PRESERVATION OF DIGITAL INFORMATION RESOURCES IN THE FEDERAL UNIVERSITY LIBRARIES IN THE NORTH WESTERN STATES OF NIGERIA

By

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OCTOBER, 2015.

DECLARATION

I hereby declare that this thesis is my personal research work. This work was never presented anywhere to the best of my knowledge. The Information derived from the literatures has been duly acknowledged by the means of references.

JIMADA Aisha …… ……

Signature Date

CERTIFICATION

This thesis entitled ‘‘Preservation of Digital Information Resources in the Federal University Libraries in the North Western States of Nigeria’’ by Jimada Aisha, meets the regulations governing the award of the degree of Masters in Library and Information Science of Ahmadu Bello University Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research work is dedicated to Almighty Allah, my parents Alhaji Usman Jimada and Hajiya Habiba Usman, my siblings Mohammed, Fatima, Idris and Maimuna Usman Jimada.

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ABSTRACT

This study 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 interview. The responses from the respondents who are staff of the digitization unit were analyzed 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.

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LIST OF ABBREVIATIONS

AFL	-Abdullahi Fodio Library
CD	-Compact Disk
CD-ROM	- Compact Disk Read only Memory
DVD	- Digital versatile Disk
HDD	- Hard Disk Drive
IRMT	- International Records Management Trust
KIL	- Kashim Ibrahim Library
PDF	-Portable Document File
JPE	- Joint Photography Exchange Graphic
TIFF	-Tagged Image File Format
ULK	-University Library Kano
XML	-Extensive Markup Language

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

The emergence of I.C.T has revolutionized the way information resources are preserved in libraries and information centers. It has greatly enhanced information accessibility, saves time, and reduce costs. Institutions are not only able to store large amount of information but can also have quick access to information in other areas. ICT has enabled librarians to carry out their mandate of information capture, preservation and dissemination. There is ever increasing flood of resources created and generated and considering the speed at which they are created their management becomes a challenge for most institutions.

Preservation of resources in the library is to allow continued access, use and easy retrieval of information resources for present, future use and to protect them against threats for as long as possible. Without an effective digital preservation of information resources in libraries, access via digital devices will produce little or no resources of research, teaching and learning in the library.

The information resources in the library are in the print and non print format. Information in the print format Include books, maps, theses, conference papers, handbooks, dictionaries e.t.c. while at the other hand, Information in the non print format includes databases, journal articles and those on the website and other digital storage media. Tammaro (2006) stated that digital information resources include online databases and e-journals. Therefore digital resources are information that can be accessed via a computer network.

Information resources preservation whether prints or digital in the library is concerned with the survival, use and access to information for as long as possible. Binding, lamination, scanning and photocopying resources are popular means of preservation in libraries. Public Record Office of Northern Ireland (2006) stated that, preservation is the means by which libraries; archives are protected for the use of present and future generations. According to them, it is a word commonly used by record offices, libraries and museums to describe the ways in which their collections are safeguarded and kept in good physical condition. This can be done through a variety of measures aimed both at minimizing the risk of loss of resources and slowing down as much as possible the processes of physical deterioration which affect most library and archival materials. This risk could be manmade disaster, natural disaster, chemical and pests. Preservation is not just concerned with conservation or restoration of physical artifacts but includes all the strategic and organization considerations that relate to the survival of information. The context of the document, the integrity of resources, records and the value of the archives are preserved.

Digital preservation can be seen as the process and activities which stabilize and protect digital resources and publications in forms which are retrievable, readable and usable over time. Digital preservation is the conservation of all digital materials, whether they were born digital, such as emails, websites, videogames, and other electronic files, or whether they have been digitized from analog materials (Conway, 2010;) Gbaje,(2011) asserted that digital preservation is the maintenance of objects close to their original conditions as far as possible until they are no longer needed. Unlike the preservation of paper or microfilm, digital objects demands special equipments for migration, conversion,

storage, retrieval, transmission and it is continuous and ongoing. Digital preservation can therefore be seen as the set of processes and activities that ensure the continued access to information. This assertion is supported by Rahaman and Muhammed (2012) who reported that, digital preservation refers to series of managed activities designed to ensure continuing access to resources in digital formats for as long as possible and to protect them from media failure, physical loss and obsolescence. Digital preservation of information resources can be done in either of two ways; that is the passive way and active preservation way. International Records Management Trust (2009) asserted that, passive preservation is the process of ensuring continuing integrity of access to digital objects along with their metadata. It is aimed at keeping the original object intact without changing the technologies used to store or process it. Passive preservation includes refreshment, data replication and emulation they are used for short term preservation. Active preservation seeks to ensure the continued accessibility of digital information resources over time by intervening on how information resources are stored and managed. Active preservation involves moving the digital objects in to a new storage environment, which may depend on new technologies that were not in existence when the objects was originally created and used. Migration is the most common approach of preserving information resources as part of a formal digital preservation. This is often used for long term preservation.

1.2 Statement of the Problem

The federal university libraries in the North Western States of Nigeria are now in the process of converting their information resources from hard copy to soft copy. The

aim of a university library is to acquire process, store, preserve and disseminate information resources that are used to support teaching, learning and research for present and future generation.

The researcher observed that some of the local contents such as thesis and dissertation in the federal university libraries in the North Western States on Nigeria mostly are in hard copies and on acidic based papers which deteriorate over time and therefore does not guarantee continuous access to information resources. Even after the information resources are digitized, continuous access to those resources pose serious challenges therefore; there must be effective and efficient management to ensure that digital information resources are easily accessible, retrievable and re-useable for both the present and future generation.

Gbaje (2011) observed that digital information will cease to be accessible without proper management and intervention. The changes in software and hardware are some of the dangers faced in the preservation of digital information resources because these media are designed to meet up with a compatible hardware, software, and operating system and storage devices. For digital information resources created to be accessed and used continuously in the present and future generation, the hardware and software must be compatible. Ngeope (2008) stated that technological change makes them obsolete within some few years because current and future computers may not have drives that can read older media, hardware connections that can be attached to older media drives and softwares that cannot read older files. Therefore, for any federal university library to ensure continuous access, use and re-use of digital information resources they must have a preservation strategy as opined by Ryes (2013) who stated that many of the strategies

were used but not all were able to meet the preservation goals. Satish and Umesh (2005) stated that digital information resources are vulnerable to loss and destruction, deteriorate rapidly and can fail due to virus, exposure to heat, humidity, faulty reading and writing devices.

Therefore, the federal university libraries have the responsibility to ensure that the digitized information resources are easily accessible, retrievable and re-useable for both the present and future generation as supported by Masakazi (2009) who stated that digitization is the creation of multimedia database enhanced by digital information and thus offering easy access to cultural and scientific change for large population of users. The university libraries as centres of learning and research have over the years increased in demand of digital information resources by users, but continuous access and retrieval becomes difficult which poses serious challenge to users of such resources. It is in view of this that the researcher decided to embark on this study on preservation of digital information resources in the federal university libraries in the north western states of Nigeria with the aim of ensuring effective, efficient, easy retrieval and access to the digital information resources in the libraries. By discovering the problems hindering effective and easy access and retrieval of digital information resources and proffer solutions to it

1.3 Research Questions

This research sought to provide answers to the following questions:

1. What types of digital information resources are available and preserved in the Federal University Libraries in North Western States of Nigeria?

2. What storage media are used to preserve digital information resources in the Federal University Libraries in North Western States of Nigeria?
3. What are the strategies used to preserve digital information resources in the Federal University Libraries in North Western States of Nigeria?
4. What are the challenges faced in the preservation of digital information resources in the federal university libraries in the North Western States of Nigeria?

1.4 Objectives of the Study

The study was set to achieve the following objectives

1. To determine the types of digital information resources available and preserved in the Federal University Libraries in North Western States of Nigeria.
2. To determine the storage media that is used to preserve digital information resources in the Federal University Libraries in North Western States of Nigeria.
3. To determine the strategies used to preserve digital information resources in the Federal University Libraries in North Western States of Nigeria.
4. To determine the challenges faced in the preservation of the digital information resources.

1.5 Significance of the Study

The aim of preserving digital information resources is to allow continuous access and re-use of digital information resources for as long as possible. Therefore, the study would be of significant value because it has revealed the various strategies that can be used to preserve digital information resources and enable libraries studied to choose from the available ones for their libraries.

The study would also be significance the libraries because by adopting appropriate digital preservation strategies this would help in elongating the lifespan of endangered and useful information resources thereby ensuring perpetual existence so that users and researchers access and retrieved the information for the future generations.

The findings arisen from the study would also assist stakeholders like university administrators and university librarians in the acquisition of ICT infrastructure for digital preservation. Lastly, the study would provide a ground for discussion of issues relating to digital preservation and as well contribute to the body of knowledge.

1.6 Assumptions of the Study

The study was based on the assumptions that:

1. Effective preservation of digital information resources can lead to continuous access, re-use and retrieval of digital information resources
2. All the federal university libraries would appreciate the strategies needed to preserve different digital information resources for as long as possible

1.7 Scope of the Study

The study covered Federal university libraries in North Western States of Nigeria .It was limited to the seven federal university libraries and the subject of the study were staff of the digitization units of the libraries who are engaged in the digitization of information resources.

1.8 Limitation of the Study

The study was limited to preservation of digital information resources in the federal university libraries in North Western States of Nigeria, due to some challenges

and inconveniences such as respondents' attitude toward data collection and time within which to complete the project.

1.9 Operational Definition of Terms

The following terms are defined as they used in this study. The terms include:

Digital Information Resources: Information born digitally or those converted from analogue to digital.

Digital Preservation: The process of maintaining and preserving information resources in digital formats.

Information Resources: Local contents such as thesis, dissertation, conference and seminar papers.

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CHAPTER TWO

REVIEW OF RELATED LITREATURES

2.1 Introduction

This chapter presents the reviews of literature related to the area of study. It is organized under the following sub headings.

2.2 Preservation of Resources

2.3 Digital Information Resources

2.4 Storage Medium for Digital Information Resources

2.5 Digitization of Information Resources

2.6 Digital Preservation Strategies

2.6.1 Digital Preservation Software

2.7 Challenges faced in the preservation of Digital Information resources

2.8 Summary of the reviews.

2.2 Preservation of Resources

Preservation is the means by which records are protected for the use of present and future generations. It is a word commonly used by record offices, libraries and museums to describe the ways in which their collections are safeguarded and kept in good physical condition. This can be done through a variety of measures aimed at both minimizing the risk of loss of resources and slowing down as much as possible the processes of physical deterioration that affect most archives and library collections. According to Kenedy (2005) Preservation of resources in the library refers to anything that contributes to the physical well-being of resources. Preservation of resources are done in many ways such as indirect preservation which includes the building where the resources are being preserved, the storage method, security against threats to the resources and handling. Ogunmodede and Ebijuwa (2013) stated that another way of

preserving resources is through substitution, which is done by making copies of original resources and allowing access to only the photocopies. This method reduces the wear and tear of resources.

Preservation is a concept that includes preventive preservation that aims at reducing the risk of deterioration of documents or resources by controlling the environment where the resources are kept, regular maintenance and protection of the collections using appropriate treatment. Active preservation refers to all the steps taken in order to prolong the lifespan of, resources which includes: re-boxing, cleaning information resources, mass de-acidification and disinfecting or fumigation against insects and rodents.(Olatokun 2008)

International Records Management Trust (2009) stated that restoration in preservation has to do with all actions taken in order to prolong the lifespan of documents in their original form in compliance with the rules of aesthetics ethics while maintaining its integrity. According to Edhebe (2004) conservation is a field of knowledge concerned with the coordination and planning for practical application of the techniques of binding, restoration, paper chemistry and other materials technology as well as other knowledge pertinent to the preservation of resources.

Olatokun (2008) affirmed the various techniques used in preservation and conservation of library collections in selected universities in Nigeria. It examined the causes of deterioration, patterns and strategies used to control the causes of deterioration, and constraint limiting effective preservation and conservation. The findings of the study revealed that preservation and conservation techniques adopted in the libraries were not effectively used. The findings also revealed that cleaning and dusting of library resources

were the commonly used technique.Furthe r the results showed that some of the libraries adopted and used some digital preservation techniques but were still not effective. He also observed that most libraries in Africa substituted photocopies of restricted materials. A lot of photocopying is done in libraries to reduce usage of the original resources as a preservation measure. It is also use to prolong the life span of library collection.

Digital preservation is rapidly becoming a principal medium to create, store contents and disseminate information. It is seen as born digital materials that are created originally in digital form and never existed in analogue form (that is born digital) as well as those converted from analogue (printed documents) to digital by the use of cameras, scanners and other imaging technologies for access and preservation purposes. Gbaje (2011) defined digital preservation as 'the series of actions and interventions required to ensure continued and reliable access to authenticate digital information resources for as long as they are deemed to be of value. Digital preservation involves a number of activities and strategies for ensuring that digital resources are not only stored appropriately. Digital preservation could also be seen as a set of processes and activities that ensure continued access to information and all kinds of records, resources, scientific and cultural heritage existing in digital formats. This includes the preservation of materials resulting from digital reformatting but particularly information that is born-digital and has no analog counterpart.

Digital preservation is an ongoing process of managing data for continued access and use. Arora (2009) affirms that digital preservation referred to series of managed activities designed to ensure continuing access to all kinds of resources in digital formats for as long as possible and to protect them from media failure, physical loss and

obsolescence. The term digital preservation is a broad term use to describe maintenance and safeguarding of digital records in to the foreseeable and distant future. It could be seen as the ability to maintain, display, retrieve and use of digital collections in the face of rapidly changing technology. Digital preservation is the maintenance of digital material for continued accessibility. It can also refer to series of managed activities designed to ensure continuing access to all kinds of resources in digital formats for as long as necessary and to protect them from media failure, physical loss and obsolescence. Digital preservation is the maintenance of digital resources for continued accessibility. It is also referred to series of managed activities designed to ensure continuing access to all kinds of resources in digital formats for as long as necessary and to protect them from media failure, physical loss and obsolescence (Rahman and Muhammed, 2012).

In 2006, the Online Computer Library Center (OCLC) 3 developed a four-point strategy for the long-term preservation of digital objects that consisted of:

1. Assessing the risks for loss of content posed by technology variables such as commonly proprietary file formats and software applications.
2. Evaluating the digital content objects to determine what type and degree of format conversion or other preservation actions should be applied.
3. Determining the appropriate metadata needed for each object type and how it is associated with the objects.
4. Provide access to the content.

Katuu (2006) further established that to preserve and provide access to authentic digital resources in the long term, various strategies can also be used to deal with this including:

1. Emulation: This is where hardware and software facilities are specially equipped to imitate older or obsolete hardware and software
2. Migration: This involves the periodic transfer of digital materials from one hardware/software configuration to another or from one generation of computer technology to a subsequent generation.

In all these, according to Katuu, various activities may be undertaken including:

1. Transfer resources to paper or microfilm
2. Transfer to software independent formats
3. Retain resources in their native format
4. Migration of resources to a system that is compliant to open systems standard
5. Store resources in more than one format

6 Create surrogates for the original resources

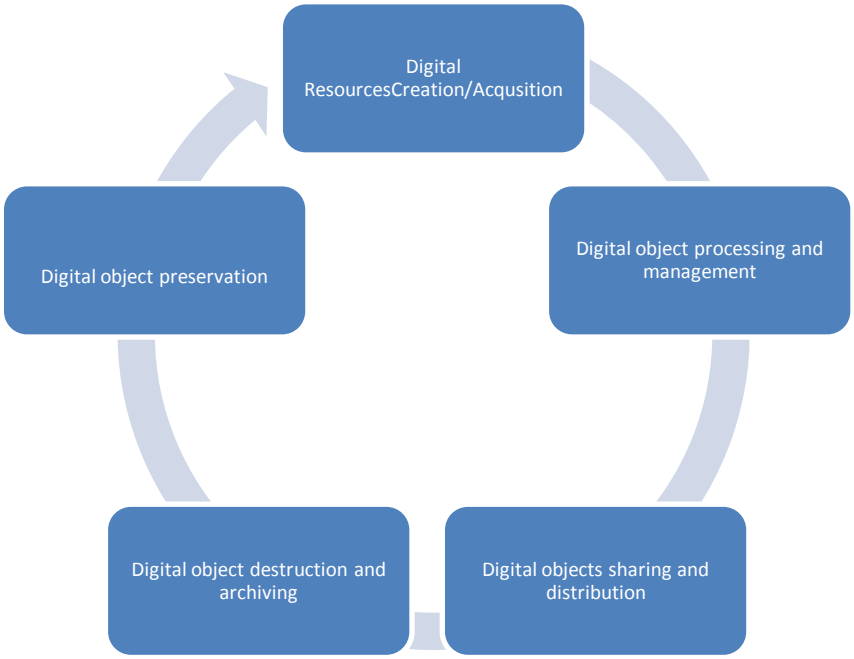
Digital preservation is the act of physically and intellectually protecting and technical stabilizing the transmission of the content and context of digital resources across space and time, and in order to produce copies of those resources that people can reasonably judge to be authentic (Hitchcock *et al*., 2007). IRMT (2009) stated that digital technology poses several challenges in the preservation of digital resources, These are among other technology comes in different formats, the cost of maintaining international standards of digital formats is expensive as it is often based on paying for upgrades to match the technology both the hardware and software. This means that institutions are always forced to change the facilities so they can meet various requirements such as software and hardware. Digital preservation presumes that there should be constant and continuous learning on the part of preservation staff both in software knowledge as well

as in hardware. This is because digital preservation methods are always changing depending on the nature of the hardware and software applied

2.3 Digital Information Resources

Digital Data Life Cycle

The life cycle of digital objects is necessary because digital resources are fragile and prompt to change from technological advances throughout their life cycle. Gbaje (2011) asserted that the life cycle of a digital object influence our ability to manage and preserve digital resources in various stages.



Source: Gbaje 2011

Digital Resources Life Cycle

1 Digital information resources creation and acquisition: This is the first stage in the life cycle of digital objects. It is the act of producing digital resources from various sources.

2. Digital object processing and management: This is the second stage in the life cycle of digital object. Digital resources that are created, /acquired are arranged in a systematic order for easy accessibility by attaching metadata to the digital objects so that users can retrieve the information needed easily.
3. Digital object sharing and distribution: The information is created for a purpose in an organization or institution, which is to support the activities of the organization or institution. The research output is used to support teaching, learning and research, the information created and acquired are stored on storage media for easy retrieval.
4. Digital object destruction and archiving: when digital object decline in value and are not selected for long term preservation they are destroyed. Archived digital objects are preserved for future use.
5. Digital object preservation: Digital information resource with long-term value are been archived/preserved, the content, the context and the structure of digital information resources. Various digital preservation strategies such as emulation, migration and refreshment can be adopted to ensure persistent accessibility of digital records.

Samir (2005) stated that there are many types of genres that are important in scientific communication. These include electronic journal articles, theses, and dissertation, conference papers and proceedings, these documents types may be presented as websites and may also be qualify as digital resources. Stephen (2012) stipulated that digital information resources are often faster than consulting print, indexes especially when searching retrospectively they are straighter forward when wishing to use combination of keywords. Open up possibility of searching multiple things at a time.

Gbaje (2012) asserted that student and faculty increasingly demand and prefer access to digital sources, delivery systems and to networked information in order to meet the information needs of the users, therefore libraries should be able to provide online information services. Opeke and Odunlade (2011) stated that science and technology teachers rely on digital resources such as datasets, disciplinary repositories, conference papers, journal articles and technical reports. Kyope (2009) stated that digital information resources life cycle involves the creation, processing, use, destruction, archiving, and preservation of digital objects.

2.4 Storage Medium for Digital Information Resources

Storage medium are technology (including devices and materials) used to preserve information. Digital storage medium include optic and magnetic technology. The optical technology includes the DVD and CD-ROM, while the magnetic technology includes floppy disk hard drives and removable disks .IRMT (2009) asserted that digital objects are stored, archived and preserved on storage medium. The two primary technologies used for digital storage are magnetic and optical storage medium. Magnetic media come in a number of formats, including the floppy disk, tape systems, removable disks and hard drives. They all rely on magnetic particles in the recording of the substrate that change direction in the presence of a magnetic field while optical technology include CD-ROM, CD-R/W, DVD-ROM, DVD-R/W and DVD+R/W are read using a laser beam which reflects the light from the surface of the disc in areas of differential reflectivity (Gbaje 2011).

Mageto (2009) provided general advice on issues that should be considered by the creators and managers of digital information resources when selecting physical storage

media for long-term preservation. He points out that Server-based hard disk storage is the most effective and secure storage regime for digital resources, provided it is well managed and includes an effective back-up strategy. He further states that any physical storage medium is, by definition completely dependent upon very specific combinations of hardware and software for access and the accessibility of information stored on such media is therefore highly vulnerable in today's rapidly evolving technological environment. The need to periodically refresh digital resources onto new media is inescapable for the near future. Nevertheless, careful selection of appropriate media can maximize the periods between refreshment cycles and simplify the refreshment process, in addition to providing the securest storage environment possible

The limited life of magnetic and optical media poses a significant problem, although it is not the primary limiting factor for digital preservation. Research longevity of magnetic media indicates a useful life span of 10 to 30 years if they are handled and stored properly. Most authorities argue that enhanced media longevity is of little value because current media outlast the software and devices needed to retrieve recorded information. Arising from the global trend, librarians are posed for training and retraining to enable them to be part of the bridging tools in the digital divide. They are ready to play more effective role using internet, CD-Rom, and other peripheral facilities as tools for generating, storing obtaining, processing, and retrieving digital information resources (IRMT 2009).

Katun (2006) observed that digital resources storage media has a shorter life span than paper, while a paper record is said to last for 200years, digital media is said to start deteriorating after the first 5years. Tale and Aliefo (2005) observed that digital offers

opportunities for compact storage through electronic and digital storage devices as they offer an alternative to bulky paper that need a considerable amount of space for storage. Optical media are susceptible to damage from high humidity, rapid and extreme temperature fluctuations and contamination from airborne particulate matter (U.S. National Archives and Records Administration) .To prevent these problems, it is imperative to store magnetic and optical media under strict environmental controls that are always available, affordable, or convenient. External hard drive is a storage device located outside a computer that is connected through a USB cable or wireless connection; it is mostly used by in libraries for backing up computer files or serving as network drive to store shared content.

According to Kimberly and Piers (1999) and Audio Engineering Society and the Internet Uniform Resource Locator (2003), the following are measures to be taken to avoid loss of digital information resources stored on digital media:

a. Preservation duplicates of permanent or long-term resources must be stored in an off-site storage facility with constant temperature (below 68 degrees Fahrenheit) and relative humidity 20 to 30 percent) controls.
b. The provision of back up digital information resources on a regular basis to safeguard against the loss of information due to equipment malfunctions, human error, or other disaster. Other digital resources media should be stored in a cool, dry, dark environment when possible
c. To keep equipment from overheating and being damaged, the server room should be temperature controlled, and set at about 65-75 degrees.

d. Smoking, eating, and drinking in areas where digital information resources are created, stored, used, or tested prohibits.

d. External labels (or the equivalent automated management system) for digital recording media used to store permanent or long-term information resources shall provide unique identification for each storage media including software in use at the time of creation so that all authorized users can identify and retrieve the stored information.

f. For all media used to store permanent or long-term digital information resources, agencies shall maintain human readable information specifying recording methods, formats, languages, dependencies, and schema sufficient to ensure continued access to, and intellectual control over, the information resources.

g. Digital information resources should not be stored closer than 2 meters (about 6 feet, 7 inches) from sources of magnetic fields, including generators, elevators, transformers, loudspeakers, microphones, headphones, magnetic cabinet latches and magnetized tools.

h. Digital resources on magnetic tape or disk should not be stored in metal containers unless the metal is non-magnetic. Storage containers shall be resistant to impact, dust intrusion and moisture. Compact disks should be stored in hard cases, and not in cardboard, paper or flimsy sleeves.

i. Personnel in charge of electronic information resources especially master copies of records should be properly trained in the use and handling of the information resources and associated equipments.

j. Conversion of storage media should be done in sure a way that it will be compatible with the organization's current hardware and software to ensure that information is not lost especially with the changes in technology or deterioration in storage media. However, before conversion of information to different media, agencies must determine that authorized disposition of the electronic records can be implemented after conversion.

2.4.1 File format

Mestl *et al* (2007) stated that there are thousands of different file formats, which have been categorized in to eight main groups and broken down into subcategories. The information on file formats will enable an organization to make decision regarding preservation of the digital object. This is because complex objects or compound objects consisting of different types of formats may also have dynamic behaviors and the complexity of the digital objects entails more maintenance that means more costs. Open file formats are preferred for long term preservation but many of the records created or received in the organization may not offer any choices in regard to storing a file in different formats where as others may allow it. Also different file formats do not only store the data in different bit stream but may actually not allow storing all the desired information. Therefore, in preparing the digital information resources for ingestion, the organisation should consider how the stored information shall be used in the future for example if it is really necessary to have all the functionality encoded in the file then a format shall be chosen that encodes for that, where as if only viewing some presentation encoding will be suitable enough.

The cost of file format conversion will depend on the selected file format. One recommendation that is agreed upon by is the use of a standard format that is non-proprietary as these kinds of formats are more likely to have a preservation path in the future and software needed to read files. Borghoff et al (2006) asserts that proprietary file format like Microsoft application packages should not be used for preservation because it can alter the file formats at any given moment without notice. Sometimes details of such file formats are kept secret in order to obstruct competitors. For the purpose of long-term preservation, the following should be used as criteria for selecting file formats:

i. The file format should be public with a full disclosure of its syntax and semantics.
ii. The file format should be standardized by a reputed organization such as the International Organization for Standardization (ISO).
iii. The file format should be generally accepted and widespread. This guarantees availability of suitable rendition software on mainstream hardware platforms now and in the near future.
iv. The file format should be available and free of patent and license fees Open file formats are preferred for long-term preservation but many of the resources created or received in the organization may not offer any choices in regard to storing a file in different formats where as others may allow it.

Also different file formats do not only store the data in different bit stream but may actually not allow storing all the desired information. Therefore in preparing the digital resources for ingestion, the organisation should consider how the stored information shall be used in the future for example if its really necessary to have all the functionality encoded in the file then a format shall be chosen that encodes for that ,

where as if only viewing some presentation encoding will be suitable enough. The cost of file format conversion will depend on the selected file format. One recommendation that is agreed upon by is the use of a standard format that is non-proprietary as these kinds of formats are more likely to have a preservation path in the future and software needed to read files. Samir (2006) stated that the universal standard for high quality digital object is Adobe systems acrobat portable document format (PDF). The other most common format for storing is XML (Extensive markup language)**.**

Buki (2012) posed that lack of proper method of digital storage medium and poor maintenance culture can lead to loss of some important digital information resources in libraries because retrieval devices are not prepared for it. It is essential that the storage system be backed up with multiple copies of all data; there should be additional copies available so that if one copy is not usable another can be accessed. It is recommended that three copies of all digital information resources be preserved, including one copy stored in a separate geographical location, to prevent loss in the event of disaster. Ideally, at least two types of storage media should be used for the three copies. For example, one copy might be stored on hard drives and the other two on CD disks or tape drives. State of Florida (2010) stated that digital storage media should be store in a cool and moderate humidity. IRMT (2009) posited that digital storage media should be cleaned, blowed, dusted and antivirus should be use in order to protect information persevered being attacked by viruses and unnecessary moving or handling of digital storage medium should also be avoided.

2.5 Digitization of Information Resources

Digitization, which in narrow terms may be seen as conversion of information from analogue to digital form has had a far- reaching impact on practical activities of libraries and other information institutions services. Kajberg and Lorfing (2005) digitization can be seen as turning information into binary digits. It refers to the process of translating a piece of information such as a book, sound recording, picture or video into bits. Bits are the fundamental unit of information on a computer. Digitization is a crucial transitional step from traditional to digital library. Urban (2002) also stressed that it is an excellent tool for allowing access to resources, preserving the original through reduced handling and providing for superior access. Indeed digitization is one of the hot topics in librarianship today. The advent of ICT has enabled the digitization of resources in libraries, it has introduced new options for preservation, conversion, scanning and uploading with the help of specific software. With the advent of ICT, it has allowed production of digital surrogate in order to prolong the life span of the original resources, records, reduce handling of fragile objects, allow access and increase the use of digital surrogate. Ekoja and Gbaje (2012) asserted that digitization and archiving of digital materials have also brought upon libraries the responsibility to preserve them for future use and reuse. Preservation is aimed at ensuring that the digital materials remain accessible and use able as long as it is required, notwithstanding technological (hardware and software) change.

Masakazi (2009) stated that digitization is the creation of multimedia database enhanced by digital information and thus offering easy access to cultural and scientific change for large population of users. Digitization therefore involves conversion of non-digital materials to digital formats. Kenedy (2005) observes that the value of digital

reformatting work has now surpassed that of photocopy, reformatting and has become the over whelming preservation reformatting method for non-paper items. Gbaje and Bot (2009) asserted that digitization is beneficial in the area of preservation of information contained in the library. Many documents in the library are in a state of deterioration making it difficult to be kept for future use. Preservation of digital materials assists the librarians to expediting the process of duplicating items. One viable tactic to avoid the loss of information is creating backup copies to library holdings Okebukola (2002) Digital version can reduce the storage space especially when dealing with a large number of items. Voluminous amount of digital materials can exist on a single hard drive or optical disk. One goal of digitization projects can be the decrease on physical size of a collection.

Alagbeleye (2009) identified the problems militating against digitization in Africa as lack of expertise, legal copyright laws, poor funding and lack of organizational infrastructure. Agreeing with this, Shibanda (2001) believed that a major challenge facing digitization projects in Africa is that of skilled manpower. According to him, the challenge for African digital information is to put in place an information management or professionalism that possesses the skill and competencies that can develop meaningful programs that supports and activate that use of information and communication technology skills.

2.6 Digital Preservation Strategies

Digital preservation strategies are techniques for keeping digital objects accessible for a long-term re-use. It is concerned on how to manage the threats that are related to

hardware and software .Digital preservation strategies can be classified in to investment, 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 Gbaje (2011).

ii. Normalization.

Migration of digital objects to digital storage repository so that there will 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 .Color, images, and structured text are converted in to 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 in to viewable format and all word processed documents might be converted to Open Document Text (ODT).

iii. **Encapsulation.**

This may be seen as a technique of grouping together a digital object and metadata necessary to provide access to that object .Ostensibly the grouping process lessens the likelihood that any critic 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, series 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.. Ferreira (2006) 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 including 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. Rahaman 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 ROM to a new CD ROM) it is therefore seeing 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. Andrews and Law (2004) affirms that refreshing only involves the change of storage medium such as the tape, CDROM; removable disk e.t.c. MIT (2005) asserted that it is a periodically moving of files from one physical medium to another in order to avoid obsolescence or degradation of the storage medium.

iii Replication

Replication is a similar process to refreshment, but with one difference: the location where the resource is stored will 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.IRMT (2009) stipulated that replication helps ensure the survival of information, by storing the files in several different locations Replication is different from refreshing data, since the new copy of the digital resource is stored in a different place. 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, use able and authentic when the applications and systems which were used to create and interprets the digital information resources will no longer be available. Ferreira (2006) 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 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 change on digital information in such a way that technology will not affect or stop accessibility to the information.

Kol & Oltmans (2005) asserted that migration as 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 face of constantly changing technology. They further point out that with migration, file formats will be converted into new formats as soon as the original formats run the risk of becoming obsolete

11 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 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 hard ware (Galloway, 2009). 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, 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 (Moghaddam, 2010).

International records management trust IRMT (2009) stated that emulation is the process of using a computer device or software program to imitate the behaviors of another device or program, thereby obtaining the same results when accessing or using the digital objects. An emulation strategy uses the software or hardware called emulator to recreate the functionality of obsolete technical environments on modern computer platforms. However, emulation allows access to the original object as though it were still

housed in its original computer environment. For example, special software can be used on a present day personal computer to produce exactly the appearance and behaviors of a document such as presentation that was created on an older computer using software that is no longer in use. Proponents of emulation strategies argue that emulation delivers the most authentic possible rendition of a digital object. Critics of emulation on the other hand express concern about the significant technical challenges involved in developing emulation technology as well as the difficulty of establishing whether in the end the user is left with complete authentication recreation of the original object

2.6.1 Digital Preservation Software

i. Lots of Copies Keep Stuff Safe (LOCKSS)

LOCKSS means Lots of Copies Keeps Stuff Safe. 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 reputation 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 has changed with any of them (Gracy & Kahn, 2012).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. This is known as a dark archive, and it should be a collection of materials that do not need to be

ever be changed or manipulated (Gladney, 2009). There should be more than one of these master copies to ensure validity if needed. Security is an important consideration for these repositories, both to guard the collections against malicious damage, loss, forgery, and theft, and to ensure files are presented according to users needs (Gracy & Kahn, 2012).

ii. D-space

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

D-space 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 (2010) Pennock (2006) views Dspace as a digital repository system design to capture, store, index, preserve, and provide access to institutional digital research materials. Morris (2009) argued that it is an out-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. D-space, however, is an open source software designed to capture, manage, preserve and disseminate digital scholarly research material in all forms: D-space captures, distributes and preserves digital research products. Here you 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 D-space.

iii. Fedora

Fedora stands for 'Flexible Extensible Digital Object Repository Architecture. This software package was jointly developed by Cornell University and Virginia University Library 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 has become the *de facto* encoding standard for the preservation of electronic records.

2.7 Challenges faced by preservation of digital information resources

Popoola (2003) stated that the management of libraries and archives has poor maintenance culture of infrastructural facilities such as electricity, buildings and control devices .This factors are responsible for quick deterioration of their collections. Preventive preservation of information calls for constant cleaning of the library/archive and the facilities. Restoration techniques such as binding and lamination of paper-based information may be used to reduce conservation

The quality of paper used in the production of information materials especially library book materials and paper based records in archives, libraries and records offices pose serious danger to preservation and conservation of information materials in African countries (Akande 2009) Sunil and Kumar (2009) stated that for any preservation and conservation programmed to succeed in libraries and archives there must be adequate and

well trained manpower. This is because preservation is a specialized field of knowledge that requires information professionals who understand the physical and chemical nature of the materials in their library and archives holdings .This advocates the need to expose librarians and archivists to conservation and restoration practices during the training. Arizona (2010) suggested that such training programme should include operating environmental control, and storage. Many library and archives staff members do not have the required training and skills needed to carry out this important work. The professional skills needed include technical proficiency in areas such as encryption, metadata schema coding, and authentication, as well as traditional archiving skills that include cataloguing and classification (Sanett, 2013).

Olatukun (2008) stated that majority of the library; records and archives managers concentrate much on the effective provision of information services to users forgetting the aspect of preservation. There is lack of proper recognition of the need of preservation, restoration and conservation. They have failed to realize that preservation improved job performance by providing good conditions of services. International Records Management trust (2004) point out that even though many current systems have password control, these controls are widely circumvented. It is very common for unauthorized persons to access files that contain information from databases by breaking access codes. There are also significant difficulties in protecting the availability of digitally generated resources for future use. Digital resources are difficult to maintain because they rely upon the computer environment in which they were created.

Katun (2006) observed that digital resources storage media has a shorter life span than paper, while a paper record is said to last for 200years, digital media is said to start

deteriorating after the first 5years. There by making digital information available for longer periods is problematic. He also said other problem relates to changes in technology, institutions find it difficult to keep up with regular upgrade in both software and hardware. This leads to situations where institutions are left with older versions of software that become difficult to use due to compatibility problems. The absence of policies and procedures to provide guidance to creators and users of digital resources pose risks that cannot be ignored. Inadequate funding remains a crippling problem in most institutions and the cost of making new purchases, maintenance culture is another drawback for most institutions struggling to stay within budget allocations.

Quickly changing digital technologies are one of the most serious challenges associated with digital preservation. Because there is no way of knowing what formats or procedures people will be using 50 or 100 years from now, it is more important to focus on a shorter time frame. If professionals focus on the coming five, ten or even twenty years, they are more likely to have a better idea of what the practices will be (Gladney, 2009).

Software corporations are both part of the problem and the solution, as due to commercial interest, the devices, software and formats used to store information are often designed for obsolescence. In other words, corporations that design these methods design them with a shelf life in order to ensure the sales of latest upgrades and models (Reyes, 2013). The findings from Mnjama and Wamukoya (2005) indicated other challenges faced by digital preservations include absence of migration strategies. Currently, humans are still performing most of the necessary acts of digital preservation. With human actions come human error, however, many libraries and archives staff members do not have the

required training and skills needed to carry out this important work. The professional skills needed include technical proficiency in areas such as e metadata schema coding, and authentication, as well as traditional archiving skills that include cataloguing and classification (Sanett, 2013). Overtime, as resources are continually reprocessed, inaccuracies will compound on top of each other.

Additionally, external and internal attacks on items, such as those by hackers, upset employees, or others committing acts of fraud or revenge, as well as economic failures such as a lack of funding or mission change, can all have a negative impact on materials (Gladney, 2009). Another major issue with digital preservation education is that the metadata used in digitization is often not standardized, and different variations of the same word or description can cause errors (Dubin, et al., 2009).

Inadequate skills in information technology by 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 digital age, and are at the same time too reluctant to leave the old practices for new one. Ayoku (2008) stated that Successful application of information handling technologies in developing countries requires an ability to overcome staff and personal resistance to such innovation. A well-funded digitization project assures new and improved services and sustainability of the project. Digital projects are expensive. Digitization of archives and libraries requires enormous funding due to frequent hardware and software upgrades (Mutula and Ojedokun 2008).

IRMT (2009) stated that the continuous changes in computer hardware and software cause technological obsolescence that is a threat to digital preservation. It causes the loss to the means of accessing information in digital form. Technological obsolescence is caused by continuous upgrade of operating system, programming language application and storage media Brendan and Ifeanyi (2012) asserted that the reason why re-digitization is unavoidable is the likelihood that digital resources created in previous years using older technologies may not be accessible or compatible with the new technologies which make it necessary for information professionals to keep abreast of these developments and assess how the technologies and products can be incorporated and exploited in their service.. Alagbeleye (2009) suggested that digital archives should be transcribed every ten to twenty years

Wamukoya & Mutula (2005) observed that legislators in Africa are neither aware, nor conversant with the requirements of digital preservation and for that reason; they either ignore or inadequately cover digital preservation issues. Frequent power outage constitute serious bottleneck to digital preservation, this has effects in damaging digital equipment. Zulu (2008) reported that inadequate supply of electricity makes it impossible to maintain a conducive and sustainable technological environment.

2.8 Summary of the Reviews

This is the review of literature from text books, journals and articles. It described preservation as a means where by resources are protected for present and future generation. It stated that the means of preservation in the library includes lamination, scanning, photocopying and binding but the most common means of preservation is cleaning and dusting. Preservation and digital information resources were discussed. It

identified that information resources includes scholarly publications, thesis, and dissertation. It discussed storage as a means of preserving information on storage medium. It stated that the shelves, racks are exigencies of good storage .It also revealed that digital information resources are stored on magnetic media such as removable disks, floppy disks, hard drives, and optical technology that includes the use of CDROM, DVD and file formats used in the preservation of digital information resources.

Digital storage media has a shorter life span than paper. Digital preservation strategies such as migration, emulation, digitization, and encapsulation were discussed; preservation software like dspace and lockss, green stone and fedora was also discussed. Some of the challenges faced by preservation of digital information resources include lack of preservation and security policy; changes in technology, inadequate infrastructure and inadequate fund.

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CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter is under the following sub headings.

3.1 Introduction

3.2 Research Method Adopted

3.3 Population of the Study

3.4 Sample and Sampling Technique

3.5 Instruments for Data Collection

3.6 Validity

3.7 Pilot Study

3.8 Procedure for Data Collection

3.9 Procedure for Data Analysis

3.2 Research method adopted

The qualitative research method was used for the study. Gbaje (2011) stated that qualitative research takes place in the natural settings. He further stated that in qualitative research, the researcher goes to the site involved in the study to find out more information about the situation on ground. This method is appropriate for the study because it involves the use of structured and open ended interview and ensures an in- depth understanding of the social phenomena; it also provides an opportunity to understand a complex situation and an ability to examine the real issues in their natural settings. The use of multiple sources of evidence such as guided questionnaires, interviews and observations was

adopted to resolve possible difficulties in case studies (Yin 2003). This method enabled the researcher to capture and understand the preservation of digital information resources

3.3 Population of the study

The population of the study comprised all the (7) seven federal university libraries in North Western States of Nigeria, from the population, only university libraries with digitization unit were selected. According to Mugo (2010), population is the total sum of a group of individuals, persons, objects or items from which samples are taken for measurement. However, the subject of the study were the staff of the digitization unit,

Table 3.1: Population of the study

States	University libraries	Number of Library Staff
Kaduna	Kashim Ibrahim Library. Ahmadu Bello University Zaria	8
Sokoto	Abdullahi Fodio Library. Usman Danfodio University Sokoto	2
Kano	University Library, Bayero University Kano	2
Jigawa	University Library, Federal University Duste	0
Katsina	University Library, Federal University Dutsinma	0
Kano	Police academy library, Nigeria Police Academy Wudil	0
Kaduna	Nigerian Defence Academy library, Nigerian Defence Academy Kaduna	0
TOTAL		14

Source: Administrative unit of the library

3.4 Sample and Sampling Technique

Out of seven university libraries (7) three (3) were found to have digitization and preservation unit, the three (3) and their staff form the sample size. These units have total of 14 staff who were automatically the subject of the study. Babbie (2007) asserted that purposive sampling is a non-probability sampling where the units to be observed are selected based on the researcher's judgment about which ones will be the most useful representative

Table 3.2: Sampling size

State	University Libraries	Sample size
Kaduna	Kashim Ibrahim Library. Ahmadu Bello University Zaria	8
Sokoto	Abdullahi Fodio Library. Usman Danfodio University Sokoto	2
Kano	University Library, Bayero University Kano	4
TOTAL		14

Source: Administrative unit of the library

3.5 Instrument for data collection

The instrument used to collect data for the study was the structured interview and observation.

3.5.1 Interview

A structured interview was used to collect data for the study; it involved interviewing the staff of the digitization unit face to face based on structured questions that was prepared before the interview. Thomas, Nelson and Silverman (2012) stated that interview is the common source of data collection in qualitative studies, interview range from highly structured style in which questions are determined before the interview. The interview sessions included series of questions that enabled the researcher gather data

from the respondents for the study. The interview was used to find out the demographic information, Types of digital information resources available and preserved, Storage media used to preserve digital information resources, Digital Preservation strategies, and Challenges faced in the preservation of digital information resources.

3.5.2 Observation.

This involved personal by the researcher of the software, hardware and the conditions of the storage medium.

3.5.3 Focus Group

The researcher also questioned the staff of digitization and preservation unit as a focus group based on structured questioning techniques. Woods (2006) recommends that, in order to gain access to deeper levels, the researcher needs to develop a certain rapport with the subjects of the study, and to win their trust. In essence, to discover the inner most meaning of ideas the researcher preferred deep involvement in the natural setting.

3.6 Validity of the Study

Triangulation was used to determine the validity of the data collected; triangulation was achieved in this study using interview, focus group and observation as data collection techniques. Ndakasharwa (2011) opined that triangulation means using different types of measures or collection techniques to examine the same variable.

3.7 Pilot Study

A pilot study was conducted in the Federal university of technology Minna to test the method of data collection and to pretest the research instrument in order to determine its consistency and accuracy. The four staff involved in the digitization of digital

information resources were interviewed as a focus group using the structured questions prepared before the interview to determine if any changes or additions were necessary.

3.8 Procedure for data collection

The researcher requested the assistance of the libraries involved in the study to conduct the interview to the unit involved and discussed the questions from the structured interview to the respondents' who are staff of the digitization and preservation unit. And three weeks was used personally by the researcher to conduct the interview.

3.9 Procedure for data Analysis

The data collected were organized, analyzed, tabulated, and discussed descriptively.

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CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter presents the analysis and discussion of the data collected for the study under the following sub headings.

4.2 Response Rate

The response rate indicated that out of 14 respondents only 12(85.7%) were interviewed because 2 of the staffs were on leave as at the time of the interview.

Table 4.1**: Response Rate**

S/N	University	Total Number of Respondents	Total Number of Respondents Interviewed	Percentage (%)
1	Kashim Ibrahim Library	8	6	75
2	Abdullahi Fodio Library	2	2	100
3	University Library Kano	4	4	100
	Total	14	12	85.7%

4.3 Data Presentation and Discussion

This section present the data collected and analyzed descriptively followed with discussions base on the research questions raised for the study.

4.3.1. Forms of Digital Information Available in Federal University Libraries in North Western States of Nigeria.

In order to find out the forms of digital information available options were given so that the libraries studied will choose the one they generated. Various forms of digital information were itemized in table 4.2 below:

Table: 4:2: Forms of Digital information Available

Forms of Digital Information Resources	Kashim Ibrahim Library	Abdullahi Fodio Library	University Library Kano
Digital-text Document	√	√	√
Images	X	X	X
Audio	X	X	X
Graphics	X	X	X
Videos	X	X	X

Key: X = Not Available √ =Available

Responses from the interview in table 4.2 revealed that all the university libraries studied made available only digital text document, other varieties of information in forms of images, audio, graphics, and video were not available. This research finding opposed that of State North Dakota (1998) where they found out that the various forms of information resources generated in the libraries comprises of E- text, data, graphics, images, video and audio which were created , modified and transmitted in digital form by computer. It was discovered that none of the libraries generated electronic images, audio, graphics and video which were part of the forms of electronic text document.

The implication of the finding is that in a situation where a library have only one form of digital information the library will not be regarded as good reference source of information that would carter for all types of users with variant information needs in formats other than that of electronic text document.

4.3.2 Types of Digital Information Resources Available and Preserved by the Federal University Libraries in North Western States of Nigeria

In order to determine the types of digital information resources available and preserved options were provided and the respondent were asked to choose the one that is applicable in the libraries studied. Thesis, dissertation, seminar papers, conference papers,

past question papers, lecture note, reports, pre-print and post print articles were provided . The result of the analysis of the respondent is presented in table 4.3

Table: 4:3: Digital Information Resources Preserved

Types of Information Resources	Kashim Ibrahim Library	Abdullahi Fodio Library	University Library Kano
Theses	√	√	√
Dissertation	√	√	√
Seminar papers	√	X	X
Conference papers	√	X	X
Past question papers	X	X	X
Lecture note	X	X	X
Reports	X	X	X
Pre-print and post print journals	√	√	√

Key: X = Not Available √ =Available

The findings from table 4.3 indicated that theses, dissertation and pre-print journals are the most popular information resources available and preserved in the university libraries studied. This is because they are the only output of scientific research published by the academic community and allowed to be digitized and preserved based on their policies. In addition to thesis, dissertation, pre-print and post print journals, K.I.L incorporate both seminar and conference papers whereas, it was noted that none of the university libraries studied preserved digital information resources like lecture notes, reports and past question papers. This implies that university libraries that do not make available all the varieties of digital information resources would not be able to meet up with the needs of the users in terms of the other digital information resources not generated and preserved. This finding is in agreement with Samir (2006) who stated that journal articles, theses, dissertations, conference papers and proceedings are the major documents that are vital in scientific communication and need to be made available to the University community.

4.3.3 Types of Storage Media Used to Preserve Digital Information Resources by the Federal University Libraries in North Western States of Nigeria.

In order to ascertain the type of storage media used in preserving the digital information, various types of storage media were listed for the respondents to choose the ones they use in their libraries. The results of the analysis is presented in table 4.4

Table 4:4: Storage Media Used to Preserve Digital Information Resources

Storage Media	Kashim Ibrahim Library	Abdullahi Fodio Library	University Library Kano
Flash drive	X	X	X
CDrom/DVD	√	X	X
Computer Hard Disk	√	X	X
External Hard Disk	√	√	√
Memory Card	X	X	X
Microfilm	X	X	X
Memory Sticks	X	X	X
Floppy Disk	X	X	X
Mirror Server	X	X	X

Key: X = Not Available √ =Available

Analysis of the findings from table 4.4 revealed that external hard drive is the most popular storage media used by the university libraries studied. In addition, K.I.L incorporates both CD-ROM /DVD and computer hard disk drive, while A.F.L and U.L.K used only external hard drive. During the interview, it was discovered that K.I.L and A.F.L libraries have back up within and outside the library. .None of the federal university libraries studied used flash drives, memory cards, floppy disk and mirror server. This implies that the university libraries are meeting up to expectations only that there are better options they could use such as cloud computing which if used will be more effective and reliable in case of any failure. The findings of this study supported the

findings of Mageto (2009) who asserted that the server based hard disk storage is the most effective and secured digital preservation medium for digital information resources.

4.3.4 Measures Taken to Keep Digital Storage Media in Good Condition by the Federal University Libraries in North Western States of Nigeria.

In order to determine the measures taken to keep digital storage medium in good condition number of techniques were itemized for the respondents to select the most appropriate means used in their libraries. Table 4.5 presents the various techniques.

Table 4:5: Measures Taken to Keep Digital Storage Media in Good Condition

Measures	Kashim Ibrahim Library	Abdullahi Fodio Library	University Library Kano
Proper Air Conditioning	√	√	√
Dusting	X	X	√
Blowing	√	X	X
Use of CDracks	X	X	X
Others Please Specify	X	X	X

Key: X = Not Available √ =Available

Table 4.5 shows that proper air conditioning is the most popular measure taken by all libraries studied to keep their digital storage media in good condition; in addition, K.I.L also incorporates blowing as another measure. However, the measures taken by the libraries are not adequate and this implies that the life span of their storage media are in danger and can lead to damage or loss of information resources stored on it. This finding supported that of state of Florida (2010) which stated that digital storage media should be preserved in a cool moderate humidity. In addition to the existing measures taken by the libraries studied, there is the need to in cooperate other means that are not applied in order to elongate the life span of the digital storage media and to ensure longevity of the resources.

4.3.5 Strategies Used in the Preservation of Digital Information by the Federal University Libraries in North Western States of Nigeria.

In order to ascertain the strategies used for preservation in the libraries studied, some options were given in tab4.6 to state the one's used by the libraries.

Table: 4:6 Strategies of Preservation

Techniques	Kashim Ibrahim Library	Abdullahi Fodio Library	University Library Kano
Migration	√	√	√
Encapsulation	√	X	X
Refreshing	√	X	X
Replication	√	X	X
Normalization	√	X	X
Emulation	√	X	X
Technology preservation	√	X	X
Use of Standards	√	√	√

Key: X = Not Available √ =Available

The findings revealed that K.I.L used all preservation strategies listed such as migration, encapsulation, refreshing, replication, ,normalization ,emulation ,technology preservation and the use of standards while A.F.L and U.L.K. used only the migration and use of standards as strategies in preservation. The strategies used by A.F.L and U.L.K. Implies that continuous use and access to digital information resources on digital storage media in A.F.L and U.L.K will become difficult due to inadequate strategies of preservation used in the two libraries.

4.3.6 File Formats Used to Create Digital Information by the Federal University Libraries in North Western States of Nigeria.

In order to find out the file formats used some options were given so that the respondents will choose the ones applicable in their libraries. Table 4.7 presents the various file formats used by the libraries under study

Table: 4.7 File Formats Used to Create Digital Information

File Formats	Kashim Ibrahim Library	Abdullahi Fodio Library	University Library Kano
Adobe pdf	√	√	√
Open Office File Format	X	X	X
Microsoft Office	X	X	X
ASC11	X	X	X
Adobe pdf/A	X	X	X

Key: X = Not Available √ =Available

Table 4.7 shows that Adobe pdf is said to be the most popular and only file formats adopted by all the libraries studied to preserve their digital information resources. From the interview it was discovered that the reason for using pdf in the university libraries studied was that it serves as a security, it is lighter, portable and used to compress larger documents. It was noted that none of these libraries used open office file format, Microsoft office, ASC11, to create digital information. The implication of choosing PDF is because it is the accepted standard worldwide, therefore it could be said that the libraries studied are meeting up with the standard but other formats can also be used. This is in line with Gbaje (2011) who stated that Adobe pdf is the popular file format used to create digital information resources and is one of the accepted formats.

4.3.7. Digital Preservation Software Used For Preservation by the Federal University Libraries in North Western States of Nigeria

In order to ascertain the software used some options were given so that the respondents can state the ones applicable in their libraries. Table 4.8 presents the types of softwares as follows

Table 4:8: Digital Preservation Software Used For Preservation

Software	Kashim Ibrahim Library	Abdullahi Fodio Library	University Library Kano
Lockss	X	X	X
Green Stone	X	X	X
Dspace	√	√	√
Fedora	X	X	X
E-prints	X	X	X

Key: X = Not Available √ =Available

The findings show that dspace is the most popular software used in the university libraries studied. It was discovered that none of the university libraries studied used green stone, lockss, fedora and e-print. The interview revealed that the reason of choosing dspace is because it is open source software; it can be modified to suit the local communities in the universities. This is in line with Walker (2010) and Pennock (2007) who concluded that dspace is a system design to capture, store, index, preserve and provide access to digital research materials.

4.3.8 Challenges faced in the preservation of Digital Information Resources by the Federal University Libraries in North Western States of Nigeria.

In order to find out the challenges faced in the preservation of digital information resources options were provided to pick the ones applicable to their libraries.

Table 4:9: Challenges faced in the preservation of Digital Information Resources

Challenges	Kashim Ibrahim Library	Abdullahi Fodio Library	University Library kano
Lack of Digital Preservation Policy	X	X	X
Lack of Infrastructure	√	X	X
Inadequate Professionals	X	√	X
Technological obsolescence	√	√	X
Poor Maintenance Culture	√	X	X
Technophobia	X	X	X
Inadequate Power Supply	√	√	√
Inadequate Fund	√	X	√

Key: X = Not Available √ =Available

The findings arisen from the study show that inadequate power supply is said to be the most challenging factor faced by the libraries under study. However, K.I.L is faced with poor maintenance culture, while A.F.L is faced with inadequate professionals to manage the available equipments. Comparatively, K.I.L and A.F.L are faced with challenges of technological obsolescence and finally, K.I.L and U.L.K are faced with the challenges of inadequate fund. The implication is that the libraries are faced with one problem or the other, which lead to them not carrying out their work effectively and efficiently. This finding is in line with Zulu (2008) who reported that inadequate power supply makes it impossible to maintain a conducive and sustainable technological environment.

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CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of findings, recommendations and conclusions were made.

5.2 Summary of the Study

The aim of the study is to investigate the preservation of digital information resources in the federal university libraries in the North Western States of Nigeria. The basic assumption of this study were effective preservation of digital information resources can lead to continuous access ,re-use and retrieval of digital information resources, All the federal university libraries would appreciate the strategies need to preserve different digital information resources for as long as possible.

In order to achieve the objectives of the study, four research questions were raised, the research questions sought to: determine the types of digital information resources available and preserved, determine the storage media that is used to preserve digital information resources, to determine the strategies used to preserve digital information resources and to determine the challenges faced in the preservation of digital information resources.

The review of the related literature was discussed under the following sub headings. Preservation information resources, digital information resources, storage medium for digital information, digitization of information resources, digital preservation strategies, digital preservation software, and challenges faced in preserving digital information resources.

The researcher made use of qualitative research method for the study, the population covered all the federal university libraries in the North Western States of Nigeria with a digitization unit and the subject of the study are staff of the digitization unit. Purposive sampling technique was used to select the three libraries which are K.I.L, A.F.L and U.L.K.

The research instrument adopted for the study was interview and observation; triangulation was used to determine the validity of the study and the data collected was analyzed, tabulated and discussed descriptively.

5.3 Summary of the Major Findings

Following the analysis and discussion of the responses to the structured and open ended interview, the following are the findings of the study.

1. Types of digital information resources available and preserved are the local content such as: theses, dissertation, pre-print and post print journals, seminar and conference papers.
2. The storage media popularly used are the: External hard drive, CDROM/DVD and computer hard disk.
3. Strategies adopted by the libraries studied are: migration and use of standards. However K.I.L in addition uses encapsulation, refreshing, replication, normalization, emulation, and technology preservation as strategies for preserving digital information resources,.
4. The challenges faced in the preservation of digital information resources include: lack of infrastructure, inadequate professionals, technological obsolescence, poor maintenance culture, inadequate power supply and inadequate fund.

5.4 Conclusions

Based on the findings of the study, it could be concluded that to some extent that preservation of digital information resources activities is carried out in the libraries studied only that it is not effective and efficient.

5.5 Recommendations

Based on the findings and conclusion of this study, the following recommendations are made.

1. Other types of digital information resources such as practical research records, project reports, inaugural lecture recording, paper evaluation report and technical report, papers film strips and records inventions should be made available and preserved in all the libraries studied. While A.F.L and U.L.K should make available and preserve seminar and conference papers.
2. Regular backup of digital information resources should be done; mirror server should also be used as a backup in case of any failure.
3. A.F.L and U.L.K should adopt digital preservation strategies such as encapsulation, refreshing, replication, normalization, emulation, and technology preservation in order to ensure continuous access to digital information resources.
4. High capacity computers, scanners and camera should be provided, more qualified professionals should be employed and trained on digital preservation, constant upgrades in hardware and software technology, regular maintenance of the infrastructure facilities, stand by generator, ups and inverters should be provided.

5.6 Suggestions for further studies

1. Evaluation of factors influencing lost of digitized contents in the federal university libraries in the north western states of Nigeria

2. Remedies to inadequate power supply in preserving digital information resources in the federal university libraries in Nigeria.

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APPENDIX I

DEPARTMENT OF LIBRARY INFORMATION SCIENCE
FACULTY OF EDUCATION
AHMADU BELLO UNIVERSITY, ZARIA

Dear Respondents,

I am a master student in the above named department carrying out a research on preservation of Digital Information Resources in Federal University Libraries in the North Western States of Nigeria.
I will be grateful if you provide answers; all answers provided will be kept confidential and used only for this study.
Thank you.

Aisha Jimada

APPENDIX II

The interview was guided by the following questions.

SECTION A: DEMOGRAPHIC INFORMATION

1. What is the name of your institution
a. Ahmadu Bello University, Zaria ( )
b. Bayero University, Kano ( )

c. Usman Donfodio University, Sokoto ( )

2. What is the name of your Library
a. Kashim Ibrahim Library ( )
b. University Library Kano ( )
c. Abdullahi Fodio Library ( )

3. Staff gender
a. Male ( )
b. Female ( )

4. Highest Educational Qualification
a. Primary School Certificate ( )
b. Secondary School Certificate ( )
c. N.C.E Certificate ( )
d. Diploma ( )
e. First Degree ( )
f. Masters ( )
g. Others specify please……

SECTION B: DIGITAL INFORMATION RESOURCES

5. What Form of digital Information do you have in your library?
a. Digital- Text Document ( )
b. Images ( )
c. Audio ( )
d. Graphics ( )
e. Video ( )
f. Others please specify……..

6. What type of digital information resources are generated and preserved in your library?
a. Thesis ( )
b. Dissertation ( )
c. Seminar Papers ( )
d. Conference papers ( )
e. Past question papers ( )
f. Lecture note ( )
g. Reports ( )
h. Pre prints and post print journal article ( )
i. Others please specify……

SECTION C: STORAGE MEDIA

7. What type of digital storage media is used for preservation in your library?
a. Flash drives ( )
b. CD-ROMs/DVD ( )
c. Computer Hard disk ( )
d. External hard drive ( )

e. Memory card ( )
f. Microfilm ( )
g. Memory sticks ( )
h. Floppy disk ( )
i. Mirror server ( )
j. Others please specify…….

8. What are the measures taken to keep digital storage media in good condition in your library?

a. Proper air conditioning ( )
b. Dusting ( )
c. Blowing ( )
d. Use of CD racks ( )
e. Others please specify……..

SECTION D: STRATEGIES OF PRESERVING DIGITAL INFORMATION RESOURCES

9. Which digital preservation strategies does your library use?

a. Migration ( )
b. Encapsulation ( )
c. Refreshing ( )
d. Replication ( )
e. Normalization ( )
f. Emulation ( )
g. Technology preservation ( )
h. Use of standards ( )

10. What file formats do your library adopts for saving digital information resources?

a. Adobe PDF
b. Open office file format ( )
c. Microsoft ( )
d. ASCII ( )
e. PDF/A ( )
f. Others please specify……

11. What digital preservation software does your library use for digital preservation?

a. Lockss ( )
b. Greenstone ( )
c. Dspace ( )
d. Fedora ( )
e. E-prints ( )
f. Others please specify…….

SECTION E: CHALLENGES FACED IN THE PRESERVATION OF DIGITAL INFORMATION RESOURCES

12. What are the challenges faced in preservation of digital information resources in your library?

a. Lack of digital preservation policy ( )
b. Lack of infrastructure ( )
c. Inadequate professionals ( )
d. Technology obsolescence ( )

e. Poor maintenance culture ( )
f. Technophobia ( )
g. Inadequate power supply ( )
h. Inadequate fund ( )
i. Others please specify……..