associated with at least one form of research output. Lecturers who reported fast internet connectivity had approximately 11 articles on average in international journals compared with nine articles for respondents who had slow internet connectivity. Fast internet connectivity also increased the number of technical reviews/reports, albeit insignificantly as shown in Table 5.

Table 5: Association between internet connectivity and research outputs

Research outputs	Swiftness of internet connectivity	Mean	F	P-value
Publications in peer reviewed international journals	Very fast	10.81	2.318	0.029
	Fast	7.84		
	Slow	8.65		
	Total	8.46		
Publications in refereed national journals	Very fast	5.83	0.291	0.748
	Fast	5.58		
	Slow	5.96		
	Total	5.76		
Books/monographs	Very fast	1.69	0.856	0.426
	Fast	1.58		
	Slow	1.89		
	Total	1.70		

Book chapters	Very fast	2.47	0.235	0.791
	Fast	2.50		
	Slow	2.71		
	Total	2.57		
Technical reviews/reports	Very fast	3.23	0.664	0.516
	Fast	2.39		
	Slow	2.41		
	Total	2.47		
Presentations at international conferences	Very fast	2.36	1.546	0.214
	Fast	2.71		
	Slow	3.16		
	Total	2.87		
Presentations at national conferences	Very fast	2.96	1.159	0.315
	Fast	3.28		
	Slow	3.72		
	Total	3.45		

Hypothesis 2: Use of data analysis and simulation software is associated with increased research outputs

The study found that proficiency in the use of data analysis and simulation software resulted in increase in research output among respondents. It significantly increased articles in peer-reviewed international journals (F: 8.260; p: 0.000), national journals (F: 5.486; p: 0.004) and technical reports (F: 3.979; p: 0.020) (see Table 6).

The results of the qualitative data also reinforced the outcome of the quantitative data that ICT can make or mar research outputs of lecturers. Speaking about the importance of the internet and adequate e-library facilities to research outputs, a respondent said:

> ICT of course aids publications. If you do not have ICT, it will be difficult for you to publish. ICT has more positive consequences on research than negative. Before you write any paper, you must do a review of literature. You need internet to get current literature. Even when writing proposals for grants, you need to know what information is available, if internet is not there, it will be difficult to know how far people have gone in that subject area. The only negative side is in terms of plagiarism because all your works and methods are online (IDI, female lecturer).

Table 6: Effect of use of data analysis and simulation software on increased research outputs

Research outputs	**Use of data analysis and simulation software**	**Mean**	**F**	**P-value**
Publications in peer reviewed international journals	Very well	10.42	8.260	0.000
	Fairly well	6.99		
	Not at all	7.83		
	Total	8.46		
Publications in refereed national journals	Very well	6.79	5.486	0.004
	Fairly well	5.16		
	Not at all	5.12		
	Total	5.76		
Books/monographs	Very well	1.97	2.546	0.080
	Fairly well	1.42		
	Not at all	1.80		
	Total	1.70		
Book chapters	Very well	2.81	1.363	0.257
	Fairly well	2.29		
	Not at all	2.72		
	Total	2.57		
Technical reviews/reports	Very well	3.16	3.979	0.020
	Fairly well	2.18		
	Not at all	1.63		
	Total	2.47		
Presentations at international conferences	Very well	3.04	0.603	0.548
	Fairly well	2.68		
	Not at all	2.94		
	Total	2.87		
Presentations at national conferences	Very well	3.65	0.498	0.608
	Fairly well	3.30		
	Not at all	3.33		
	Total	**3.45**		

Another respondent also alluded to the role of e-library facilities in research outputs thus:

> The main problem is access to current literature. Lack of ICT can limit the approach and accessibility to materials and constrain researchers to use readily available methodology. ICT enhances your work and promotes your visibility globally. It also makes you competitive globally. The only danger is that it limits creativity: when you have everything, you will no longer be able to think and fashion out solutions to problems. That is why many publications are not solving any problem but only exploring loopholes. They look for gaps, but the gaps they find are they solving any problem? (IDI, male lecturer).

Hypothesis 3: Access to functional research laboratory will increase research outputs

Results show that access to functional research laboratories did not significantly influence any of the research outputs of respondents. This is because many respondents came from fields that do not use laboratories. Use of a laboratory is common in the sciences (see Table 7).

Table 7: Association between access to functional research laboratory and research outputs

Research outputs	Access to functional ICT based research laboratory	Mean	T	P-value
Publications in peer reviewed international journals	No	8.03	-1.215	0.225
	Yes	8.98		
Publications in refereed national journals	No	5.76	-0.019	0.985
	Yes	5.76		
Books/monographs	No	1.74	0.378	0.705
	Yes	1.65		
Book chapters	No	2.46	-0.907	0.365
	Yes	2.73		
Technical reviews/reports	No	2.43	-0.197	0.844
	Yes	2.51		
Presentations at international conferences	No	2.94	0.524	0.600
	Yes	2.78		
Presentations at national conferences	No	3.50	0.388	0.698
	Yes	3.37		

Hypothesis 4: Availability of functional laptop computers is associated with research outputs

Across all the items, availability of laptop computers yielded increased, but insignificant, outputs. It yielded 8.6 international articles compared to 7.9 for those who did not have functional laptops. Similarly, availability of functional laptops yielded 2.9 international conference presentations compared to 2.3 for those without, as shown in Table 8.

Table 8: Association between availability of functional laptop computers and research output

Research outputs	Availability of laptop computers	Mean	T	P-value
Publications in peer reviewed international journals	Available	8.58	0.460	0.645
	Not available	7.87		
Publications in refereed national journals	Available	5.84	0.089	0.929
	Not available	5.75		
Books/monographs	Available	1.68	0.305	0.760
	Not available	1.54		
Book chapters	Available	2.51	0.132	0.895
	Not available	2.42		
Technical reviews/reports	Available	2.51	0.600	0.549
	Not available	2.00		
Presentations at international conferences	Available	2.90	0.920	0.358
	Not available	2.30		
Presentations at national conferences	Available	3.51	0.920	0.358
	Not available	2.47		

Hypothesis 5: Use of e-library is associated with research outputs

Like availability of laptop computers, frequent use of e-libraries yielded increased but insignificant number in international publications, articles in national journals, technical review/reports, and presentation in local conferences, as represented in Table 9.

Table 9: Association between use of e-library and research outputs

Research outputs	Use of e-library	Mean	F	P-value
Publications in peer reviewed international journals	Always	9.07	1.053	0.349
	Sometimes	7.95		
	Never	7.87		
	Total	8.46		
Publications in refereed national journals	Always	5.83	0.300	0.741
	Sometimes	5.81		
	Never	5.22		
	Total	5.76		
Books/monographs	Always	1.82	0.461	0.631
	Sometimes	1.60		
	Never	1.63		
	Total	1.70		
Book chapters	Always	2.58	2.073	0.127
	Sometimes	2.77		
	Never	1.73		
	Total	2.57		
Technical reviews/reports	Always	2.68	1.305	0.273
	Sometimes	2.45		
	Never	1.48		
	Total	2.47		
Presentations at international conferences	Always	2.82	0.807	0.447
	Sometimes	3.03		
	Never	2.36		
	Total	2.87		
Presentations at national conferences	Always	3.63	1.603	0.202
	Sometimes	3.46		
	Never	2.57		
	Total	3.45		

Hypothesis 6: Private universities perform better in research outputs than government universities

Although private universities published more articles in peer-reviewed journals than state and federal universities, the difference was not significant. However, state universities had produced significantly more books and publications in local journals. Lecturers in federal universities have had significantly more presentations in international conferences than those in state and private universities, but state universities have had significantly more presentations in local conferences. Upon reviewing each university's research performance, it was determined that Covenant University (a private institution) led with an average of 106.8 publications, closely followed by the University of Ibadan (federally owned), which had an average of 103.67 publications. Each of the two institutions has published more than twice the number published by other universities, except for Ekiti State University, which had an average of 64.5 publications per respondent. Interestingly, while a private university took the lead in the numbers of publications, two private universities were also at the bottom of the chart, as depicted in Table 10 and Figure 4. This implies that while ownership type of university may influence research outputs of academics, it may not be the only predictor of output.

Table 10: Association between university ownership type and performance in research outputs

Research outputs		**Mean**	**F**	**P-value**
Publications in peer reviewed international journals	Federal	8.00	0.981	0.375
	State	8.73		
	Private	9.49		
	Total	8.46		
Publications in refereed national journals	Federal	5.71	4.882	0.008
	State	6.55		
	Private	4.02		
	Total	5.76		
Books/monographs	Federal	1.56	2.064	0.128
	State	2.05		
	Private	1.51		
	Total	1.70		

Book chapters	Federal	2.67	3.073	0.047
	State	2.86		
	Private	1.79		
	Total	2.57		
Technical reviews/reports	Federal	2.78	2.633	0.073
	State	2.46		
	Private	1.50		
	Total	2.47		
Presentations at international conferences	Federal	3.12	6.158	0.002
	State	3.06		
	Private	1.61		
	Total	2.87		
Presentations at national conferences	Federal	3.62	8.473	0.000
	State	3.89		
	Private	1.81		
	Total	3.45		

Relationship Between Selected Socio-demographic Characteristics and Research Outputs of Respondents

Data were manipulated to determine the relationships between key demographic variables such as gender, age, and education of respondents on their research outputs. It transpired that while gender of lecturers was not a predictor of research outputs, age and education were found to have a considerable influence on research outputs. The analysis shows that research outputs increased with age as lecturers aged 50 have more publications than younger groups. This may be because research output is important criterion for promotion to Associate Professorial and full Professorial positions, which occurs around age 50 in Nigeria. Similarly, lecturers who have a PhD had more than 100 per cent research outputs higher than those who did not.

Table 11: Relationship between selected socio demographic characteristics and research outputs of Respondents

Gender	**Mean number of publications**	**Standard deviation**	**Standard error**	**F**	**P**
Male	22.6275	22.70383	2.24801	0.723	0.397
Female	26.5750	29.79407	4.71086		
Total	23.7394	24.85837	2.08607		
Age	Mean number of publications	Standard deviation	Standard error	F	P
Below 30	14.6000	22.75522	10.17644	6.992	P<0.001
30–9	16.2439	15.96838	2.49384		
40–9	22.7467	22.61134	2.61093		
50 and above	44.0952	35.72661	7.79618		
Total	23.7394	24.85837	2.08607		
Education	Mean number of publications	Standard deviation	Standard error	F	P
Master's	10.8889	13.85389	2.30898	14.196	P<0.001
Doctorate	28.3077	26.46818	2.59542		
Total	**23.8286**	**25.01652**	**2.11428**		

Binary logistic regression for the predictors of selected research outputs

Binary logistic regression analysis was performed to establish the predictors of some selected research outputs. As is seen in Table 11, when all the predictors were put together, at least one of them predicted one or more research outputs. For instance, data simulation software predicted writing at least one technical review/report and one article in an international publication. Lecturers who used data analysis/simulation software very well were 1.9 times more likely to have written at least one technical report than those who have never used the software at all. Lecturers who do not use the software at all were 1.6 times less likely to have published in international journals than those who used the software very well. Also, access to functional research laboratory predicted publication of books as lecturers who had access to same were 1.9 times more likely to have published at least one book than those who had no such access. Use of e-libraries predicted publishing in international journals and authoring books. Surprisingly,

respondents who never used e-libraries were 3.1 times and 4.8 times more likely to publish in international journals and to publish books respectively than those who always used e-libraries. Nature of university ownership was associated with publishing in international journals and authoring technical reports. In both dependent variables, lecturers in federal universities were more likely than those in state and private universities to publish at least one book and write at least one technical report. State universities were similarly likely to have had better publications than their counterparts in private universities.

Table 12: Binary logistic regression for the predictors of selected research outputs

Predictors	**Having articles in international journal**			**Having published books/monograph**			**Having written technical review/ report**		
	B	**Exp. (B)**	**Sig.**	**B**	**Exp. (B)**	**Sig.**	**B**	**Exp. (B)**	**Sig.**
Internet connectivity									
Very fast			.791			.283			.508
Fast	.009	1.009	.983	.389	1.476	.239	.342	1.408	.285
Slow	-.161	.851	.710	.544	1.722	.116	.202	1.224	.552
Use of data analysis/ simulation software									
Very well			.010			.142			.036
Fairly well	-.499	.607	.052	-.038	.963	.854	-.141	.869	.497
Not at all	.451	1.570	.226	.405	1.500	.093	-.683	.505	.011
Access to functional research lab									
No									
Yes	-.050	.951	.836	.648	1.912	.001	.285	1.330	.139
Availability of laptop computer									
No									
Yes	-.056	.945	.886	-.279	.756	.359	-.631	.532	.082
Use of e-library									

Always			.028			.000			.258
Sometimes	.009	1.009	.970	.347	1.415	.069	-.240	.787	.218
Never	1.135	3.110	.011	1.573	4.823	.000	-.450	.637	.144
Nature of university ownership									
Federal			.000			.586			.000
State	-.693	.500	.014	.194	1.214	.336	-.621	.537	.003
Private	-1.344	.261	.000	.015	1.015	.951	-.861	.423	.000
Constant	2.556	12884	.000	-1.539	.215	.000	-.128	.880	.705

Discussion of Findings

The research findings in this study showed that most middle-level lecturers now have access to the basic ICT infrastructure such as laptops, printers and internet facilities (Wifi/LAN), even though ownership of most of these facilities is largely personal rather than institutional (with the exception of managed facilities such as university emails and university websites). However, the study shows that many of them are yet to have access to e-library resources and ICT-based research laboratories. The finding on availability of ICTs infrastructure such as computers is in line with the research of Ajegbelen (2016), which established that while access to computers has improved in most universities in Nigeria, further narratives on the state of supplied computers supplied indicate that most are either malfunctioning or poorly maintained by the university administration.

Furthermore, although most of the middle-level lecturers have access to ICT facilities, these have not translated to high productivity in research across the board as output is still considerably low in some universities. This may be explained by the reported lack of regular public electricity, slow internet connection, poor funding support for publications, among others. This aligns with the views of Teferra and Altbach (2004), who noted that inadequate electricity supply remains one of the constraints to effective teaching and research in many higher institutions of learning in Africa and a major stumbling block to the integration of ICT into the education sector in sub-Saharan Africa.

More fundamentally, findings from this study suggest that ICT has a positive influence on research productivity. This agrees with the outcome of similar studies discussed earlier in this article. However, in agreement with Okafor et al. (2011), the findings of this study also indicate that while ICT services may influence performance in research output, some

other variables such as lack of funds, unfavourable university policies/ guidelines on promotion and publications, individual traits of academics, environmental factors, differences in perspectives and other social constraints could mediate between internet use and research publications. Other variables could include individual academics' ranks, priorities and perception about their situations and goals in the university system. Senior academics may not prioritise the internet because they are under less pressure to publish, having reached the peak of their career, compared to their junior and middle-level counterparts. These other variables may also explain the mixed results regarding the influence of university ownership where some private universities did better than public ones in certain areas, while performing below the latter in other areas.

Of interest too is the finding that less than 40 per cent of the academics who took part in this study possess the skills to use data analysis software and conduct simulation exercises, thus aligning with Schaefer et al.'s (2016) argument that, even when internet access is available, lack of skills to maximise the gains of the global technology can still inhibit the productivity of lecturers in the university system. It also points to the fact that there is need to shift higher education policies towards capacity building to create world class researchers.

Conclusion

This study has investigated the influence of ICT availability and utilisation on the research outputs of middle-level lecturers in Nigerian universities using 12 Universities from South-western Nigeria. The study found that availability of ICT was about 68.6 per cent across all the universities studied; however, only 49.3 per cent of these were functional. This raises questions about university governance, leadership, and maintenance culture, especially in government owned universities. The study found further that ICT, where available and utilised, has a positive influence on the performance of academics in research, but that there could be other intervening variables that predict research outputs.

The study further found that availability and functionality of critical ICT infrastructure was more prevalent in private universities relative to public institutions. This raises the question again of whether the government has the capacity to continue the funding of university education.

The results of the study bring to the fore the urgent need not only to intensify efforts in the digitisation of higher education in Nigeria, and indeed in the rest of Africa, but to also isolate and remove all probable barriers to the maximum utilisation of ICT in research in the tertiary

sector. If lecturers are to be productive, the learning environment must have adequate ICT support and infrastructure that promotes research and development. This is the goal of national governments and other stakeholders in the education sector, including the World Bank, the United Nations, UNESCO, the African Union and the Council for the Development of Social Sciences in Africa, and the Nigerian government cannot ignore the need for improved funding and more aggressive integration of ICT in higher education in the country.

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