INFLUENCE OF PRESERVATION TECHNIQUES AND ACCESS TO DIGITAL RESOURCES ON RESEARCH OUTPUT OF ACADEMIC LIBRARIANS IN FEDERAL UNIVERSITY LIBRARIES IN NORTHERN NIGERIA

BY

MOHAMMED, Abubakar Abdullahi
Ph.D/SICT/2016/856

DEPARTMENT OF LIBRARY AND INFORMATION TECHNOLOGY
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA,
NIGER STATE

JANUARY, 2023.

ABSTRACT

This study examined influence of preservation techniques and access to digital resources on research output of academic librarians in federal university libraries in Northern Nigeria. The study formulated eight objectives and eight research questions as well as three null hypotheses and the hypotheses were tested at 0.05 level of significance. The study employed the use of descriptive survey design. The population of the study was 484 academic librarians in the twenty-three (23) federal universities in Northern Nigeria. Multi-stage sampling procedure was used to select the nine (9) universities generational establishments starting from the first generation to the fourth generation. The total of 289 academic librarians working in the federal university libraries in Northern Nigeria were used as sample size. The study used questionnaire and observation check list as data collection instruments. The content, construct and face validity of the instruments were ascertained by the supervisors and other experts in language and test and measurement. To determine the reliability of the instrument, pilot study was conducted through splithalf method involving 20 academic librarians and the reliability coefficient index power for the items was determined using Cronbach alpha formula and consequently the internal reliability index was 0.89. Percentage and frequency counts were used to analyse the bio-data variables of the respondents while mean and standard deviations were used to analyze the data generated. Pearson Product Moment Correlation (PPMC) and Multiple Regression Model were used to test the null hypotheses at the fixed probability of 0.05. The study among others found that the use of the digital information was significant and explained 27.5% of the total variance for research output in the selected university libraries and that the types of digital resources that facilitate research output of academic librarians were identified to include e-journal, e-conferences, e-book/book in chapters, e-theses, dissertations and data bases among others. In conclusion this study found out that the extent to digital resources for research outputs in the library was high by the extent of 2.65 mean score, which is higher than the benchmark of 2.50 and it was found to facilitate research outputs in federal university libraries. Among the preservation techniques utilised for digital resources that facilitated research output of academic were identified to include, encapsulation, refreshing, technology preservation, information emulation, information migration, digitisation and replication among others. To sustain research output of librarians, activities such as training, workshops, conferences, and presentations should preserved and made accessible on social networks and internet supporting platforms for retrospection, visibility and retrieval of these digitally documents. It is recommended that libraries join and/or consortium to share the cost of preservation soft, build a reputable technical support, mentorship and courses that outsources experts to resolve challenges of adopting the appropriate preservation technique and making research output open. For purposes of description, it is recommended that met that support digital object identifier should be prioritised by the academic librarians.

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LIST OF ABBREVIATIONS

Compact Disc-Read-Only Memory **(CD ROM)**

Contextual Query Language**(CQL)**

Catalogue Online Public Access Catalogues (**COPAC)**

Dark Archives in the Sunshine State**(DAITSS)**
Digital Item Declaration Language**(DIDL)**
Document Mediated Delivery **(DOCMD)**
Digital Preservation Europe **(DPE)**
Digital Resources **(DR)**
Electronic Information Resources**(EIRs)**
Electronic Mail **(EM)**
Electronic Resources **(ERs)**
Electronic Thesis and Dissertations **(ETD)**
Flexible Extensible Digital Object Repository Architecture **(FEDORA)**.
Information and Communication Technology **(ICT)**
Internet Search Engines **(ISE)**
International Federation of Library Associations**(IFLA)**

International Standard Bibliographic Description for Electronic Resources International Research**(ISBDER**)
International Records Management Trust **(IRMT)**
Information Technologies **(IT)**
Joint Photography Expert Group **(JPEG)**
Lots of Copies Keep Stuff Safe **(LOCKSS)**
Metadata Encoding and Transmission Standard**(METS)**
Metadata Object Description Schema **(MODS)**
National Science Documentation Centre **(NASSDOC)**
Networked Digital Library of Theses and Dissertations**(NDLTD)**

National Science and Technology Library **(NSTL)**

Ohio College Library Centre **(OCLC)**

Online Information Resources **(OIRs)**
Online Public Access Catalogues**(OPACs)**
Open Document Text **(ODT)**

Preservation Metadata Implementation Strategies**(PREMIS)**
Research Libraries Group **(RLG)**
Technology Acceptance Model **(TAM)**
World Wide Web

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Research is of great importance to national development of a nation. Research is meant for the purpose of affecting societal development and improvement. It is a way of acquiring functional, dependable and useful information and data about a particular object of research. Ochia & Omofonmwan (2013) while stressing the perceived importance of research, stated that research has an impact that transcends all spheres of human endeavour such as social, economic, political, educational, science and technology. Research is a purveyor of growth, development and industrialization. The messages and the suggestions made in research output create job opportunities, increased income, increased production of goods and services, create wealth, improved quality of life, improved transportation and

communication system, networking the regions of the world, clustering of people and creating interactions among nations, socially, economically and politically.

The concept of research has been viewed by different scholars from different perspectives and approaches, it is a quest for knowledge (Baltatu 2011). Research is also a systematic method of inquiring into existing phenomenon, it is characterized as a carefully, but detailed and organised study that helps to substantiate information, proffering solution(s) to specific problems, concerns or issues affecting humanity (Creswell, 2013). Ibrahim (2013) describes research as studious inquiry or systematic investigation of a phenomenon or series of phenomena by experimental method, in order to discover facts, establish or reverse a theory, or to develop a plan of action based on the facts discovered. There are different types of research methods, for example, Sambo (2015) opined that applied research, case study research, ex post facto research, action research, and experimental research among others are different types of research.

One of the appropriate institutions charged with the responsibility of carrying out research for national development is the university and the end product of research activities in universities is called research output. Research outputs are published print and non-print based that contain thoughts within themes and follow ethical principles guiding academics to proffer solutions to identified challenges. These research outputs are not limited to seminar papers, journal articles, conference papers and proceedings, books, chapters in books, theses, dissertation, and projects (electronic and print versions). These information are expected to be housed in institutional repositories such as the libraries, museums, digital centres and in the cloud.

Typical example followed by tertiary institutions to safeguard, make visible and encourage the expansion of research is financing their libraries to subscribe to numerous types of

research outputs to facilitate current and anticipated future research activities that fulfil the objectives of teaching, learning and research. As time goes by, use of these resources is affected by chemical and physical challenges. Electronically, those in such formats are affected by obsoleteness of facilitating gadgets. To proactively respond systematically to these challenges there is need to factor technology, understand and institute a holistic preservation technique. Use of technology takes care of the chemical and physical challenges of preserving print-based resources, leaving what ways to address the electronic-based resources. The preservation techniques that when instituted to resolve the challenges of electronic information preservation and conservation comprise technology preservation, preservation emulation, information migration, refreshing, replication, preservation software choice and encapsulation.

Preservation of digital materials has gained significant prominence because of the roles it plays in combating theft, mutilation and distortion of information sources on one hand, and on the other support the creation of digital contents that are valuable to research output. This has continued to grow exponentially because it has a distinguished set of processes; activities and management of information resources which over time ensures long-term accessibility and help to relatively change the short life-cycle of physical resources and retains its original letterings. Another dimension reiterates the different formats in which these materials exist, particularly with the inception and adoption of information and communication technologies to enhance service delivery by libraries. Preservation techniques is a set of activities aimed at prolonging the life span of document or object, and the relationship between preservation techniques and access is to enable user have access for both current and future generation. Digital resources acquired by university libraries are characterised to save space, and support the creation and maintenance of repositories, and joining consortium.

Apart from the traditional methods of preserving collection in libraries, the modern method of preservation is through digitisation. Digitisation is the process of converting the printed materials into the digital/electronic format which can later form databases (Saka, 2013). The printed information resources that could undergo digitisation include: serial publication, project thesis/digitisation and technical reports. The digital collection include: e-Journal, e-thesis, e-books, and databases, respectively. The essence of considering the choice of digital preservation techniques are manifold. First is to guarantee the medium used for preservation of digital resources. Second is to guard against media deterioration or immediate obsolescence and, third to prevent loss of data. Therefore, digital preservation technique recognises the importance of digital data management and utilisation of technologies which serve as tools as well as help conserve resources and diagnose causes of loss to subscribed information resources. Digital resources used for academic and non-academic purposes is dependent on access and

retrieval tools.

Access is a general term used to describe the degree to which resources, services, product, environment are accessible to as many people as possible. It can be viewed as the ability to access information with little or no stress. Accessibility of information resources is an important recurring theme in the literature. According to Aguolu and Aguolu (2002), resources may be available in the library and even identified bibliographically as relevant to one's subject of interest, but the user may not be able to lay hands on them. One may identify citations in indexes, but may not have access to the resources containing the relevant articles. The more accessible information resources are, the more likely they are to be used. Readers tend to use information resources that require the least effort to access (Tofin &Tofi, 2019).

Access tools according to Udofot (2019) include: catalogues, indexes, bibliographies, guides, abstracts and databases in computerised formats. The commonly access tool used in university libraries in Nigeria is the library catalogue. The library catalogue according to Mohammed (2012) is a list of books and other graphic material in a library arranged according to a recognized order and containing specific items of bibliographical information for the purpose of identification, location and retrieval of the material. Bibliographies are access tools provided by libraries to provide resources for writing scholarly articles or paper or a list of books or articles an author has published on a specific subject (Ozioko, 2014).

Abstract as a type of access tool according to Ezekwe & Muokebe (2012) provide the summary of a research article, theses, review, conference, seminar and conference proceedings. The purpose of abstract is to provide prospective readers the opportunity to judge the relevance of the longer work and if there is need to peruse. Abstracts generally include key terms found in the longer work and the purpose and methods of the research output. The index, yet another type of access tool is a systematic guide to items contained in or concepts derived from a collection (Encyclopaedia of Library & Information Science, 2018).Indexed items are derived concepts that are represented by entries arranged in a known or stated searchable order (alphabetical, chronological or numerical).

The pool of digital information resources contained in databases has made it to be described as another type of access tool of rich information resources. According to Patra (2019) database is a collection of information that is organized to facilitate access, retrieval, storage the aggregated data records or files for a preconceived research output activity. The subscription and use of databases are popular among tertiary institutions globally. The reasons given by numerous academic libraries for the choice of databases is for its currency,

specialization, conservation of space, cost, serving large number of patrons at the same time, and support virtual access to library collections.

Universities in Nigeria are established to provide solutions to topical problems, undertake researches, produce human resources with competent technical know-how and befitting workforce. The objectives of the establishment of universities is not limited to teaching, learning, research and community services because it is also looked upon for the advancement of science, technology, social, political and environmental well-being of a country. Libraries attached to universities therefore, perform functions that are directly linked to the objectives of the universities and their research output. There are obvious challenges to effectively and efficiently operate university libraries. The challenges include changes as a result of modern era which brought with it technologies that oppose the traditional methods. Modern technology also changed the ways university libraries acquire, process, organise, disseminate, retrieve and more importantly preserve their collections.

This study concentrated on academic librarians working in federal university libraries in Northern Nigeria. Academic librarians are employed in tertiary institutions to serve as facilitators and support research promotion, enhances teaching and literary engagements through instituted basic instructions programmes that are not certificate awarding but proffer solutions and enhances access and retrieval to information that influence achieving the objectives of the tertiary institution. It therefore means that the role of an academic librarian is strenuous, perhaps because they operate within the library opening and closing periods daily and weekly. And also expected to publish, produce and promote knowledge through academic activities based on research, teaching, social activities and scientific research.

In Northern Nigeria, there are three geo-political zones made up of nineteen states namely: Borno, Yobe, Adamawa, Taraba, Bauchi, Gombe, Plateau, Nasarawa, Benue, Niger, Kogi, Kwara, Jigawa, Zamfara, Kaduna, Kano , Katsina, Kebbi, and Sokoto respectively. In each of these states there are federal universities established and owned by the federal governments. This researcher decided to investigate the influence of preservation techniques and access to digital resources on research outputs of academic staff in federal university libraries in Northern Nigeria.

1.2 Statement of the Research Problem

One of the cardinal goals of establishing university libraries is to support the research outputs of academic staff. Academic staffs under normal condition are expected to be highly productive in terms of research outputs. High productivity on the part of academic staff becomes one of the yardsticks used in career development of academic staff in universities and other institutions of higher learning. The academic staff would be highly productive if they have access to different digital information resources which have been kept in university libraries. However, literature has reported that disposition of the academic staff to access and use of digital resources can influence research output (Akinola & Ngeme, 2015). They further reported that the effect of popular and indispensable roles of digital resources and skills required by academic staff to facilitate their access, retrieval and storage of digital resources for research purposes also influence research output.

Preliminary investigation by the researcher discovered that most of the research outputs have not been well preserved. In this digital age many institutions lack techniques of preserving information resources. In some other places where the information resources have been preserved, there appear to be little or no access to these digital resources. When appropriate techniques are not employed in preserving digital information resources, access

to these resources are not guaranteed and utilisation of such resources for research outputs could be well undermined. It is against this background that the researcher decided to investigate the influence of preservation techniques and access to digital resources on research outputs of academic librarians in federal university libraries in Northern Nigeria.

1.3 Aim and Objectives of the Study

The aim of this study was to determine the influence of preservation techniques and access to digital resources on research outputs of academic librarians in federal university libraries in Northern Nigeria. The specific objectives were to:

1. identify the types of research outputs of academic librarians in federal university libraries in Northern Nigeria;

2. examine the extent to which access to digital resources facilitate research outputs of academic librarians in federal university libraries in Northern Nigeria;

3. ascertain the preservation techniques utilised for research outputs by academic librarians in federal university libraries in Northern Nigeria;

4. determine the access tools that facilitate access to research outputs in federal university libraries in Northern Nigeria;

5. determine the popular metadata types that facilitate access to digital resources for research outputs by academic librarians in federal university libraries in Northern Nigeria;

6. determine the activities undertaken by the federal university libraries in Northern Nigeria to ensure long-term accessibility to digital resources by academic librarians for research outputs;

7. find out the technical factors militating against the exploration of digital contents contributions to research outputs of users of digital resources from federal university libraries in Northern Nigeria.

8. find out the challenges influencing the adoption of preservation techniques that ensure the use of digital resources by academic librarians for research outputs of in federal university libraries in Northern Nigeria.

1.4 Research Questions

The following research questions were asked.

1. What are the types of research output of academic librarians in federal university libraries in Northern Nigeria?

2. To what extent has access to digital resources facilitate research outputs of academic librarians in federal university libraries in Northern Nigeria?

3. What are the preservation techniques utilised for research output by academic librarians in federal university libraries in Northern Nigeria?

4. What are the access tools that facilitate access to research output in federal university libraries in Northern Nigeria?

5. What are the popular metadata types that facilitate access to digital resources use for research outputs by academic librarians in federal university libraries in Northern Nigeria?

6. What are the activities that is undertaken by the federal university libraries in Northern Nigeria to ensure long-term accessibility to digital resources by academic librarians for research outputs?

7. What are the technical factors militating against the exploration of digital content contributions to research outputs of users of digital resources from federal university libraries in Northern Nigeria?

8. What are the challenges influencing the adoption of preservation techniques that ensure the use of digital resources by academic librarians for research outputs in federal university libraries in Northern Nigeria?

1.5 Research Hypotheses

The following hypotheses are proposed to inferentially test the results at 0.05 level of significance:

H_{O1}: There is no significant influence of the preservation techniques adopted on research outputs of academic librarians in university libraries in Northern Nigeria.

H_{O2}: Access to digital resources does not significantly influence research output of academic librarians in federal university libraries in Northern Nigeria.

H_{O3}: Adopted preservation techniques and access to digital resources will not jointly influence research outputs of academic staff in federal university libraries in Northern Nigeria.

1.6 Significance of the Study

The study is expected to be of immense benefits to the following people:

Patrons of the library: As the patrons are served by the librarians through facilitation and support services such services will be provided in simplified ways during physical visits or virtually particularly that these resources can be accessed and retrieved without recourse to loans as the library patrons achieve their information needs.

Academic librarians: The outcome of the study shall benefit academic librarians who by virtue of the employment and for promotion requirements are expected to be productive and publishing. The work is therefore going to expose the academic librarians to the best preservation technique that are suitable for diverse types of research output that shall be sort for fulfilling the employment and promotion requirements.

University library: The library as a system is expected to benefit from the empirical data. The results can guide the library staff institute futuristic plans for the utilisation of research output acquired and subscribed information resources.

Policy makers: As important roles of the library such as promoting access, operating an inclusive and popular metadata. Policy makers will be flourished with recommendations and alternatives necessary to underscore tools that facilitate access and reliable metadata to achieve library services.

University librarian: As a strategic manager the benefits of the study to such categories of staff will include the provisions that proffer solutions on challenges caused by technical factors as well as those influencing the adoption of preservation techniques based on fear or low familiarity.

1.7 Scope of the Study

The study was confined to the determination of the influence of preservation techniques and access to digital resources on research outputs of academic librarians in federal university libraries in Northern Nigeria. The study covers the variables such as types of digital resources, preservation techniques, popular metadata use, roles of federal university libraries, technical factors, the challenges of adopting preservation techniques, and their influences in Northern Nigeria. The subject of this study covered academic librarians in the following Federal Universities: namely (i) Ahmadu Bello University,

Zaria, (ii) Bayero University, Kano, (iii) University of Maiduguri, (iv) Modibbo Adama University of Technology, Yola, Adamawa State, (v) University of Jos, (vi) University of Abuja, (vii) Federal University Lokoja, Kogi State, (viii) Federal University Lafia, Nasarawa State, (ix) Federal University of Technology, Minna, Niger State, (x) Federal University Dutsin-ma, Katsina State,(xi) Federal University Gusau, Zamfara State, (xii) Federal University Dutse ,Jigawa State (xiii) Federal University Kalgo, Kebbi State,

(xiv) Usman Danfodio University, Sokoto, (xv) Federal University Kashere, Gombe

State, (xviii) Abubakar Tafawa Balewa University, Bauchi State (xvii) Federal University Wukari,Taraba State (xviii) Federal University Gashua, Yobe State (xiv)

Federal University of Agriculture Makurdi, Benue State (xx)Nigerian Defence Academy, Kaduna, (xxi) Police Academy, Wudil, Kano (xxii) Nigerian Army University,Biu and

(xxiii) University of Ilorin in Northern Nigeria.

1.8 Operational Definition of Terms

The following terms are defined operationally as used in this study.

Academic Librarians –in this research, academic librarians staff employed in federal university libraries, with qualifications not below a bachelor's degree (2.2) in library and information science or its equivalent and their appointment require them to carry research activities in order to progress in their career.

Access – Information retrieval, a device or method whereby a document may be found, permission and opportunity to use a document, or the approach to any means of storing information e.g. index, bibliography, catalogue and computer terminal.

Digital Information Resources – Refers to information resources available in electronic formats such as databases, journals, newspapers, theses, conferences, dissertations, technical reports and research papers in digital format.

Digital Preservation - Is the process of maintaining information resources in digital formats.

Northern Nigeria an autonomous division in Nigeria, distinctly different from the southern part of the country, with independent customs, foreign relations and security structures.

Preservation- Is a set of activities aims of prolonging the life span of document or object.

Preservation Techniques – This is a way or procedure of carrying digital preservation of information resources.

Research Output – is a particular dissemination, publication, presentation, communication in which research is made available to people other than the author. **Utilisation** – Refers to

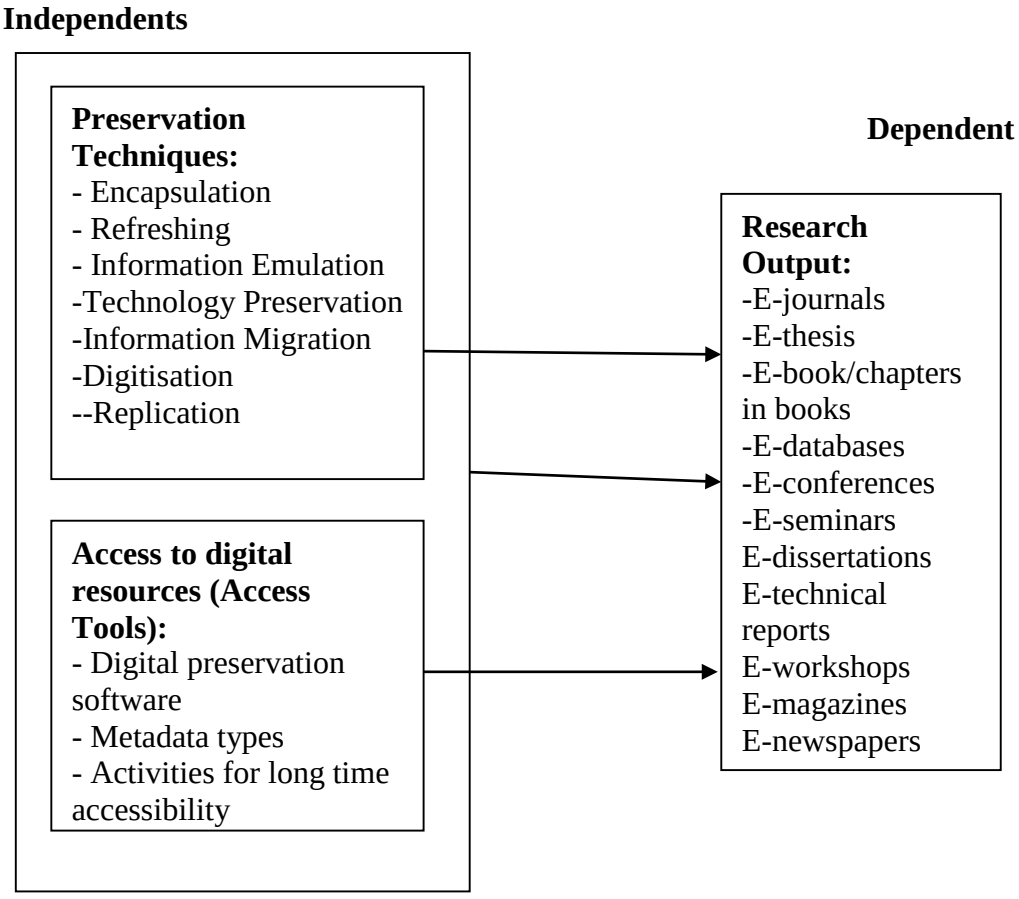
the ability to use or consult available information resources subscribed by the library for users or patrons.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Model

In behavioural sciences and social sciences, models are designed to simulate efforts that represent certain aspects of the real world. These models also identify certain variables with possible links between them in a way that demonstrates, simplifies and improves understanding. Understanding models can therefore contribute to the truth and accuracy of the real system. The model explains the process by which the study was carried out, and explains the interactions between the independent and dependent variables of the study. Figure 2.1 shows the conceptual model



Developed by the Researcher (2021)
Figure 2.1: Conceptual model

The influence was established between and among the two independent variables and the dependent variable where the influence test was conducted on the independent variable versus the dependent variable. The second test of preservation techniques the influence of access to digital resources on research output and lastly the combine influence of both the preservation techniques and access to digital resources on research output.

2.2 Conceptual Review

2.2.1 Preservation

The concept of preservation, in this study refers to all necessary strategies, measures and steps invested into prolonging the lives of library information resources. As defined by

Lasisi (1999) preservation is intended at conserving library materials for posterity. Sambo (2018) explained that preservation is an indirect method of treatment in which the environment around an item is changed. This includes stabilizing, maintaining and monitoring temperature, humidity, light exposure, air pollution, dirt, dust and mold (Iyushi, *et al.*2014). preservation also includes surveying the proper storage and handling techniques, security, including theft, vandalism, disaster prevention, education, training and outreach programs for staff, patrons, clients, and the public, while conservation is a direct method of treatment in which an item is physically or chemically changed. This includes cleaning, repairing, rebinding and reformatting. All conservation treatments entail the least intrusive methods possible and use of acid-neutral materials in line with this study which sees preservation access which is necessary for the promotion and sustenance of research output.

2.2.2 Accessibility

The concept of accessibility can be described as ability to retrieve information, a device or method whereby a document may be found, permission and opportunity to use a document, or the approach to any means of storing information e.g., index, bibliography, catalogue and computer terminal. Accessibility has to do with the way and manner of locating someone or something. Accessibility according to Ukachi (2013) refers to openness, convenience, ease of locating and proximity to information resources.

Similarly, Hikmany (2013) defined access as "the right or privilege to approach, reach, enter or make use of something". In relation to e-resources, the word 'access' means to obtain or retrieve (information) from a storage device. Accessibility to e-resources can also be seen as the ability to get, locate or obtain electronic information resource with ease in the conduct of research (Aliyu, 2014). Aina (2013) sees accessibility as a process in which academic staff can easily locate e-resources aided by ICTs in research, he maintains that accessibility is about being able to use what is available when it is required.

Access to information is important because its attributes include making except of information source accessible to users. Accessibility of information materials is one of the prerequisites of information utilisation. Resources may be available in the library and even identified bibliographically as relevant to one's subject of interest, but the user may not be able to lay hands on them because of accessibility problems. Udofot (2019) opined that the more accessible information sources are, the more likely they are to be used and readers tend to use information sources that require the least effort to access.

Obviously, accessibility constraints that could be experienced in the use of EIR include: inadequate provision of infrastructure, Internet connection problem, online database subscription problem, library electronic resources use policy and indifference behaviour of staff towards assisting users. Accessibility of information sources is an important recurring theme in the literature. According to Aguolu and Aguolu (2002) resources may be available in the library and even identified bibliographically as relevant to one's subject of interest, but the user may not be able to lay hands on them.

The prioritisation of access points by academic librarians cannot be overemphasised. For instance, one may identify citations in indexes, but may not have access to the sources containing the relevant articles. The more accessible information sources are, the more likely they are to be used. Readers tend to use information sources that require the least effort to access. The user may encounter five possible types of inaccessibility. The types are conceptual, linguistic, critical, bibliographic, and physical inaccessibility. Tofin and Tofin (2019) noted that availability of an information source does not necessarily imply its accessibility, because the source may be available but access to it is prevented for one reason or the other. According to Anyim (2020) access to information is one of the most important pre requisites for an efficient, productive and relevant research system. Researchers must obtain timely and relevant information from various sources for effective research. A recent study by Mahmood and Shafique (2011) affirmed the importance of access to information to facilitate and support efficient and productive research. Osamor (2014) explained that as the society is witnessing the digital age, information has become a vital resource for socio-economic development and research is a panacea for effective socio-economic development in the society. ICTs and electronic resources are sources of information in modern electronic information environment. Notably and relatively, ICTs and electronic resources provide quick access to information than the conventional print resources. Besides, access to

information, information use is postulated to be a correlate of academic productivity (Ani, *et al* 2014).

Ozioko (2014) attributed natural and artificial barriers to free access to information as the problem that makes the utilization of library difficult. Therefore, a library's poor reputation arose from the lack of accessibility of information sources perhaps it is remains one of the prerequisites of information use.

2.2.3 Digital Information Resources (DIRs)

Digital resources otherwise called Electronic Resources (ERs), Electronic Information Resources (EIRs), E-Resources, Digital Resources (DRs), Online Information Resources (OIRs) among other names is seen as information stored in electronic format in computer or computer related facilities like CD-ROMs, flash drives, virtual libraries or the Internet (Sahabi *et al.*, 2019). These resources consist of databases, books, journals, newspapers, magazines, archives, theses, conference papers, government papers, research reports, scripts and monographs in an electronic format (Muhammad, *et al.*2017).

According to Doaa and Abdel-Aleem (2020) digital resources are "material (data and/ or program(s) encoded for manipulation by a computerized device. These materials may require the use of peripheral directly connected to a computerized device (for example, CD ROM drive or a connection to a computer network like, the internet). Electronic resources can be accessed through remote networks from information providers or locally mounted by a consortium or one of its member libraries. In addition, Anyim (2019) defined digital resources as "materials that are computer controlled, including materials that required the use of a peripheral (a CD ROM player) attached to a computer; the items may or may not be used in the interactive mode." Electronic resources are defined as being publicly available information resources, which can be accessed through a personal computer.

Aderibidge and Ajiboye, (2013) opined that "EIR are information stored in a computerreadable format and that can only be retrieved through computer systems and other related technologies". Haridasan and Khan (2009) defined electronic information resources as "resources in which information is stored electronically and which are accessible through electronic systems and networks". This is consistent with the description of electronic information resource as a generic term "for electronic information stored both offline or online" (Thanuskodi, 2012). In a related development, Islam (2016) sees digital information resources as "those which can be either accessible from libraries' in-house database or from the world-wide web" those resources "which deal with both born digital and digitized materials which can be either accessible from libraries' in house database or from the world-wide-web".

Electronic information sources according to Ukpebor (2012) are computer network facilities such as online library catalogue, the internet, the world wide web, digital libraries, government portals and websites, CD-ROM databases, online academic databases such as Medline online, or commercial databases such as LEXIS and NEXIS. Ukachi (2011) describes EIR Databases as those kinds of documents in digital format which are made available to users through computer-based information retrieval systems. The category includes electronic texts, bibliographic databases, e-newspapers/magazine, e-books, e-journals theses/dissertations collections etc. There are online electronic resources available free of charge and some are fee based that requires licensing and authentication before users can access it. It is in line with this study because access which is one of the independent variable is one of the objectives of library because it serves as a chain for attraction, retention and feedback to library patron or users.

According to Ebenezer and Diana (2018) defined electronic information resource databases as a collection of electronic journals, books and other study materials available through the

computer and the internet. Some can be accessed free of charge, while others are subscribed to by universities or organizations before users can have access to these resources online. Electronic resources are invaluable research tools that complement the print-based resources in a traditional library. Their advantages include access to information that might be restricted to the user due to geographical location or finances, access to more current information, and provision of extensive links to additional resources or related content. Therefore, in the light of the foregoing definitions and review, it can be concluded that digital resources are books, journals, monographs, theses, dissertations, newspapers, magazines, periodicals, proceedings, government reports, databases, repositories and so on in electronic format.

2.2.4 Research Output

Research output means the production of work that may be wholly in written form or in the form of a composition, performance, exhibition or creative or other approved work (Okafor, 2011). Research is a systematic or scientific method of investigation of some phenomena or series of phenomena by experimental method in order to discover fact, to establish or reverse a theory. Ocholla, *et al.* (2012) defined research to be a way of finding answers to unknown problems emerging from natural and artificial phenomena, within our environment, through a systematic, logical and verifiable process. On a more practical basis, research is done to fulfil learning, domestic and career needs; to satisfy curiosity; for egoistic reasons, such as recognition and visibility; for career related rewards, such as promotion, securing tenure or permanent appointment; and for selfdevelopment or growth, among others. Lertputarak (2008) states further that research productivity in any university is the totality of research performed by academic staff members within a given period in universities. The significance of research in the academia is that it enables academics to share insight, demonstrate academic scholarship and gain recognition for creative thinking.

The position of research as a prerequisite to society advancements, learning, teaching and community development was factored in the study as its dependent thrust to promote sharing of experience and document evidences. For maintaining the continuity of research the contributions of other authors is important because of three (3) assessment components of the evidence-portfolio. This component measures the quality of research through focusing on an assessment of research outputs. It is a particular dissemination, publication, presentation, communication in which research is made available to people other than the author. An output is an outcome of research and can take many forms. Research Outputs must meet the definition of Research. Some examples of outputs of research include: e-books/chapters in books, e- journal articles-conference publications and databases (Argungun, 2007).

2.3 Theoretical Framework

This study is anchored in two models and a theory for assessing preservation and conservation practices of library materials by Alegbeleye (1997) and extension of the technology acceptance model (TAM 3) by Venkatesh and Davis (2000). The choice of these two models is because the models could influence preservation technique adoption and incorporation of appropriate technologies for specific tasks that can enhance access and use.

2.3.1 Model for Assessing Preservation and Conservation of Library Materials The Alegbeleye (1997) model for assessing preservation and conservation of materials in libraries was adopted. It proposed attention on operating three coherent programmes: - (i) minimum or small programme level, (ii) middle programme (iii) optimal or full-scale levels. According to the model, the first step involves measures to improve the physical handling of library materials circulated among users particularly those in print formats such as books and serials. The second phase of the model refer the middle level

programme which influences the choice of preservation technique as it takes into cognizance the environmental factors such as stable temperature, humidity and moderate exposure of materials to light and pollutants which must be controlled. Air conditioners are vital for the survival and prolong the lifespan of library materials. The full-scale programme phase encompasses substitution and reprographic methods i.e., to change library materials into stable media particularly using technologies. These include but not limited to deacidification and digitisation.

This model is relevant to the present study owing to the fact that apart from carefully handling the provision of moderate environmental factors of physical library materials, the printed materials in this modern age undergo retrospective conversion exercise which is nothing other than the concept of digitisation.

2.3.2 Technology Acceptance Model (TAM)

Venkatesh and Davis (2000) theoretical extension of the technology acceptance model (TAM 3) is adopted to explain preservation techniques, software adoption, and librarians behaviours as it affects access and use of digital information resources. According to TAM, adoption behaviour is determined by the intention to use a particular system, which in turn is determined by perceived usefulness and perceived ease of use of the system. One benefit of using TAM in this study will be the provision of a framework on which to investigate the effects of external variables on system usage, cost and benefits

(Ajsen & Fishbein, 1980). The implication is to synergize the explanations from librarians (users) and system perspectives, and by extension help built better digital libraries.

Particularly, TAM states that usage of an information system is determined by users' intention to use the system, which in turn is determined by users' belief about the system, probably because of its perceived usefulness and the perceived ease of use of the system.

Perceived usefulness is the extent to which a person believes that using the system will enhance his job performance whereas, perceived ease is the extent to which a person believes that using the system will be free of effort. Worthy of note is that, perceived usefulness has a direct effect on adoption, and perceived ease of use has both a direct effect and an indirect effect on perceived usefulness. Compared to other theoretical models aimed at understanding information system (IS) adoption behaviour, TAM has been found to have similar or better explanatory power to enable technology adoption, evaluate contents, services, architecture, distributed environments and universities performance (Osisanwo, 2012).

2.3.3 Theory of Preservation

The requirement for a theory of preservation is driven by the need to develop database and information management technology that can be used to build up a vibrant collection. The metadata-driven approach promotes the Consultative Committee Space Data System (2012), Reference Modell which was propounded by the consultative committee for space data system in year 2012. The OAIS standard focuses on the ability to access and interpret records through the creation of information. However, at present work has begun on the development of a rule-driven approach that provides a more complete characterization of preservation processes using the OAIS (Moore & Smith,

2017). This approach, it can be argued, will provide a new way to migrate all preservation processes (not just metadata), onto new technologies. As a result, librarians and archivists will be able to interact with future unknown technologies and systems so that potentially, any information can be interpreted and displayed, guaranteeing authenticity and integrity, over time.

A theory of preservation extends the concept of digital preservation from one that is focused on sending the records (metadata), into the future to one that can also send into the future a description of the environment that is being used to manage and read the records. The true

test of a preservation environment is whether it describes the entire preservation information context sufficiently well that the records can be migrated into an independent preservation environment without loss of authenticity or integrity. This requires migrating not only the records, but also the characterizations of the preservation environment context. The new preservation environment would have to apply the same management policies, the same preservation processes, use the same logical name spaces, and manage the same persistent state of information. If all of these context components can be expressed and migrated to a new preservation environment, then the preservation context is correctly described (Moore & Smith, 2017).

2.4 Types of Digital Resources

Digital resources are electronic resources that are characterized by their format and nature, and frequently available and accessible over some forms of electronic device (Anyim, 2018). Both digital resources and electronic resources appear in many literatures to be used interchangeably to mean the same (Khan, 2016). But digital resources encompass collections held in object forms as well, that is, print resources converted into digital format as a result of digitization. Digital resource supports the arrangement of metadata facets to create a constellation of digital objects across diverse resource types and collections, increase usage and enriches research processes (Phillips, *et al.*, 2019).

Digital resources are information resources in electronic formats made accessible by use of electronic devices. According to Arora, *et al.* (2013), the content of digital resources may be accessed remotely. Library of Congress Collections Policy Statements Supplementary Guidelines (2008) concept of electronic resources can help itemize what constitute the types of digital resources to include any work encoded and made available for access through the use of a computer. To Ugwu and Onyegiri (2013) digital resources is not limited to web

sites, online databases, e-journals, e-books, electronic integrating resources and physical carriers in all formats, whether free or fee-based, and may be audio (mps), visual (videos) and/or text (html, pdf, doc), born-digital, or digitized. These digital resources are themselves collections that are deliberately selected, acquired, organised, and preserved to be made accessible. They comprised wide range of materials such as:

1. Collections of complete contents of documents created or converted into machine readable form for online access.

2. Scanned images of text, photographs or converted printed texts.
3. They include specific scientific data sets
4. Online databases and CD-ROM information products, particularly those with multimedia and interactive video components

5. Computer storage devices such as Optical disc, CD-ROM/DVD-RAM
6. Databases accessible through internet and other networks, and
7. Meta documents

The classifications of Electronic Information Resources are discussed below:

(i) Databases

It is an organised collection of data in the form of schemas, tables, queries, reports, views and other objects. E-database is one of the renowned electronic information resources frequently used in the academic circle and elsewhere for accessing first hand and up-todate information in a particular field of interest. According to Patra (2019) database is a large, regularly updated file of digitized information (bibliographic records, full-text documents, directory entries, images, statistics, etc.), sometimes related to a specific subject or field,

consisting of records of uniform format organised for ease and speed of search and retrieval and managed with the aid of database management system (DBMS) software that includes an internal mechanism (search interface) for searching based on proprietary metadata.

Also, Kenny (2012) sees database as a set of organized data for some purposes which are available in digital format. The database provides searching facilities to the users by titles, authors, key words and subjects with Boolean operators. The database consists of products such as directories, abstracts and indexes, encyclopaedias, dictionaries and other references works. There are basically two types of e-databases viz. Full-text database and Bibliographic database. Full-text databases contain the whole content of an article such as citation information, text, illustrations, diagrams and tables. According to Johnson, *et al.* (2012), full-text databases are defined as a collection of data in a server or computer for easy access format that provide full-text document instead of just a citation typically in PDF or HTML. Full-text databases became common around 1990 when computer storage technology made them economic and technologically possible.

Examples of the full-text databases are Health Internetwork Access to Research Initiative (HINARI) which consists of health disciplines; Access to Global Online Resources in Agriculture (AGORA) database which provides environmental and agricultural disciplines; Emerald Insight which provides a wide range of management, library and information management journal; Science Direct; Ebscohost, a multidisciplinary database which provides access to many databases including communication, mass media business, religion and philosophy and other disciplines; and LexisNexis which provides access to full-text glossaries, legislation, procedures of South African Legal services.

A bibliographic database contains bibliographic records. It is an organised collection of references to published digital literature, which includes conference proceedings, journal and newspaper articles, government and legal publications, patents, standards, reports, books, periodicals etc. A large proportion of the bibliographic records in bibliographic databases describes articles, conference papers, etc. rather than complete monographs.

These contain rich subject descriptions such as keywords, subject terms, call numbers (Ahmed & Anjili (2015).

(ii) E- Journals

A journal is a publication in any medium issued in successive parts bearing numerical or chronological designations and indented to be continued indefinitely. Electronic journals, also known as e-journals, and electronic serials, are scholarly journals or intellectual magazines that can be accessed via electronic transmission. E-journals are also referred as "electronic publishing', "electronic serials", "online journals" and "electronic periodicals". In practice, this means that they are usually published on the Web. They are a specialized form of electronic document: they have the purpose of providing material for academic research and study, and they are formatted approximately like journal articles in traditional printed journals (Misra, 2013). The Glasgow University Library stated that "any journal that is available over the Internet can be called "electronic journal".

Similarly, Okogwu and Dike (2017) sees e-journal as "a digital version of a print journal, or a journal-like electronic publication with no print counterpart, made available via the

Web, e-mail, or other means of Internet access". An electronic journal is also known as online journal, e-journal, and electronic serial, available full text in electronic form. Electronic journals are accessed via electronic transmission, usually published on the web (Patra, 2014). A journal can be called as long as its contents are produced and stored in electronic form or if its contents can be scanned in a database and retrieved online (Alahakon &Jayasundar, 2015). Being in electronic form, articles sometimes contain metadata that can be entered into specialized databases, such as DOAJ or OACI, as well as the databases and search-engines for the academic discipline concerned. Some electronic

journals are only online journals; some are online versions of printed journals, and some consist of the online equivalent of a printed journal, but with additional onlineonly (sometimes video and interactive media) resources. These days, most electronic journals are born digital, i.e., online only where as some are online editions of print journals. PDF is the most popular format of electronic journals but some electronic journals are published in HTML also. The other formats may include Doc., image and MP3 audio. E-journals are available through aggregator database or directly publisher site such as EBSCOHOST, PROQUEST, Lexis-Nexis, JSTOR, Project Mouse, Science Direct, Emerald (Friday, 2021).

(iii) E-Books

An electronic book or e-book is a book-length publication in digital form, consisting of text, images, or both, and produced on, published through, and readable on computers or other electronic devices. Sometimes, the equivalent of a conventional printed book, ebooks can also be born digital. In addition, Emasealu (2018), stated that e-books are books that are provided in a digital format for checkout or use via an internet browser, a computer, or another electronic device like an e-book Reader. According to Mincicobradovic (2011) an electronic book is a book composed or typed on a computer, or converted from print to digital (machine-readable) format by scanning or some other process, for display on a computer screen. E-books are usually read on dedicated e-book readers or tablets using e-reader applications. Personal computers, many mobile phones, and nearly all smart phones can also be used to read e-books. Aregbesola and Oguntayo (2014) reports the rapid growth and use of e-books in schools, colleges and universities in developing countries. E-books have become an important part of the learning environment in tertiary institutions. Their

importance continues to grow, and the number of academic libraries supporting digital collections grows with it.

The reading of e-books via a standard web browser seems to be in keeping with the general moves for online delivery. The web interface allows the user to read the text, but also opens up possibilities of linking to other resources, cross-text searching, and utilisation of dictionaries and some of the advantages of using e-books according to

Sejane (2017) are;

i. Access anytime, anywhere. Academics and students do not have to come to the library to check something; they can do it at their own convenience. Academic staff are frequently away from their offices or travelling internationally and want to be able to access collections at times that suit them.

ii. Full-text searches. E-books offer full-text searches with other search capabilities and more comprehensive retrieval of information.

iii. Enriched text. Functionalities of electronic text that are useful include the ability to change font sizes and typefaces. E-books allow non-permanent highlighting and annotation.

iv. The potential advantages of e-books also include access, speedy publications, space-saving and lower costs.

(iv) E-Magazines

Electronic magazine or e-magazine is an online magazine published on the World Wide Web. Some online magazines call themselves a webzine. An ‘ezine’ (also spelled e-zine) is a more specialized term appropriately used for small magazines and newsletters distributed

by any electronic method, for example, by electronic mail (Misra, 2013). Some social groups may use the terms cyberzine and hyperzine when referring to electronically distributed resources. Similarly, some online magazines may refer to themselves as "electronic magazines" or "e-magazines" to reflect their readership demographics or to capture alternative terms and spellings in online searches. An online magazine shares some features with a blog and also with online newspapers, but can usually be distinguished by its approach to editorial control.

Magazines typically have editors or editorial boards who review submissions and perform a quality control function to ensure that all material meets the expectations of the publishers (those investing time or money in its production) and the readership. Many large print-publishers now provide digital reproduction of their print magazine titles through various online services for a fee. These service providers also refer to their collections of these digital format products as online magazines, and sometimes as digital magazines. Social Studies as mentioned earlier is an eclectic distillation of knowledge and as a result, electronic magazines that have bearing to socio-economic, political, educational, cultural, religious, science and technology, environmental, health and other aspects related to man's social and physical environment will be explored by Social Studies to effectively plan, organise and deliver the contents of the curriculum for learners' overall development.

(v) E- Newspapers

Electronic news is a publication that covers the semiconductor production equipment industry. It was originally a weekly trade newspaper, which covered all aspects of the electronics industry including semiconductors, computers, software, communications, space and even television electronics. Today, a large number of newspapers are available in electronic format (Konappa, 2014).

(vi) E- Reference Sources

According to Ukachi (2013) it is an electronic version of references sources, such as Encyclopaedia, Dictionaries, Yearbooks, and Biographies.

(vii) E-Technical Report is an electronic document that describes the process, progress or result of technical or scientific research, it may also include recommendation and conclusion of the results (Bee, 2016).

(viii) Bibliographic Indexes

A bibliographic index is a bibliography intended to help find a publication. Citations are usually listed by author and subject in separate sections, or in a single alphabetical sequence under a system of authorized headings collectively known as controlled vocabulary, developed over time by the indexing service (Abubakar and Saka, 2009).

Online indexes allow you to look beyond subject, author, or title. They allow you to look for keywords or phrases throughout the bibliographic information--including the abstract. Sometimes people refer to indexes as "Article Databases," since they are mainly used to search for articles in journals. Many also include the full-text of an actual article online. However, it is important to realise that many indexes cover other research materials such as conference papers, book chapters, dissertations and research studies.

(ix) Electronic Thesis and Dissertation

It is an electronic document that explains the intellectual works or research of researchers carried out in a particular subject domain and specifying a particular period. An Electronic Thesis and Dissertations (ETD) are expressed in a form simultaneously suitable for machine archives and worldwide retrieval as well as its paper predecessor. It provides a technological advanced medium by any word processor for expressing ideas with less expensive, small space, easy handling, high longevity and never collects dust.

At user's choice they can be available to anyone who can browse World Wide Web (Saka, 2013).

(x) Library Catalogue

Most libraries now provide access to their catalogue from their web sites. Many others provide information about their holdings into larger databases such as World Cat or the RLG Union Catalogue. The Library provides links to these catalogues under the "Catalogue " section on its web site (Mohammed, 2009).

(xi) Internet as an Electronic Information Resource

The Internet and its World Wide Web (www) have given a paradigm shift to information management. The information available on net is increasing rapidly and the task of providing relevant information to patrons is gaining paramount importance in all types of libraries. Most of the reputed publishers, learned and commercial societies are hosting their products on net and also all libraries are sharing their internal and external information resources by means of web pages and Web-OPACs.

The powerful search engines over net are aiding the information location quite efficiently. The Internet services like E-mail, Bulletin Boards, Newsgroups and Discussion Lists are gaining importance in libraries and are becoming indispensable resources for the users. Due to impact of Internet, there is a swift migration from offline to online, as Web is becoming a popular user interface for providing access to remote and frequently updated resources. From the aforementioned, digital resources influence the learning process and are the new faces of services. According to Vrana (2017) digital resources offer services for different purposes and audience as they connect them of all ages and the use for which these electronic devices accord each one of them.

2.4.1 Digital resources and research output of academics

Digital technology which is the platform on which digital resources are accessed and utilised brought significant improvement in the ways libraries capture, store, preserve and provide access to information. It offers important reformatting advantages over the traditional methods, and also creates higher quality reproduction of deteriorating information sources from their originals. According to Okonkwo (2015) digital technologies has facilitate reproduction of digital resources popularly referred to as digital images. The digital images over and over again have responded sufficiently with measures that reduce loss of image quality and enhance greater flexibility in terms of access, visibility and storage. These have contributed immensely to research output and the distribution of information. These have also evolved with it potential cost savings of storage spaces and volume of resources that can be distributed at any given time.

These attributes significantly influence research output. As the prominent technology of the post 21st Century, digital resources is becoming the desire of many publishers who are phasing out the traditional prints and adopting the production and circulation of electronic formats (Parida, 2010). Besides, scholars are also found on the digital space, particularly the web as accomplishments and attributed as the best ways to get cited as their research output are continually made visible, accessible and utilized without such barriers as time and geography. Digital resources are expected to possess contain specifications to bridge information gap and targeting a specific audience and researchers particularly.

The significance of research in the academia is that it enables academics to share insight, demonstrate academic scholarship and gain recognition for creative thinking (Mohammed & Okwilagwe, 2014). Research plays an important role in the society. This is because; the quality of any institution such as universities is measured by the amount of researches it

produces. It helps to solve professional problems, develop tools and methods for analysis of organisations, services and behaviour. Its ultimate benefit lies not only in the generation of new knowledge but in the translation of such knowledge into technologies, interventions and strategies effectively and appropriately delivered to the needy (Ugwuona & Dike, 2015).

Gbaje (2012) asserted that student and faculty increasingly demand and prefer access to digital sources because of its easy delivery systems and capability to be networked in order to meet the information needs of users, thereafter influencing the literary outcome of research output. Earlier, Opeke. and Odunlade (2011) report that science and technology teachers also rely on digital resources such as datasets, disciplinary repositories, conference papers, journal articles and technical reports for their own works. Electronic resources are used by academic staff for teaching, research, forming note and assignment. Electronic resources have become major tools in carry out research in the universities by academic staff. Academic staff access electronic resources right in their university offices/ Laboratory or in the university libraries and off campus, this is made possible through university libraries who had subscribed to many of these electronic resources and databases which are being access free of charge.

Some of these electronic resources and databases are available in various forms such like e-books, online journals, e-data archives, Health International Network Access to

Research Initiatives (HINARI), Access to Global Online Research in Agriculture (AGORA), Joint System to Order Resources (JSTOR), The Essential Electronic Agriculture Library (TEEAL) and Ebscohost among others. This had enabled academic staff to improve on their research output in Nigerian university. Shukla and Mishra (2011) stated that the use

of electronic resources by academic staff in the UK universities has shown that 87% of the respondents are using e-resources in their academic and research activities. Deng, *et al.* (2010) has shown that electronic resources have been effectively integrated into learning, teaching and research in Australian universities. This has motivated him to explore the patterns and trends of utilizing electronic resources among all categories of staff and students in higher education in Australia (Majumder & Roy, 2018). Parameshwar and Pati (2009) observed that the Internet is redefining how research is being conducted in the universities. Their survey exploring the extent of use of the electronic resources by faculty and research scholars at Gulbarga University, India indicated that most respondents were accessing and using electronic resources frequently in research.

Egberongbe (2011) stated that the emergence of electronic resources has tremendously affected how information is been accessed and used by academic staff in Nigerian university. In her study, she surveyed the use of electronic resources by academic staff at the University of Lagos, Nigeria. It was found that over 90% of the respondents accessed and used electronic resources in carryout research in their various disciplines. Issah, *et al*. (2009) submitted that the emergence of electronic resources has cut the barrier to valuable information resources which until now were difficult to access especially by scholars in the developing nations of the world. Electronic resources are invaluable research tools which complement print based resources in any traditional library; they provide access to information that might be restricted to the user because of geographical location or finances. Madhusudan (2010) examined the use of electronic resources by research scholars of Kuruksetra University in India. It was found that electronic resources have become a major part of the information needs of research scholars at Kurukshetra University. In a study conducted by Ajala, *et al.* (2010) in their study on the use of electronic resources by academic staff in Ladoke Akintola University of Technology Ogbomosho, Nigeria, found that a vast majority of respondents were using electronic resources in their research.

Ellis & Oldman (2015) explored the extent to which academic in the UK universities are accessing information as a result of the emerging electronic resources, particularly the Internet resources. The basic aim of the study was to determine the extent of accessibility and utilization of the Internet resources in research in the Humanities. It was found that most of the respondents were accessing and using electronic resources in their research. Heterick, *et al.* (2013) opined that the proliferation of electronic resources has significantly affected access and use of information by academic staff in the U.S. universities, as these electronic resources are invaluable tools for research. Thus, he conducted a study that explored how academic in the U.S. are accessing and using electronic resources in research. It was found that over 60 percent of the respondents were using electronic resources, since they believe that a variety of electronic resources is invaluable in their research.

Al-Ansari (2016) studied the use of Internet by academic staff in Kuwait University, the Interest resources that are used and the purpose for use. He postulated that, the Internet has changed the research process in the universities, but, that the intensity of Internet use varies from individual to individual, institution to institution and from country to country. Sharma (2009) perceived that availability of electronic resources is now common in university libraries in India; and carried out a survey to find out the preferences and frequency of use of online resources among research scholars at the Guru Gobind Singh Indraprasha University. It was found that the use of electronic journals was relatively high among the researchers, with high frequency of use. This shows an increasing trend towards access and use of relevant electronic resources. Khan

(2016) conducted a survey to assess the extent of Internet use by academic staff in College of Moradabad, India. The findings of the study revealed increasing use of the Internet in research by the respondents. Sujatha and Murthy (2010) studied the use of electronic

information resources by researchers at the Fisheries Sciences Institutions of South India. The results showed that there has been significant use of electronic resources mainly for research purposes among the respondents.

2.4.2 Digital preservation techniques

Digital preservation was described by Arizona (2010) as combined policies, strategies and actions to ensure the accurate rendering of authenticated content over time, regardless of the challenges of media failure and technological change. A large number of materials or resources exist in digital forms: e-mails, blogs, social network websites, national websites. Electronic information includes a variety of object types such as electronic journals, e-books, databases, data sorts, reference works, and websites (Ndagi & Madu, 2018). Lee (2012) stated that digital preservation should be examined in two perspectives: users hoping to get satisfaction from access and the use of digital materials; and the library satisfying the immediate needs of the users. The thrust enable users to establish authenticity require libraries to store much more than the content of digital documents. Therefore, digital preservation programmes include preparing materials along with associated documentation or metadata into an archival digital storage system where they can be managed to deal with the threats of data loss or technology change.

Digital information in libraries are preserved by copying, refreshing, or migration, transferring from less stable magnetic and optical media by printing on paper or microfilm, and preservation in simple digital formats in order to minimize the requirements for sophisticated retrieval software. It involved controlling the material sufficiently to support its long-term preservation, ensuring that the material will remain understandable to this defined community of expected users and ensuring that the materials is protected against all likely threats, and enabling the material to be accessed and its authenticity trusted. While

Gbaje (2011) posited that digital preservation strategy is a method for keeping stored digital objects permanently accessible for long-term use. He also pointed out that strategy is a crucial part of managing the risk associated with rapid hardware and software obsolescence.

According to Lee, *et al.* (2018) techniques for the preservation of digital information include technology preservation, preservation emulation, information migration, refreshing, replication and encapsulation. Digital resources can be stored on any medium that can represent their binary digits or bits, such as a Compact disk read only memory (CD-ROM) or a Digital video disk (DVD). To preserve the bit stream requires that there is no intervening spaces, punctuation, or formatting. A medium that is stable can be utilized; however, care must be taken that the media do not deteriorate or become obsolete before the digital information is copied into another medium, else, the data will be lost (Jimada & Aduku, 2015). Therefore, digital preservation involves copying the digital information into newer media before the old media becomes obsolete. Ensuring long-term access to the digitally stored information poses a significant challenge, and is increasingly recognized as an important part of digital data management.

Digital preservation involves the retention of both the information object and its meaning. It is therefore necessary that preservation techniques be able to understand and re-create the original from or function of the object to ensure its authenticity and accessibility. Recently, several approaches for digital preservation have been identified and presented. Conventional methods are mainly technology emulation, information migration, and encapsulation (Zhang, *et al.*2011).Therefore, preservation technique begins immediately to slow down deterioration as a result from use, abuse or age from the inception of the technique of preservation and comparatively adds value to the library collection from the time of acquisition, that is why it is included as requisite of a comprehensive preservation

plans (preservation technique, hardware, software and personnel development) made at that time, and is the responsibility of every department in the library to ensure so. Maravilla (2016) states that preservation includes all the managerial and financial considerations, including storage and accommodation provisions, staffing levels, policies, techniques and methods involved in preserving library and archival materials and the information contained in them.

Preservation and conservation comprise:

(i) Preventive conservation which focus is to guide against environmental conditions such as temperature, exposure to light (ultraviolet), humidity, and many other environmental induced challenges which these techniques are poised to protect, particularly maintaining the resources within a range of damage-limiting levels.

(ii) Interceptive conservation focused on actions undertaken direct on the materials to restore them. This implies that the preservation techniques aim to keep digital objects accessible for a long-term re-use. It is concerned with how to manage the threats that are related to hardware and software. Digital preservation techniques can be classified into investment strategies, short-term and the long-term strategies.

a. Investment strategies include the following:

(i) Use of standards for digital preservation

Adobe PDF is a portable document format that is used to present documents that include text, images, multimedia and webpage link. This strategy involves the use of preferably open, widely available, supported or agreed standards and file formats, for which there is an increased likelihood of stability and longer term support. Reliance on standards may lessen the immediate threat to a digital document from obsolescence for example; the

PDF/A standard had been widely adopted as the standards for long-term preservation of documents due to its omitting embedded scripts (Adekannbi and Wahab, 2011).

(ii) Normalization.

This relates to migration of digital objects to digital storage repository so that there would be no need to rely on the original software that was used to create the digital object. International Records Management Trust (IRMT), (2009) stated that normalization is sometimes referred to as migration on ingest. It is a formalized implementation of reliance of standards within an archival repository; all digital objects of a particular type, Colour, images, and structured text are converted into a single or more preferable file format. Images are converted from their original computer format such as joint photography expert group (JPEG), to Uncompressed Baseline tagged image file format tagged image file format (TIFF), in order to view the image, the user needs access to (TIFF), image viewing to software, to render the bits into viewable format and all word processed documents might be converted to Open Document Text (ODT) Jimada (2015).

(iii) Encapsulation.

This may be seen as a technique of grouping together a digital object, and the metadata necessary to provide access to that object. Ostensibly, the grouping process lessens the likelihood that any critical component necessary to decode and render a digital object will be lost. Encapsulation is a process whereby metadata is added to a digital object. It gives a brief description about the work such as the keywords, author, citations, and series of the creator, the title of the work, the abstract, the publishers and year of publication. This is done to allow easy access and retrieval of documents. Saffady (2009) argued that encapsulation strategy is generally oriented at collections of objects that are expected to remain unexploited for long period.

b. Short-term digital preservation strategy includes

(i) Technology preservation.

Preservation of the technical environment that runs the systems includes the operating systems, original application software and media drives. This is called the computer museum solution. Technology preservation is more of a disaster recovery strategy for use on digital objects that have not been subject to a proper digital preservation strategy. It offers the potential of coping with media obsolescence assuming the media has decayed beyond readability. Rahman and Muhammad (2012) posited that access to digital objects requires keeping older technology available for use. They said this will help future generations to view digital objects in their native format with their original layout and functionality. Creating hardware or software museum is prohibitive in cost, space and technical support requirement.

(ii) Refreshing

Refreshing is the process that involves the copying of digital information from one long term storage medium to another of the same type or a newer version (e.g. copying from a decaying tape to a new tape or from an older CD read only memory (CD ROM) to a new CD ROM. It is therefore seen as the periodically moving of files from one physical medium to another in order to avoid the obsolescence or degradation of the storage medium which could lead to inaccessibility of the materials. Refreshment is the transfer of data between two types of the same storage medium so that there are no changes or alteration of data. Miller and Roper (2009) affirms that refreshing only involves the change of storage medium such as the tape, CDROM; removable disk.

(iii) Replication

Replication is a similar process to refreshment, but with one difference: the location where the resource is stored would likely be different when a file is replicated. Again, the goal of replication is to ensure the bits of data do not change. Data that exist in only one location are highly vulnerable to damage or loss. The software or hardware could fail; someone could alter or delete the files accidentally or intentionally; or the data could be lost in a fire, flood or other environmental disaster (Kavishe, 2016). Replication is also different from the process of backing up data, since replication may involve copying

specific digital resources, whereas backup processes usually involve copying entire systems, with software and data together. Accessing replicated files requires knowing what software and hardware were used to create the records in the first place, which makes the preservation of metadata so important.

c. Long-term digital preservation strategy

(i) Migration

Migration is the process of transferring data or digital objects from one computer format to another format in order to ensure access to the digital object using new technologies. Digital preservation is concerned with ensuring that resources which are created digitally using today's computer systems and applications will remain accessible, useable and authentic when the applications and systems which were used to create and interpret the digital information resources would no longer be available. Gladney (2009) described migration as the periodic transfer of digital materials from one hardware/ software configuration to another or from one generation of computer technology to subsequent generation.

Migration is the copying of digital information from a medium that is becoming obsolete or that physically deteriorates to a newer one; converting from one format to another and moving documents from one platform to another. The reason of migration is to effect a change on digital information in such a way that technology would not affect or stop accessibility to the information. Sanett (2013) asserted that migration is copying data, or converting data, from one technology to another, whether hardware or software, preserving the essential characteristics of the data. The purpose of migration is to preserve the

integrity of digital objects and to retain the ability for clients to retrieve, display, and otherwise use them in the lace of constantly changing technology.

(ii) Emulation

Emulation strategy seeks to combine the software and hardware to provide in all essential characteristics the performance of another computer of a different design allowing programs or metadata designed for a particular environment to operate in a different environment, usually a newer environment. It requires the creation of emulators, programs that translate code and instruction so that it can be properly used in another. Emulators are computer programs designed to mimic or emulate other operating systems, and are one solution to outdated software or hardware (Pandy & Misra, 2019). Using an emulator allows users in the future to see exactly how the material would have looked, and by creating a similar operating environment to the original, it helps the files to remain interactive. Because it is important to be able to see something in its original form whenever possible, in order to preserve historical authenticity, emulators would need to be created and updated regularly, as older technology becomes obsolete.

(iii) Digitisation

The term digitisation is often used when diverse forms of information, such as an object, text, sound, image or voice, are converted into a single binary code. The core of the process is the compromise between the capturing device and the player device so that the rendered result represents the original source with the most possible fidelity, and the advantage of digitisation is the speed and accuracy in which this form of information can be transmitted with no degradation compared with analogue information (Craveiro & Domingues, 2017). According to Toyo (2017), digital projects allow users to search for collections rapidly and comprehensively from anywhere at any time without hindrance. Digitisation removes the

problem of distance, as users do not have to travel to libraries that possess the hard copies to be able to access and use such desired information resources.

2.4.3 Digital Preservation Software

(i) Lots of copies keep stuff safe (LOCKSS),

Lots of copies keep stuff safe (LOCKSS). The software that was developed by Stanford University Libraries was initially designed to enable libraries to preserve web content and electronic publications through automatic capture of web resources. The idea was to support redundancy or the preservation of multiple copies of digital materials, and there seems to be an emphasis on the management of web-based publications rather than electronic records that need to be preserved as evidence. The software conforms to the OAIS model in terms of storage and access and is actively used by libraries and publishers. The programmers are currently working on a feature that would perform migration on demand as well as migration on access, meaning that a record would be migrated once it is opened or created by a user the first time. The system also automatically compares multiple copies of a document to detect and repair any errors.

The LOCKSS software enables institutions to locally collect; store, preserve, and archive authorized content thus safeguarding their community's access to that content. The LOCKSS model enforces the publisher's access control systems and, for many publishers, does no harm to their business models. Accuracy and completeness of LOCKSS caches are assured through a peer-to-peer polling and system (operated through LOCKSS communication protocol), which is both robust and secure. LOCKSS replicas cooperate to detect and repair preservation failures. LOCKSS is designed to run on inexpensive hardware and to require almost no technical administration.

Reich and Rosenthal (2009), assert that LOCKSS collects and preserve not only the intellectual content but also its original look and feel. The technology enables administrators to create and manage their own preservation network via a Private LOCKSS Network. To make a content LOCKSS compliant requires publisher (whoever is hosting the content on the web) to give permission for the LOCKSS systems to collect and preserve content via manifest page. The LOCKSS model is based on interlibrary cooperation. An increasingly common repository framework is the Lots of Copies Keep Stuff Safe (LOCKSS) system which allows a group of consortia members to have a group of interconnected LOCKSS boxes, which continually monitor each file in each box, ensuring nothing changes with any of them. Because authenticity and reliability are always important considerations when archiving and preserving any material, at least one copy of every file or piece of information should be stored in a safe location where it is never accessed or attached to any other computer network (Gracy & Kahn, 2012).

(ii) Dspace

It is open source software used for digital repositories. It was developed by Massachusetts Institute of Technology and Hewlett Packard in November 2002. Dspace capture preserves and enables access to all types of digital content. It captures and ingest materials including metadata by facilitating easy access to materials both by listing and searching to facilitate long term preservation of materials. D-space stores digital journal, data sets, thesis, reports, conference proceedings, video and images.

Dspace is a digital repository software platform with broad functionality for the capture, management, preservation, redistribution of digital scholarly research materials in a variety of formats and for a variety of purposes, Walker (2013) and Abdulkadir (2011)

view D-space as a digital repository system designed to capture, store, index, preserve, and provide access to institutional digital research materials. Morris (2009) argued that it is an outs-of-the-Box repository software package for creating open repositories focused on delivering digital content to end users, and providing a full set of tools for managing and preserving content within the application. Dspace, however, is an open-source software designed to capture, manage, preserve and disseminate digital scholarly research material in all forms: Dspace captures, distributes and preserves digital research products. Here one can find articles, working papers, preprints, technical reports, conference papers and data sets in various digital formats. Content grows daily as new communities and collections are added to Dspace.

(iii) Fedora

Fedora stands for 'Flexible Extensible Digital Object Repository Architecture. This software package was jointly developed by Cornell University and Virginia University

Library in 2013 and was sponsored by Rep-Hat Company and then tested by Yale University and Tufts University, Cornell University. Fedora is designed as a digital storage software system and can both preserve individual digital objects and maintain relationships among different digital components that make up a complex electronic resource. All objects and related metadata are stored as xml files, which have become the *de facto* encoding standard for the preservation of electronic records (Ukachi, 2013).

(iv) DAITSS

DAITSS stands for ‘Dark Archives in the Sunshine State,’ and was developed by the Florida Digital Archive and Florida State University. The software supports the creation of a digital preservation repository by ingesting, managing and disseminating information.

The software contains no public interface, but can be used in conjunction with other access-oriented software (Vries &Marchionni, 2017).

(v) CONTENTdm

Contentdm is a commercial, proprietary software programme, designed to ingest batches of electronic records from specific user groups. The software is interoperable with the

Online Computer Library Centre, which can host the digital repository and make it available via World Cat.

2.4.4 Access and Retrieval Tools in Information Systems

The concept of information retrieval presupposes that there are some documents or records containing information that have been organised in an order suited for easy retrieval. An information retrieval system is designed to retrieve the documents or information required by the user community. It should make the right information available to the right and targeted users. Thus, an information retrieval system aims at collecting and organising information in one or more subject areas in order to provide it to users as soon as it is requested for. Atanda and Adeyemi (2018), opined that an information retrieval system does not inform in change of knowledge of the users on the subject of his enquiry; it merely informs him/her of existence or nonexistence and where about of documents relating to his request.

The information retrieval system serves as a bridge between the world of creators or generation of information and the users of that particular information. Two categories of information retrieval have been mentioned: In-house information retrieval and online information retrieval. In-house information retrieval systems are set up by a particular library or information centre to serve mainly the users within the organization. An example of an in-house database is the library catalogue. Online public access catalogue (OPAC) provides facilities for library users to carryout online catalogue searches, and then check the availability of the item required. By online information retrieval systems, we mean those that have been designed to provide access to remote databases to a variety of users. Such services are available mostly on commercial basis, and there are a number of vendors that handle this sort of service.

In typical library environment, there are two categories of patrons, the library and information personnel and the end users. Library and information personnel often act as intermediaries and they may also act as end users seeking for information for their own use or for decision making. All information retrieval system should be user oriented. As such the interest of every users should be given due importance at every point of information storage and retrieval. Yusuf and Iwu (2010) and Edem, *et al.* (2011) underscore the importance of academic libraries as not only hubs around which teaching, learning and scholarship revolve in academic institutions but also emphasis that these libraries have the responsibility to provide appropriate information resources to meet the objectives and mission of their institutions. Today, due to developments in ICT, several thousands of published information resources both in print and electronic forms are being churned out. It has become difficult, if not impossible to keep track with available published resources. Consequently, retrieving information from the myriads of information devices and carriers has become a matter of grave concern to libraries and information scientists.

Information retrieval is concerned with the process of selecting information from storage devices or carriers. This process is dependent in physical mechanism in library collections and or computers/technologies information system designs. The information environment today requires basic knowledge and understanding of retrieval tools to facilitate access to information. It has become compelling to equip users with knowledge about access tools available to them in order to assist them explore opportunities provided in a new information environment.

Success in information seeking and utilisation requires some basic skills. Uzuegbu (2014) avow that to be information literate, a person must be able to recognize when information is needed, have ability to locate, evaluate and use effectively the needed information. Anato and Filson (2014) succinctly observed that because of the growing

complexity of new information environment, individuals are faced with diverse abundant information choices in their personal and academic lives. The implications here is that individuals today are as earlier stressed should have knowledge to be able to carry out a couple or all of the following tasks necessary to source and utilize information resources in a digital age. Some of the critical skills required include: (i) knowledge of sources of information (ii) Knowledge of search strategies and must fundamentally (iii) Knowledge of retrieval tools to access information.

The need to equip prospective library users with knowledge of information retrieval tools cannot be overemphasized. It can be very time wasting and frustrating if users have spent fruitless and laborious efforts in searching and looking for information materials needed in vain. Echem and Udo-anyanwu (2018) stressed that the effectiveness of a library as an instrument of learning is determined by the success with which it is able to provide the users with the necessary tools capable of accessing and retrieving the information they seek. Retrieval tools enable information seekers to quickly and efficiently search, find/or locate and retrieve the resources that they seek. Nwosu and Ottong (2014) define information access or retrieval tools as systems created to facilitate access or retrieval of information in an organized information centre. They see them as basic building blocks for systems that organize recorded information that are collected by libraries, archives and museums. According to Ojedokun (2018) information access or retrieval tools also sometime called finding aids are produced for the sole purpose of leading users to particular types of information sources. Some of the traditional tools in libraries include catalogues, Indexes, abstracts and bibliographies.

In recent times due to developments in ICTs, computerized access tools have begun to offer full-text access to digital documents in addition to bibliographic records. Ezekwe and Muokebe (2012) investigated abstracts and indexes as guides to information retrieval. The study revealed a significant importance and usefulness of abstracts and indexes in libraries as access facilitators to library resources. Inyokwe (2011) carried out a study on the relationship between retrieval devices and utilization of information resources in

University libraries in South-South Zone, Nigeria. The survey used a sample size of 1523 registered-library undergraduate users. The data collected was analysed using Pearson Product Moment Correlation (PPMC) and Multiple Regression Analyses. The result also showed positive relationship between information retrieval devices such as abstracts, bibliographies, author/title catalogues, indexes, internet and library classification and students' utilization of information resources in the universities surveyed.

In a related work by Dike and Edem (2015) which examined the extent of use of library catalogues as retrieval tools by students of Federal University of Technology, Owerri library, Nigeria, it was revealed that low awareness of catalogue use as a retrieval tool was a factor in the under-utilization of its library resources. Also, Ajiboye, *et al.* (2013) surveyed the use of information retrieval tools by post graduate students of selected universities in South Western Nigeria. They used frequency counts and percentages to elicit responses from a randomly selected sample of 1923 respondents from different faculties in the universities studied. The study showed that respondents used information retrieval tools for various purposes and that their university library user education and information literacy programmes accounted for their main sources of their knowledge about information retrieval tools. Bro, *et al.* (2010) assessed Internet Search Engines

(ISE) usage by undergraduate students in selected universities in the Niger Delta region of Nigeria. The purpose of the study was to find out the types of ISEs used, their ability to use ISEs and method of acquiring ISE search skills. A sample size of 300 students was interviewed using a structured questionnaire.

Access to information is conspicuously one of the objectives of academic libraries because its serve as a chain of feedback, attraction and retention of library clients. Resources that attract library patrons to the library has value to the academic and nonacademic activity that the library as an information system is expected to provide. Therefore, making access

unhindered should focus on ensuring that the content of information courier be it either physical in digital form is prioritised. For academic libraries, access to information is crucial because it accelerates the level of individual's advancement as well as corporate educational development.

It is understandably that the problem of access is evaluable from the perspective of information resources retrieval. Information retrieval in information system like the library is affected by the proliferation of access tools which is to ease the process of searching for information in the library before retrieval. Accordingly to Pooya and Hanieh (2016) identified the potentials of access tools roles to the retrieval of desired information resources as follows:

1. Provision of information on what the library has by author, title and subject.
2. Provision of information on where a material can be located in the library.
3. Allowing retrieval to the library collection and provision of services to its user.
4. Enabling a library user to know the edition of a work a library has and any other bibliographic details of an information resources that may necessitate its immediate retrieval.

2.5 Metadata types and long-term access to digital resources

Metadata is data about data, Information about information. Metadata means machine understandable information to identify, locate and or describe web resources. We know the card catalogue in the library. Those cards contained the title of the book, subject of the book, author, date of publication, pages of the book. Those card catalogues were metadata. This catalogue card is a form of metadata. MARC 21 and set of rules used with it, such as AACR2 and metadata standards, Metadata can include bibliographic information,

Libraries and librarians have been involved with metadata for a long time. They called it as cataloguing rules, controlled vocabulary Indexing format etc. for machines they have developed. A set of conventions to enable machine exchanges of cataloguing records. Dublin Core has the potential of being adapted as an international standard for resource description and discovery on the web and as linger Franca for metadata, partly because of the simplicity. In recent development of digital libraries, Librarians have joined the other efforts related to metadata.

According to Gartner and Lavoie (2013) the common and more widely used metadata types include, but are not restricted to, administrative, descriptive, structural, technical, transformative, and preservation metadata. Each metadata type describes a unique set of characteristics for digital objects. Administrative metadata include information on permissions as well as how and when an object was created. Transformative Metadata includes logs of events that have led to changes to a digital object (Phillips, *et al.*2013). Structural metadata describe the internal structure of an object and any relationships between components. Technical metadata describe the digital object with attributes such as height, weight, format, and other technical details. Preservation metadata support digital preservation by maintaining authenticity, identity, renderability, understandability, and viability. They are not bound to any one category as they comprise multiple types of metadata, not including descriptive or contextual metadata (Hart & de Vries, 2017). However, unlike the common metadata types, preservation metadata are unique from the other metadata types and are often ambiguous.

For multimedia objects characterized as dynamic and interactive, and often composed of multiple image, audio, video, and software files, descriptive metadata are increasingly important because they can be used to describe, organize, and package the files (Hart,

2015). It is also stressed that content description is of great importance because digital objects are not self-describing, which makes identifying semantic-level content difficult; without description metadata, context is lost (Smith & Schirling, 2016). Tests were undertaken to discover how vulnerable metadata can be in digital files that are subject to change, which can lead to loss, addition, and modification. The tests were conducted using the file types JPEG, PDF, and DOCX (Word, 2007). The tests revealed what metadata can be extracted and what metadata could be present in the selected file types. Furthermore, they revealed how specific metadata can verify and validate the

authenticity of a file such as an image (Betrot, 2019).

2.5.1 Purpose of Metadata

The purposes of metadata have been elaborated by Haynes (2013) to include provision of information that substantiate information using different attributes that ensure the described information is discovered, utilized, administered and help to the recovery of the resource. These purposes have help to assemble large volumes of information of similar attributes that influence decidedness to use and retrieve. According to National Information Standard Organization (NISO 2004) metadata could be defined as organized data that depicts, clarifies, utilize or deal with a data resource. These metadata contain elements of encoded information that recognize proof, reveals, evaluate and administer information resource use, access and retrieval in diverse ways.

In the library environment, metadata is an applied apparatus for the access, retrieval, identification, storage and retention of acquired digital objects. The metadata has helped the library to disclose its holdings, promote equitable resources collection development, improve research productivity and promote property rights. These make metadata roles in the library to be unique because it facilitate searches of catalogue, support archiving and

retrieval of both traditional and modern (digital format) collections. Incidentally, metadata use in the libraries has taken the forms of specified digital resources access and retrieval available across a network.

The following are among the five major essence and roles of metadata in the preservation and conservation of digital resources as well as facilitating research output in the library environments:

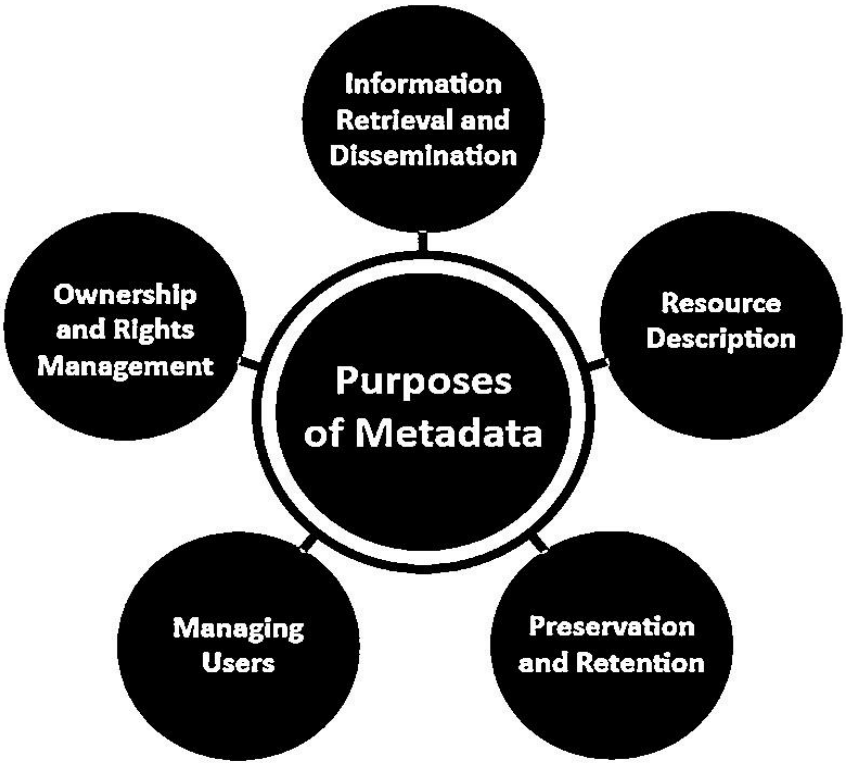


Figure 2.2: Role of metadata in information system
Source: Haynes, 2013

Resource description: Metadata helps to describe digital objects and provide elements for the authentication of these digital objects using several tools and techniques.

Preservation and retention: With emphases on accessing digital resources available on networks, metadata serve as suitable platform for the preservation of these digital objects. With several international standards used for metadata creation, the standards also help actualise the retention of these digital objects.

Managing users: Metadata facilitate the administration and use of information resources to many users at the same time and in different locations.

Ownership and right management: Metadata support right to protect numerous copyrights precepts, ownership and able to describe different types of access rights and protocols.

Information retrieval and dissemination: Metadata has help to reduce the challenges associated with the retrieval of desired information resources due to high proliferation on networks. This has also affected the dissemination patterns which metadata use has helped to address.

2.5.2 Metadata Protocols

Two main protocols influencing the choice of preservation technique particularly for interoperability are the Open Archives Initiative Protocol for Metadata Harvesting (OAIPMH) (Sompel, *et al.* 2004) and the Search/Retrieval via URL (SRU) (McCallum, 2019). OAI-PMH was created by the Open Archives Initiative for repository interoperability. It consists of six verbs or services invoked over HTTP. The verbs/services are: (i) Get Record; (ii) Identify; (iii) List Identifiers; (iv) List Metadata

Formats; (v) List Records; (vi) List Sets (Sompel, *et. al* 2019). The repositories can act as data providers, exposing structured data through the protocol or as service consumers making requests through the protocol to harvest metadata from the providers. SRU is a

XML-based protocol to allow search queries over the internet. It uses the Contextual Query Language (CQL) standard (Kiodo, 2012), a syntax for representing queries to retrieve data from the repository and exposes them in a structured form through XML.

2.5.3 Metadata Standards

Metadata standards define the main characteristics needed to describe digital objects, such as, videos, sounds, images, texts and web sites. The main standards are Dublin Core

(Weibel, *et al.*1998), preservation Metadata Implementation Strategies (PREMIS) (Caplan & Guenther, 2005), Machine Readable Cataloguing (MARC) (Rebecca, 1997), Encoded Archival Description (EAD) (Pitti, 1999), Metadata Encoding and Transmission Standard (METS) and the Metadata Object Description Schema (MODS) (Guenther & McCallum, 2003).

The Dublin Core standard was created in 1995 and is maintained by the Dublin Core Metadata Initiative. It comprises 15 properties with metadata vocabularies and technical specifications, which can describe a wide range of resources (Weibel, *et al.* 1998). PREMIS, MARC, EAD and METS are all XML-based standards. PREMIS, developed by the Online Computer Library Centre (OCLC) and Research Libraries Group (RLG), consists of a data dictionary, an XML schema and supporting documentation. MARC was developed by the American Library of Congress (ALC) for cataloguing digital objects stored in a repository. METS is a part of MARC for encoding descriptive, administrative and structural metadata about digital objects within a repository. MARC21 is the most recent version, while MARCXML is an extension of MARC21 with additional features for sharing and networked access of bibliographical information (Radebaugh, 2007). MODS is another MARC21 compatible XML for descriptive metadata. EAD is a descriptive XML-based standard aimed at describing the hierarchy structure of archival data. It bears some similarity with MARC, although EAD focuses on archives, while MARC is oriented towards bibliographical materials (Rebecca, 1997).

Others, standards and protocols comprise the Digital Item Declaration Language (DIDL) (Burnett,*et al.* 2005) cited in Rosa *et al.* (2017) for video content, the Metadata for Images in XML (MIX) (American Library of Congress, 2015) for still images, the

Technical Metadata for Text (TextMD) (Gartner, *et al.* 2008) for text, the Advanced Encryption Standard (AES) (Daemen & Rijmen, 2013) for encryption, the Document Mediated Delivery (DocMD) (Schnell, 2003), AudioMD for audio, and VideoMD for video (American Library of Congress, 2014). It is important to note that regarding metadata standards, there is no consensus about which ones are the most important (Rosa, *et al.*2017).

2.5.4 Metadata Support to the Usability of Digital Materials

Metadata are needed to record the migration history and record contextual information of a digital object (Rechert, *et al.*2015). Accurate and complete metadata is central to both migration and emulation (Lopatin, 2014). They are necessary to accurately render digital objects in emulated environments. Emulated environments are designed around a digital object's dependencies, which typically include, but are not limited to, drivers, software, and hardware.

Metadata describe the attributes of the digital object from which the type of system in which it can run can be derived. Metadata are used to support the preservation of digital objects as well as provide the history and provenance of the digital object, search and retrieval functionality of the digital object in a repository where it is held. Preserving digital objects is difficult if adequate metadata is not present. Digital objects go through many changes, requiring that such processes are captured to reveal what has happened to the object over

its lifecycle. The changes may include how the object has been modified, migrations to different formats, and what software created or changed the object.

Metadata support to the usability of digital materials has credence to its need for long time preservation of digital materials, access permissions and how the whole data could be interpreted when accessed (Musa & Shittu,2011). Therefore, for the choice of metadata formulation and use to be effective, librarians must be thoroughly familiar with the descriptors the library deemed appropriate and sufficient to facilitate access and eventual use of its collection. For instance, according to Lavoie (2014), the OAIS recommended four different types of metadata that could be embedded into the following four categories: (i) description (provided by the user), (ii) technical (extracted by specific tools), (iii) preservation (data from operations carried out during the preservation process), and (iv) structured (defines relationships between files).

2.6 University libraries Roles on the subscription and use of digital resources for research purposes

Electronic resources represent the logistic support needed to provide electronic services, which are offered via the communicational technologies. The advantages coming from the provision of these services are intrinsically related to the rapid access to information, by the elimination of the barriers related to space and time. The electronic services that can be provided by a university library are: access to online catalogues, access to online databases, e-mail reference services, Internet access among others. The role played by the university library in an increased efficiency of the access to this type of resources is a very important one. Yet, we also need to have in view the influence of certain factors that lead to the

efficient use of the electronic resources: technology, costs, management, training, content, and information support (Eric, 2013).

As far as the technology is concerned, the Internet connection needs to be a very good one, as the electronic resources require easy accessing (rented line, satellite connection, Wireless connection, sufficient digital bandwidth). This can only be achieved through investments in the infrastructure and technology. Often, these aspects mentioned above are ignored and, in this situation, the people responsible need to be informed of the need of such investments. The hardware equipment (computers, printers, scanners) needs to be updated, the recommendation being 1 computer for every 10 students. So, the costs involve infrastructure investments: network, hardware, software; maintenance expenses: repairs, supplies, replacements, updates; subscriptions to online databases; personnel salary expenses (keeping technical personnel often means paying more), training for personnel and users (computer literacy, information literacy, library literacy) (Aliyu, 2014).

All these expenses need to be foreseen in the budget in order not to be faced with the unpleasant situation of lacking the necessary funds. For example, when we think about buying a computer, we need to be aware that it has a purchase price, to which repairs and updates should be added. At the same time, computers should be replaced for good every five years (Eric, 2013). To appreciate the role of university libraries, Mohammed (2017) reiterated its position in the university. He said university libraries facilitates and support higher education and research in their quest to grant academic degrees. According to Owolabi, *et al.* (2012) students trained using effective and efficient libraries will be able to deal with the increasing specialised problems and possess intellectual and mental perspectives that prepare them to operate and accomplish more than their specialised areas. This makes the university libraries serve as the heart of university, as a heart it provides

essentially two types of services, i.e., behind the scene services and user services (Mohammed, 2017).

Behind the scene services are tailored toward making acquire information resources accessible, while user service provides user with user education services, scholarly literature and selective dissemination of information services. The use of information and communication technology in university libraries has transformed the ways these libraries provide services that is not limited to digital services (Akpojotor, 2016). Services affected comprise information access, storage, description, retrieval and dissemination. The roles of university libraries were also influenced by the ways the libraries acquire, process and organise their resources. These roles are dependent on significant investment on digital technologies to improve information sources and services. The digital technologies improve quality, access, storage, preservation, conservation and making libraries operate virtual services. These have permeated university libraries to provide digital library resources and services. The services facilitate rapid access to electronic resources, digitalisation, copying, uploading, downloading, and storage for preservation (McCredie, 2013).

The university libraries roles on the subscription and use of digital resources has been tied to the modern library services. They reported the perceived roles to be structural and promoting knowledge creation and distribution among institutions and stakeholders. The structure operates offline, online through databases and institutional repositories. The management of digital assets presents new challenges to the academic library community in terms of administering complex hardware and software, but mass digitisation has not changed the fundamentals of library services. The ephemeral nature of digital items will require more expense and staff attention in meeting preservation commitments, but the

relationship of user needs to item selection and organisation remains essential (Bamgbade, *et al.* 2015).

The complexities involved in supervising intricate information systems optimized to meet specialized user needs requires a strategic approach to management that takes into account the role of digitised collections within the larger context of the library and parent organization (Toyo, 2017).Guiding users to the items most suited to their information needs becomes a very different task as service points become more remote, but the digital environment brings with it increased possibilities to meet the traditional goal of providing personalized services to every user. However, digitisation of library resources poses a great deal of challenge to the major stakeholders, that is, the library management, employees and library users. Despite everything that digitisation can accomplish, there are some good reasons librarians and archivists in developing countries may regret embarking on such project. Not everything in the collection is worthy of digitising because the idea of an entire archives or library being digitised is a long way process (Kiodo, 2012).

According to the Digital Preservation Coalition (DPC) (2008) digital objects are much more "fragile" and require various layers of technological mediation before they can be heard, seen or understood by people, and particularly more vulnerable to physical damage for instance, one scratch on CD- ROM containing 100 e-books can make the content inaccessible; whereas to damage 100 hard copy books by one scratching move is – fortunately impossible. Therefore, any truncation could cause severe damage to the physical reliability of the data; continued usability of the data; and the integration into information and dissemination systems. The purpose of preservation according to Adeleke, *et al.* (2011) is to ensure protection of information of enduring value for access by present and future generations. More so, because preserving digital objects for longterm re-use

could require policies and strategies addressing inclusion of information and communication technologies (hardware, storage media and software) against obsolescence. Preservation techniques adoption poses a great challenge for libraries and other heritage institutions. Kulhavy, *et al* (2017) confirmed this assertion when she acknowledged that preservation management for traditional media is fairly well developed, with management tools and techniques, standards, guidelines and benchmarks to help in the policy development and implementation of preservation programmes. According to her, it is clear that there are quite fundamental differences between the preservation of more traditional types of information carrier and digital information which requires intermediary technology for access.

Haseney and Krtallic (2010) posited that when considering preservation of written heritage in general, it is possible to consider the term preservation on three levels: Strategic, Technical and Operational levels. Strategic level – This includes creating national and international projects, starting initiatives for preservation of paper material in the context of preservation of the complete corpus of national heritage suggesting ,adding and correcting legal regulation of preservation, promoting awareness among specialists and the wider public about the importance of preserving written heritage, as a part of national identity; and encouraging and organizing the education of experts in the field of preservation.

Technical Level – Technical level includes professional and scientific issues regarding the specificity and characteristics of material that heritage is made of as well as factors that endanger them, and the organization of restoration and conservation tasks. Tasks on this level are usually conducted through researching the specificity and structure of paper material using various chemical, physical and mechanical methods and procedures;

applying conservation principles and techniques to preservation of certain items of written heritage material; researching the multi-disciplinary (historical, technical, sociological), context in which certain items of written heritage were made, in order to be able to apply ethical and other principles that need to be respected during restoration and conservation; researching the interaction of different factors (microclimate, chemical, biological) and materials out of which heritage material is made.

Funding Digital projects are expensive. Digitisation of archival/library automation requires enormous funding due to frequent hardware and software upgrades, and increasing cost of subscription to electronic databases. Apart from inadequate fund to train archivists in Africa, training of archivists in digitisation and preservation of electronic format creates a herculean problem. A well-funded digitisation project assures new and improved services and sustainability of the project.

Operational Level – Operational level includes issues that deal with everyday information experts in heritage institutions who take care of collecting, safeguarding, storing and organizing written heritage. Some of the most important issues at this level are the specific issues of storing written material , such as controlling and regulating microclimate conditions, using standards for handling written material, educating users about preserving written material, conducting professional and legal issues regarding preservation of material and other safety issues (protection from fire, flood, burglary, vandalism), organizing work in legal and financial framework of an institution where material is stored, and developing criteria for evaluating, assessing and choosing certain items of written material need to be conserved or restored.

Legal Aspects-This is related to intellectual property rights. A major challenge for digital libraries is complying with copyright, intellectual property rights and related issues like

plagiarism (Uzeugbu, 2012). This is an aspect where librarians and researchers need to take precaution. There is an increasing unease among members of the library community that copyright changes will adversely affect the ability of libraries to provide digital collections and services. If libraries do begin to systematically collect digital information on a larger scale, the provision of effective access could be questionable. In fact, copyright could end up preventing libraries from providing open access to the digital information they collect. Questions of copyright must be managed so that digital information can be created and distributed throughout "digital libraries" in a manner that is equitable for both in information producers and information customers. Copyright could become an insurmountable barrier to the development of digital collections (Friday.2021).

Technophobia-Due to inadequate skills in information technology, many traditional librarians and archivists are conservatives and have phobia for computers. Because of generation gaps between the new and old professionals, computers are perceived as a threat to their status as experts. Thus, they find it difficult to cope or measure up with the requirements of the electronic/digital age, and are at the same time 'too reluctant to jettison the old practices for new one' (Jibrin, 2021). Successful application of information handling technologies requires an ability to overcome staff and personal resistance to such innovation.

Constantly Changing Software and Hardware-This creates greater pressure on archival institutions because preservation of digital archival collections centres on the interim mechanism for storing the digital information, migrating to new form and providing long-term access (Kyope, 2017). Earlier, Ogbodo (2011) reported that it takes a conscious effort of archivists to make sure that the digital information is preserved since continuously change software and hardware creates headache for staff working on digital longevity. One

of the greatest issues facing the longevity of digital collections is not only the storage media deterioration, but the problem of rapidly changing storage devices. Unlike analogue information which places emphasis on the preservation of physical artefacts, it is the informational contents of the digitized material that is preserved.

Inadequate Technology Infrastructures-Frequent power outage constitute serious bottleneck to digitization in Africa. This has the effects in damaging digital equipment and where there is generating set the cost of running them is prohibitive (Mohammed & Okwilagwe, 2014).

Technological Obsolescence-The continuous changes in computer hardware and software cause technological obsolescence which is a threat to digitisation and digital preservation. It causes the loss of the means to access to information in digital form. Technological obsolescence is caused by continuous upgrade of operating system, programming language application and storage media (Yaya, *et al.* 2015).

2.7 Challenges in the access and use of digital information services

The need to provide information content and system is usually a function of professional staff more especially when it comes to digital library services as they are designed for library clientele. As infrastructural services are required by the digital library especially mounting on institutions or at institutional level are needed (Bagudu & Sadiq, 2013).Funding as well as the knowledge level of the librarians is key to the promotion of preservation and conservation practices. It has been long identified that preservation knowledge is a significant factor in preservation endeavour and by this assertion Omeluzor, *et al.* (2012) affirmed that the level of knowledge in any information centre is one of the

four major factors that determine the ability of such library to develop a satisfactory preservation programme for their information resources.

The management of libraries and archives has some substantial degree of a poor maintenance culture of infrastructural facilities which is a great threat to the preservation of digital information resources. It is upon this that Sunil and Kumar (2019) stated that for any preservation program to succeed in libraries and archives, there must be adequate well trained manpower. This is because preservation is a specialised field of knowledge that each and every information professional is required to have that knowledge. Mohammed (2012) posited that, in order to utilise the growing range of electronic resources, students must acquire and practice the skills necessary to exploit them. Onyancha (2017) suggests that the skills required to maximize the potentials of electronic resources are much greater than those required for searching printed sources. These skills include knowledge of the structure of the database and the instructions which must be inputted into the computer by the searcher as well as an understanding of the ways in which instructions are linked with one another. Ovowuh and Iwhiwhu (2010) further averred that the ability to find and retrieve information effectively is a transferable skill useful for future life as well as enabling the positive and successful use of electronic resources while at university. In a study conducted by Olatokun (2010), he discovered that inadequacy of facilities is another problem faced by users of electronic resources, thereby leading to congestion in libraries. Patra (2019) reported that among factors that might inhibit use of electronic resources is the irrelevance of search results from databases.

Likewise, are the quality and authentication of the content of electronic resources and the usability of the library websites. Sadaf (2016) declared that, there is also a poor computer communication system which may be interpreted as poor bandwidth consequently leading to poor utilization of these resources. Similarly, Rahman and Muhammad (2012) noted that

high cost of hardware, software, and particularly internet service providers were significant barriers to the provision of electronic resources. Mwantimwa and Elias (2017) assessing the usage of electronic resources via the internet in special libraries in Tanzania observed that awareness, lack of enough internet skills, poor infrastructure and connectivity were the major reasons for the low patronage of electronic resources.

According to Koehn and Hawandeh (2010) the growing need of users for digital information access call for the need to revisit the strategy in managing financial resources and providing information services to larger communities. In a research conducted by the researcher using telephone interviews, less than 4,000 people drew the conclusion that there was an over whelming preference of internet to the library. Printed documents were more than the electronic subscriptions and acquisition while some libraries required retrospective conversion and digitisation of information resources too. Tzoed and Millard (2011) maintained that the digital technologies help to solve preservation problem of documents in libraries as it enhances access to digitalised documents when compared with electronic networks. In a related write-up Chowdhury, (2010) was of the opinion that digital library services are faced with the threat of obsolete technology i.e. even the information content of the technology is outdated. There is expensive conversion of printed text into digital objects as well as division of manpower and resources.

Some of the major administrative challenge is in complying with the copyright and intellectual property rights issues. The library authorities have to discuss seriously with publishers on this aspect in order to involve some mechanism of profit to users, publishers and authors. Users may be charged for each access, downloading from severs, or each kind of digital library collection and this causes the challenge to the user due to cost demands. Security aspects are the most pressing challenge of digital information service. Piracy of database, vital invasion and parallel satellite networking stress are some of the issues

academic libraries are confronted within as a way of routine. Additionally, lack of expertise, not too many vendors are available in the country and abroad as well. Overseas vendors charge exorbitantly and are reluctant to import techniques or technology (Abubakar, 2016).

There is also the challenge of trained staff and ICT facilities. Ajuwon and Rhine (2020) have reported that capacity building is a major problem in ICT usage. Without proper training and education, available resources will be under-utilised. They pointed out that there are many ways that organisations lose knowledge: lay-off and termination, retirement or death, employees walk away, excellent working teams split and databases become infected with virus or whole functions are out sourced. For adequate preservation and conservation of information materials in this 21st century, librarians must be thoroughly familiar with the nature of materials collected by the libraries and with the deteriorative processes that act on them; environmental, inherent, and as a result of storage, handling, use and inappropriate treatments performed in the past. This involves knowledge of the physical and chemical makeup of materials, their structure and working properties and their reaction over time and during use to stresses placed on them. It is also expected that librarians should be well grounded in both conservation theory and practice.

Libraries are being forced to explore the possibilities of fee base; cost recovery and profit potentials for their survival. Libraries must change according to changing market conditions. Libraries need to achieve an imaginative design of service and products, and develop communication methods and a feedback mechanism to improve service. Though the concept of charging for information, particularly in developing countries is a difficult task, libraries must consider what funds that can be generated this way. It must be carefully considered which services can have only a token price, which one cover a reasonable proportion of cost, and which can generate revenues. The impact of the information

technology and the adoption of the marketing approach will help improve services for users and enhance the reputation of library and information services and professionals. (Sambo, 2018).

2.8 Review of Related Empirical Studies

Ogunniyi and Adejubee (2014) investigated the strategies of curbing deterioration of library materials in selected colleges of education libraries in Southern Nigeria. Six objectives guided the study and two hypotheses, survey research method was adopted. Questionnaire was used to collect data from respondents, a total population of 13 academic librarians were used and the procedure for data analysis is descriptive statistical analysis. It was discovered that the most prominent incidences of deterioration were broken spine of projects, vandalism and mutilation of the projects. Furthermore, results showed that none of the college libraries has digitised the undergraduate projects. The study therefore recommends digitisation of projects in all colleges of education, provision of air condition and ventilation, cleaning and dusting of information resources, provision of photocopy machines, re-binding and microfilming.

The above study relate to the current study in the subject matter and method of data collection .However, the study differ in term of the area of the study and sample techniques

Gowda and Shivalingaiah (2009) carried out a study on the **"**Attitude of research scholars towards usage of electronic information resources: A survey of university libraries in Karnataka." The objectives of the study were to find out the: preferences of the research scholars towards print and electronic resources; the effectiveness of usage of e-resources among researchers of various disciplines; the impact of electronic resources on the quality of research; and usage pattern of resources accessible through UGCInfonet. Six Karnataka state universities that receive UGC financial grant and that are also members of UGC-Infonet e-consortium were considered for the study. The target respondents were research scholars of these universities. The population of the study spanned across humanities, social sciences and sciences disciplines. The respondent libraries had the total population of 1413 research scholars across three disciplines. Of 1413 target respondents, the study received 845 responses resulting in a response rate of 59.80%. The survey (Questionnaire) method was employed to gather data.

Responses received from 845 research scholars shows that in general the research scholars prefer print resources and there exists significant differences in the preference of print and electronic resources among various disciplines. It was also discovered that the electronic resources have created a positive hope among the research community in searching the information. The study made some recommendations which include the need to maintain information resources both in print and electronic formats. The study was limited to a single university while the current study intends to improve on this by focusing on

academic librarians from nine universities so as to have wider view of problems and peculiarities in the preservation and access in various universities.

Muhammed, *et al.* (2017) carried out a study entitled "Assessment of Teachers' Attitudes toward electronic resources use for social studies instructional delivery at colleges of education in North-west, Nigeria." The study assessed teachers' attitudes toward

electronic resources use for Social Studies instructional delivery at colleges of education in north-west, Nigeria. The study is specifically aimed to determine the attitude of teachers toward electronic resources use for Social Studies instructional delivery at colleges of education in north-west, Nigeria in relation to their gender and college ownership type. In the light of the above, corresponding research questions and null hypotheses are formulated for the study and tested at 0.05 level of significance. Descriptive survey design is used in the study. The population of the study consisted of all Social Studies Teachers' in Colleges of Education in North-west Zone of Nigeria numbering 200. A total of 132 respondents based on tables of sample selection at 95% confidence level and margin error of 5%. Proportionate sampling technique is used in allocating the sample for the study. The study used a duly validated teacher designed questionnaire called "Social Studies Teachers' Attitude on Electronic Resources Questionnaire" (SOSTAEREQ) as data collection instrument. The Cronbach alpha formular for calculating reliability co-efficient is used and 0.83 is obtained. Arithmetic mean, standard deviation and independent samples t-test are used in data analysis. The study discovered significant differences in the mean attitudes of teachers on the use of electronic resources on the basis of gender and institution type. This study is equally related to the study area in term of descriptive survey design

and method of data collection. However it differ in term of coverage, sample techniques, study area and population.

Mwantimwa and Elias (2017) study was on "Utilization of E-Resources to Support Teaching and Research in Higher Learning Institutions, Tanzania". This study was conducted to compare the use of electronic information resources in selected universities in Tanzania. The study employed a mixed methods research approach to collecting, processing, analysing data and discussing the resultant findings. In all, 119 academic staff and researchers participated in the study. The key findings suggest that the majority of academic staff and researchers were aware of, have access to and utilise e-resources to support teaching and research. On the whole, the study found a significant and positive association between awareness and access, access and use. In fact, most of the eresources the selected higher learning institutions subscribed to through COTUL were under-utilised. Apart from information literacy skills, personal motivations and eresource infrastructures, demographic characteristics such as age and education level of academic staff and researchers are predictors in e-resources usage. Furthermore, the challenges and problems that deter the effective utilization of e-resources were include slow internet connectivity, inability to access full-text articles, unreliable power supply, inaccessibility of e-resources outside university premises due to IP address limitations, inadequate ICT infrastructure and inadequate skills and knowledge. The study found that there was a need to promote the usage of e-resources through web technologies to enhance the quality of teaching and research. The study differ from the current study in term of coverage, area of the study, population and sampling techniques, the study was limited to selected universities in Tanzania on utilisation of e-resources while this study intend to improve on focusing on research outputs of academic librarians in Northern Nigeria.

Akinola and Ngeme (2015) conducted a study entitled **"**Accessibility, Use of Electronic Information Resources and Research Output of Librarians in Universities in Ekiti, Ondo and Osun States, Nigeria". The aim of the study is to investigate accessibility, use of electronic information resources and research output of librarians in universities in Ekiti, Ondo and Osun States. The survey research design was adopted for the research. The population of the study was 160 librarians from 18 universities in Ekiti, Ondo and Osun States. Census was used to include all the 160 librarians that participated in the study. A self-structured questionnaire was used. Cronbach's alpha reliability test was used to validate the instrument with value ranging from 0.7 to 0.81. 89.4% (143) was the return rate of the questionnaire. Data collected were analysed using descriptive statistics (frequency count, tables, percentages, standard deviation and means) for research questions while inferential statistics (Pearson's Product Moment Correlation Coefficient and ANOVA) were used for the hypotheses.

There was no significant relationship between electronic information resources accessibility and research output of librarians in the study locale ($r = -0.13$, $N = 143$, $P = 0.117$).The study showed no significant relationship between electronic information resources use and research output of librarians in universities in Ekiti, Ondo and Osun States ($r=-0.05$, $N=143$, $P=0.561$).The combination of accessibility and use of electronic information resources did not significantly influence research output of librarians in the universities ($R = .13$, $F_{2140} = 1.30$, $P >0.05$). Findings also revealed that there was high level of accessibility of electronic information resources and that librarians frequently used AGORA, JSTOR, HINARI, E-Library, TEAL, EBSCOHOST, OARE, E-Directory and Science Direct E-Journal. Librarians published mostly on hardcopy journals, book chapters, co-authored textbooks and conference/seminar/workshop papers. The major challenge faced by librarians in universities in Ekiti, Ondo and Osun States was lack of time due to library routine tasks. This study concluded that most librarians in universities in Ekiti, Ondo and Osun States have access to electronic information resources but they do not maximize these resources for their research work. Hence this study recommended that librarians' routine task should be minimized so that they can have time to embark on

research activities using the electronic information resources. The study is related to the current study in the area of coverage, subject but limited to only selected states in South

West Nigeria while the current study covers all the federal universities in Northern Nigeria.

Omeluzor, *et al.* (2012) examined the use of electronic information resources and research output by academic staff in private universities in Ogun state, Nigeria. Five objectives guided the study and three private universities were selected out of the nine private universities in Ogun state. These universities are Crescent University, Abeokuta,

Babcock University, Ilishan-Remo, and Redeemers' University, Mowe, all in Ogun State, Nigeria. Purposive sampling method was used to investigate respondents. The instrument used for data collection was structured questionnaire. 225 copies of the questionnaire were administered at Babcock University and 144 were retrieved. 88 at

Crescent University and 80 were retrieved, while 215 at the Redeemers' University and 130 were retrieved. A total of 528 copies of the questionnaire were distributed to the respondents at the three universities and a valid number of 354 (66%) questionnaires were retrieved and analysed. The study revealed that lack of personal computer and erratic power supply among others are major constraints that inhibit use of electronic information resources in the three private universities which invariably affects their research output.

In view of the above findings, the researchers recommend as follows: The academics should be encouraged to use electronic information resources to prepare papers for presentations. Moreover, there is need for the academics to improve their research output through constant use of electronic information resources. This will justify the efforts of various private universities in Nigeria towards ensuring availability and accessibility to

those resources. This study is equally related to the study but differ in the subject, coverage area and sampling techniques.

Mohammed, *et al.* (2019) in their study investigated the problems of preservation and conservation of library digital resources in Federal University of Technology Minna and Ibrahim Badamasi Babangida University Lapai. Four research questions guided the study. The study adopted descriptive survey design and population of 74 professional and paraprofessional library staff from Federal University of Technology Minna and Ibrahim Badamasi Babangida University Lapai. The study used the entire population of professional and paraprofessional library staff and thus total enumeration was used. Seventy-four (74) copies of the questionnaire were distributed sixty (60) copies filled and returned; representing a return rate of 81%. The data collected were analysed using percentages. The findings of the study revealed that library staff agreed that the aim of preservation and conservation of digital information resources in the library is to prolong their lifespan, the library staff also agreed on the type of preservation and conservation techniques in used to digital information resources in the selected libraries and how those types helped in protecting the digital resources. The study thus recommended that libraries should be given allocation from the budget of the library, exclusively meant for preservation and conservation of digital information resources. The need for more qualified staff in the area of preservation and conservation of digital information resources in academic libraries should be a matter that needs urgent attention, there is need to educate library users on how to handle and use this modern information resources with care. This study is also related to the current study matter, purpose, sampling and methods of data collection, the only difference is this current study focus

on how to improved research outputs among academic librarians in federal universities in Northern Nigeria.

Saka (2013) conducted a conceptual and empirical study to determine the trends in the Digitisation of thesis and dissertations in Nigeria universities. According to the author digitisation projects in University of Jos, Ahmadu Bello University, Zaria, University of

Nigeria Nsukka, and University of Ibadan where at most advanced stages. Ahmadu Bello University Zaria and University of Nigeria, Nsukka both use Dspace software for the digitisation of their theses/dissertations. Access to the digitised resources were facilitated by their respective library web -pages and university websites. The study did not factor the influence of preservation techniques which are pertinent for the effective operation and sustainability of digital resources use. This current study will bridge this gap by investigating the success of these universities with the exception of University of Ibadan which fell out of the scope of the study.

Saka, *et al.* (2017) conducted a conceptual and empirical study to determine the management of research output in respect of undergraduate and postgraduate students' university libraries in Kenya and Nigeria. Five research questions guided the study and contained variables such as programme covered format of submission methods of processing, arrangement and organisation as well as methods of preserving and challenges involved in the management of research output. Survey research was used with six universities in the capital cities of Kenya and Nigeria and six university librarians. Questionnaire was used as instrument for data collection. Data collected for this study were analysed using frequency distribution and percentage. Results showed that research output were acquired and submitted to university libraries in both hard and soft copies.

Preservation strategies were mostly through shelving and computerisation of collections. A major challenge to the management of research output was space**.** This study relates to the current study in term of methodology and sampling techniques.

Danazumi, *et al.* (2017) conducted a survey that showed the factors affecting teachers in Sabon Gari local government area Kaduna state. The respondents were teachers in secondary schools in the study area who make full use of digital information resources. Three research questions guided the study and questionnaire was used to collect data from the respondents. Simple random sampling was used and a population of 150 teachers. The study found out that used of digital information resources is complex such as method of use and cognition unfamiliarity with computer and networks, and lack of ability. In addition, many did not know what the library actually buys, while some older ones assume and think that the age factor is hindrance to use of digital information services and resources. When such users need digital sources, graduate students are used to search and help them. The study recommends library orientation and in-house training for teachers on how to search for information in libraries. The above study is relates to the current study matter, sampling and method of data collection. This study deal with teachers usage of digital information resources while the current study focus on influence of preservation techniques and access.

Jimada (2015) investigated preservation of digital information resources in federal university libraries in north western states of Nigeria. To achieve the objective of the study, four research questions were constructed. A qualitative research methodology was used; purposive sampling was used for the study, the instrument used for data collection was the structured questionnaire and interview. The responses from the respondents who are staff of the digitisation unit were analysed descriptively using tables. The result of the findings

showed that the most popular information resources generated and preserved are theses dissertation, preprint and post print journals. External hard drives, CD-ROM/DVD and computer hard disk are the common storage media used for preservation in the libraries studied. It was also discovered that migration and use of standard are the popular strategies used for preservation. The study discovered that the major challenges in preservation of digital information resources include; lack of infrastructure, technological obsolescence, poor maintenance culture, inadequate power supply and inadequate fund. The study concludes that even though some form of preservation is carried out on digital information resources in libraries studied but yet not effectively and efficiently done. In view of this a number of recommendations were made including providing different types of digital information resources such as record inventions, technical report, use of mirror server, use of strategies such as emulation, refreshment, constant upgrades of hardware and software. The above study is related to the current study interms of subject matter, purpose and method of data collection as they are directly related to the current study, the only different is the sampling and area of coverage.

Lopatin (2014) investigated metadata practice in Academic and non-Academic libraries for digital project. Four objective and four research questions guided the study. Survey research method was used for the study. The study examined and compared the metadata practices of academic and non-academic libraries regarding digital projects. It explores the types of metadata and vocabularies utilised, issues of interoperability, end-usercreated metadata, and staffing for metadata planning and creation. Participants from 87 academic libraries and 40 non-academic libraries responded to the survey. The survey found that despite their different environments, academic librarians and non-academic librarians engage in similar metadata practices. The majority of the participating libraries have metadata librarians, whose jobs involve describing, cataloguing and classification of

acquires digital resources and retrospective conversions of the resources to access points facilitated by OPAC, institutional repositories and other library links. This implies that metadata is an essential requirement for returning appropriate search result to meet the need of users. The study is equally related to the current study matter, sample and method of data collection and therefore relevant to the current study.

Shameenda (2011) investigated preservation and conservation of library materials, techniques and practices in the University of Zambia Library and its two branches. Five research questions guided the study. The study highlighted preservation and conservation issues which included managerial and financial considerations including storage and accommodation, staffing levels, policies, techniques and practices in preserving and conserving library materials and the information contained in them in order to ensure long term access to them. Survey research method was adopted for the study and the population of study were 35 library staff, 6 bindery staff and 11 faculty academic staff total 55. Questionnaire, observation lists, interview and documentary sources were used as instrument for data collection. Purposive sampling was used for this study. The research findings revealed that although the University of Zambia libraries were involved in the long-term preservation of library materials, they did not provide a well-planned preservation and conservation care because preservation 7 was given least priority and conservation programmes were addressed in varying degrees in the libraries. Further results showed the lack of awareness concerning preventive preservation measures, poor handling and use of library materials. The study differs in term of area of coverage and instrument for data collection but are related in subject coverage

Musa and Shittu (2011) examined digitisation of library resources in Kashim Ibrahim

Library: process challenges and impact of the services using documentary research method and oral interview in gathering data. Five research questions guided the study, the method adopted for the study was documentary research method using interviews as instrument for data collection, a web search was conducted, and information was also gathered by observation and work experience from the researcher who had been a part of the digitalisation exercise. The study discovered copyright issues, difficulty in digitising some materials, constant changing hardware and software, lack of lenses, virus attacks, and unavailability of needed materials, technical support and security. Based on the findings, recommendations were proffered. These included migration, emulation, encapsulation, use of anti-virus, constant upgrading of software with backup before each upgrade, staff should be deployed for checking of CD before submitting and the use of digital camera and photocopy software should be encouraged, workflow time should be reduced and advocacy and submission of preprint should be encouraged by library. The above study is equally relates with the current study in term of subject matter but differ in method of data collection and study area.

Njeze and James (2013) investigated capacity building initiatives in preservation techniques with reference to Nigerian Universities. The researcher randomly selected four universities libraries and used descriptive method, using self-developed questionnaire. The respondents in the study comprised librarians and non-librarians, a total of 120 copies of questionnaires were administered, but a 112 copies were retrieved and analysed. The study revealed that the universities in Nigeria are not exposed to capacity building in preservation. The study recommended regular trainings and retraining for the development of all staff and for any university to stand out amongst others. The study is also relates to the current study in subject matter, sample and method of data analysis. However, the current study differs in types of respondents and coverage.

Ndakalu (2014) conducted a study on the accessibility and utilisation of digital information services in academic library university of Nairobi as a case study. The aim of the study was to assess the extent of accessibility and utilization of digital information services in academic libraries in Kenya with reference to University of Nairobi Library. The objectives of the study were to assess the accessibility and utilisation of digital information resources in the University of Nairobi library, establish the level of awareness of digital information services in the library, identify the challenges facing the library users in

relation to accessibility and utilisation of digital information services in the library and suggest possible solutions to the identified problems in the library. The study used descriptive survey design where the target population comprised 96 postgraduate students of the University of Nairobi. Purposive sampling technique was applied to the study and questionnaire was used as the instrument for data collection. The findings of the study showed that the majority of the respondent rarely approached the librarians for assistance in the library and the majority of them were not aware of digital information services. The major challenges the library users faced while accessing and using digital information were lack of adequate information skills, lack of awareness, training and poor information infrastructure. Recommendations were made to include the following: provision of Internet facilities, regular library orientation for both staff and students, training of library staff on ICT skills and provision of power supply. The study is related to the current study in term of methodology population and subject matter but differ in the area of sampling, coverage and respondents.

Osunride and Adetunla (2017) studied the preservation and conservation practices across all categories of personnel in academics' libraries in south west Nigeria, and found that library security is the most used measure of preservation and conservation practices.

Dust and particulate matter are the greatest causes of deterioration to library materials that threaten conservation. For popular preservation technique they found comprise dusting, cleaning and proper shelving as preservation techniques adopted by the libraries. They recommended use of technologically enabled preservation techniques for the preservation of digital resources. The study is equally related to the current study in subject, sampling and method of data collection. However the current study adopt digital preservation techniques to improved research output, the above study use print preservation method

Irene (2016) conducted a study on digital preservation and institutional repositories; A case study of Universities in Kenya. The study investigated the strategies used by universities in Kenya for the preservation of their scholarly contents was the first of its

kind. The survey method was used within multiple case study design. Data was collected using questionnaires administered to 350 postgraduate students conveniently selected from six universities in Kenya. Personal interview was used to collect data from the university libraries in these six universities. The findings from the study revealed that the scholars in these universities were personally engaged in preservation of their digital information but did not extensively use university digital archives, servers or repositories. This was largely attributed to lack of awareness of the important role of digital preservation. The study recommended that even with the existence of institutional repositions, much was needed to be done to create more awareness and acceptance of digital repositories. The study is related to the current study to enhance research outputs of academic librarians.

Nnadozie, *et al.* (2017) investigated the accessibility of e-resources and online information services provided at Michael Okpara University of Agriculture, Umudike

(MOUAU) and National Root Crop Research Institute (NRCRI), Umudike libraries in Abia State, Nigeria. Six research questions and two null hypotheses guided the study. The research design used was descriptive survey method while useful data were elicited through a customized research instrument entitled. "Questionnaire on Availability and Accessibility of e-Resources and e-Services in Academic and Special libraries." The finding showed that while availability of e-resources was sporadic, accessibility and frequency of use of online information services were abysmally low. Several factors were identified as impeding accessibility of e-platforms in the libraries surveyed such as inadequate ICT facilities, slow bandwidth, poor funding and high cost of Internet subscription. This study is also related to the current study matter, sampling and method of data collection but differ in area of coverage.

In a research work conducted by Dada (2016) to assess the preservation of information resources in Federal College of Education (FCE), Zaria, found that preservation of information resources in the College Library is affected by lack of suitable or adequate equipment and lack of knowledge of preservation technique application on the part of the college librarians. This study is related to the current study in term of subject, area of

coverage while the current study intend to improve by focusing on academic librarians from 9 selected federal university in Northern Nigeria.

Bagudu and Sadiq (2013) conducted a study to determine the perception of students toward digital library services in the International Islamic University of Malaysia. Survey research method was used and five research questions guided the study. A sample of 164 postgraduate students from the Faculty of Engineering were selected through random sampling questionnaire was used to collect data. The finding revealed lack of student orientation, training on how to use computer appliances, obsolete hardware and software, technical support and difficulty in digitising past question papers.

Based on the findings, the following four recommendations therefore made. The university management should strive to make an effort to upgrade the digital library system to be more user friendly so that it will be easier to use by students. The institution can also organize a kind of training workshop at least once in a semester. For the postgraduate students in order to enable them effectively utilise and benefit from this new library technology. The library should put more steps forward in the digitisation of up to date past question papers because they serve as guides for students on how to go about confronting their end of semester examinations. The library management should provide a feedback stock which will serve as a means for users' responses on the performance of each digital item or content and the level of satisfaction derived. The study is equally relates to the current study but differ in area of coverage and population. The study is limited to one single academic university while the current study intend to improve this by focusing on academic librarians working in 9 federal university libraries to improved their research outputs in their institutions.

Kavishe (2016) carried out a study on investigation of the preservation skills and strategies being used by the University of KwaZulu-Natal libraries in preserving electronic information resources (EIRs) to ensure their long term availability and access. Five research questions guided the study and a population of 60 library staff was adopted for the study. Respondents are engaged through a census sampling technique and instrument for data collection is self- administered questionnaire comprising closed and open questions. A quantitative approach using the survey research design is used. Data is analysed using Statistical package for the Social Sciences version 20. The analysis of the results reveals that there is intermediated level of ICT knowledge and skills regarding preservation of EIRs amongst respondents. The results also reveal that the respondents need trainings in migration, metadata and emulation techniques. It is believed that the study will assist the library staff on what areas to be improved in the EIRs management. The study recommended that useful research information can help the university libraries involved the study to properly preserve EIRs for optimal benefits of its users. Other universities in related situations can also benefit from the research findings and emphasised the need for training of library staff on ICT skills/ preservation of electronic information resources. The study differ from coverage, population of the study and area of the study while this current study focusing on academic librarian on how to utilise and improved their research outputs.

Kulhavy, *et al.* (2017) equally carried out a study on digital preservation and access of various resource document. A case study of current status of North American University. The study adopted content analysis method to assess the level of Digitisation preservation of natural resources documents. The methods in this study can be applied to other natural resource collections increasing their use and distribution. The process of decision making for documents and their preservation and inclusion in Scholar Works is presented as a part

of the Forest Sciences Commons as a subset of the Life Sciences Commons of the Digital Commons Open Network launched and maintained by is press. The finding shows that digitisation has increased the roles and skill sets needed for librarians and from libraries. This creates new challenges and opportunities for the library as publisher and as an advocate for open access. The study relates to the current study in term of subject area and method of data collection, the only different is the study area, sample and sampling techniques.

In a related study, Kay, *et al.* (2017) investigated the backup digital preservation practice with empirical research. The study introduces the National Library of Australians digital preservation knowledge base, which helps library to manage digital objects from its collections over a long term. The knowledge base information which format rendering software, operating systems, hardware and most importantly, the relationships between them were discussed. Most of the works on the knowledge base over the last few years have been focused on the mapping of functional relationships between file formats, their versions and software applications. The information is gathered through unique empirical research and initially recorded in multiple worksheet excel file in semi – structured format, through the development of a prototype graph data base. The study recommended that even though most libraries have their backup, there is a need for more external backup due to erratic power supply and virus attacks. This study is equally relates to the current study in term of subject coverage, purpose. While the current study is to determine the influence of preservation and access on research outputs. The above study deal with backup digital preservation practice.

2.9 Summary of Literature Review

The reviewed literature in this study covered an extensive review of related literature, indicating the empirical work that has been done on influence of preservation techniques and access to digital resources on research output of academic librarians in federal university libraries in Northern Nigeria. The available literature reviewed through their relevance drive this study by revealing strong points that could help in understanding compliance with of preservation techniques and access to digital resources on research output of academic staff.

A review of literature on preservation techniques showed gaps that most of the previous studies did not pay attention to. These are the variables that influence research output of academic librarians in federal university libraries in Northern Nigeria. It is therefore essential to critically investigate research output of academic librarians as determined by the above mentioned variables. The compliance decision theory, theory of assessment and preservation and conservation practice of library material and technology acceptance model (TAM) are theories upon which this study is predicated. The application of these theories represents a new approach to understanding how to improve on research output of academic staff. The literature reviewed has shown the importance of research output of academic staff, its benefit and relevance to the author, universities, the government, researchers and the country (Ndakulu 2014, Nnadozie, *et al.* 2017). It was also established from literature that research output of academic librarians is low and inadequate according to (Osunrinde & Adetuna 2017).

Some past studies on research output of academic librarians in federal university libraries in Northern Nigeria did not make adequate provision, therefore it is difficult to access. A good number of literatures reviewed on preservation techniques and access to digital resources that continues to lead to high productivity and accomplishment of organisational

goals. Conclusively, there are some noticeable gaps in such as depending on the interpretation of results from the descriptive basis neglecting other areas. For instance, most of the studies identified on research output of academic librarians in Nigeria are empirically proven not content analysis.

Despite all these, the basis for this research is still provided for by the available research findings, mainly journal publications, unpublished thesis, conference proceedings and online publications which are sources for a larger part of this review. Therefore, this study intends to fill gaps in knowledge by investigating the influence of preservation techniques and access to digital resources on research output of academic librarians in federal university libraries in Northern Nigeria.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

The study employed the use of survey research design. According to Ibrahim (2013) survey research design is used to collect participants' responses on facts, opinions and attitudes. A survey research is one in which a group of people or items are studied by collecting and analysing data from only a few people or items considered to be representative of the entire group. Therefore, the adoption of survey research design enabled the researcher to reach out to the population of the study in their different locations

3.2 Population of the Study

The population of this study comprised 484 respondents made up 484 academic librarians working in federal university libraries in Northern Nigeria. The academic librarians

working in the university libraries were in charge of providing access to digitised information resources subscribed and sustain their use to support and facilitate research and teaching needs.

The distribution of academic librarians in the federal universities studied is presented in Table 3.1.

Table 3.1: List of federal universities and number of academic librarians in Northern Nigeria

S/No	Universities	No of Academic Librarians
1.	Ahmadu Bello University, Zaria	117
2.	Bayero University Kano, Kano	37
3.	Usmanu Danfodio University, Sokoto	18
4.	Federal University Dutsinma, Katsina	7
5.	Federal University Gusau, Zamfara	10
6.	Federal University Kalgo, Kebbi	10
7.	Federal University Dutse, Jigawa	10
8.	University of Jos, Jos	36
9.	University of Ilorin, Kwara	13
10.	Federal University of Agriculture, Makurdi	13
11.	University of Abuja, Abuja	15
12.	Federal University of Technology, Minna	28
13.	Federal University, Lokoja, Kogi	14
14.	Federal University, Lafia, Nasarawa	10
15.	University of Maiduguri, Maiduguri	51
16.	Modibbo Adama University of Technology, Yola	9
17.	Abubakar Tafawa Balewa University, Bauchi	31
18.	Federal University, Kashere, Gombe	7
19.	Federal University, Wukari, Taraba	12
20.	Federal University, Gashua, Gashua	10
21	Nigerian Defence Academy, Kaduna	10
22	Police Academic, Wudil, Kano	8
23	Nigerian Army University, Biu	8
	Total	**484**

Sources: www.nuc.listofapproveduniversities ,annual reports and registry record of each university/phone calls (2020)

3.3 Sample and Sampling Techniques

A sample size of 340 respondents from 23 universities was used for the study .Multistage sampling procedure was used to get the sample for the study from the 23 universities found in Northern Nigeria. Thus, Otaha (2015) view multi-stage sampling as procedure that consisted of processes, stages, and sampling techniques to arrive at reasonable and appropriate sample size. To do this, two stages were itemized and utilized. At the first stage, three universities were randomly selected (using the ballot system) from each geographical zones which comprised the North Central, North East and North West. Nine (9) universities out of 23 federal universities across Northern Nigeria were randomly selected. These nine (9) federal universities were selected from the three geopolitical zone sand are presented on Table 3.2.

At the second stage, total enumeration or census method was adopted for administration of the research instrument and those that served as respondents. This implied that the study do not have sample size and researcher considered the population as not too large to manage and that the use of the total enumeration can eliminate any potential bias that could occur and influence generalisation of the findings. Total enumeration can be adopted when the population size is small and shares a common characteristic (Ibrahim, 2013). This is affirmed by Saka (2014) that the whole population can be used if it is manageable in terms of cost and accessibility to the participants of the study. Thus, all

340 academic librarians working with the Federal University Libraries in Northern Nigeria constituted the respondents for this study.

Sample Size

Table 3.2: Sample of the Universities

S/N	University	Total sample
1	Ahmadu Bello University, Zaria	117

2	Bayero University, Kano	37
3	University of Jos, Jos	36
4	Federal University of Technology, Minna, Minna	28
5	University of Maiduguri, Maiduguri	51
6	Abubakar Tafawa Balewa University Bauchi, Bauchi	31
7	Usmanu Danfodio University, Sokoto	18
8	Federal University of Agriculture, Makurdi,	13
9	Modibbo Adama University of Technology, Yola	9
	Total	340

3.4 Instruments for Data Collection

The instruments used for data collection was structured questionnaires and observation check list.

3.4.1 Questionnaire

The research instrument used for this study was structured questionnaire with four point rating scale of strongly agreed (SA) Agreed (A) Strongly Disagree (D) Disagree (SD) and Very High Extent (VHE) High Extent (HE) Low Extent (LE) and Very Low Extent

(VLE) used for data collection, the questionnaire was named "Influence of Preservation Techniques and Access to Digital Resources on Research Outputs of Academic librarians in Federal University Libraries in Northern Nigeria." (IPTADRRO) Questionnaire. The questionnaire was sub-divided into eight sections of: A. Types of research outputs of academic librarians and there are 6 items: B. Access to digital resources of academic librarians and there are 6 items: C. Preservation techniques utilised by academic librarian and there are 7 items: D. Access tools that facilitated research outputs of academic librarians and there are 6 items : Metadata types used for long-term access and there are 6 items : F. Activities undertaking to ensure long-time accessibility of digital resources for research outputs and there are 6 items: G. Technical factors militating against the

exploration of digital contents contribution to research outputs and there are 8 items; F. Challenges influencing the adoption of preservation techniques and there 8 items. The total items in the questionnaire are 53. This method is found appropriate as the questionnaire is capable of reaching so many people and provides an opportunity for respondents to give frank and anonymous answers. (See Appendix A).

3.4.2 Observation Check List

The observation check list contain various items listed that are used for digitalisation.

The researcher physically visited almost all the selected university libraries in Northern Nigeria in order to observe the application of digital preservation techniques and practices in the respective university libraries. The visit also availed the researcher to ascertain from some of the academic librarians the extent they exploit digital resources of their libraries when undertaking research-based activities. Based on visit, the researcher observed that the study areas shared the same facilities for preservation, such as D-space, fedora, digital camera, printers, scanners and photocopiers. Therefore the researcher mage the observation check list in some of the questions raised on the questionnaire for easy analyses and interpretation. The total number of items in the observation list are 17.

(See Appendix B).

3.5 Validity of the Data collection Instruments

The draft copy of the instruments was distributed to the supervisory team for surface and structural validity. In addition, experts in the Faculty of Education, Department of Library and Information Science, and Department of Mathematics Education, Ahmadu Bello University, Zaria went through the instruments. All the corrections, suggestions made

were incorporated and resubmitted to the supervisory team for approval. The researcher believed that the evaluation, comments and judgments of the supervisory team helped to determine the extent to which the items seeking to elicit information reflect and are suitable for the actualization of the study objectives. (See Appendix C).

3.6 Reliability of the Data Collection Instruments

To determine the reliability of the questionnaire and observation checklist, the modified version of the instruments was pretested in university located outside the geographical study zone. Twenty copies of the instruments were administered on 20 academic librarians in the University of Ibadan, Ibadan using split half method. The returned copies of the instruments were then tested, processed and analysed with the application of Cronbach-Alpha method, to determine the reliability coefficient of the instrument. The reliability coefficient for the items of the reliability of the items of the librarians was 0.88. The obtained level of reliability co-efficient for library staff working in university library showed that the instruments were reliable and can be adopted for the study (See Appendix D).

3.7 Method for Data Collection

The two instruments were administered on the respondents who are academic librarians that work in the university libraries in the study area. Ethical practices that regulate research of this nature were appropriately observed. A letter of introduction was collected from the Head of the Department of Library and Information Technology, Federal University of Technology, Minna to seek permission from the universities to involve before the study was conducted. Again, informed consent was sought from the participants who were made aware that the study is purely an academic exercise and that their confidentiality was assured. All scholarly work and data consulted in any form or format

were duly acknowledged, cited and referenced. The administered questionnaires was also guided by the observation checklist. The observation check list was synthesis and validated using Federal University of Technology, Minna School of Information and Communication Technology, Department of Library and Information Technology academics who facilitated assessment and attestation of the instrument appropriateness, clarity, simplicity, suitability, coverage, structure, grammar and suggestions that could improve the quality of the instrument administered on respondents to achieve the objectives of the study.

The data collection started with the distribution of the research instruments to the respondents in their various university libraries in the selected institutions with the help of nine research assistants who were recruited for the purpose of the study. Data collection lasted for two month, for the distribution and collection of the distributed questionnaire. The period of two months was to give sufficient time to the respondents to fill and return the administered copies of questionnaire. (See Appendix E).

3.8 Method for Data Analysis

The data generated was analysed using descriptive and later inferential statistical analysis. For descriptive analysis, mean and standard deviation were used to answer the eight research questions raised based on decision benchmark of 2.50; while Pearson Product Moment Correlation Coefficient (PPMC) and Regression Analysis were used to test the three null hypotheses. All the hypotheses were tested at the fixed probability of

0.05.

3.9 Response Rate

A total of two 289 copies of the questionnaire were administered to academic librarians of the selected federal universities. A breakdown of the response rates from the different

universities is presented in Table 3.3 below. The Table shows the copies of the questionnaire administered and the number returned from each of the universities along with the computed percentage of the response rate.

Table 3.3: Response rate of the administered copies of the questionnaires from each university

University	Total administered	Total Returned	Percentage
Ahmadu Bello University, Zaria	100	95	95.0
Bayero University, Kano	32	30	93.8
University of Jos, Jos	32	30	93.8
Federal University of Technology, Minna	26	25	96.2
University of Maiduguri, Maiduguri.	39	38	97.4
Abubakar Tafawa Balewa University Bauchi	23	21	91.3
Usman Daffodil University, Sokoto	18	16	88.9
Federal University of Agriculture, Makurdi	10	9	90.0
Modibbo Adama University, Yola	9	8	88.9
Total	289	272	94.1

Source: Field survey, 2020

At Ahmadu Bello University, Zaria, a total of 100 copies of the questionnaire were administered to the academic librarians out of which 95 copies were successfully retrieved giving 95% response rate. In Bayero University, Kano, a total of 32 copies of the questionnaire were administered and 30 copies were successfully filled and returned which gave a response rate of 93.8%. Total copies administered at University of Jos, was

32 and 30 and were successfully retrieved, amounting to 93.8% response rate. In Federal University of Technology, Minna, a total of 26 copies of the questionnaire were administered to the academic librarians and 25 copies were successfully completed and returned, making 96.2% response rate. At the University of Maiduguri, 39 copies of the questionnaire were administered and 38 copies were retrieved, amounting to 97.4% response rate. A total of 23 copies of the questionnaire were administered at Abubakar Tafawa Balewa University Bauchi and 21 copies were completed and returned amounting

to 91.3% response rate. In Usman Daffodil University, Sokoto, 18 copies of the questionnaire were administered and 16 copies were successfully filled and returned with a response rate of 88.9%. The copies of the questionnaire were administered at

Federal University of Agriculture, Makurdi was 10 and Nine (9) were filled and returned with 90.0% response rate. At Modibbo Adama University, Yola, Nine (9) copies of the questionnaire were administered and Eight (8) were completed and returned and the response rate was 88.9%. In the overall, 272 or 94.1% response rate was obtained for the study.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Answer to Research Questions

Research question one: What are the types of research outputs of academic librarians in federal universities in Northern Nigeria?

Table 4.1: Means responses on the types of research outputs by academic librarians in the selected Federal University libraries (n=272)

S/N	Research outputs of Academic Librarians	SA F	A F	D F	SD F	Mean	Std. Dev.	Decision
1	e-books/ chapters in a book	74	134	51	13	2.99	0.808	Agreed
2	e-theses and e-dissertations	111	117	38	6	3.22	0.767	Agreed
3	e-journal articles.	72	138	48	14	2.99	0.806	Agreed
4	e-Conference paper/Seminars/Workshops	57	139	65	11	2.89	0.775	Agreed
5	e-Magazine/Newspaper/ Monographs /Technical reports	32	86	127	27	2.45	0.827	Disagreed
6	Databases	52	133	72	15	2.82	0.803	Agreed
	Weighted mean					2.89	0.577	Agreed

(Decision mean =2.50)

The type of research outputs produced by the academic librarians cut across e-books/chapters in books, e-theses and e- journal articles. The only exception to this generalisation was emagazine/newspapers/monograph and technical reports which the respondents disagreed as part of their research outputs. Among the research outputs, e-theses and e-dissertations was the highest with a mean affirmation of 3.22. Next in the ranking were e-books/ chapters in

books and e-journal articles. They were then followed by e-conference paper/seminars/workshops and databases. For e-theses and e-dissertations, 40.8% and 43% strongly agreed and agreed respectively that they were output of academic staff of the libraries. For e-magazine/newspapers/monograph and technical report, only 11.8% and

31.6% of the respondents strongly agreed and agreed with the suggestion that the academic staff in the libraries were responsible for the production of such output while 46.7% and 9.9% disagreed and strongly disagreed with the opinion. The weighted mean for the table was 2.89 which support the notion that the listed items were actually the research outputs of the academic librarians of the university libraries studied.

Research question two: To what extent has access to digital resources facilitate research outputs of academic librarians in federal university in Northern Nigeria?

Table 4.2: Means responses on accessibility to research output for academic librarians in the selected Federal university libraries (n=272)

S/N	Accessibility to research outputs	Very High Extent F	High Extent F	Low Extent F	Very Low Extent F	Mean	Std. Dev.	Decision
1	Access to e-newspapers improves my research outputs	26	101	103	42	2.41	0.861	Disagreed
2	Access to relevant ebooks facilitate my research outputs	76	115	61	20	2.91	0.890	Agreed
3	Access to e-theses promotes my research outputs	11	77	88	96	2.01	0.895	Disagreed
4	Access to e-technical reports facilitates my research outputs	32	75	128	37	2.38	0.863	Disagreed
5	Access to e-journals improves my research outputs	89	137	39	7	3.13	0.747	Agreed
6	Access to databases improves my research outputs	78	131	57	6	3.03	0.765	Agreed
	Weighted mean					2.64	0.433	Agreed

(Decision mean = 2.50)

The respondents did not agree that they have access to relevant e-newspapers that facilitated research outputs. This is seen in response to the first item of the table where 37.9% and

15.4% of the respondents disagreed and strongly disagreed with the suggestion. Only 9.6% and 37.1% of the respondents strongly agreed and agreed with the suggestion. The mean score (2.41) for the item is lower than the decision mean of 2.50. The respondents affirmed their access to e-books improved their research outputs. In response to the second item in the table, 27.9% and 42.3% of the respondents strongly agreed and agreed respectively with the suggestion that their access to e-journals improved their research outputs in federal university libraries. The respondents did not agree that accessibility to e-theses helped to promote their research outputs. In response to the suggestion in item 3 of the Table, only 4.0% and 28.3% of the respondents strongly agreed and agreed respectively with the suggestion. The mean score was 2.01 which could be considered lower than the decision mean of 2.50. The same observation was obtained for the 4th item of the Table where 11.8% and 27.6% of the respondents strongly disagreed and disagreed respectively that access to e-technical reports helped to facilitate their research outputs while 47.1% and 13.6% disagreed and strongly disagreed with the suggestion. The mean score of 2.38 was lower than the decision mean for affirmation to the suggestion. But the respondents were of the opinion that access to ejournals helped to improve research outputs. In response to the item, 32.7% and 50.4% of the respondents strongly agreed and agreed with the opinion. The mean score was 3.13 and it implied that most of the respondents agreed with the suggestion. In the last item in the Table, 28.7% and 48.2% of the respondents strongly agreed and agreed respectively that access to databases improved their research outputs. The mean score was 3.03 and it was higher than the decision mean of 2.50 which implied that most respondents agreed with the suggestion. In the overall assessment, the weighted mean score obtained for the Table was 2.64 implying that respondents were of the view that accessibility to research outputs improves their research output in the university libraries studied. The position of access for research productivity was high.

Research question three: What are the preservation techniques utilised for research outputs by academic librarians in the federal university libraries studied?

Table 4.3: Means responses on the preservation techniques utilised for research output in the federal university libraries (n=272)

S/N	Preservation Techniques	SA F	A F	D F	SD F	Mean	Std. Dev.	Decision
1	Encapsulation has helped the library group subject fields accordingly.	44	72	127	29	2.48	0.888	Disagreed
2	Refreshing has based the transfer of information from one medium to another.	54	63	83	72	2.36	1.078	Disagreed
3	Technology preservation has helped the library recovered new and damaged information sources.	84	123	45	20	3.00	0.878	Agreed

4	Information Emulation has helped the library take cognisance of software and hardware requirement.	115	125	20	12	3.26	0.779	Agreed
5	Information Migration has helped the library change resource format to ensure access.	49	140	61	22	2.79	0.830	Agreed
6	Digitisation has helped the library change print to electronic resources	122	129	18	3	3.36	0.656	Agreed
7	Replication has aided the addition of new access point.	77	113	36	46	2.81	1.030	Agreed
	Weighted mean					2.87	0.497	Agreed

(Decision mean = 2.50)

Respondents did not agree that encapsulation had helped the libraries to group subject fields accordingly. In the Table, the mean score was 2.48 and in response to item 2, the respondents disagreed with the suggestion that refreshing has based the transfer of information from one medium to another in the libraries. The mean score was 2.36. In an ordered or hierarchical impact, use of digitisation ranked the most used technique used for the preservation of research outputs in the federal university libraries studied involved in the study. This was indicated in response to item 6 of Table 4.3 where 44.9% and 47.4% of the respondents strongly agreed and agreed respectively with the suggestion that digitisation has helped the library change resource format for ensured access to research outputs of the academic staff of the federal university libraries. In response to item 4 of the table, 42.3% and 46.0% of the respondents strongly agreed and agreed respectively that digitisation has resulted in information emulation which has helped the libraries to take cognisance of software and hardware requirement for research output preservation in the libraries. The mean score was 3.26. Next in the order of hierarchy was information migration suggested in item 3 of the table where 30.9% and 45.2% of the respondents strongly agreed and agreed respectively that technology preservation has helped the library recovered new and damaged information sources which improved their accessibility.

The mean score was 3.0. The respondents agreed with a mean score of 2.79 in response to item 6 of the table that digitisation as a preservation technique has helped the libraries to change from printed resources to electronic resources. In response to item 7 of the table, 28.3% and 41.5% of the respondents strongly agreed and agreed respectively that replication as a preservation technique has assisted in additional access to research outputs in the federal university libraries. The weighted mean score for the table was 2.87 and it is higher than the decision mean of 2.5.

Research question four: What are the access tools that facilitate access to research output in federal university libraries in Northern Nigeria?

Table 4.4: Means responses on the access tools that facilitated research outputs for academic librarians in the Federal University libraries (n=272)

SN	**Access tools**	SA F	A F	D F	SD F	Mean	Std. Dev.	Decision
1	Bibliographies make it easy for researcher to find out more about topic area in research	147	84	27	14	3.34	0.857	Agreed
2	Abstracts aided user with fully description of item	115	93	34	30	3.08	0.993	Agreed
3	Catalogues assist user to locate books and other materials available in the library.	101	123	32	16	3.14	0.853	Agreed
4	Index provide user with clear description of items in the library.	79	113	28	52	2.81	1.062	Agreed

5	Database enable user to search for relevant information.	125	104	27	16	3.24	0.859	Agreed
6	Finding aids help user to find information on a specific group, collection or series of archival collection.	107	93	34	38	2.99	1.040	Agreed
	Weighted mean					3.10	0.643	Agreed

(Decision mean = 2.50)

All the respondents strongly agreed and agreed that the selected access tools were adequately facilitating their outputs in the federal university libraries. In response to the first item of Table 4.4, 54.0% and 30.9% of the respondents strongly agreed and agreed with the suggestion that bibliographies make it easy for researchers find out more about topics areas of specific research. The mean score for the item was 3.34 which affirmed the suggested opinion. Another access tool which the respondents affirmed was adequately used to facilitate their research outputs was Abstracting. In the Table, 42.3% and 34.2% of the respondents strongly agreed and agreed respectively that it aided user with full description of items being sought and the mean score was 3.08 which affirmed the suggested notion. Cataloguing was another equally rated access tool by the respondents. In the Table, 37.1% and 45.2% of the respondents strongly agreed and agreed with the suggestion that assist user to locate books and other materials available in the library. Only 11.8% and 5.9% of the respondents disagreed and strongly disagreed respectively. The mean score of 3.14 affirmed that the tool adequately facilitated research outputs by the academic librarians. Indexing was rated by 29.0% and 41.5% of the respondents who strongly agreed and agreed respectively that it provide user with clear description of items in the libraries. The mean score was 2.81 which affirmed that most of the respondents agreed with the opinion. Another access tool was databases with ratings of 46.0% for ‘strongly agree’ and 38.2% for ‘agree’ and a mean score of 3.24. In emphasizing the importance of the available access tools, 39.3% and 34.2% of the respondents strongly agreed and agreed that findingaids helps user to locate information on a specific group, series of archival collections in libraries.

The weighted mean score for the table was 3.10 which affirmed that the identified access tools adequately facilitate research outputs by academic librarians in the federal university libraries studied.

Research question five: What are the popular metadata types that facilitate access to digital resources use for research outputs by academic librarians in federal university libraries in Northern Nigeria?

Table 4.5: Means responses on the choice of metadata types that promote usability of digital resources for research outputs by academic librarians (n=272)

S/N	Metadata types that promote usability of digital resources	Very High Extent F	Very High Extent F	Std. Low Extent F	Low Mean F	Dev. Decision		
1	Administrative metadata provide information to manage resources.	99	122	37	14	3.13	0.832	Agreed
2	Descriptive metadata aided in discovery and identify of information.	95	115	38	24	3.03	0.919	Agreed
3	Structural metadata indicate how compound object are put together.	88	97	43	44	2.84	1.053	Agreed
4	Technical metadata relate how a system function or behaves.	75	88	67	42	2.72	1.032	Agreed
5	Transformative metadata helps in conveying data from one format/structure to another.	70	102	57	43	2.73	1.015	Agreed
6	Preservation metadata contain information needed to preserve a resource.	70	121	49	32	2.84	1.941	Agreed
	Weighted mean					2.88	0.680	Agreed

(Decision mean = 2.50)

The respondents affirmed that administrative metadata provided information for the management of information resources. This is indicated in response to the first item of Table 4 with a mean score of 3.13. In terms of the ratings, 36.4% and 44.9% of the respondents strongly agreed and agreed respectively with the suggestion. In terms of structural disposition, 34.9% and 42.3% of the respondents strongly agreed and agreed that descriptive metadata aided in discovery and identification of information and 32.4% along with 35.7% of the respondents strongly agreed and agreed respectively that it helped to indicate how compound object were put together. The mean scores were 3.03 and 2.84 for items 2 and 3 respectively. The respondents agreed with a mean score of 2.72 that technical metadata helps in relating how a system functioned or behaved while on a transformative basis; it helped in conveying data from one format/structure to another. These are indicated in items 4 and 5 of the table with mean scores of 2.72 and 2.73 respectively. For preservation purpose, 25.7% and 44.5% of the respondents strongly agreed and agreed respectively that it provides information needed to preserve a resource. The weighted mean for the table was 2.88 which affirmed the respondents' agreement that metadata helps to facilitate access to digital resources used for research outputs by academic librarians in the selected Federal University libraries.

Research question six: What are activities that are undertaken by the federal university libraries in Northern Nigeria to ensure long-term accessibility to digital resources by academic librarians for research output?

Table 4.6: Means responses on the activities undertaken to ensure long-term accessibility to digital resources by academic librarians research outputs (n=272)

S/N	Activities Undertaken to ensure long-term accessibility	SA F	A F	D F	SD F	Mean	Std. Dev.	Decision
1	Use of digital preservation software	72	111	52	38	2.80	0.987	Agreed
2	Managerial commitment	67	114	55	36	2.78	0.966	Agreed

3	Funding of preservation activities	53	123	58	38	2.70	0.939	Agreed
4	Staff training on agreed procedure and processes regularly	65	114	53	40	2.75	0.981	Agreed
5	Policy modification in-line with current preservation trends (Technological/technical requirements)	71	112	47	42	2.78	1.003	Agreed
6	Planning for the future	74	99	61	38	2.77	1.003	Agreed
	Weighted mean					2.76	0.783	Agreed

(Decision mean = 2.50)

Among activities for ensuring long-term accessibility to digital resources for research outputs by the academic librarians were use of digital preservation software which 26.5% and 40.8% of the respondents strongly agreed and agreed respectively was used in the libraries. The mean score for affirmation of the activity was 2.80. Others were managerial commitment, 2.78, funding for preservation activities, 2.70, Staff training on an agreed procedures and processes regularly, 2.75, Policy modification in-line with current preservation trends (Technological/technical requirements), 2.78 and Planning for the future, 2.77. The weighted mean score for the table was 2.76, affirming that all the activities necessary for ensuring long-term accessibility to digital resources for research outputs by academic librarians of the libraries were adequately identified.

Research question seven: What are the technical factors militating against the exploration of digital content contributions to research outputs of users of digital resources from federal university libraries in Northern Nigeria?

Table 4.7: Means responses on the technical factors militating against access and use of digital resources in the selected Federal University libraries (n=272)

S/N	Technical factors militating against access	SA F	A F	D F	SD F	Mean	Std. Dev.	Decision
1	Information availability	66	120	59	27	2.83	0.94	Agreed
2	Interactive nature of technology	66	117	63	26	2.82	0.910	Agreed

3	Data management	82	131	43	16	3.03	0.835	Agreed
4	Portability of digital content	84	104	60	24	2.91	0.937	Agreed
5	Device networking	51	147	40	34	2.79	0.891	Agreed
6	System connectivity	52	129	55	36	2.72	0.922	Agreed
7	Collaboration tools	89	103	52	28	2.93	0.964	Agreed
8	Document transfer protocols	66	106	66	34	2.75	0.962	Agreed
	Weighted mean					2.85	0.624	Agreed

(Decision mean = 2.50)

Table 4.7 revealed that data management was the foremost among technical factors militating against access and use of digital resources for research outputs of academic librarians in the federal university libraries studied. The mean score for affirming the suggestion was 3.03. Others were collaboration tools (2.93), portability of digital content (2.91), information availability (2.83), interactive nature of technology (2.82), device networking (2.79), document transfer protocols (2.75) and system connectivity (2.72). Based on the mean scores in the Table, it could be stated that all the listed technical factors were major constraints to access and use of digital resources for enhancing research outputs of the academic librarians of the selected federal university libraries.

Research question eight: What are the challenges influencing the adaption of preservation techniques that ensure the use of digital resources by academic librarians for research outputs in federal university libraries in Northern Nigeria?

Table 4.8: Means responses on the distribution of the challenges influencing academic librarians from adoption of preservation techniques and access in the selected federal university libraries (n=272)

S/N	Challenges to preservation/ access to digital resources	SA F	A F	D F	SD F	%	Std. Dev.	Mean	Decision
1	Absence of library policy on digital preservation	74	115	54	29	10.7	0.938	2.86	Agreed
2	Poor security and confidentiality controls	96	89	70	17	6.3	0.929	2.97	Agreed

3	Lack of records retention and disposal policies	63	121	63	25	9.2	0.894	2.82	Agreed
4	Absence of migration strategies for records	58	92	82	40	14.7	0.980	2.62	Agreed
5	Understand the function requirement for records preservation	57	126	63	26	9.6	0.884	2.79	Agreed
6	Competences and skills required to manage information delivery system	67	127	61	17	6.3	0.844	2.90	Agreed
7	Accurately documented policies	94	101	52	25	9.2	0.952	2.97	Agreed
8	Lack of standard operating preservation procedure	71	121	63	17	6.3	0.858	2.90	Agreed
	Weighted mean						0.635	2.85	Agreed

(Decision mean = 2.50)

The challenges to adoption of preservation technique and access to digital resources for research outputs in the federal university libraries studied can be classified into basically two categories which were administrative and human resources. At the administrative dimension, were poor security and confidentiality controls (2.97), lack of accurately documented policies

(2.97), lack of competences and skills required to manage information delivery system (2.90), Lack of standard operating preservation procedure (2.90). Others with equally relative ratings were absence of library policy on digital preservation (2.86), lack of records retention and disposal policies (2.82) and lack of understanding of the functional requirement for records preservation (2.79). Absence of migration strategies for records was another challenge which was rated above average (2.50). From the weighted mean score of 2.85, it could be said that the respondents affirmed the view that the selected constraints constituted major challenges to preservation and access to digital resources for research outputs by academic librarians in the federal university libraries studied.

4.2 Test of Hypotheses

The hypotheses formulated to validate the contributions of preservation techniques and access to digital resources for enhancing research output of academic librarians of the federal university libraries studied were tested here at a significant level of 0.05. The hypotheses were tested with the Ordinary least square regression procedure as follows:

Hypothesis I: There is no significant influence of the preservation techniques adopted on research outputs of academic librarians in university libraries in Northern Nigeria.

Research outputs was used as the dependent variable for the regression model here while preservation technique was used as the independent variable. Table 4.9 showed the regression estimates for the model and estimated Beta coefficients for determining the functional relationship between the response variable (research outputs) and the predictor or explanatory variable (preservation techniques).

Table 4.9: Regression estimates of preservation techniques for digital resources as predictors of research outputs by academic librarians of the Federal University Libraries

Explanatory Variables	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	2.731	0.205		13.308	0.000
Preservation	0.057	0.071	0.049	0.802	0.423

Dependent Variable = Research outputs

Table 4.9 revealed that preservation techniques adopted for digital resources was not a significant predictor of research outputs by academic librarians in the federal university libraries studied. The observed F-value which explain the model was 0.644 and the probability level of significance for the model was 0.423 ($p > 0.05$). The observed coefficient of determination (r^2) was 0.002 which means that the preservation techniques adopted for digital resources could only explain 0.2% of the total variance for research outputs by the academic

librarians in the federal university libraries. The multiple R which is the Pearson Product Moment correlation coefficient was 0.049. The functional relationship for the model could thus be estimated as: Research outputs = 2.731 +0.057Preservation techniques adopted in the libraries. Based on these observations, the null hypothesis that, there is no significant influence of the preservation techniques adopted on research outputs of academic librarians in university libraries in Northern Nigeria is therefore retained. The finding here contradicted the report of Kay, *et al* (2017) from a study on backup digital preservation practice with empirical research. Where relationships between preservation and accessibility to digital information resources was found to be significant.

Hypothesis II: Access to digital resources does not significantly influence research output of academic librarians in federal university libraries in Northern Nigeria. The regression estimates for the linear regression used for the hypothesis is summarized in Table 4.10.

Table 4.10: Regression estimates of preservation techniques for digital resources as predictors of research outputs by academic librarians of the federal university libraries

Explanatory Variables	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.
(Constant)	1.046	0.185		5.664	0.000
Access to digital resources	0.698	0.069	0.525	10.126	0.000

Dependent Variable = Research outputs

Access to digital resources was a significant contributor to research outputs by academic librarians in the federal university libraries studied as revealed in Table 4.10. The observed Fvalue which explain the model was 102.530 with a p-value of 0.000 ($p < 0.05$). The observed

coefficient of determination (r^2) was 0.275 which means that access to digital resources could explain 27.5% of the total variance for research outputs by the academic librarians in the Federal University libraries. The multiple R which is the Pearson Product Moment correlation coefficient was 0.5259 which implied that the two variables were highly correlated or that access to digital resources has significant influence on research outputs by academic librarians of the federal university libraries involved in the study. The functional relationship for the model could thus be estimated as: Research outputs = 1.046 +0.698 Access to digital resources in the libraries. From these observations, the null hypothesis is that, access to digital resources does not significantly influence research output of academic librarians in federal university libraries in Northern Nigeria is therefore rejected. The findings here agrees with the findings of Ndakalu (2014) from a study on access and use of digital information services in academic libraries, a case study of University of Nairobi where it was reported that access to digital information have significant influence on research output of users of libraries and that majority of users rarely approached the librarians for assistance in the library and that most were not aware of digital information services.

Hypothesis III: Adopted preservation techniques and access to digital resources will not jointly influence research outputs of academic staff in federal university libraries in Northern Nigeria.

The multiple regression approach was used here because of the two explanatory variables (preservation techniques and access to digital resources) involved in the model. The research outputs remain the dependent. A summary of the estimated Beta coefficients for determining the functional relationship in the model is presented in Table 4.11.

Table 4.11: Regression estimates of preservation techniques and access to digital resources on research outputs of academic librarians in the federal university libraries

	Unstandardized Coefficients		Standardized Coefficients		
Explanatory Variables	B	Std. Error	Beta	T	Sig.

(Constant)	1.494	0.198		7.528	0.000	
Preservation techniques		-0.333	0.067	-0.287	-4.996	0.000
Access to digital resources		0.890	0.076	0.669	11.646	0.000

Dependent Variable = Research outputs

The result in Table 4.11 revealed that a combination of the two explanatory variables (preservation techniques and access to digital resources) constituted significant contributors to research outputs by the academic librarians in the selected federal university libraries. The observed F-value which explain the model was 68.294 and the probability level of significance for the model was 0.000 ($p < 0.05$). The observed coefficient of determination (r^2) was 0.337 which means that the preservation techniques adopted and access to digital resources in the libraries could only explain 33.7%% of the total variance for research outputs by the academic librarians in the selected federal university libraries. The multiple R which is the Pearson Product Moment correlation coefficient was 0.580 which showed a highly positive relationship between the combined explanatory variables and research outputs by the academic librarians. The functional relationship for the model could thus be estimated as:

Research outputs = 1.494 - 0.333Preservation techniques adopted in the libraries + 0.890 Access to digital resources. Based on these observations, the null hypothesis that, adopted preservation techniques and access to digital resources will not jointly influence research outputs of academic librarians in federal university libraries in Northern Nigeria was therefore rejected. The result showed that a combination of the two variables could significantly influence research outputs by academic librarians of the federal university

libraries.

4.3 Summary of the Finding

The summary of the findings of the study are the following:

1. Research outputs produced by academic librarians of the federal university libraries studied include: e-books/chapters in books, e-theses and e-dissertations, e-journal articles, e-conference proceedings and databases.

2. The high extent to digital resources in the library was found to facilitate research outputs in federal university libraries with e-journal being top on the list.

3. Preservation techniques utilised for digital resources that facilitated research outputs of academic librarians were: encapsulation, refreshing, technology preservation, information emulation, information migration, digitisation and replication among others.

4. Access tools used for digital resources for research outputs in the libraries include: bibliographies, abstracts, cataloguing, indexing, database and finding aids among others.

5. The popular metadata types found to facilitate access to digital resources in the libraries include: administrative, descriptive, structural, technical, transformative and preservation among others.

6. Activities adopted to promote access to the digital resources which enhanced research outputs were: digital preservation software, managerial commitment, funding, staff training, policy modification and planning for the future

7. Technical factors militated against effective access to digital resources in the libraries were: lack of information availability, interactive nature of technology, data management, portability of digital content, device networking, system connectivity, collaboration tools and document transfer protocols.

8. Challenges influencing the adaptation that ensure accessibility and use of digital resources for enhanced research output of academic librarians of the libraries were: absence of library policy on digital preservation, provision of security measures, lack of records management policies, absence of migration strategies for records, lack of functional requirement for records preservation and lack of competence and skills among others.

4.4 Discussion of the Findings

From the finding of the study, it was discovered that the research outputs of academic librarians include: e-theses (e-dissertations) which had the highest mean score. Next in the ranking were e-books/ chapters in a book and e-journal articles. They were then followed by e- journal, e-conference paper/seminars/workshops and databases respectively. The research output of academic librarians in the universities have been contributing significantly in the research output and innovation these institutions in Nigerian. The only exception to this generalisation was e-magazine/newspapers/monograph and technical report which the respondents disagreed as part of their research outputs. The findings here are consistent with the Murtz, *et.al* (2017) as the co-authors stated that research outputs are published academic work such as books, journals, articles, conference proceedings and masters or doctoral thesis. The findings also agrees with the findings of Ugwuona and Dike, (2015) who reported that universities are ranked on the basis of their researches/research output and that research helps to solve professional problems, develop tools and methods for analysis of organizations, services and behaviour whose ultimate benefit lies not only in the generation of new knowledge but in the translation of such knowledge into technologies, interventions and strategies effectively and appropriately delivered to the needy.

Findings of the study revealed that the respondents agreed that access to e-journals improves their research outputs in the federal university libraries, next is databases with a decision mean score. The respondents agreed with the suggestions that their access to e-books improves their research outputs which implied that the respondents agreed with the suggestion. This is not surprising because with availability of e-books, e-journals and databases available on the internet has made it easier for academic librarians to publish on regular bases thereby increasing the research outputs of academic librarians. The position of access for research productivity is high. However, respondents disagreed that e-newspapers, e-technical reports and e-theses improves research output. The findings agree with the findings of Ndakalu (2014) who reported that journals conferences and seminars as the most prefer channel and consulted of research output in the universities because they are always convey current information which are mostly empirical.

Result shows that the respondents were of the view that preservation techniques adopted in the libraries enhances the research outputs of the academic librarians involved in the study.The result of the analysis on preservation techniques to digital resources revealed that digitisation was the popular preservation technique adopted by academic librarians in the university libraries studied. The findings are in line with the findings of Saka, (2013) who opined that digitisation is the process of converting the printed materials into the digital/electronic format which can later form databases. However the findings contradict the findings of Saka, Abbas and Salman (2017) as the authors reported that research output acquired were submitted to university libraries of Nigeria and Kenya in both hard and softcopies and were preserved through shelving and computerisation.The adoption of information emulation for preservation of digital resources agrees with the findings of Moghaddam (2010) who opined that it is important to be able to see something in its original form whenever possible, in order to

preserve historical authenticity, emulators would need to be created and updated regularly, as older technology becomes obsolete.

Findings of the study affirmed that the identified access tools adequately facilitate research outputs by academic librarians in the selected federal university libraries in Nigeria. These tools which include bibliographies, abstracting, cataloguing, indexing, databases, catalogues and archival collection. These tools over the years have aided academic librarians and other researchers in terms of research work. The results which showed affirmation follows the description of these tools and their roles by Udofot (2019) and Mohammed (2012) as consistent with the performance of academic librarians for the facilitation of services used by the librarians. Moreover this findings is in line with the findings of Ezekwe and Muokebe (2012) as the authors reported that access tools could be seen as information location aids that are used to identify what a library has in a stock for use.

The result affirmed that administrative metadata provides information for the management of information resources. The finding affirmed the respondents' agreement that metadata helps to facilitate access to digital resources used for research outputs by academic librarians in the selected federal university libraries. The findings of the study are contrast to the findings of Musa and Shittu (2011) also reported that accurate and complete metadata is central to both migration and emulation metadata types use goes beyond the two to include administrative, structural, technical, transformative and preservative metadata types promotes usability of digital materials. However, the findings here agrees with the findings of Lopatin (2014) who reported that metadata is consider as essential requirement for returning appropriate search result to meet the need of any users.

The result of the study for the activities in ensuring long-term accessibility to digital resources for research outputs by the academic librarians were use of digital preservation software. Others were managerial commitment, funding staff training on an agreed procedure, policy modification in-line with current preservation trends and planning for the future affirming that all the activities necessary for ensuring long-term accessibility to digital resources for research outputs by academic librarians of the libraries were adequately identified. This finding is in line with the findings of Saka (2013), who reported that the Dspace software is being used in the digitisation of theses in Nigeria university libraries. This finding do not concour with the findings of Osunride and Adetunla (2017) who reported security as the most used preservation and conservation practice in universities in south-west Nigeria.

The finding of the study revealed that data management was the foremost among technical factors militating against access and use of digital resources for research outputs by academic librarians in the selected federal university libraries. It could be stated that data management, portability of digital content and device networking are some of the listed technical factors were major constraints to access and use of digital resources for enhancing research outputs of the academic staff of the selected Federal University libraries. These findings are in line with the findings of Jimada and Aduku (2015) as the co-authors reported that interactive nature of technology, system connectivity and portable digital content as the foremost technical factors militating against the exploration of digital information. The findings here agreed with the findings of Rahman & Muhammad (2012) who posited that access to digital objects requires keeping older technology available for use. They further stated that this will help future generations to view digital objects their native format with their original layout and functionality adding that creating hardware or software museum is prohibitive in cost, space and technical support requirement.

The study revealed that challenges influencing adoption of preservation technique and access to digital resources for research outputs in the selected federal university libraries: were poor security and confidentiality controls, lack of accurately documented policies and lack of standard operating preservation procedure among others. From the finding of the study, it could be said that the respondents affirmed the view that the selected constraints constituted major challenges to preservation and access to digital resources for research outputs by academic staff in the selected federal university libraries. The findings here are consistent with the findings of Bagudu & Sadiq (2013) as co-authors stated that the need to provide information content and system was usually a function of professional staff more especially when it comes to digital library services as they are designed for library clientele. Moreover, findings here agree with the findings of Nnadozie, *et.al* (2017) as authors posited that if an organisation lacks stable power, adequate network connectivity, adequate ICT facilities, adequate finance, or using its finance efficiently and effectively, it will fail to meet its objectives and Shameenda (2011) who stated that, for library to discharge its responsibilities satisfactorily, it should be funded adequately.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

From the analysis of the data of this study, the researcher wishes to conclude that research outputs produced by academic librarians in selected federal university libraries are ebooks/chapters in books, e-theses and e-dissertations, e-journal articles, e-conference papers among others. Extent to digital resources in the library which is high and it was found to

facilitated research outputs in federal university libraries. Among the preservation techniques utilised for digital resources that facilitates research outputs of academic librarians were: encapsulation, refreshing, technology preservation, information emulation, information migration, digitisation and replication among others. Access tools used for digital resources were adequate for enhanced research outputs by academic librarians of the libraries.

Equally, the metadata types used to facilitate access to digital resources for research outputs of academic librarians in the selected federal university libraries. Activities undertaken to ensure long-term accessibility to digital resources were found to be adequate for enhanced research outputs of academic librarians of the federal university libraries. There were technical factors militating against the use of digital resources in the libraries which included: Data management, Collaboration tools, lack of information availability, Interactive nature of technology, Portability of digital content, Device networking, System connectivity and Document transfer protocols among others. There were major challenges to accessibility of digital resources for research outputs in the federal university libraries studied. They included: poor security and confidentiality controls, accurately document policies, absence of library policy on digital preservation, lack of records retention and disposal policies, absence of migration strategies for records and lack of standard operating preservation procedure among others.

5.2 Recommendations

Based on the findings of the study the researcher recommended as follows.

1. Academic librarians should be encouraged to write and patronised other digital resources which are considered as research outputs such as social media and online services. Research outputs should not be only disseminated but also create and preserved the research outputs in the institutional repository of their university libraries. Other research outputs of the librarians in federal university libraries should be

considered through training, workshop, conference organised for particular research output such as journal paper, conference paper and power points.

2. Accessibility to research outputs of academic librarians in the federal university libraries should be prioritised to attain effectiveness and efficiency service delivery on digital platforms by the academic libraries in Northern Nigeria. while use of theses and technical reports should be promoted as a research outputs of academic librarians due to the fact that majority of them are professionals and policy makers;

3. Federal university libraries be encourage to introduce and adopt other Preservation techniques for research outputs such as web and cloud data management tools for efficiency preservation in their digital collection. Other preservation techniques utilised for research outputs in the federal university libraries should also be sustained annually through the use of sensitisation programme, treading software, consortium building and subscription to organised training on preservation techniques.

4. Access tools to digital resources on research outputs in federal university libraries be extended to other access tools such as OPAC, blog, Instant messaging (IM) and

Streaming Media (SM) to promote research outputs of academic librarians;

5. Choice of Metadata types that facilitated access to digital resources use for research outputs by academic librarians should be based on possessing modules that support administrative, structure, technical, transformative procedure and preservation:

6. Activities undertaken to ensure long-term accessibility to digital resources by academic librarians research outputs should be improved through the use of modern digital software such as Imaging software, Analysis software and Packaging Software.

7. Technical factors militating against exploration of digital content contribution to research outputs by the federal university libraries in Northern Nigerian to promote access and use of digital resources should be addressed through adequate funding for

   Internet service provision and online data subscriptions

8. It is recommended that there should be library policy on digital preservation and operationalised in order to promote access and use of digital resources for research outputs.

5.3 Contributions to Knowledge

This study presented a theoretical and empirical result of the influence of preservation techniques and access to digital resources on research outputs of academic librarians in federal university libraries in Northern Nigeria. The outcome of this study particularly underscored five important contributions to knowledge.

1. The study provided empirical evidence on influence of preservation techniques and access to digital resources on research outputs of academic librarians in federal university libraries in Northern Nigeria.

2. The conceptual model provided by the study which considered the influence of preservation techniques and access to digital resources on research outputs of academic librarians in federal university libraries in Northern Nigeria is a major contribution to knowledge. The exact variables in this study appear not to have been considered in any other studies on research outputs. This is therefore a major contribution to knowledge, as the conceptual model can be of use to future

   researchers.

3. As far as literature review is concerned, this would appear the first time when literature is brought together on influence of preservation techniques and access to digital resources on research outputs of academic librarians in federal university libraries in Northern Nigeria.

4. This empirical study is useful to researchers in their quest for knowledge on research outputs and it is a valuable contribution to the body of knowledge in librarianship and information resources management.

5. Finally, the study has provided a blue-print for librarians, scholars, researchers, policy makers of the universities. Hence the study has filled an existing gap.

5.4 Suggestions for Further Studies

The researcher therefore suggested the following topics:

1. Influence of preservation techniques and access to digital resources on research output of academic librarians in federal university libraries in South-west Nigeria.

2. Preservation and utilisation of digital resources by academic librarians in federal polytechnics in North-West Nigeria.

3. Influence of preservation techniques and access to digital resources on research output of academic librarians in federal research institutes in Northern Nigeria.

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APPENDICES

APPENDIX A

QUESTIONNAIRE

Department of Library and Information Technology,
Federal University of Technology, Minna.

3rd September, 2019

Dear Sir/Madam,

INFLUENCE OF PRESERVATION TECHNIQUES AND ACCESS TO DIGITAL RESOURCES ON RESEARCH OUTPUT OF ACADEMIC STAFF IN FEDERAL UNIVERSITY LIBRARIES IN NORTHERN NIGERIA

I am a PhD student of the Department of Library and Information Technology, Federal University of Technology, Minna. Working on the above title, this questionnaire has been chosen as an instrument that will help the researcher to obtain the needed information for the study.

Please feel free to fill the questionnaire, as the information given here will purely be used for academic purpose only. I assure you that every information provided will be treated with utmost privacy.

Yours sincerely,

MOHAMMED, Abubakar Abdullahi

QUESTIONNAIRE FOR ACADEMC LIBRARIANS

INSTRUCTION: Please respond appropriately
KEY: SA = strongly agree; A = Agree; D = Disagree; SD = strongly disagree

SECTION A: Respondents Demographic Data
1. Indicate the name of your university -- 2. Name of library -- - - - - - - - - - - - - - - - - - - -

2	Access to E-journals improves my research outputs				
3	Access to E-theses promotes my research outputs				
4	Access to E-reports facilitates my research outputs				
5	Access to E-newspapers improves my research outputs				
6	Access to databases improves my research outputs				

Question 3: Section C: Digital preservation techniques used for research outputs by academic staff in your library

S/N	Items	SA	A	D	SD
1	Encapsulation has helped the library group subject fields accordingly.				
2	Refreshing has based the transfer of information from one medium to another.				
3	Technology preservation has helped the library recovered new and damaged information sources.				
4	Information Emulation has helped the library take cognisance of software and hardware requirement.				
5	Information Migration has helped the library change resource format to ensure access.				
6	Digitisation has helped the library change print to electronic resources				
7	Replication has aided the addition of new access point.				

Question 4: Section D: Access tools that facilitated research output of academic librarians

S/N	Items	SA	A	D	SD
1	Bibliographies make it easy for researcher to find out more about topic area in research.				
2	Abstracts aided user with fully description of item				
3	Catalogues assist user to locate books and other materials available in the library.				
4	Index provide user with clear description of items in the library.				
5	Database enable user to search for relevant information.				

6	Finding aids help user to find information on a specific group, collection or series of archival collection.				

Question 5: Section E: Metadata types used for long-term access to digital resources for research outputs.

S/N	Metadata	VHE	HE	LE	VLE
1	Administrative metadata provide information to manage resources.				
2	Descriptive metadata aided in discovery and identify of information.				
3	Structural metadata indicate how compound object are put together.				
4	Technical metadata relate how a system function or behaves.				
5	Transformative metadata helps in conveying data from one format/structure to another.				
6	Preservation metadata contain information needed to preserve a resource.				

Question 6: Section F: Activities undertaken to ensure long-term accessibility of digital resources for research output

S/N	Items	SA	A	D	SD
1	Use of digital preservation software				
2	Managerial commitment				
3	Funding of preservation activities				
4	Staff training on agreed procedure and processes regularly				
5	Policy modification in-line with current preservation trends (Technological/technical requirements)				
6	Planning for the future				

Question 7: Section G: Technical factors militating against the exploration of digital contents contributions to research output by academic staff

S/N	Items	SA	A	D	SD

1	Information availability				
2	Interactive nature of technology				
3	Data management				
4	Portability of digital content				
5	Device networking				
6	System connectivity				
7	Collaboration tools				
8	Document transfer protocols				

Question 8: Section H: Challenges militating against the adoption of preservation techniques

S/N	**Items**	**SA**	**A**	**D**	**SD**
1	Absence of library policy on digital preservation				
2	Poor security and confidentiality controls				
3	Lack of records retention and disposal policies				
4	Absence of migration strategies for records				
5	Understand the function requirement for records preservation				
6	Competences and skills required to manage information delivery system				
7	Accurately documented policies				
8	Lack of standard operating preservation procedure				

APPENDIX B

OBSERVATION CHECK LIST FOR HEADS OF DIGITISATION/ICT UNITS

Facilities that are available for digitisation exercises in the federal university libraries in Northern Nigeria.

Please indicate by a tick (√)

Key: Available and Use (AU), Available but Not in Use (ANU), Not Available (NA),

S/N	**ITEMS**			
1	**FURNITURE**	**AU**	**ANU**	**NA**
2	Tables			
3	Chairs			
4	Display stands			
5	Notice board/bulletin			
6	Periodical display rack			
7	Fans			
	ELECTRONIC FACILITIES			
8	Scanner			
9	Printer			
10	Flash Drives/ Software's			
11	Photocopier			
12	Overhead Projector			
13	UPS/External Hard Drive			
14	Computer software(OISR)			
15	Online database			
16	Digital camera			
17	Computer System			

APPENDIX C

VALIDATION OF RESEARCH INSTRUMENT

Department of Library and Information Technology,

Federal University of Technology, Minna.

15 August, 2019 Dear

Sir,

REQUEST FOR VALIDATION OF RESEARCH INSTRUMENT

I am a Ph. D student of the above named department carrying out a research on the **INFLUENCE OF PRESERVATION TECHNIQUES AND ACCESS TO RESOURCES ON RESEARCH OUTPUT OF ACADEMIC STAFF IN FEDERAL UNIVERSITY LIBRARIES IN NORTHERN NIGERIA**. I humbly request that you read through my research instrument and make necessary corrections, as this will help to examine the clarity of expression and language appropriateness of the instrument in relation to the purpose of the

study as well as the research questions. Find attached copies of the purpose of the study and research questions as well as the hypothesis to facilitate the validation process.

Thank you.

Yours sincerely,

MOHAMMED, Abubakar Abdullahi

VALIDATION OF QUESTIONNAIRE

VALIDATION FORM

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY

DEPARTMENT OF LIBERARY INFORMATION TECHNOLOGY

Dear Sir/Madam,

INSTRUMENT VALIDATION FORM

The bearer is a student of the above named University and Department. He/she is conduct a research and you have been selected as one of those with requisite expertise to validate his/ instrument. Kindly grant him or her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the quali of his/her research instrument. We therefore crave your assistance to validate the instrumen The completion of the form serves as evidence that the student actually validated th instrument.

Thanks for your anticipated assistance.

DR K.A Saka 30/08/2019

Head of Department (Signature, Date and Official Stamp)

Student's Surname MOHammed

Registration Number PHD/SICT/2016/865 Other names ABUBAKAR ABDULLAHI

Programme PHD

Title of the Instrument Q. Ettonnaire

ATTESTATION SECTION

Summary of the Remark on the Instrument.....

I hereby attest that the above named student brought her instrument for validation.

Name of Attester U.A. Ginga

Designation Attester

Name and Address of Institution A.B.U. Zaria

Phone Number 08069191276 E-mail uaginga2@yahoo.com

Signature and Date 07/06/2019

Please comment on the following:

1. Appropriateness of the instrument for the purpose it's designed for.....
   .....Very good.....
2. Clarity and simplicity of the language used.....
   .....Satisfactory.....
3. Suitability for the level of the targeted audience.....
   .....Suitable.....
4. The extent in which the items cover the topic it meant to cover.....
   .....It has covered very good part of the construct
5. The structuring of the questionnaire.....
   .....well structured.....
6. Others (grammatical errors, spelling errors and others) .....
   .....need to be vetted.....
7. General overview of the instrument.....
   .....Very good.....

Suggestions for improving the quality of the instrument

1. .....Effect all the corrections in order to
2. .....improve on the quality of the instrument.
3. .....
4. .....
5. .....

Name of validator.....U. A. Ginga.....

Areas of specialisation.....Mathematics Education.....

Name of institution.....A. B. U. Zaria.....Department.....Science Education

Signature.....[signature].....date.....07/06/2019

Thank You

VALIDATION FORM

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY

DEPARTMENT OF LIBERARY INFORMATION TECHNOLOGY

Dear Sir/Madam,

INSTRUMENT VALIDATION FORM

The bearer is a student of the above named University and Department. He/she is conduct a research and you have been selected as one of those with requisite expertise to validate his/ instrument. Kindly grant him or her all necessary assistance to make the exercise a success.

Your competency and expertise was considered as factors that will serve to improve the qual of his/her research instrument. We therefore crave your assistance to validate the instrumen The completion of the form serves as evidence that the student actually validated th instrument.

Thanks for your anticipated assistance.

DR K.A Salka 30/8/2019

Head of Department (Signature, Date and Official Stamp)

Student's Surname: Mohammed Other Names: Abubakar A.

Registration Number: PHS/SCIT/2016/865

Programme: PHD

Title of the Instrument: Questionnaire

ATTESTATION SECTION

Summary of the Remark on the Instrument

I hereby attest that the above named student brought her instrument for validation.

Name of Attester: M. Habu (PhD)

Designation: Attester

Name and Address of Institution: ABU, Zaria

Phone Number: 08065763039 E-mail: Sokowochin@gmail.com

Signature and Date: 02/9/19

Please comment on the following:

1. Appropriateness of the instrument for the purpose it's designed for
   The instrument is appropriate for this study.
2. Clarity and simplicity of the language used
   The language is clear and simple
3. Suitability for the level of the targeted audience
   Suitable
4. The extent in which the items cover the topic it meant to cover
   The items in the questionnaire covers the topic in question
5. The structuring of the questionnaire. The structure is OK
6. Others (grammatical errors, spelling errors and others) The grammatical errors and spelling are fair enough
7. General overview of the instrument
   above average

Suggestions for improving the quality of the instrument

1. The questions should be directly to the respondent
2. Not all questions should be in a scaling form
3.
4.
5.

Name of validator MOHAMMED HABIBU (PhD)

Areas of specialisation Knowledge Management

Name of institution ABU, ZARIA Department LLS

Signature ... date 2/9/19

Thank You

APPENDIX D DATA

ANALYSIS

INFUENCE OF PRESERVATION TECHNIQUES AND ACCESS TO DIGITAL RESOURCES ON RESEARCH OUTPUT OF ACADEMIC STAFF IN FEDERAL UNIVERSITIES IN NORTHERN NIGERIA

All the variables

Reliability

Reliability Analysis

QUESTIONNAIRE FOR LIBRARIANS

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.889	.893	41

Item Statistics			
	Mean	Std. Deviation	N
E-books/ chapters in a book	2.7000	.92338	20
E-theses and e-dissertations	2.8000	.89443	20
E-journal articles.	2.6500	1.13671	20
E-Conference paper/Seminars/Workshops:	2.6500	.81273	20
E-Magazine/Newspaper/Monographs /Technical reports	2.3000	.73270	20
Databases	2.6000	.82078	20
Encapsulation has helped the library group subject fields accordingly.	2.4500	.68633	20
Refreshing has based the transfer of information from one medium to another.	2.1500	.81273	20
Technology preservation has help the library recovered new and damaged information sources.	2.5500	.82558	20
Information Emulation has helps the library take cognisance of software and hardware requirement.	2.4500	.88704	20
Information Migration has helped the library change resource format to ensure access.	2.3000	.86450	20
Digitisation has help the library change print to electronic resources	2.2000	.69585	20
Replication has aided the addition of new access point.	2.5500	.82558	20
Administrative metadata provide information to manage resources.	2.2500	.71635	20
Descriptive metadata aided in discovery and identify of information.	2.2500	.71635	20
Structural metadata indicate how compound object are put together.	2.6500	.93330	20
Technical metadata relate how a system function or behaves.	2.9000	.78807	20
Transformative metadata helps in conveying data from one format/structure to another.	2.6500	1.03999	20
Preservation metadata contain information needed to preserve a resource.	2.8500	.74516	20
Use of digital preservation software	2.5500	.88704	20
Managerial commitment	2.8500	1.03999	20
Funding of preservation activities	2.2000	.89443	20
Staff training on agreed procedure and processes regularly	2.5500	.94451	20
Policy modification in-line with current preservation trends (Technological/technical requirements)	2.7500	.91047	20
Planning for the future	3.0000	.79472	20
Information availability	2.6000	.75394	20

Interactive nature of technology	2.7500	.96655	20
Data management	2.5500	.68633	20
Portability of digital content	2.5500	.82558	20
Device networking	2.5000	1.00000	20
System connectivity	2.7500	.96655	20
Collaboration tools	2.9000	.71818	20
Document transfer protocols	2.4500	.82558	20
Absence of library policy on digital preservation	2.8000	.89443	20
Poor security and confidentiality controls	2.6000	.75394	20
Lack of records retention and disposal policies	2.8000	.83351	20
Absence of migration strategies for records	2.6500	.81273	20
Understand the function requirement for records preservation	2.9000	.85224	20
Competences and skills required to manage information delivery system	2.7000	.73270	20
Accurately documented policies	2.5500	.75915	20
Lack of standard operating preservation procedure	3.0000	.97333	20

Summary Item Statistics							
	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	2.606	2.150	3.000	.850	1.395	.049	41

APPENDIX E

DEPARTMENT OF LIBRARY AND INFORMATION TECHNOLOGY
SCHOOL OF INFORMATION AND COMMUNICATION TECHNOLOGY
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

ViCE – CHANCELLOR:
Prof. Abdullahi Bala, *PhD, fsssn*

REGISTRAR:
Mr A.N. Kolo, *B. Sc., MSC, ACIPM*

HEAD OF DEPARTMENT:
Dr. K.A. Saka, *NCE, BLIS (ABU), MLS(BUK) Ph.D(Unimad)*

Tel: +234 (0) 80368880881
Fax: +234(0) 66 223275
Telegram: FUTECH, Minna

E-mail:s.katamba@futminna.edu.ng
Tel: 07038706880

10th July, 2018

.....

.....

.....

TO WHOM IT MAY CONCERN

LETTER OF INTRODUCTION: MOHAMMED, ABUBAKAR ABDULLAHI 2016/2017/PHD/SICT/865

The above named is a PhD student of the Department of Library and Information Technology, Minna.

He is writing a thesis titled: "**Preservation Techniques and Access to Digital Materials on Research output of Users in Federal Universities in Northern Nigeria.**

I therefore request you to kindly give him necessary assistance he/she require for the success of his/her assignment.

Thank you for your anticipated cooperation.

Yours Sincerely

DR. K.A. Saka

HOD/LIT

APPENDIX F

Researcher Publications

Mohammed, A.A, Katamba, S.A, Babalola, G.A &Ahmed, A.O (2019).Access to Digital Materials on Research Output; Experience of Federal University Libraries Users in Northern States, Nigeria. *Samaru Journal of Library and Information Science,* Department of Library and Information Science Ahmadu Bello University, Zaria,19 (12) 72-91.

Mohammed, A.A, Katamba, S.A, Babalola, G.A &Ahmed, A.O (2020). Influence of preservation techniques and access to digital resources on research outputs of academic staff in federal university libraries in Northern Nigeria, *Library Philosophy and Practice (e-journal).* Fall 4-8, 2020.

Mohammed, A.A, Katamba, S.A, Babalola, G.A &Ahmed, A.O (2021). Challenges influencing the adoption of preservation techniques that ensure the use of digital resources by academic staff for research output in federal university libraries in Northern Nigeria. *Proceedings of 2021 Nigeria Library Association Kaduna State Chapter, held at National Research Institute for Chemical Technology (NARICT), Zaria on 4-5 August, 2012*. 17-25.