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INFORMATION AND COMMUNICATION TECHNOLOGY INFRASTRUCTURE RESOURCES UTILIZATION IN LIBRARIES AS CORRELATE OF POSTGRADUATE STUDENTS' RESEARCH OUTPUT IN NIGERIAN FEDERAL UNIVERSITIES

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Abstract

The study determined the relationship between Information and Communication Technology (ICT) infrastructure resources utilization in libraries and post-graduate students research output in the Nigerian federal universities. The study adopted correlational survey research design in six selected Nigerian federal universities with population of 40,328 postgraduate students as at 2018/2019 academic session with a sample size of 2,016 (5%). Questionnaire was the instrument used for data collection through online google forms. Linear regression and process macro analysis were used. The result shows the coefficient of determination (R^2) associated with the correlation coefficient of 0.351 was 0.123 for ICT infrastructure resources. The findings of the study show low level of relationship between ICT infrastructure utilization and post graduate research output. The study recommended that the universities managements investigated should upgrade their libraries with current and relevant ICT infrastructure resources across the campus by creating the conducive research enabling environment.

 Keywords: Information and Communication Technology; ICT infrastructure; resources utilization in libraries; postgraduate students; Nigerian Federal Universities.

Introduction

The efficiency of a library as an integral part of any institution is determined by the ease of access to information resources by users of the library. Advances in information and Communication technology (ICT) have led to far-reaching developments in most higher learning institutions, the ICT have had a huge effect in every human endeavour. It has brought a revolution in every sphere of life such as banking, farming (agriculture), well-being (health), security, transportation, information centres and libraries, it has brought a revolution in educational institutions and research centres among others.

University is the engine of social and economic growth and an institution dedicated to the pursuit of knowledge and training of the next generation of researchers, were it produce innovative technologies, incubate entrepreneurial projects and produce scientific discoveries that are useful to government and industries. Goetze (2019) describes the university as a place that is made up of

people with different backgrounds in term of needs, skills, talents, status, competencies, knowledge, behavioural styles, interests and perceptions where it promotes inquiry and dialogue to encourage collaboration and team learning. The students include undergraduates and postgraduate students, this study is on postgraduate students.

A post graduate student is a person who has successfully completed an undergraduate degree and proceeded to the next level such as: postgraduate diploma, master or PhD in any field of studies, the student is required to undergo course work, conduct research and present a report at the end of the studies (Ankamah. Akussah and Adams, 2018) for this study, postgraduate students are persons studying in Nigerian universities for PGD, M.Sc. MLS, Med, MPhil, Ph.D. In Nigeria, and in most universities, any student who is pursuing a Masters or Doctorate degree (Ph.D) in any field of specialization is called a postgraduate student (NUC, 2021). The postgraduate student is expected to undergo course work and research to support his learning process. The researcher will look at how the ICT infrastructure resources use in library (infrastructure) correlate with PG students research output and as moderated by programme of study.

Programme of study is a course require to complete a specific type of degree in an institution. Tofi, Agada and Okafor (2020) opine that the studying a postgraduate course, including a master's course, an MPhil (Master of Philosophy) and a PhD (Doctor of Philosophy) requires an undergraduate degree as part of the entry requirements in the University.

University libraries are information centres that serve the university communities and they are as varied and distinctive as the institutions themselves, providing information services to staff, students, researchers and the communities in which they are located. Federal Ministry of Education (2019) highlighted the objective of a university library to include, provision of wide range of scholarly materials that are consisted with the institution's mission.

Utilization is the act of making something practical and effective (Osuchukwu, Obuezie and Ogwuche, 2017). ICT utilization in a library is the process of applying the infrastructures (tools) to library operations and routines for effective services delivery to it users (providing timely, current and relevant information to clienteles).

Information and communication technology library infrastructures/equipment's (hardware's) are tools the library uses to enhance the viability of the services rendered to the community such as; the projector, microfilming or micro printing facilities, Optical character Recognition (OCR), Magnetic Ink Character Recognition (MICR), barcode reader and video conferencing facilities, work station among others, the postgraduate students utilize them to ease the research process;

Research is an investigative process of finding reliable solution to a problem through a systematic selection, collection, analysis, and interpretation of data relating to the problem. Research is the most significant segment of postgraduate studies (Smith, 2006). Research enables postgraduate students to systematically investigate society's problems and proffer solutions to them through their research output.

> "Research is a systematic, exhaustive, and intensive investigation and study of a topic, often employing hypothesis and experimentation, to discover new knowledge, facts, theories, principles, and laws. Research comprises "creative and systematic work undertaken to increase the stock of knowledge, including knowledge of humans, culture

and society, and the use of this stock of knowledge to devise new applications." It is used to establish or confirm facts, reaffirm the results of previous work, solve new or existing problems, support theorems, or develop new theories. ……. (Glossary of Library and information science, 2021)"

Research output are those outcomes from research process and reports as Adeagbo, Van Deventer, Asubiojo and Pienaar in Seer-Uke and Tyoakaa (2021) noted that research output can be in form of abstracts, textbook, patent, certified inventions, monographs, journal articles and technical reports. Borgman (2006), Meyer and Dutton (2009) expressed that the research output could include, seminars paper, dissertation, thesis, project report and books. For this study, the postgraduate students research outputs are the project, dissertation, thesis, journal articles, seminar, conference paper presentation, monograph and technical reports produced by postgraduate students.

In the past libraries were book-oriented librarianship, where users come to the library to use or surf the manual library catalogue, indexes, abstracts, and consult/loan books on the shelves, due to the rigidity of the type of information resources, the library then was the second home of many university students. Students may need to wait for weeks or months to have access to a book in the library. But this has given way to user-centered librarianship. The ICT has changed this narrative to the great extent, as an e-book can be used by many students, at the same time, and in different locations. The library ICT infrastructure resources, when adequately provided and utilized, would produce great critical thinkers and well taught postgraduate students in Nigerian universities. This will, hopefully, reduce plagiarism among postgraduate students; increase the visibility of university local content through the Institutional Repository (1R) and improve quality research.

Statement of the Problem

Studies have shown that many Nigerian university libraries have made significant investments in acquiring library ICT infrastructure resources to enhance information dissemination so that users such as postgraduate students can utilize and add value to their scholarly research work. However, despite such investments, it has been noted that post-graduate students are yet to take full advantage of library ICT infrastructure resources for effective research and some of them are often poorly prepared for the stressful postgraduate-level research and study.

It is therefore important to look at the ICT infrastructure resources utilization in libraries as correlate of Postgraduate students' research output in Nigerian Federal Universities.

Objectives

1. relationship between ICT infrastructure resources utilization in libraries and postgraduate students' research output in the Nigerian federal universities;
2. relationship between ICT resources utilization in libraries and postgraduate students' research output in the Nigerian federal universities as moderated by programme of study;

Hypotheses

Ho1. There is no significant relationship between ICT infrastructure resources utilization in libraries and postgraduate students' research output in the Nigerian Federal Universities.

Ho2. There is no significant relationship between ICT resources utilization in the libraries

and the postgraduate students' research output in the Nigerian federal universities as moderated by programme of study.

Significance of the Study

The findings of this study are expected to have both theoretical and practical significance. Theoretically, the study will hopefully add to the body of theories on ICT resources utilization in libraries, the study as it deduced on Unified Theory of Acceptance and Use of Technology (UTAUT) which is to ensure that postgraduate students performance expectancy and effort expectancy will hopefully influence the research output.

Practically, the outcome of this research work will benefit the following: post-graduate students, university managements, and library and information science students. For post graduate students, the findings of this research work will sensitize them on the potential of the ICT infrastructures resources use in their research process which will enhance their research output. It is expected that the result of the study will encourage the university managements investigated to provide the necessary and adequate library 1CT infrastructure resources that will enhance effective research by post-graduate students.

Scope of the Study

This study centred on Information and Communication Technology (ICT) infrastructure resources utilization in libraries as correlate of post-graduate students' research output in six (6) selected Nigerian federal universities located in each of the six (6) geopolitical zones of the country. The study was delimited to first generation federal universities only where 1CT resources are available. The postgraduate students in the six universities were used as the subjects of the study. The study was delimited to relationship between information and communication technology infrastructure resources utilization in libraries and it was equally delimited to ICT resources and postgraduate students' research output in Nigerian federal universities as moderated by programme of study.

Review of Literature

Utilization of Information and Communication Technology (ICT) infrastructure resources in libraries for effective research output

They are the tools the library utilized to facilitate the process, organize, and disseminate of information in order to enhance the daily routines and operations by the library. Okonoko and Eruvwe (2021) noted that they include but not limited to the combination of computers, storage media that allow for processing, storage, and retrieval, and telecommunications that allow for the transfer and communication of data or information from one workstation to another.

Information and communication technology consist of three associated terms namely: information, communication and technology. Information connotes any idea, opinion, or feeling capable of influencing the human view of about the current state of affairs. It reinforces peoples' opinions about the current state of the world and adds to their knowledge. For an information to be deemed good, it must be complete (assist in decision making), relevant to the problem at hand, timely and accurate for its intended purpose. O'Brien (2004) noted that information is data that has been converted to meaningful and useful context for a specific end user. Communication is the exchange or transfer of information among people and from one place to another. It is the transmission of data/information from sender to the recipient through the aid of a transmission media. Jessup and Valachi in Adubika (2018) defined communication as the transfer of digital data, voice, fax, sound and video from one location to another over some type of network. While technologies are mechanical means to supplement or extend or replace human, manual operation or devices. In order words, technology consists of new innovation of utilizing modern equipment or tools to replace obsolete ones in the performance of a given task. It is the use of scientific knowledge to invent tools that enables man to overcome the challenges of the environment in order to improve or enhance the quality of life.

The importance of research to a university is not debatable. The availability of library ICT resources research output will lead to generation of new knowledge, engage innovations, enhance the quality of teaching staff, increase the institution's reputation and its economic status. Adeleke and Nwalo (2017) noted that till recently, libraries used to finish the information needs of users by means of their vast printed information resources. But, due to the impact of ICT resources, the story is fast changing. The new electronic era, having the internet in the forefront, it is pushing libraries towards the digital environment. This has led libraries to acquire, organise and provide access to electronic resources required for their users. Use of ICT infrastructure in research output by postgraduate students in developed countries are getting access to digital information and creating their information electronically. Academic now have access to global digital information resources, particularly the internet for their scholarly communication (Ani and Ahiauzu, 2008). Interestingly, the online environment provides scholars with quick and easy access to electronic information resources located around the globe. Researchers now exchange preliminary drafts of research findings with colleagues and maintain contacts by monitoring electronic bulletin boards, chat rooms, and list serve on subject of interest.
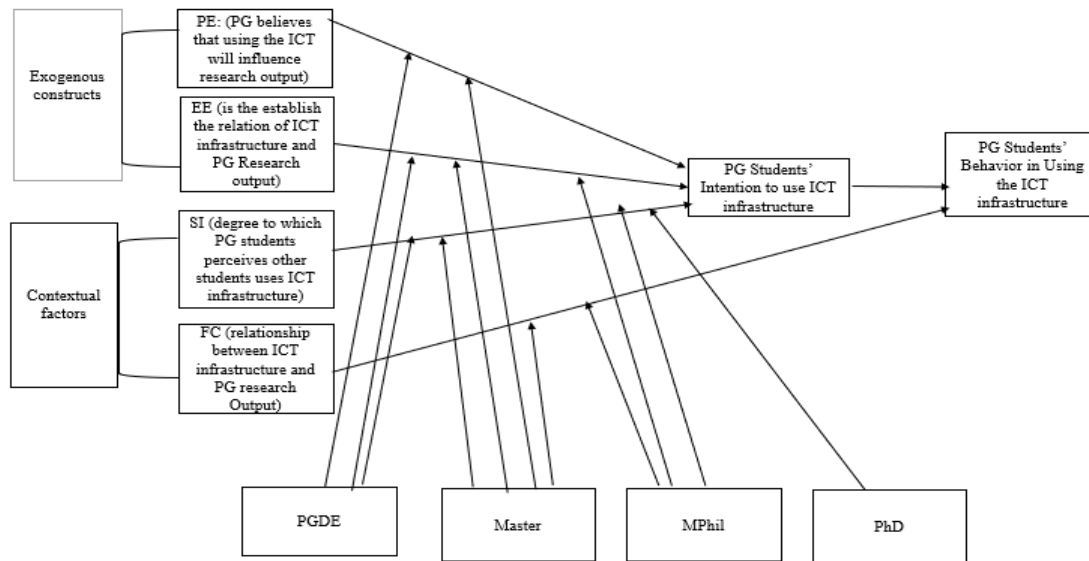
Researchers or information users use the web to access remote databases and full-text document resources that were previously only available through expensive on-site research visits. Researchers use the web to watch real-time images from remote research stations and satellites or participate in group discussions and group projects. Availability of electronic information sources relates to the provision for and inclusion of the resources in the collection of the libraries at the disposal of users in academic institutions. Similarly, Rehman and Ramzy (2004) added that the availability of electronic resources provides access to authoritative, reliable, accurate and timely access to information. In addition to this, the resources can enable innovation in teaching and increase timeliness in research. Awareness is part of availability and it indicates the extent to which users have information and knowledge of electronic resources being subscribed to. When users of a library have adequate information on the electronic resources being subscribed to, they are encouraged to use them. Available ICT and e-resources must be known to the users.

Theoretical framework

Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) was formulated by Venkatesh, Morris, Davis and Davis in 2003 to use as the consolidated model for analyzing intention of using new technology and actual use. The UTAUT aims to explain user intentions intention (postgraduate students hoping to conduct research in the good conducive environment with all the necessary infrastructure resources in the university libraries which they can publish in reputable journals, government and organizations using their research output to solve issues in the country and world at large) and to use an information system and subsequent usage behavior. The theory holds that there are four key constructs: performance expectancy, effort expectancy, social influence and facilitating conditions. The first three are direct determinants of user and behavior, and the fourth is a direct determinant of user behavior. The four exogenous constructs in the UTAUT model may be viewed as representing technology attributes (such as performance expectancy and effort expectancy) and contextual factors (such as, facilitating conditions and social influence) even when they may be view as perceptions held by individuals regarding the technology and the context. Despite the evidence that these four constructs explain a significant proportion of variance in the adoption and usage behaviours, a key element missing from the UTAUT model is the "individual" engaging in the behavior i. e., individual characteristics that describe the dispositions of the users may be influential in explaining their behaviours.

The theory also submits that the effect of these four key constructs is been moderated by other four variables namely: PGDE, Master, MPhil and PhD. Performance Expectancy (PE) is the degree to which an individual (such as post graduate students) believes that using the system will help the student to attain gains in research writing, PE is hypothesized to moderate the influence on behaviour intended by age and gender of postgraduate student. Effort Expectancy (EE) is the extent of ease associated with the used of system (information and communication technology infrastructure available in the library), EE is hypothesized to moderate the influence on behaviour intention by programme of study of the library users which are the postgraduate students. Social Influence (SI) is the degree to which an individual (postgraduate student) recognizes or perceives that others will believe the student should use a particular technology (ICT infrastructure) SI is hypothesized to moderate the influence on behavior intention by programme of study (PGDE, Master, MPhil and PhD); Facilitating Condition (FC) is the extent to which a person (post graduate students) believes that an organizational and technical infrastructure exist to support use of the system, the FC hypothesized to moderate the influence on behavior intention by programme of study as shown in figure 1.

Figure 1: Schematic Representation of Unified Theory of Acceptance and Use of Technology

Source: Whong (2021)

Review of Related Empirical Studies

Information and communication technology Infrastructure resources utilization in libraries

Before the emergence of ICT, library service provision was cumbersome, time wasting, without giving any room for flexibility. However, with the integration of ICT into library services, particularly at the higher educational institutions, access to e-resource materials has been made easy as well as closed the global gap for information retrieval (Omagbemi, Akintola and Olayiwola, 2004 in Anafo, Akpah and Ofori, 2020). They further stated that ICT infrastructure such as Local Area Network (LAN) availability in the library will interact with different information networks to make available e-resource materials to students, academic and non-academic staff. This can only be achieved over a dedicated LAN infrastructure.

A study by Ruzegea and Msonde (2021) on the University Students' E-Resource Usage: Predictors, Problems and Practical Implications was aimed to investigates predicting factors for effective e-resources usage, emanating problems and practical implications at Muhimbili University of Health and Allied Sciences (MUHAS), Tanzania. The study was guided by three objectives: to explore the level of awareness of electronic resources among the students; to assess students' information literacy competency in supporting the use of electronic resources and to predict factors contributing to the usage of e-resources among students in higher learning institutions. Using a survey, the study employed SPSS to analyse the resultant data. Moreover, regression analysis and One-way ANOVA determined the predicting factors and differences in e-resources usage between student categories. The findings demonstrate that undergraduates demonstrated higher usage levels of e-resources than postgraduates. The education level,

Information Literacy (IL) competency, and individual experience were factors that contributed to effective e-resources utilization. Therefore, integrating IL skills into postgraduate curricula and improving IL training may bring out valuable students' competence for effective e-resource utilization.

The study has low number of respondents compare to the current study in sample size and number of responses rate of 38% (n=300) out of 789 administered questionnaires was inadequate, and using one university in the country, the result cannot be generalized, but the significance of the results is not undermined. Therefore, the current study incorporated more universities in Nigeria, research methods is correlational design and data collected will hopefully help in assessing the relationship between ICT infrastructure resources utilization in libraries and post graduates research output in Nigerian federal universities. The current study will create awareness and effectiveness of ICT infrastructure resources utilization within higher learning institutions. Such undertakings will help to determine and improve the post graduate students' research output.

A Survey of Information and Communication Technology Resources for Instructional Delivery in Universities in Adamawa State, Nigeria. by Suleiman, Soetan, and Ogunlade (2020) was conducted to examine key ICT resources for instructional delivery in terms of their availability and utilization across three universities in Adamawa State, Nigeria. The study adopted a quantitative survey and sampled 214 lecturers from Modibbo Adama University of Technology (MAUTECH), Yola, Adamawa State University (ADSU), Mubi, and American University of Nigeria (AUN), Yola. It found that there is a differential deployment in hardware, software and ICT infrastructure among the three universities. It was also discovered that lecturers in Adamawa State perceived ICT resources to be useful for teaching, research, and social interaction.The study is related in term of ICT infrastructure resources but differ in area of study (universities in Adamawa state while the current has six federal universities one from each geopolitical zone of Nigeria), methodology (quantitative survey design while the current study used correlational survey design) and data analysis (descriptive statistics of frequency count and mean, while the current study used linear regration and process macro analysis.

A study was conducted by Abubakar, Gupiyem and Banwar (2017) to examine the correlation of ICT accessibility and use of electronic resources in Nigerian university libraries by postgraduate students. A survey research and multi-stage sampling technique were used to select 2726 postgraduate students from 16 Nigerian federal conventional universities. Two instruments (questionnaire on ICT Accessibility and an interview schedule for e-resources/ICT librarians) were used to collect data and data was analyzed using percentages and Pearson's Product Moment Correlation. The findings revealed that the extent to which postgraduate students' level of accessibility to ICT resources for using e- resources was low (weighted average = 2.44). The frequency of the usage of e-resources by the postgraduates was adjudged low (weighted average = 2.45). There is positive, very strong and significant relationship between postgraduate students' ICT accessibility and their use of library e-resources (r = .776; df = 2284; p< .05). The implication of this study is that the postgraduate students who were expected to access and use the library's ICT resources for retrieving their needed electronic information had low level of accessibility to the ICT resources. The implication is that it would impede their rate of learning and also affect their general scholarship, particularly now that the whole society is in the information age where students communicate using ICT resources.

The study therefore, is relevant to the present study because it has revealed that the provision of ICT resources with flexible policy postgraduate students can utilize e-resources for effective research. However, the major difference between the two studies is that the former targeted the access and use of ICT (e-resources) from Nigerian federal universities, while the present study is targeted at the relationship between ICT Infrastructure resources utilization in libraries and post graduate students research output in six selected federal universities one from each geo political zone, the research design differ as the former was descriptive while the present study is correlational. Therefore, a study such as the present one is needed to provide better understanding of how ICT resources correlate with postgraduate student's research output.

RESEARCH METHOD

Correlational survey research design was employed for the study. The population of the study consisted of 40,328 registered postgraduate students in the six selected Federal Universities in Nigeria as at 2018/2019 academic session. A sample size of 2,016 (5%) postgraduate students formed the subject of this study see table 1. The universities selected in each geo-political zone were: University of Ibadan, Oyo State; University of Nigeria, Nsukka, Enugu State; Ahmadu Bello University, Zaria. Kaduna State; University of Benin, Edo State; University of Ilorin, Kwara State and University of Maiduguri, Borno State respectively. Structure questionnaire was used for data collection using google form through social media platforms like WhatsApp groups, Telegram groups and Email etc. The instruments were face validated by two (2) experts in the field of Library and Information Science as well as one (1) from Measurement and Evaluation, Faculty of Education, University of Nigeria, Nsukka. Out of the 2,016 expected responses from the postgraduate students, 1,563 (77.5%) respondents filled the online questionnaire. The quantitative data collected from the study was analysed descriptively using frequency count, mean to show the background of the data to be correlated and linear regression to address research questions 1, while process macro analysis was used to answer research questions and hypothesis 2 Regression ANOVA was used to test the hypotheses 1 at 0.05 level of significant.

Results and Discussion

Table 1: Population and Sample size of the study

S/No	Name of university	Number of postgraduate students				Total population	Sample size of 5%
		PGDE	Master	MPhil	PhD		
1	University of Ibadan	1,512	7,964	1,097	3,381	13,954	698
2	University of Nigeria Nsukka	156	1,279	769	1,617	3,821	191
3	Ahmadu Bello University Zaria	1,678	6,852	29	1,638	10,197	510
4	University of Benin	485	2028	84	1,782	4,379	219
5	University of Ilorin	996	2,618	133	1,377	5,124	256
6	University of Maiduguri	231	2,381	0	241	2,853	143
Total		**5,058**	**23,122**	**2,112**	**10,036**	**40,328**	**2016**

Source: *Records from school of Postgraduate studies in the universities under study between September 2019 and February 2020*

Table 1 shows the distribution of detailed 2018/2019 registered Post Graduate students in the Six Federal Universities studied. A sample size of 2,016 (5%) postgraduate students formed

the subject of this study out of the population of 40,328 postgraduate students. As proposed by Ukachi (2015) and Ifidon in Furfuri (2016) that a population of thirty-five thousand (35,000) and above a sample size of 5% should be used, the response rate is shown in table 2.

Table 2: Response rate of respondents

S/No	Name of university	No of respondents by programme of students				Total
		PGDE	Master	MPhil	PhD	
1	University of Ibadan	86(5.5%)	337(21.6%)	38(2.4%)	49(3.1%)	510 (32.6%)
2	University of Nigeria Nsukka	13(0.8%)	94(6.0%)	19(1.2%)	51(3.3%)	177 (11.3%)
3	Ahmadu Bello University Zaria	34(2.2%)	286(18.3%)	70(4.5%)	72(4.2%)	462 (29.9%)
4	University of Benin	32(2.0%)	62(4.0%)	29(1.9%)	26(1.7%)	149 (9.5%)
5	University of Ilorin	26(1.7%)	78(5.0%)	36(2.3%)	18(1.2%)	158 (10.1%)
6	University of Maiduguri	5(0.3%)	74(4.7%)	0(0.0%)	28(1.8%)	107 (6.8%)
Total		**196**	**931**	**192**	**244**	**1563**
(%)		*(12.5%)*	*(59.6%)*	*(12.3%)*	*(15.6%)*	*(100%)*

Table 2 revealed that university of Ibadan has the highest number of respondents with a total of 510(32.6%), followed by Ahmadu Bello University Zaria with 462(29.9%). While the least was university of Maiduguri with 107(6.8%) response rate. Is not surprising as is proportionate to the population of post graduate students in table 1.

The table shows master students accounted for 931 (59.6%), followed by PhD with 244 (15.6%) while MPhil accounted for 192 (12,3%) of the total respondents in the study. The respondents were asked to indicate the ICT infrastructure resources the utilized in the library to enhance their research output in the university, using the 4 points likert scale of measurement of; NU =Not Utilized, FU=Fairly Utilized, MU=Moderately Utilized and HU=Highly Utilized their responses is shown on table 3

Table 3: ICT infrastructure utilization in Library by Post Graduate Students

ICT Resources (Infrastructure)	NU	FU	MU	HU	MEAN
Projectors	200 (12.8%)	611(39.1%)	450 (28.8%)	302 (19.3%)	1.26
Microfilming or micro printing facilities	427 (27.3%)	685 (43.8%)	356 (22.8%)	95 (6.1%)	0.95
Optical Character Recognition (OCR)	552 (35.3%)	614 (39.3%)	308 (19.7%)	89 (5.7%)	0.94
Magnetic Ink Character Recognition (MICR)	626(40.1%)	611 (39.1%)	225 (14.4%)	101 (6.5%)	0.93
Barcode reader	575(36.8%)	633 (40.5%)	257 (16.4%)	98 (6.3%)	0.93
Video conferencing facilities	507 (32.4%)	607 (38.8%)	338 (21.6%)	111 (7.1%)	0.98
Smart board for presentations	525 (33.6%)	609 (39.0%)	270 (17.3%)	159 (10.2%)	1.02
Alternative power supply (solar or inverter)	499 (31.9%)	642 (41.1%)	279 (17.9%)	143 (9.1%)	1.00
Reading Carrel with research work stations	495 (31.7%)	656 (42.0%)	279 (17.9%)	133 (8.5%)	0.98
The learning common (interactive area for PG students only)	481 (30.8%)	635 (40.6%)	283 (18.1%)	164 (10.5%)	1.03
Cumulative Mean					**1.00**

The ICT infrastructure utilization in library by post graduate students was measured in four points Likert scale according to level of utilization. list of ICT infrastructure in the library that correlated with postgraduate research outputs were listed for the postgraduate students to indicate their level of utilization, the result in table 3 revealed that 685(43.8%) respondents indicated fairly utilization of microfilming or micro printing facilities, barcode reader, video conferencing

facilities and smart board for presentations accounted for 98(6.3%), 111(7.1%) and 10.2%) highly utilized ICT infrastructure resources in the library study. With a cumulative mean of 1.00, out of 4 points on the scale, the utilization of the ICT infrastructure in library in selected federal universities could be adjudged low. The respondents were asked to indicated their level of agreement of how ICT infrastructure resources correlate with their research output, their responses are shown on table 4.

Table 4: Postgraduate students' research output

Postgraduate students' research output	SD	D	A	SA	MEAN
Project	289(18.8%)	575(36.8%)	408(26.1%)	291(18.6%)	1.08
Dissertation	352(22.5%)	611(39.1%)	342(21.9%)	258(16.5%)	1.04
Thesis report	442(28.3%)	537(34.4%)	325(20.8%)	259(16.6%)	1.05
Journal article	482(30.8%)	522(34.4%)	316(20.2%)	243(15.5%)	1.05
Seminar paper	483(30.9%)	546(34.9%)	331(21.2%)	203(13.0)	1.01
Conference presentation	485(31.0%)	563(36.0%)	350(22.4%)	165(10.6%)	0.98
Monograph	540(34.5%)	588(37.6%)	329(21.0%)	106(6.8%)	0.93
Technical report	536(34.3%)	554(35.4%)	367(23.5%)	106(6.8%)	0.94
Patent and certified invention	544(34.8%)	559(35.8%)	357(22.8%)	103(6.6%)	0.93
Blogs/website	532(34.0%)	518(33.1%)	298(19.2%)	215(13.8%)	1.01
Cumulative mean					1.00

The postgraduate students research output in the federal universities selected was measured with 10 items in a four-point Likert scale. According to the result in table 4, 611(39.1%), 588(37.6%) and 575(36.8%) disagreed to the utilization of ICT infrastructure to Dissertation, monograph, and project respectively, while only 103(6,6%), 106 (6.8%) and 165(10.65) strongly agreed to the utilization of ICT to patent and certified invention, technical and conference presentation research output. The cumulative mean of 1.00 of 4point scale is low.

Research Question One

What is the relationship between ICT infrastructure resources utilization in libraries and postgraduate students' research output in the Nigerian federal universities?

Table 5: Linear Regression Analysis of The Relationship between ICT Infrastructure Resources Utilization in Libraries and Postgraduate Students' Research Output

Variables	r	R^2	Adjusted R Square	Std. Error of the Estimate
ICT Infrastructure Resources Utilization and Postgraduate Students' Research Output	.351	.123	.123	.37872

(R^2) = Coefficient of Determination

Table 5 shows that the correlation coefficient between ICT infrastructure resources utilization in libraries and postgraduate students' research output in the Nigerian federal universities was 0.351. This implies that there exists a positive low relationship between ICT infrastructure resources utilization in libraries and postgraduate students' research output in the Nigerian federal universities. It also revealed that the coefficient of determination (R^2) associated

with the correlation coefficient of 0.351 was 0.123. The coefficient of determination (R^2) of 0.123 implies that ICT infrastructure resources utilization in libraries accounts for up to 12% of postgraduate students' research output in the Nigerian federal universities. This is an indication that 88% of the variation in postgraduate students' research output in the Nigerian federal universities is attributed to other factors other than ICT infrastructure resources utilization in libraries.

The findings of the analysis revealed that there exists a positive low relationship between ICT infrastructure resources utilization in libraries and postgraduate students' research output in the Nigerian federal universities. The findings of the study shows that ICT infrastructure resources (projectors, video conferencing facilities, smart board for presentations, alternative power supply, reading carrel with research work stations and learning common utilization among others) in libraries accounted for only 12% of postgraduate research output (project, dissertation, journal article, seminar paper, conference presentation among others) in the Nigerian federal universities. These results were surprising because of the significant investments by Nigerian Government through the Tertiary Education Trust Fund (TETFund) intervention in the provision of library resources in academic libraries. The implication of this finding is that the postgraduate students who were expected to access and use the ICT resources available in the library for effective and quality research output had low level of utilization and it would impede their rate of learning, research and also affect their general scholarship, particularly now that the whole society is in the information age where students collaborate, access grants and partnership through research outputs.

While the federal universities selected by virtue of their status as the first established university in the geopolitical zones are expected to demonstrate a high availability, functioning and postgraduate students' awareness of the ICT resources in the libraries. This relates on how postgraduate students are presented with a new technology and there are factors that influence their decision on how to utilize the ICT resources in libraries, the Unified Theory of Acceptance and Use of Technology (UTAUT) identified the aims of post graduate students intentions to use the available technology (infrastructure resources) in the libraries to enhance their research output This is an indication that some of these resources are not available, or available but not functioning or the postgraduate students are not aware of their availability or how to utilize them to enhance their research output. The findings are consistent with the study of Abubakar, Gupiyem and Banwer (2017) who found that the extent to which postgraduate students' level of ICT resources was low. Ruzegea and Msonde (2021) also found that undergraduates demonstrated higher level of ICT usage than postgraduate students in Muhimbili University of Health and Allied Sciences in Tanzania. Similarly, Anafo and Ofori (2020) on their studies revealed low inadequate ICT infrastructure to enable users utilized the e-resources in the library. The findings are similar to Adeyoyin, Alewiye and Ewulo (2019) who found that despite the rising in other part of the world on the utilization of alternative power supply like solar energy, Nigeria is recording low pace of alternative solar development. The findings of the study are contrary to the finding of Suleiman,

Soetan and Ogunlade (2020) that computers, printers, scanners, projectors and interactive whiteboards were available and utilized for teaching in Universities in Adamawa State. Ankrah and Atuase (2018) that most of postgraduate students were aware and highly utilized the ICT resources in the libraries.

Based on these findings, it is clear that 88% of the postgraduate students surveyed conduct their research using their personal resources other than ICT infrastructure resources available in the libraries. It can be argued that ICT infrastructure resources is an important component for quality and effective research output. The implication is that research output by postgraduate students may be delayed and they would not graduate when due, which may result in abandonment of the research process.

Hypothesis One

There is no significant relationship between ICT infrastructure resources utilization in libraries and postgraduate students' research output in the Nigerian Federal Universities.

Table 6: Regression Analysis Significant Relationship between ICT Infrastructure Resources Utilization in Libraries and Postgraduate Students' Research Output

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	31.508	1	31.508	219.678	.000[b]
	Residual	223.891	1561	.143		
	Total	255.399	1562			

Table 6 shows that an F-ratio of 219.678 with associated exact probability value of 0.00 was obtained. This probability value of 0.00 was compared with 0.05 set as level of significance for testing the hypothesis and it was found to be significant because 0.00 is less than 0.05. Thus, the null hypothesis of no significant relationship was rejected. The researcher therefore, concludes that there is a significant relationship between ICT infrastructure resources utilization in libraries and postgraduate students' research output in the Nigerian Federal Universities.

Research Question Two

What is the relationship between ICT resources utilization in libraries and postgraduate students' research output in the Nigerian federal universities as moderated by programme of study?
Table 7: Process Macro Analysis on the Relationship between ICT Resources Utilization in Libraries and Postgraduate Students' Research Output as Moderated by Programme of Study

Model		R^2	SE	t	P
1	Programme of Study	.24	.020	-3.107	.0019

Table 7 revealed that coefficient of determination of .24 was obtained for the relationship between ICT resources utilization in libraries and postgraduate students' research output in the Nigerian federal universities as moderated by programme of study. The result indicates that

programme of study moderated 24% of the relationship between ICT resources utilization in libraries and postgraduate students' research output in the Nigerian federal universities.

Programme of study moderated 24% of the relationship between ICT resources (infrastructure, media and information resources) utilization in libraries and postgraduate students' research output of Project, dissertation, journal article, seminar paper, conference presentation, monograph, technical report, patent and certified invention and blogs/website in the Nigerian federal universities. Here, the question remains whether the university libraries could afford to increase and maintain the number of ICT resources to match the ever-increasing number of postgraduate students in their universities.

The increase in postgraduate students' admission without a corresponding increase in the number of ICT resources to enhance research process and effective research output will remain a problem in Nigerian universities, for lack of deliberate increase in ICT resources. Most likely, only very few postgraduate students could likely afford the needed ICT resources without the university libraries support. This will certainly have dual implications on both the students and the universities. On the postgraduate students' part, necessary ICT resources to enhance their research work would be lacking. This would slow their research work and eventually set in frustration. This study tends to validate the finding of Gilbert (2015) that postgraduate students at the Modibbo Adama University of Technology, Yola programme of study has significant relationship with their utilization of library electronic information resources. Pelemo, Onanuga, Ilori, and Ugbala (2020) remark that master, MPhil and Ph.D students' utilization of e-resources in Nigerian university libraries found that preprogramme of study of post graduate students has significant relationship. The implication of this findings is that the programme of study is related to the research output (Project, dissertation, journal article, seminar paper, conference presentation, monograph, technical report, patent and certified invention and blogs/website) of postgraduate students.

Hypothesis Two
There is no significant relationship between ICT resources utilization in the libraries and the postgraduate students' research output in the Nigerian federal universities as moderated by programme of study.
Result in Table 7 was also used to test hypothesis four. It revealed that t value of -3.107 with exact probability value of 0.0019 was obtained. Thus, the null hypothesis of no significant relationship between ICT resources utilization in the libraries and the postgraduate students' research output in the Nigerian federal universities as moderated by programme of study was rejected. This is because the probability value of 0.0019 was less than the level of significance set at 0.05. The researcher therefore concludes that there is a significant relationship between ICT resources utilization in the libraries and the postgraduate students' research output in the Nigerian federal universities as moderated by programme of study.

Conclusion and Recommendation
Information and communication technology has been widely acclaimed as a veritable tool for enhancing research output. It is clear from the findings that ICT infrastructure resources utilization in libraries and postgraduate research output are correlate, whereby the dimension of infrastructures and postgraduate research output are the main variable that can cause effective research output among the postgraduate students in Nigerian federal universities.
The study showed that higher institutions most especially universities are at the forefront of most impactful scientific research initiative worldwide and that advances in the ICT particularly

in research which is a tool for building knowledge and facilitating learning, improved businesses, increase collaboration of universities around the world and awareness and visibility of local content of research. Unfortunately for many universities in developing countries investment in ICT infrastructure resources in libraries have not kept pace with either new challenges in research or new opportunities for their academic mission.

It is time postgraduate students explored other sources of ICT resources to meet their research programme if the postgraduate students research work is to be improved and reduce research frustrations. When these are met, research output of the postgraduate can compete favourably in the global institution and it will increase the university ranking, attract grants, create partnership and collaborations around the world and the research output will proffer society's solutions to issues. The university management need to keep her postgraduate students with current and relevant of ICT infrastructure resources in the library to keep faith with its set goals hence the present study. Based on the findings the following recommendations are made:

1. The university managements investigated should upgrade the university library with current and relevant information and communication technology infrastructure resources across the campus by creating the conducive research enabling environment through involvement of librarians in acquisition process and maintenance of existing infrastructure like smartboard for presentations, projectors, video conferencing facilities, research reading carrel with work stations and interactive learning common for postgraduate student.
2. Introduction or upgrading of the use of library general course for all the postgraduate programme in federal universities investigated to teach the postgraduate student how to apply the ICT resources utilization in their research process for effective research output.

REFERENCES

Abubakar, D., Gupiyem, G. G., & Dakur, M. B. (2017). Information and communication technology accessibility as correlate of E-Resources usage among postgraduate students in Nigerian university libraries. Journal of Applied Information and Technology, 10 (2), 181. Retrieved from https://tinyurl.com/w8sybli1

Anafo, P., Akpah, S., & Ofori, Y. (2020), The Information and communication technology infrastructure on university of Mines and Technology Campus and its impact on library E-resource accessibility. Ghana Mining Journal, 20 (1) 75 – 83.

Ankamah, S., Akussah, H., & Adams, M. (2018). Postgraduate students' perception towards the use of ICT in research in Ghanaian public universities. Library Philosophy and Practice (e-journal). 1737. Retrieved from https://tinyurl.com/smn6kha

Borgman, C. L. (2006). What can study of e-Learning teach us about collaboration in e-Research? Some findings from digital library studies. Computer Supported Cooperative Work, 15(4), 3, 59–383. https://doi.org/10.1007/s10606-006-9024-1

Federal Ministry of Education (2019) Objectives of establishing university Libraries in Nigeria. Retrieved from https://education.gov.ng/library-service-unit/

Furfuri, M. I. M. (2016). Application of hybrid library resources for effective service delivery among federal university libraries in North West Nigeria. (Doctorate's thesis) University of Nigeria, Nsukka, Nigeria.

Gilbert, K. (2015). Utilization of Electronic Information Resources by Postgraduate Student of Modibbo Adama University of Technology, Yola, IOSR Journal of Humanities and Social Science (IOSR-JHSS), 20, (8) 58-65. Retrieved from https://tinyurl.com/2sdh753k

Glossary of Library and Information Science (2021). Librarianship studies and information technology. Retrieved from https://www.librarianshipstudies.com/2015/04/glossary-of-library-information-science.html

Goetze, T. (2019). The Concept of a university: Theory, practice, and society. Danish Yearbook of Philosophy. orcid.org/0000-0002-3435-3264. Retrieved from https://eprints.whiterose.ac.uk/143833/3/The%20concept%20of%20a%20university%2C%20final%20version.pdf

Meyer, E. T., & Dutton, W. H. (2009). Top-Down e-infrastructure meets bottom-up research innovation: The Social Shaping of e-Research. Prometheus, 27(3): 39–250. Retrieved from https://doi.org/10.1080/08109020903127810

National University Commission (NUC) (2022). List of Nigerian universities and year founded. Retrieved from https://tinyurl.com/yc8qbygn

Tofi, S. T., Agada, E. O. & Okafor, C. J. (2020) Utilization of digital reference resources and services by postgraduate students in university libraries in Benue State, Nigeria. *International Journal of Research and Innovation in Social Science* (IJRISS) 4(6). Retrieved from **https://tinyurl.com/mry5ysp2**

Pelemo, G. D., Onanuga, A. O., Ilori, O. O, & Ugbala, C. P. (2020). Library Orientation and Information Literacy Skills as Correlate of Scholarly Research of Postgraduate Students in Federal University of Agriculture, Abeokuta" (2020). Library Philosophy and Practice (e-journal). 4059. https://digitalcommons.unl.edu/libphilprac/4059

Okonoko, V. N & Eruvwe, U. (2021) Utilization of Information and Communication Technology Based Information Resources in Library User Education Programmes: A Study of Colleges of Education in South-South, Nigeria. Information Impact: Journal of Information and Knowledge Management, 12:1, 76-87, DOI: https://dx.doi.org/10.4314/iijikm.v12i1.6

Osuchukwu, N. P., Obuezie, A. C., & Ogwuche, G. O. (2017). Availability and utilization of information communication technology facilities in a private university library. Nigeria Journal of Information and Knowledge Management, 8 (3), 16 – 25. Retrieved from www.informationimpact.org

Seer-Uke, E., & Tyoakaa, A. (2021). Knowledge, use and problems of computer/information and communication technology in health education research among final year physical and health education students of colleges of education in Benue State. Journal of Research and Contemporary Issues in Human Kinetics and Health Education, 6, 32-42. Retrieved from https://tinyurl.com/s6y5jb69

Ruzegea, M., & Msonde, S. (2021). University students' e-resource usage: predictors, problems and practical implications. International Journal of Education and Development using Information and Communication Technology (IJEDICT), 17 (2) 104-119

Suleiman, Z. Soetan, A. K. & Ogunlade, O. O. (2020). A Survey of Information and Communication Technology Resources for Instructional Delivery in Universities in Adamawa State, Nigeria. African Scholar Publications & Research international. 18(8), 95-106. Retrieved from https://tinyurl.com/esfrxa9z

Ukachi, N. B. (2015) Information literacy of students as a correlate of their use of electronic resources in university libraries in Nigeria", The Electronic Library, 33 (3): 486-501. Retrieved from https://doi.org/10.1108/EL-05-2013-0085