



PERSPECTIVES ON...

## Adoption of Digital Preservation Methods for Theses in Nigerian Academic Libraries: Applications and Implications



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## ABSTRACT

Graduating students of higher institutions in Nigeria usually write and submit theses, as a requirement for the award of diplomas, undergraduate and postgraduate degrees. This paper examines the importance of students' theses to research, industrial and economic development of the nation and therefore advocates the need to preserve them. It discusses the intricate dimensions of the preservation of theses in academic libraries and notes the urgent need to address the worsening deteriorating state of students' theses in academic libraries in Nigeria. The paper also discusses the current traditional preservation methods practiced among academic libraries and observed that these methods are not adequate. It recommends that academic libraries in Nigeria should digitize theses and adopt the cloud computing preservation model through the operations of institutional repositories. The paper further identified digital divide and poor technological infrastructure, inadequate funding, data security breaches and issues revolving around copyright as challenges of digitization and cloud computing, and made recommendations.

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## INTRODUCTION

Academic Libraries exist to support their parent institutions in their teaching, learning and research functions. These libraries acquire, process and preserve information resources; in addition, they also provide access to information resources in their holdings. Student theses are among the important information resources stored in academic libraries.

The writing and submission of theses are essential requirements for the award of undergraduate and postgraduate degrees in academic institutions like Colleges of Education, Polytechnics, Universities and the like. Egonu (1999) posited that projects, theses and dissertations refer to bound copies of research reports produced for the award of a certificate, diploma, first degree, masters, or doctorate degrees. The names 'projects', 'theses' and 'dissertations' are used rather discriminately and can be virtually synonymous (Nweze, 2010). The word 'theses' as used in this study is the plural form of 'thesis' which is synonymous with student's project or dissertation. Nweze (2010) further asserted that thesis is the first expression of graduates' maturity and mastery in a field of study. Lang (2002) argued that a thesis should be publishable or a source of publishable material. Libraries collect and preserve copies of these works. According to Okoro (2003), the reason for procurement, preservation, and management of theses is that these unpublished

sources contain important information useful for economic, academic and research purposes. Johnson and Kallaus (1987) noted that these works are collected and preserved to assist departments in communicating with each other and the outside world, to provide a record of the past, and to supply data useful for legal purposes. In addition, students, scholars and researchers also consult them for study and reference purposes. Theses also contain vital research findings which are useful to industries and important sectors of the economy of a developing nation like Nigeria. Thus, they are important parts of an academic library collection which must be protected and preserved from deterioration for both current and future use.

Provision of adequate space and facilities to house and preserve theses is a herculean and assiduous task, especially as the collection grow larger. ACKCITY (2014) reports that Nigeria produces about 400,000 graduates annually, each of which should have written and submitted a thesis to his or her institution. This implies that Nigerian academic libraries receive about 400,000 theses annually. These materials by the nature of their loose bindings are prone to quick deterioration. In recognition of the usefulness of theses, academic libraries have always evolved techniques and strategies from time to time to preserve them from deterioration. However these preservation techniques have proved inadequate as the collection increases in number (Kiondo, 2004). This informs the rationale for special emphasis on theses in this paper.

## LITERATURE REVIEW

Deterioration of important information resources including theses has been a source of concern to libraries globally and a phenomenon

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to which they must always respond if their objective of meeting the information needs of users must be achieved. Information resources in many academic libraries in Nigeria are stored under very poor environmental conditions (Olatokun, 2008). Consequently, vital information meant to be kept for posterity has been routinely wiped out (Popoola, 2003). The negative impact of deterioration of theses on the education, research and economic sectors of any nation cannot be overemphasized. Vital information needed for the transformation of these important sectors of the nation may be lost (Adebayo, 2012). Deterioration of theses begins as a result of natural aging process and other factors such as poor storage environment, activities of biological agents, improper handling and chemical composition of the materials with which they are made (Edhebe, 2004).

In librarianship, preservation is the process through which deterioration of library materials is curtailed. Eden (1998) defined preservation as 'all managerial, technical and financial considerations applied to retard deterioration and extend the useful life of (collection) materials to ensure their continued availability'. Over the years, libraries have adopted preservative measures based on location and environmental factors (Olatokun, 2008; Popoola, 2003). Library collections are always on the increase as more and more information resources are acquired. Collections of theses in academic libraries grow larger annually as graduating students write and submit their theses to their libraries. As the collection grows larger, libraries invest huge amount of their meager budgets in preservation processes without achieving complete success (Sunil & Kumar, 2009). Kiondo (2004) observed that the methods and techniques practiced by academic libraries in Africa (Nigeria inclusive) for the preservation of theses are inadequate and inefficient. There is therefore an urgent need to review current preservation practices, with a view to adopting better and sustainable methods and techniques. Njeze (2012) noted that Nigerian academic libraries need to deploy better ways of preserving information resources, in order to attain the same height with their counterparts in the developed world. UK Theses Digitisation Project (2009), among others, has shown that theses can be better preserved through digitization. The project which involved a group of University libraries and the British Library had successfully digitized about 10,000 theses in June, 2009 and new theses are added on a continuous basis. Few academic libraries in Nigeria have attempted some forms of ICT based preservation techniques with little or no success, due to incessant challenges which they could not resolve. For example, the University of Nigeria, Nsukka has made attempts to digitize its institutional research output with little success, due to poor electricity supply and inadequate qualified manpower (Ezeani & Ezema, 2011). However, Ezeani and Ezema (2011) concluded that with the provision of necessary infrastructure, digitization of theses can be successfully implemented in Nigerian libraries.

#### DETERIORATING NATURE OF THESES

The nature of the materials with which theses are made, fastens their deterioration process. The constituents of these materials include paper, card board, ink, adhesives, and leather. The pages of theses are loosely bound by local bookbinders who have little or no professional training. The type of paper used in the binding process is very low in archival quality. The paper is made using ground wood fibers, which retains impurities like resins, tannin and lignin. Lignin accelerates acidic reactions, when exposed to heat, light, high humidity, or atmospheric pollutants. This causes the pages of theses to become brittle and deteriorate quickly. Adverse environmental conditions are the root causes of deterioration of theses. The environmental conditions of sub-Saharan Africa in general and Nigeria in particular are primary factors that aid deterioration of theses. The most important factors in environmental control are humidity, temperature and light; others include dust and air pollution (Ifjeh, 2012). Mahapatra and Chakrabarti (2003) outlined

the following as the physical and chemical causes of deterioration of print materials (including theses):

- natural aging of paper, since most of its constituents are organic in nature.
- oxidizing agents present in the constituents of papers.
- alkalis used in the manufacture of paper, which encourages the growth of fungi.
- dust particles discolor paper, invite chemical impurities and accelerate biological growth.
- heat and exposure to light make paper brittle and fade in color.

Library staff and users who mishandle theses also contribute to the degeneration of the materials. Pests like rodents which feed on papers can be classified as agents of deterioration.

#### CURRENT ORGANIZATION, STORAGE AND PRESERVATION METHODS IN NIGERIA

Nweze (2010) reported that most academic libraries in Nigeria keep their theses in designated storage rooms. The names given to such rooms vary from library to library. However, 'Project Room' appears most common. Some libraries keep theses along with other important information resources in their 'reserve sections'. The common characteristic of these storage rooms is that theses stored in them are kept in 'closed access'. This implies that patrons can only make use of these materials within the storage room. The theses are arranged on shelves, in accordance with their broad subject areas. They are neither classified nor catalogued, based on any known classification scheme. Some libraries create indexes to the content of theses in order to facilitate access.

Preservation methods adopted are based on location, weather and environment. Air conditioners are installed in the rooms to control temperature and humidity. Fire outbreak may be prevented by banning smoking in the library, while inflammable articles like fuels and waste papers are kept outside. Electric wirings are enclosed in metal conduits to reduce the effects of sparks and fire extinguishers are installed at strategic points. Paraprofessionals are trained to help users in handling the materials so as to minimize damage to them. Theses which are infected by fungi and other microorganisms are fumigated with recommended chemicals (mostly pure reagents). Fumigation is also used in the control of pests and insects. When materials are physically damaged, they are sent to the bindery for repairs. Some libraries also use vacuum cleaners to clear off dust from the materials periodically.

As earlier stated, the current preservation methods have their limitations. One of the major limitations is that for the theses to remain preserved, these methods would have to be repeated over and over again. The boring and monotonous nature of these preservation methods has promoted neglect and total abandonment of theses over the years. Another limitation is the inadequacy of storage facilities. As more theses are received every year, the problem of space for storage becomes inevitable. Consequently, as new theses are received, the older ones are removed from the shelves to create space for the new. Unfortunately, the old theses become inaccessible, neglected and damaged. In a bid to overcome this problem, some libraries receive only postgraduate students' theses, exempting those of the undergraduate students (Nweze, 2010). Except appropriate measures are taken, the storage conditions of theses will continue to degenerate. Expectedly, vital information and research findings will be lost.

#### INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) AND PRESERVATION: WHAT ROLE?

The advent of information and communication technology (ICT) has revolutionized library operations. Information and communication technology has made significant impact on all library services. The *International Encyclopedia of Library and Information Science* (2003) defined information communication technology as the application of

modern electronic and computing capabilities (technologies) to the creation and storage of meaningful and useful facts or data (information) and its transmission to users by various electronic means (communication). A review of literature reveals that many academic libraries in Nigeria have at least partially automated their operations and services (Oyegade, 2000; Ukachi, 2008). Library automated operations and services cut across acquisitions, cataloguing, circulation and reference services; ICT facilities have not been given adequate consideration as a veritable alternative in the storage and preservation of library materials especially theses. Maximizing the use of ICT remains the only alternative to handling the limitations identified in the current preservation methods adopted by libraries.

## DIGITIZATION

In the context of this study, digitization may be defined as the process of documenting information in electronic format and making such information available through such media as compact discs (CDs), the internet and so on. Digitization in Nigerian libraries is relatively recent, having started in the past decade. Olatokun (2008) observed that very few academic libraries have considered at least a partial digitization of students' theses.

In digitizing theses, graduating students will be required to submit electronic copies (in the form of compact discs (CDs) and diskettes) of their theses to their libraries. Libraries may scan print copies of retrospective theses on CDs and diskettes. The CDs and diskettes may be stored in purpose-built racks and kept in 'closed access' under good environmental conditions. In order to facilitate access and use of the materials, libraries will need to classify and catalogue them as well as provide computer systems. Digitized preservation method will help resolve the problem of space.

## CLOUD COMPUTING

Perhaps, one of the most effective ways to preserve theses, as well as conserve space in the library is through cloud computing. Scale (2009) defines cloud computing simply as the sharing and use of applications and resources of a network environment to get work done without concern about ownership and management of the network's resources and applications. Gosavi, Shinde, and Dhakulkar (2012) consider cloud computing as an emerging computer paradigm where data and services reside in massively scalable data centers in the cloud and can be accessed from any connected device over the internet. They also affirm that cloud computing offers many interesting possibilities to libraries that may help to reduce technology cost, increase capacity reliability and performance.

Cloud computing is a novel concept in the Nigerian library scene. This paper will therefore discuss in details the characteristics, models and services of cloud computing.

Britto (2012) citing Mell and Grance (2011) outlined the following characteristics as inherent in cloud computing services:

- On-demand self-service: customers can access computing capabilities and resources on their own when needed without necessitating human intervention.
- Broad network access: access and capabilities are available over the network through such devices as cell phones, laptops, PDAs and so on.
- Resource pooling: resources such as network bandwidth, virtual machines, memory, processing power and storage capacity are pooled together to serve multiple customers, using a multi-tenant model.
- Rapid elasticity: resources and capabilities can be quickly deployed at any quantity and time.
- Measured service: customer usage of the vendor's resources and services is automatically monitored and reported, thereby offering a high level of transparency for the customer and vendor.

There are three types of cloud computing service:

- Software as a Service (SaaS): This is popularly known as software on demand. It implies that the application or software is supplied as a service to the customer who accesses the content online using a web browser. A good example is Google Apps. The customers need not worry about hosting, installing and maintaining the software. However they have very little control of the application.
- Platform as a Service (PaaS): In this case, the vendor provides, manages and controls the cloud infrastructure, except for applications, which the customer has control over. The vendor provides tools and resources which allows the customers to create and acquire applications to meet their needs. Example is Google App Engine
- Infrastructure as a Service (IaaS): This is also known as Hardware as a Service (HaaS). This service offers both storage and computing power capabilities. It delivers Computer infrastructure. Example is Amazon's web services.

Britto (2012) also citing Mell and Grance (2011) outlined the following deployment models of cloud computing:

- Private Cloud: This is a cloud infrastructure managed by an organization or a third party, solely to meet the needs of the given organization.
- Community Cloud: This is cloud infrastructure managed by more than one organization, to serve the common interests of the organizations or community. It can operate in the form of an academic consortium cloud.
- Public Cloud: In this case, the cloud infrastructure is available to the general public and is owned by a vendor selling cloud services.
- Hybrid Cloud: This is a combination of two or more cloud infrastructure.

It is pertinent to note that the service and deployment models as well as the characteristics of cloud computing as discussed do not run independently but are interrelated and connected to each other (Britto, 2012). Bishop (2011) illustrated these interrelations and connections in a diagram as shown in Fig. 1.

Some examples of cloud computing applications used in libraries include OCLC, Library of Congress online catalogue, Exlibris, Polaris, Worldcat and a host of other applications.

Arguably, institutional repositories provide the most useful cloud computing applications for storage and preservation of theses.

## INSTITUTIONAL REPOSITORIES AS VIABLE ALTERNATIVES FOR STORAGE AND PRESERVATION OF THESES

An institutional repository is a set of services that an academic institution offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members (Lynch, 2003). Repository services are presently offered by institutions using open source software such as EPrints, DSpace, and Fedora Commons to provide open access to scholarly resources. The Directory of Open Access Repositories (2014) reveals that there are about 1300 institutional repositories in the world. Unfortunately, out of the over 100 universities in Nigeria, only six of them have repositories. These are Ahmadu Bello University, Zaria; Covenant University, Ota; Federal University of Technology, Akure; Federal University, Oye-Ekiti; University of Jos and University of Nigeria, Nsukka. A look at these repositories shows that Covenant University and University of Nigeria have uploaded some doctoral theses and research papers of their lecturers on their repositories. The other University repositories contain a few scholarly works of their academic staff. These could become models to Nigerian academic institutions for preservation of

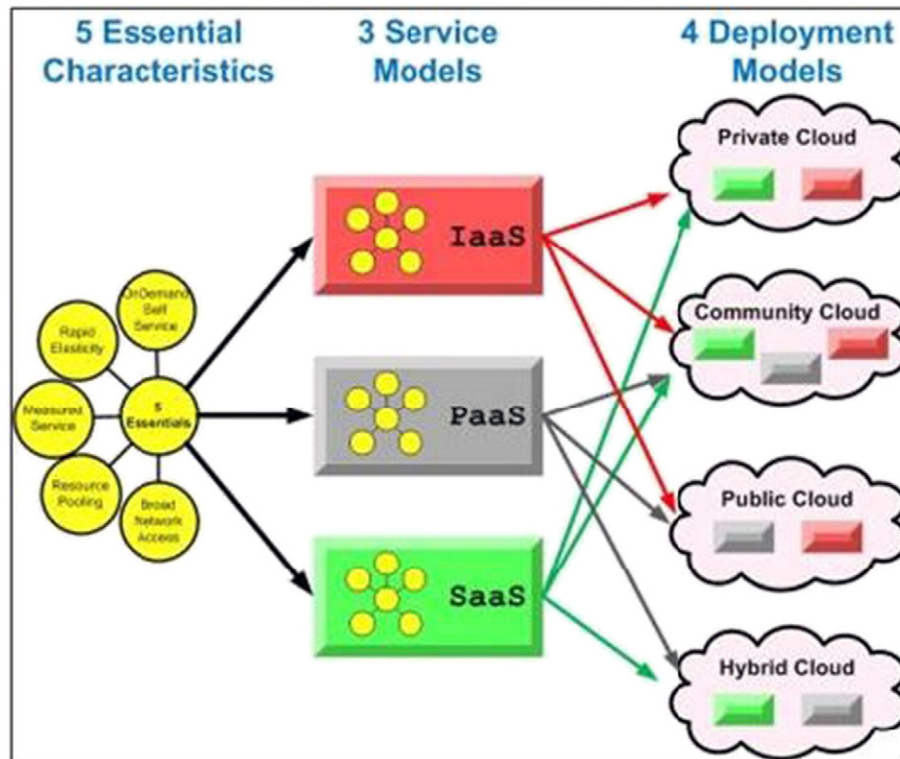


Fig. 1. An illustration of the interrelations and connections of services, deployment models and characteristic of cloud computing encapsulated by Bishop (2011).

theses. What is required is for libraries to simply digitize and upload copies of students' theses into their institutional repositories.

A briefing paper by [EnablingOpenScholarship \(2014\)](#) outlines the following as the advantages of institutional repositories:

- opens up the scholarly outputs of institutions to the outside world.
- maximizes the visibility and impact of institutions' scholarly outputs.
- showcases the institutions to interested constituencies—prospective staff, prospective students and other stakeholders.
- collects and curates digital outputs of both students and scholars of the institutions.
- manages and measures research and teaching activities of institutions.
- provides a workspace for work-in-progress, and for collaborative or large-scale projects.
- enables and encourages interdisciplinary approaches to research.
- facilitates the development and sharing of digital teaching materials and aids.
- supports student endeavors, providing access to theses and dissertations and a location for the development of e-portfolios.

In addition to the above advantages, the adoption of institutional repositories will also help libraries to deal with the problem of space and other preservation challenges as environmental and chemical factors, negative effects of micro and macro-organisms. Institutional repositories also provide platforms that allow multiple users access to a single document at the same time.

#### PERCEIVED OBSTACLES TO DIGITIZATION AND CLOUD COMPUTING IN NIGERIAN ACADEMIC LIBRARIES AND SOLUTIONS

Despite the obvious advantages of digitization and cloud computing, there are perceived obstacles to their implementation and management

in Nigerian academic libraries. Some of the obstacles are discussed below.

#### DIGITAL DIVIDE AND POOR TECHNOLOGICAL INFRASTRUCTURE

In spite of the positive impacts of information and communication technologies (ICTs) on the educational and economic development of nations, there is relative disparity in the level of acquisition and utilization of ICT between developing and developed nations of the world. It is this disparity that evolved into the concept of digital divide. The [International Telecommunication Union \(2005\)](#) defines digital divide as the uneven distribution difference or gap that exists in opportunities to access and use of information and communication technologies among diverse groups or nations. Digital divide is evaluated through the Digital Opportunity Index (DOI). DOI measures three sequential classifications of the digital divide, which are opportunity (encompassing accessibility and affordability), infrastructure (network indicators and indices) and utilization (ICT usage and quality).

Nigeria falls within the countries with low digital opportunity index scores. The digital opportunity index scores released by [International Telecommunication Union \(2005\)](#) revealed that Nigeria was ranked 31 in the African continent with very low score of 0.41, 0.03 and 0.01 for opportunity, infrastructure and utilization respectively. In support of the International Telecommunication Union rankings, [Ogege \(2010\)](#) posits that Government Ministries, agencies and institutions of higher learning do not have basic technological infrastructure. There are also the challenges of poor electricity supply and low internet bandwidth. Nigeria ranks among the lowest in terms of electricity supply and consumption globally ([Ogege, 2010](#)).

The Federal Ministries of Power and Communications have budgeted about \$150 million on improvement of electricity supply and ICT

infrastructure in 2014 (Eboh, 2014). It is hoped that the efforts of the Government would yield positive results.

#### INADEQUATE FUNDING

Initiating, implementing and managing digitization and cloud computing processes are quite expensive. Libraries must be automated, qualified technical and professional staff must be employed, computer and telecommunication facilities must be installed and there must be stable electricity supply. Being able to fund these programs is a challenging task to Nigerian academic institutions. The Federal Government of Nigeria has consistently allocated only 9% of its annual budget to education (Mordi, 2008). Recurrent expenditure consumes most part of the budget, leaving a meager sum for infrastructure that could boost ICT deployment. Between 1999 and 2007, the Government budgeted \$5.2 billion for education (The Punch, 2008). Out of the sum, \$3.5 billion was spent on wages and salaries, leaving a meager \$1.75 billion for infrastructural development. Considering the number of educational institutions in the country, this budgetary allocation is far too small for a period of 8 years. Though there has been an improvement on budgetary allocation to education in recent times (with \$2 billion allocated to education in 2013), the amount allocated is not enough for massive ICT infrastructural development required in institutions of higher learning and their libraries. Fortunately, this challenge is not insurmountable. Libraries only need to improvise and generate funds from both internal and external sources.

Libraries may source for funds from nongovernmental agencies that are sympathetic with laudable educational and research causes. The parent institutions of libraries can also approach international agencies for help. Academic libraries may institute and collect ICT levies from graduating students (at the point of submitting their theses) in order to augment their budgetary allocations. They may also make appeals to their institutions' alumni. Heads of these libraries also need to embark on library advocacy especially to the management of their institutions and philanthropic organizations.

Implementation of digitization and cloud computing projects should be done in phases. It should be a gradual process that would go from one level to the other. Academic libraries may also adopt an academic consortium cloud model. This would operate in the form of a consortium among interested academic libraries, thus harnessing resources and eliminating duplications. They could also take advantage of free open source software available on the internet.

#### DATA AND INFORMATION SECURITY BREACHES

There are growing concerns about vulnerability to security breaches in cloud computing (Britto, 2012). Perhaps, the most important of these security risks to libraries are data protection, limiting access to only authorized users and loss of governance as a result of connivance between persons within and outside the library.

However, data encryption, frequent and reliable data backups and recovery, the viability of the cloud vendor and appropriate laws regarding storage and access to data may prove viable solutions in the long term.

#### COPYRIGHT AND OWNERSHIP ISSUES

Intellectual property right, privacy and data integrity also pose challenges to digitization and cloud computing. Copyright can be defined as the 'exclusive right given by law for a certain term of years to the creator of a literary work, composer or artist with regard to the use, reproduction, and exploitation of his created works for economic or moral purposes' (Nkiko, in press). In uploading students' theses into an online repository, there are ownership conflicts between the students who made researches and wrote the documents and their institutions. Most institutions assume ownership of the theses as soon as the

students submit them, and therefore demand that they be recognized in citations as owners of the literary works. On the other hand, students insist that they be recognized as the copyright owners of their theses and be cited as such. Sometimes, copyright issues could be complicated when students publish parts of their theses as articles in journals. Some of the journals in which parts of the theses were published may have acquired the copyrights of the materials from their authors. These contentions are brought about by the fact that documents which are uploaded into repositories become more visible and available in public domain.

This is however being resolved, as citations from documents found in institutional repositories acknowledge both the students and their institutions. But resolving copyright issues with journals (especially subscribed journals whose articles are not available for free on open access) remains a challenge.

#### CONCLUSION

Preservation of information resources has always been and will continue to be a source of concern to libraries in Nigeria, except a lasting solution is found. The discourse presented in this paper shows that a paradigm shift to digitization of preservation methods is underway in academic libraries in Nigeria. The adoption of the digitization and cloud computing preservation model appears to be the only way forward especially for vital information resources like students' theses. Though the adoption of this model will require huge amounts of money, the benefits far outweigh the cost. Globally, there is a paradigm shift from traditional library practices to innovative and more pragmatic practices powered by information and communication technology. Academic libraries in Nigeria must begin to align with this trend if they must remain relevant in the 21st century and beyond. Digital preservation of theses will help libraries solve their preservation challenges as well as provide effective and efficient access to vital information for research, industrial and economic development of the nation.

In order to facilitate the application of ICTs in libraries in particular and other sectors of the Nigerian economy in general, there is need for the Nigerian Government to evolve a policy framework that is consistent with making ICTs the nucleus of its long term national planning. Essentially also, the power grid and telecommunication infrastructure must be upgraded (Ogege, 2010). It is only when this is done, that libraries and other institutions in the country can take full advantage of the use of ICTs to meet their organizational objectives and contribute to national development.

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