DIGITAL SKILLS AND TECHNOLOGIES FOR DIGITAL PRESERVATION AND WEB ARCHIVING AMONG LIBRARIANS IN NIGERIAN UNIVERSITY LIBRARIES

BY

NNENDA W. TOM-GEORGE (PHD) and VINCENT C. OPARA

Abstract

This study explored the digital skills and technologies for digital preservation and web archiving among Librarians in Nigerian university libraries. Descriptive research survey was adopted. The respondents were librarians in university libraries in Nigeria. The librarians were selected using simple random sampling technique. Online questionnaire was used to gather the respondents. 235 responses were valid for analysis. The data was analysed using mean scores and simple percentages. The result shows that librarians in Nigeria skills for digital preservation are inadequate, libraries in Nigeria less frequently digitize its collections; university libraries acquire digital materials through born digital collection and consortium/resources sharing. The technologies and techniques used for digital preservation and web archiving are integrated library management system, institutional repositories, CD/disks and data migration. The challenges affecting digital preservation includes poor funding, lack and inadequate facilities, limited training opportunities, copy right issues and lack of digital preservation policy. It was recommended that libraries should undergo digitization of library their collection, librarians should be trained to enhance their digital skills through professional development programs. Ultimately, this research underscores the need for a strategic approach to digital preservation and web archiving that involves both technological and human capacity building in Nigerian university libraries, ensuring that valuable digital assets are preserved for future generations of scholars and researchers.

Keywords: digital skills, digital preservation, web archiving, technologies, university libraries.

Introduction

The main function of a university library is to provide access to relevant and up-to-date information resources which are crucial to research, teaching and learning. University libraries are libraries designed to acquire, process and provide recorded knowledge (published or unpublished), print and non-print materials relevant to prescribed academic discipline of tertiary educational institutions. In university institutions, the library is very necessary because it plays an indispensable role in the dissemination of information and knowledge. Ifijeh (2021) agreed with this view by stressing that the university library exists in an academic context and its role is subsumed in developing a highly visible collection that is well organized and serves as academic support for teaching, learning and research by faculty and students. Indeed, the university library is a centre for research, a ground for intellectual activities and a home for distinguished academics. This is because the main purpose of a university library is to support the objectives of that university in the areas of learning, teaching, research and service.

The main objectives of university libraries include the provision of information resources in support of learning process, promotion and dissemination of knowledge, encouraging and developing research, ensuring that users are satisfied while protecting and preserving information resources in whatever form. Preservation and conservation have always been a core objective of university institutions, this is as a result of the fact that the university library of any institution serves as the repository and knowledge house of the university. The extent of information and knowledge base of any university can be attributed to their university library and so the need of university libraries to engage in active preservation, especially in this digital age.

The continuous deterioration, damage, theft of library materials caused by various factors including light, humidity, heat, climate change, pollutants, termites, cockroaches, silverfish and firebrats, humans mal-handling, also natural hazards like floods, fire or earthquakes is increasingly becoming a serious threat in quest to keep up library's role as a repository of adequate, save and vast availability of information resources. As a way of curbing this menace libraries have applied several preservation measures the most common being fumigation,

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application of insecticides, mass decalcification, lamination, cold storage, temperature and humidity control. The IFLA Principles for the Care and Handling of Library Materials (as cited in Sambo, Urhefe & Ejitagha (2017)) define preservation as practices applied to reduce deterioration and prolong the life span of a material either by directly intervening in its physical or chemical make-up. These preservation measures reduced damage and deterioration of library materials, so to some extent the goal was achieved. However, the majority of library resources, such as books and journals, are composed of paper, which degrades quickly due to the usage of chemicals and other materials during production. For instance, papers are typically composed of cellulose fiber, which is not in its natural state. The cellulose fiber's quality determines the paper's quality. This presents just a natural threat to effective preservation of library materials. However, in the modern times various methods have been adopted to minimize damage, deterioration and mal-handling of library materials as well as provide efficient and effective services delivery in the 21st century. Due to its backdrop, academic libraries have adopted a more aggressive and saver approach by the acquisition of Electronic Information Resources (EIRs) and or digitization of library materials. The United Nations Educational, Scientific and Cultural Organisation (UNESCO) (as cited in 2019:1), defined digital materials as

"resources of human knowledge or expression, whether cultural, educational, scientific and administrative or embracing technical, legal, medical and other kinds of information that are increasingly created digitally, or converted into digital form from existing analogue resources. These digital materials include texts, databases, still and moving images, audio, graphics, software and web pages among a wide and growing range of formats"

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Digital preservation requires the conversion of library materials into EIRs or acquiring born digital contents. The conversion could be created by scanning for example books, journals, newspapers, projects, theses and dissertations while born digital contents such as ebook and ejournals could be acquired or bought. Kavishe and Dulle (2016) recommended the "need to perform digital preservation strategies and have skilled librarians in terms of managing EIRs in libraries and other collection centers that preserve EIRs". Regrettably, despite the proliferation of information technologies in many libraries and information centers, preserving Electronic Information Resources (EIRs) for continuous access by users is a main issue for many libraries all over the world (Usman and Gopakumar, 2018). Preservation of EIRs according to Karvishe and Dulle (2016) is a challenging exercise that needs appropriate digital preservation strategies. As a result, librarians involved in preserving EIRs should be Information Technology (IT) literate and there should be IT trainings whenever a change in technology occurs. Altobellis (2012) identified the use of interfaces, storage devices, metadata basics, collaboration, reformatting strategies and equipment as well as workflow management software packages as the training required for digital preservation and web archiving. It is therefore, expected that university libraries regularly organize trainings to equip librarians with digital skills such as scanning, creation of digital contents, how to born digital contents and burning files to disks, uploading documents to the cloud, retrieving documents from the cloud, data security, data management, the use of digital preservation technologies such as institutional repositories, Integrated Library Management Systems (ILMS), Databases, cloud technology. This is important for academic libraries to maintain its claim as the heart of its parent institution.

The use of digital preservation and web archiving are the key innovations in embraced by university libraries. The exploitation of these skills requires ICT skill. ICT skills according to

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Igwela and Nsirim (2018) are those "technology and or computer skills and knowledge required by librarians to be able to fully exploit information services in the wake of new technology". ICT skills for preservation as identified above seem to be inadequate among librarians despite its role in the preservation of digital information resources. Note (2018) confirmed that "the archival field lacks people with the expertise needed to extend the digital preservation agenda. Formal training opportunities for digital preservation are still rare and new archivists may be uncertain as to where to acquire specific skills, seasoned archivists need to broaden their knowledge or expand their roles professionally". It therefore culminated the need to investigate librarian's digital skills for digital preservation and web archiving in academic libraries in Nigeria.

Research questions

- 1. To what extent do librarians possess digital skills for digital preservation in university libraries in Nigeria?
- 2. How frequently do university libraries in Nigeria digitize library collections?
- 3. How do university libraries acquire digital contents?
- 4. What are the technologies used by university libraries for digital preservation and web archiving?
- 5. What are the challenges affecting the digital preservation and web archiving among librarians in Nigerian university libraries?

Review of Related Literature

Technology Acceptance Model (TAM)

Acceptance and use of technology is the readiness of an individual, group, organization or institution to adopt, implement and use technology. TAM was developed by Davis in 986 Tom-George, N.W.; Opara, V.C. © 2025. IJIRM. All rights reserved (https://www.ijirm.com.ng)

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based on the theory of reasoned Action. It suggests that the acceptability of an information system is determined by two main factors which are: Perceived usefulness and perceived ease of use. Perceived usefulness is found to be 50% more influential than perceived ease of use. This is because perceived usefulness is an indicator for the extent of job performance improvement perceived by a person who applies the new system. Instead, perceived ease of use measures the degree to which a person assumes that using the new information system will be free of effort (Al-Mamary, Shamsuddin & Hamid, 2015). Library and information science profession has had a drastic change due to the development of ICT. ICT has been a useful tool in the preservation of library materials. But adopting EIR and the use of ICT to preserve library materials seems to be on the low side. This could be due to the factors identified by the TAM model; perceived usefulness and perceived ease of use. Several studies have shown the reason responsible for the low usage of technology.

Adeoye and Olarenwaju (2019) stated that there are many factors responsible for undergraduates use of electronic information some of them include, the flexible nature of electronic resources in-term of multiple access points, search ease and retrieving information from various mobile electronic devices as compare to print resources. Ammarukleart (2017) applied the theory in his study on the factors affecting faculty acceptance and use of institutional repositories in Thailand and confirms that performance expectancy, social influence, and resistance to change were direct determinants of faculty members' intention to use institutional repositories. Scherer, Siddiq & Tondeur (2019) showed that TAM models remain a good choice for explaining teachers' adoption of digital technology in education. Given the above prove TAM has been found as a determinant of the use of technologies. The study which surveyed digital skills and technologies for digital preservation and web archiving adopted the TAM model due to its link with the use of technology.

Digital Preservation Strategies

The processes intended to acquire, index, give access and preserve digital resources covers two distinct kinds of digital material; documents digitized from physical media (books, engravings, maps, etc.) and born-digital material bought or collected under its legal deposit mandate (Derrot, Jean-Philippe, Oury & Reecht, 2014). Strategically, Sambo, Urhefe & Ejitagha (2017) asserted that to preserve digital documents from being lost, regular migration of the bits onto new media to guard against technological obsolescence was necessary. It was suggested that data on magnetic tape needed to be copied once a year to guarantee that none of the information was lost. The term 'data migration' according to them is now preferred to 'data refreshing'. Empirically, Kari and Baro (2016) investigated the digital preservation practices in institutional repositories (IRs) in Nigeria. The population comprised 141 approved universities in Nigeria. Interviews, questionnaire and investigation from websites were used to gather data. It was found that only 15 university libraries were found to have developed institutional repositories in Nigeria out of which 12 responses were recorded. Furthermore, half of the IRs engaged in information migration. Different libraries may adopt different practices in preserving digital material depending on the available fund of policy put in place.

Altobellis (2012) in his study "essential skills for digital preservation addressing the training needs of staff in small heritage institutions" found that user interfaces and access tools (58%), workflows and management (55%), metadata basics (54%), reformatting strategies and equipment (51%) were the skills possessed by staff for digital preservation. Kavishe and Dulle (2016) investigated the preservation skills and strategies being used by the University of

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KwaZulu-Natal libraries in preserving electronic information resources (EIRs) for long term availability and access. The results showed that the respondents had intermediated level of ICT knowledge and skills regarding preservation of EIRs. It also showed that the respondents needed trainings in migration, metadata and emulation techniques. In addition, skills such as data migration, data curation and recovery, metadata entry, scanning and uploading are necessary for digital preservation.

Technologies and digital preservation

Several digital technologies can be used as tools for digital preservation. Pal (2012) in his study on "digital preservation methods and technology in digital era" established that:

"The uses of digital technology include analog- to- digital conversion for sound and video recordings, images-to digital conversion for documents, books photos etc. and text – to digital conversion for documents and books using OCR/ICR optical. The wide range of technology and tools are available to create digital information for text and multimedia staff such as web publishing using HTML, XML, JAVA, PERL etc. Floppies and CDS are the examples of new digitization technology. It has become possible to store electronic new images of the documents on magnetic tape, floppy or CD which can be read on computer screen whenever wanted. Email and Internet have proved to be beneficial for libraries since they have given a new dimension to their reprographic services no doubt but seen from a different angle these developments are beneficial for preservation programmers also. While digitizing documents certain things need to be kept in mind like the basic materials needed for digitizing, the software requirements, and standards to be followed".

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Similarly, Adamou and Ntoka (2017) opined that for an effective scanning of library materials, apart from hardware equipment, an appropriate software package must be accompanied. They identified Greenston, OpenDLib, Fedora and DSpace as software packages used for preservation. Furthermore, after scanning, the material become digital and can be stored in different digital formats such as JPEG and PDF on the hard disk of the computer. It was also discovered as recommended by Panteion University Librarians that "a server is a safer means of preservation whereas CDs are more sensitive means of preserving material as there is a danger of physical destruction and lack of compatibility."

Web archiving

Web archiving is the process of appraising, selecting, organizing and storing of data that has been recorded on the World Wide Web, amassing it, ensuring the data is preserved in an archive, and making the collected data available for future research (Niu, 2012). Preserving web resources involve a number of steps that must be followed to ensure proper recording of web pages. This process starts with the following;

1. **Appraisal**: this refers to the process of evaluating the value of records, and deciding whether and how long records should be preserved. It is essentially a process of selection. It is essentially a process of selection. All web archives select web resources to preserve based on one or more criteria. Existing web archiving efforts use the following selection criteria to determine what to preserve: domain (such as .gov or .edu), topic or event, media type and genre. Many European countries archive the web in their country domain. Media-type based selection includes or excludes certain media types. The Goddard library, for example, avoids crawling large video 2 files and software products (Senserini et al., 2004). Selection based on topic or event, however, needs human judgment. Manual selection by information professionals is time-consuming and

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expensive, and therefore only used in small-scale web archives. To reduce the cost of manual selection, some web archives accept user recommended URLs, use existing registries of URLs or involve subject specialists in helping select web resources to archive.

2. Selection: Depending on the scale of the web archive, the relationship between the web archive and the website owners, and the nature of the archived web content, different acquisition methods may be used to obtain web content. Libraries and archives have a long tradition of accepting transfers from government agencies, donors and legal deposits from publishers. This method still applies to web archiving. An acquisition method unique to web archiving is crawling. This method relies on crawlers to harvest content from web servers. Crawlers use a seed list to start downloading web content, and follow the hyperlinks to discover and download additional web content (Lasfargues et al., 2008).

3. Organization and storage: Web archives need to preserve the authenticity and integrity of archived web content. The requirements for authenticity and integrity vary with the purpose of the collection. For web resources, the concept of original order can be combined with the concept of structure defined in traditional archives management theory. The original order is essentially the external structure of the archived web object. The structure defined in traditional archives management theory is essentially the internal structure of the archived web object. The structure defined in traditional archives management theory is essentially the internal structure of the archived web object (Niu, 2012). For example, for an archived website, its external structure shows how this website is arranged in relation to other websites, which can also be regarded as the original order of the website. Incoming links that come from outside of the website and outgoing links from this website to other websites are part of this external structure and thus the original order of this website.

4. Description and Metadata: The metadata generation approach and the richness of metadata generated vary depending on the scale of the web archive and the resources available at the archiving organization. Very large web archives often rely on automatic metadata generation. Some metadata information, such as the timestamp generated when the web resource was harvested, the status code (e.g., 404 for not found or 303 for redirection), the size in bytes, the URI, or the MIME type (e.g., text/html), can be created or captured by crawlers. Metadata information can also be extracted from the meta tags of HTML pages, although some meta tags are not accurate due to Search Engine Optimization. The Greek Web Archive project automatically extracts keywords from web pages and anchor text, and then uses the keywords to classify web pages into clusters (Lampos et al., 2004).

Research Methodology

The study adopted a descriptive survey design. The population comprised all the librarians in academic libraries in Nigeria. The study intended to sample all librarians in university libraries therefore, simple random sampling technique was used to gather the respondents. Due to the online survey used which only gave opportunity to those with IT complaints, only 232 responses were received. The online questionnaire was a Google form distributed to the Nigerian Library Association groups, online forum and several other associations' forum of librarians across the country. The questionnaire was a four point likert scale of Strongly Agree (SA=4), Agree (A=3), Disagree (D=2) and Strongly Disagree (SD=1). The data collected was analysed using mean scores and simple percentages. The decision on the analysis of the mean scores was that items with 2.5 above was accepted and below rejected while items with 50% above were accepted and below rejected.

Findings of the Study

Research question one: To what extent do librarians possess digital skills for digital preservation in university libraries in Nigeria?

Please indicate the extent to which you can perform the following?	Mean	Decision
Digital Scanning	1.9	Reject
Uploading	2.8	Accept
Digital curation and recovery	2.1	Reject
Data backup	2.8	Accept
Migration	1.6	Reject
Microfilming	1.5	Reject
metadata entry	2.7	Accept
Programming	1.6	Reject
Grand Mean	2.0	Reject

Table 1: digital skills possessed by librarians for digital preservation? (n=232)

Table one shows the mean scores of skills possessed by librarians for digital preservation. It shows that apart from uploading (2.8) and metadata entry (2.7), data backup (2.8) with mean scores above the reference mean of 2.5 indicating the possession of digital preservation skills, other items like digital curation and discovery (2.1), migration (1.6), microfilming (1.5) were possessed below average. The grand mean of 2.0 shows overall lack of digital preservation skills by librarians.

This research question shows that apart from uploading and metadata entry with mean scores above the reference mean of 2.5 indicating the possession of digital preservation skills, other items like digital curation and discovery data backup migration, microfilming, were possessed below average. The grand mean of 2.0 shows overall lack of digital preservation skills by librarians. This should not be neglected by library management as digitization process requires skilled librarians. This is in agreement with Usman, and Gopakumar (2018) and Zhang Tom-George, N.W.; Opara, V.C.

and Gourley (2009) who recommended that when selecting materials for digitization, the library should consider whether it has the staff and skill sets to support the digitization, metadata entry, user interface design, programming and search engine configuration that is required for the project to implement the desired functionality.

Research question two: How frequent do university libraries digitize library printed materials?



Fig. 2: The extent university libraries digitize library materials.

Fig. 2 shows that books (61%), journals (61%), projects, thesis & dissertation (59%) were rarely digitized. On the other hand, lecture note (67%), official gazette (64%) and past question papers were never digitized.

The research question two show that books, journals, projects, thesis & dissertation were rarely digitized. On the other hand, lecture note, official gazette and past question papers were never digitized. This could be because some of the academic libraries were not automated and or lack the resources to digitize their collection. This result align with the research of Igwela and

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Opara (2020) on availability and use of electronic information resources by postgraduate students in Rivers State University library while it is not in agreement with Derrot, Jean-Philippe, Oury & Reecht, (2014) that library collections including pictorial material, maps, printed music, manuscripts, books and serials were digitized.



Research question three: How do university libraries acquire digital material?

Fig. 3: acquisition of digital material in university libraries in Nigeria

Fig. 3 shows that most of library digital collections were acquired through born digital (57%) and consortium/resources sharing (50%). On the other hand, 57% said it was not applicable to digitize library collections.

Research question three shows that most of library digital collections were mostly acquired through born digital consortium/resources sharing as against converting collections into digital contents. It is not in agreement with National Diet Library (NDL) that has been

converting the content of materials into digital contents to achieve compatibility of use and preservation.



Fig 4: Technologies/techniques in Use in university libraries for digital preservation

The study shows that the technologies and techniques used for digital preservation are integrated library management system (59%), institutional repositories (58%), CD/disks (56%) and data migration (52%).

In research question four, respondent's answers shows that the technologies and techniques used for digital preservation are integrated library management system, institutional repositories, CD/disks and data migration. The study corroborates with that of Adamou and Ntoka (2017) that Greenston, OpenDLib, Fedora and DSpace as software packages used for preservation. Furthermore, after scanning, the material become digital and can be stored in different digital formats such as JPEG and PDF on the hard disk of the computer

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Research question 5: what are the challenges affecting digital preservation and web archiving

among librarians in Nigerian university libraries?

Table 5:	Challenges	affecting	digital	preservatio	n and	web	archiving	in academic	libraries
in Nigeria	a								

What are the challenges facing your library in	SA	А	D	SD	Mean
practicing digital preservation					
Lack of digital preservation policy	81	91	41	19	3.0
poor funding	93	95	30	14	3.2
Inadequate skills	88	94	30	20	3.1
Copy right issues	89	91	35	17	3.1
inadequate facilities	96	92	29	15	3.2
Grand Mean					3.1

Table 5 shows that poor funding (3.2), inadequate facilities (3.2), inadequate skills (3.1), copy right issues (3.1) and Lack of digital preservation policy (3.0) are above the reference mean of 2.5 indicating the challenges facing digital preservation in university libraries in Nigeria. Research question five shows that poor funding, lack or in most cases inadequate facilities, inadequate skills, copy right issues and lack of digital preservation policy are above the reference mean of 2.5 indicating the challenges facing digital preservation policy are above the reference mean of 2.5 indicating the challenges facing digital preservation in academic libraries in Nigeria. The study is in line with that of Sambo, Urhefe & Ejitagha (2017) on a survey of digital preservation challenges in Nigerian libraries: librarians' perspectives and found that hardware and software obsolesces, poor training, ineffective of backup and standards systems, lack of strategic policy, lack of funds, lukewarm attitude among the librarians and lack of legal right to preservation of content as the challenges facing the digital preservation.

Conclusion

Digital preservation and web archiving in libraries has come to stay. It therefore requires that libraries, librarians, especially in academic libraries where there is high rate of dynamism, equip themselves to be able to blend with the modern set up of archiving and preservative technique and practices of information resources. How be it, this study investigated the digital skills and technology for digital preservation and web arching in university libraries in Nigeria. The result shows that librarians in Nigeria digital skills for digital preservation and web arching are inadequate so, they rarely digitize their collections. The technologies and techniques used for digital preservation are integrated library management system, institutional repositories, CD/disks and data migration. The challenges affecting digital preservation includes poor funding, lack or inadequate facilities, inadequate skills, copy right issues and lack digital preservation policy.

Furthermore, this study is able to conclude that digital skills, digital preservation and web archiving are very important for sustainable procurement of information resources and for improved library service delivery in this age of ICT.

Recommendations

The study recommended that:

- 1. University libraries should be automated to ensure easy upload or transfer of digital resources from one device to another.
- 2. University libraries should digitize their library collection for easy digital preservation and web archiving.
- 3. Librarians should be trained on digital preservation and web archiving.

- 4. Digital preservation policies should be formulated to promote digital preservation in university libraries.
- 5. Libraries management should provide the equipments and atmosphere required to promote digital preservation and web archiving practices.

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