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# Digital Preservation Strategies for Information Resources in Academic Libraries: (A Study of Southern Delta University, Ozoro)

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**Abstract**
*This study discusses the methods of technological digital preservation and the various techniques used in preserving both traditional and digitized documents using modern technologies, with particular reference to Delta State University Library. Libraries serve as repositories of documentary resources such as records, manuscripts, books, films, journals, and other information materials that require adequate preservation to ensure their continuous availability for present and future generations. The study adopted a descriptive research approach through the review of relevant literature and existing practices in digital preservation. Findings revealed that libraries increasingly rely on strategies such as migration, refreshing, digitization, emulation, cloud storage, and microfilming to preserve both physical and digital collections. The study further revealed that preservation and archiving of digital contents have become major concerns for libraries due to technological obsolescence, media deterioration, and the growing dependence on electronic information resources acquired through subscriptions, purchased digital media, and in-house digitization projects. The study concludes that effective digital preservation strategies are essential for maintaining long-term accessibility, authenticity, and usability of information resources. It recommends that libraries should adopt sustainable preservation policies, provide adequate funding, and continuously upgrade technological infrastructures to ensure reliable preservation of documentary heritage.*

**Keywords:** Digital Preservation, Information Resources, Academic Libraries, Technological Methods, Digitization, Conservation, Archiving, Library Preservation Strategies.

## Introduction

Libraries are indispensable institutions in the educational system because they serve as centers for knowledge acquisition, preservation, organization, and dissemination. A well-equipped library is essential for supporting teaching, learning, research, and community development. Academic libraries in particular provide access to both print and non-print information resources required by students, lecturers, researchers, and other members of the academic community. According to recent studies, modern libraries have evolved beyond the traditional

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role of storing books to becoming hybrid information centers that integrate digital technologies for effective information management and service delivery (Aina, 2020; Ezeani & Igwesi, 2021).

Academic libraries perform several important functions, including acquisition, cataloguing, classification, storage, preservation, conservation, and dissemination of information resources. These resources include books, journals, manuscripts, archival records, films, photographs, electronic databases, institutional repositories, and other scholarly materials. The preservation of these resources is very important because information materials are vulnerable to deterioration caused by environmental conditions, poor handling, technological obsolescence, pests, fire outbreaks, humidity, and inadequate storage facilities. Consequently, libraries must adopt both traditional and modern technological methods to ensure the long-term accessibility and usability of information resources.

The emergence of Information and Communication Technology (ICT) has significantly transformed library operations, particularly in the area of digital preservation. Digital preservation involves the use of technological tools and strategies to maintain and ensure continued access to digital information resources over time. Recent developments in cloud computing, digitization, data migration, emulation, artificial intelligence, and electronic archiving systems have improved the capacity of libraries to preserve valuable information resources in digital formats (Olatokun & Ayanbode, 2019; Yusuf & Salisu, 2022). These technological preservation methods have become increasingly important due to the rapid growth of electronic resources and the risk of losing valuable digital content through technological failures or format obsolescence.

Despite the increasing adoption of digital technologies in libraries, many academic libraries in Nigeria still face serious challenges in preserving their information resources effectively. Problems such as inadequate funding, unstable electricity supply, insufficient technological infrastructure, lack of skilled personnel, poor maintenance culture, and absence of comprehensive preservation policies continue to hinder effective preservation practices. In Delta State University Library, there is growing concern regarding the sustainability and preservation of both traditional and digital information resources as the demand for electronic access to information continues to increase.

Although several studies have examined library preservation practices generally, there remains a gap in literature regarding the application of modern technological methods for preserving information resources in academic libraries within developing countries, especially in the context of Delta State University, Ozoro. Most previous studies focused primarily on traditional preservation techniques with limited attention to recent digital preservation technologies and their practical implementation in Nigerian academic libraries. This study therefore seeks to examine the technological methods used in the preservation of

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information resources in academic libraries, with emphasis on the preservation strategies adopted by Delta State University Library, Ozoro.

The main objective of this study is to examine the technological methods used for preserving information resources in academic libraries. Specifically, the study seeks to:

1. identify the various technological methods used in preserving information resources;
2. examine the challenges associated with digital preservation in academic libraries;
3. determine the effectiveness of technological preservation strategies in ensuring long-term access to information resources; and
4. suggest possible measures for improving preservation practices in academic libraries.

The study is significant because it will contribute to existing knowledge on digital preservation and information resource management in academic libraries. It will also provide useful recommendations to librarians, researchers, educational administrators, and policy makers on effective strategies for preserving valuable information resources in the digital age.

The primary aim of library is to provide and preserve the information for users. Chukwuma (2004), use of library states that "library is a place where professionally selected and acquired books and non-book materials are processed and orderly arranged to make for easy location, retrieval and use". Eyisi (2011), foundation of library states that "library is a collection of sources, services and the structure in which it is housed which is organized for use and maintained by a public body, an institution or a private individual". There is need therefore, for any library to acquire information materials that would satisfy the need of us users and also preserve these information materials for posterity. This study will therefore, focus on preservation of library materials in SDU library.

Preservation is used to refer to all necessary strategies, measures and steps invested into prolonging the lives of library material. As supported by Lasisi (2019), preservation is used to denote all those activities and measures intended at conserving library materials for posterity. Murray (2015) explained that preservation is an indirect method of treatment in which the environment around an item is changed. This includes stabilizing, maintaining and monitoring temperature, humidity, light exposure, air pollution, dirt, dust and mold. preservation also includes surveying the proper storage and handling techniques, security, including theft, vandalism, disaster prevention, education, training and outreach programs for staff, patrons, clients, and the public, while conservation is a direct method of treatment in which an item is physically or chemically changed. This includes cleaning, repairing, rebinding and reformatting. All conservation treatments entail the least intrusive methods possible and use of acid-neutral materials.

According to New Encyclopaedia Britannica, preservation is defined as "planned management of natural resources or the total environment of a particular ecosystem to prevent exploitation, destruction or neglect and to ensure the future of that resources".

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Boochaarden (2020), simply defined preservation as "action taken, anticipated, prevent, stop or retard deterioration". Preservation of library material in the public libraries is the act of keeping both books and non-book materials safe from the destructive effects of sunlight, human handling, animals and other insidious enemies of library material such as book-worms and moulds. at a higher level, preservation connotes far more than keeping a material in its original form or being familiar with all reformatting technologies available. It also means accessibility; when a user needs it, he gets it. Hence, the whole process of security, shelving, shelf-reading and circulation are actually preservation techniques. Preservation from abuses like mutilation, defacing and or stealing of materials are preservation tenets. These are done to ensure longevity of the lifespan of library materials. According to Hornby (2018), preservation implies the state of being or remaining in a stated condition after a longtime while conservation refers to the controlled use of a limited supply of materials to prevent waste or loss so as to facilitate its use in the future. According to Digital Preservation Coalition (DPC 2020) the term 'preservation' is an umbrella word or concept under which most librarians and archivists cluster all the policies and options for the managing, including conservation treatments of different formats of information material. Digital material preservation therefore is a way of preserving information materials, which refers to digital surrogates created as a result of converting analog materials to digital form (digitization), as well as those that are "born digital" for which there has never been, and is never intended to be analog equivalent, and digital records.

The deterioration of information materials is not a recent phenomenon. Research predicts that all paper base records may face imminent ruin if nothing is done to preserve them. Williams (2016) noted that was everything in the library collection is deteriorating today was deteriorating yesterday and will continue to deteriorate tomorrow although we ought to retard the process". According to Akwabro (2019) "the issue of preserving library materials stared as far back as 668-626 BC in Assyria Egypt and China where knowledge was recorded in papyrills and palm leaves which were mostly used in Egypt then were special rooms and some people were employed to take proper care of them, chains were usually used to hold the table by typing them to the reading tablets.

A preservation programme provides a complete protection services beginning with systematic cleaning of the collection at suitable interval. However, the entire collection will have to pass through repair, rebuilding, replacement, microfilm or new stabilization process. To ensure that library materials remain available to be presented to future generation of library users. Librarians should engage in a variety of preservation efforts such as conserving the original material and the transfer of information from original materials to more durable formats. This can be achieved by appointing a conservator who will be expert in weather preservation, insect control, mold and foxing as well as binding and lamination, such a person must be expert in photograph reproduction; he guard against all chemical unstabilized articles

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especially the atmospheric condition and protects the books against excessive exposure to sunlight. He must know the problems of housing manuscript, maps and sheet music.

Library materials are in wide variety of sizes, shapes and formats which often present problems in relation to library storage and access procedures. Some of the materials like television sets, cassettes, cartridges, film recording, computers etc can prove heavy and cumbersome for handling, while others like slides, filmstrips and multi-media kits can prove very difficult to organize, shelve and control. Media records quite often have standards laid down that are associated with storage and control. Enright (2021) stated that playing a videotape removes minute layers of the original, and a librarian concerned with media records has to be aware of the point at which the technical condition of an item will militate against its effective use. It is necessary to mention that many media materials are more vulnerable to careless treatment and abuses than books. The annoyance and frustration caused to users and audience by providing damaged or defective materials can dent the reputation of a library and deflect a user's confidence in its services. And, this can be very monumental indeed. Materials in the library face a lot of problems in the course of their preservation. Unfortunately, even when the custodians of these materials become aware of these of these problems, they may be handicapped by the relative unavailability of expert advice on which procedures to follow in conserving these materials.

Materials are the heart of libraries. They are vital access to learning and information, and in the future sustain knowledge and allow interpretation of the past. Every library, large or small should have a well-defined programme for preserving the materials which it houses. In planning for preventive preservation, users and staff should be aware of their roles in the preservation programme. Libraries should not only strive to acquire materials but should ensure that the materials acquired are preserved and conserved in a usable condition for generations of users. Libraries should be air-conditioned as its importance to library materials cannot be over-emphasized. Though damage to library materials are sometimes unavoidable, but with careful preventive measures, deterioration of the materials may be lessened or prevented as the old adage says "prevention is better than cure". The main purpose of technological methods of preservation is to ensure protection of information of enduring value for access by present and future generations. Digital technology is revolutionizing the traditional concepts of preservation, access and archival of information.

## LITERATURE REVIEW

### Concept of Preservation

Preservation is a fundamental aspect of library and information science that focuses on protecting information resources from deterioration, damage, and loss in order to ensure their continuous accessibility and usability for present and future generations. Preservation involves all activities directed toward maintaining the physical and intellectual integrity of information materials, including conservation, restoration, storage, environmental control,

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digitization, and technological management of information resources. According to Popoola (2003), preservation encompasses all managerial, financial, and technical measures undertaken to prolong the lifespan of library and archival materials.

Over the years, scholars have viewed preservation from different perspectives. Earlier studies concentrated mainly on the physical conservation of print materials such as books, manuscripts, journals, and archival records. However, recent developments in Information and Communication Technology (ICT) have expanded the concept of preservation to include digital resources and electronic information systems. Contemporary scholars such as Aina (2020) and Yusuf and Salisu (2022) argue that preservation in modern libraries now extends beyond physical conservation to the maintenance of digital contents, databases, institutional repositories, and electronic records through technological means.

The increasing dependence on electronic information resources has made digital preservation a major concern for academic libraries globally. While traditional preservation methods focus on repairing and conserving physical materials, digital preservation emphasizes maintaining the accessibility, authenticity, integrity, and usability of electronic information over time. Studies conducted in Nigerian academic libraries reveal that many institutions face serious challenges in preserving both print and digital resources due to inadequate funding, poor technological infrastructure, unstable electricity supply, insufficient skilled manpower, and the absence of comprehensive preservation policies (Olatokun & Ayanbode, 2019; Ezeani & Igwesi, 2021).

Although preservation remains a global concern, the nature of preservation challenges differs between developed and developing countries. Teygeler et al. (2001) observed that preservation problems in developing countries are often more severe because of unfavorable environmental conditions, limited funding, and inadequate technological facilities. Recent African studies support this position by emphasizing that many libraries in sub-Saharan Africa continue to struggle with obsolete technologies, poor internet connectivity, and limited access to modern preservation tools (Mnjama, 2021). Consequently, academic libraries in Nigeria and other African countries must adopt sustainable technological preservation strategies capable of addressing local preservation challenges.

**Technological Preservation**

Technological preservation refers to the use of digital technologies and technological environments to preserve information resources for long-term access and usability. It involves maintaining the hardware, software, operating systems, storage devices, and digital platforms required to access electronic information resources. Technological preservation is sometimes described as the "computer museum" approach because it seeks to preserve both the digital content and the technological environment necessary for accessing such content.

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Several technological preservation strategies have been identified in literature. These include migration, emulation, refreshing, cloud storage, digitization, data replication, and backup systems. Migration involves transferring digital information from obsolete formats or systems to newer and more accessible formats. Emulation, on the other hand, involves recreating older software or hardware environments on modern computer systems to ensure continued accessibility of digital files. Refreshing refers to the periodic copying of digital information from aging storage media to newer storage devices in order to prevent data loss.

Recent studies indicate that digitization has become one of the most widely adopted technological preservation methods in academic libraries. Digitization involves converting physical information materials into digital formats for easier storage, retrieval, and preservation. According to Ezeani and Igwesi (2021), digitization enhances accessibility, reduces physical handling of fragile materials, and supports remote access to information resources. Similarly, cloud computing technologies now provide libraries with opportunities for secure backup, remote storage, and disaster recovery solutions.

Despite the benefits of technological preservation, scholars have identified several associated challenges. Feather (1996) earlier noted that the rapid growth of electronic information has created concerns regarding long-term accessibility and technological obsolescence. More recent researchers argue that technological preservation requires continuous financial investment, regular software upgrades, skilled personnel, and adequate infrastructure to remain effective (Yusuf & Salisu, 2022). This situation is particularly challenging for many Nigerian academic libraries where financial and technological limitations hinder the implementation of advanced digital preservation systems.

**Necessity for Preservation of Information Resources**

The preservation of information resources is necessary because library collections constitute valuable intellectual and cultural heritage that supports teaching, learning, research, and national development. Academic libraries preserve knowledge resources that provide evidence of historical events, scientific discoveries, cultural values, and scholarly achievements. According to Mnjama (2021), documentary heritage serves as the collective memory of society and enables present and future generations to understand the past and make informed decisions.

Scholars generally agree that preservation is essential because information resources are expensive to acquire, process, organize, and maintain. Popoola (2003) emphasized that preservation helps libraries maximize limited financial resources by extending the lifespan of valuable materials. Similarly, Cloonan (2001) stated that preservation ensures continuity between the past, present, and future by safeguarding documentary heritage against destruction and deterioration.

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In academic libraries, preservation is particularly important because library resources support educational and research activities. Without proper preservation measures, information materials may become inaccessible due to physical deterioration, technological obsolescence, environmental disasters, or poor handling. Studies in Nigerian university libraries reveal that high humidity, pests, poor storage facilities, and inadequate maintenance culture contribute significantly to the deterioration of information resources (Aina, 2020).

Another major justification for preservation is the increasing demand for electronic access to information resources. Modern library users expect uninterrupted access to digital databases, institutional repositories, e-books, journals, and multimedia resources. Consequently, libraries must implement effective technological preservation systems capable of ensuring continuous accessibility and data security. Recent studies further reveal that digital preservation enhances global accessibility, supports information sharing, saves physical storage space, and provides reliable backup mechanisms for valuable resources (Olatokun & Ayanbode, 2019).

**Technological Methods of Preservation of Library Information Resources**

Technological advancement has transformed the methods used for preserving library information resources. Traditional preservation techniques such as binding, fumigation, lamination, and microfilming are now complemented by modern digital preservation technologies. Academic libraries increasingly rely on automated systems, electronic databases, cloud technologies, and institutional repositories to preserve and disseminate information resources.

One important technological preservation method is digitization. Digitization converts printed or analog materials into electronic formats that can be stored and accessed digitally. This method is widely used for preserving rare books, manuscripts, photographs, theses, dissertations, and archival materials. Studies show that digitization reduces physical deterioration caused by frequent handling and enhances remote accessibility of information resources (Ezeani & Igwesi, 2021).

Another widely used method is migration, which involves transferring digital files from outdated storage media or software formats into newer formats compatible with current technologies. Migration helps prevent information loss caused by technological obsolescence. Refreshing is also important because digital storage media such as CDs, DVDs, flash drives, and hard disks deteriorate over time. Through refreshing, libraries periodically transfer data to newer storage devices to ensure data continuity.

Cloud storage has recently emerged as an effective preservation strategy in modern libraries. Cloud technologies provide secure online storage, remote accessibility, automatic backup, and disaster recovery opportunities. According to Yusuf and Salisu (2022), cloud-based

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preservation systems are increasingly being adopted by academic libraries because they provide flexible and cost-effective storage solutions.

Microfilming remains another important preservation method, especially for newspapers, government records, and archival documents. Although digital preservation methods are increasingly dominant, microfilming is still valued because of its long-term stability and reliability during technological failures.

However, despite these technological developments, many Nigerian academic libraries continue to experience difficulties in implementing effective preservation systems. Inadequate funding, poor electricity supply, lack of skilled ICT personnel, weak internet connectivity, and insufficient technological infrastructure remain major barriers to successful digital preservation initiatives. These challenges highlight the need for sustainable preservation policies, government support, staff training, and improved technological investment in Nigerian academic libraries, including Delta State University Library.

Digitisation as a tool for the preservation of information originally created in conventional formats, especially newspapers, has been canvassed widely in recent years (Feather, 1996). Conversion to a digital format gives the user a whole range of new search tools, since what is created is a file that is flexible and can be manipulated just like any other electronic data file. Digitization is an expensive option for preservation though legitimately viable.

**Challenges of Digital Material Preservation**

Challenges of preserving or archiving digital information are not new, and have been explored at many forums over the last five decades. Several scholars and institutions, respectively, such as Garret and Walter (1996), Lin, Ramah and Wal (2003), Caplan (2004), Wamukoga and Mutual (2005) and the national library of Australia (2003), have cited the following challenges to the preservation of digital materials:

- Technological obsolescence;
- Continous migration;
- Lack of legislation, policy and strategy
- Lack of awareness
- Lack of collaboration and partnership;
- Deterioration of the digital media
- Disaster planning and recovery

Each of these challenges faced in preserving digital materials are briefly discussed below:

**Technological Obsolescence**

Markets are full of a variety of digital formats that continually change from time to time with some formats getting obsolete (Caplan, 2004). Format obsolescence is complemented by rapid hardware and software obsolescence, which is a significant threat to digital preservation,

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as it causes the loss of the means of access (Wamukoya & Mutual, 2005). This comes as a result of the continuous upgrade of operating systems, programming languages, applications and storage media (Lin, Ramiah & Wal, 2003). Such loss of access makes preservation of digital materials meaningless since the main purpose of preserving digital materials is to maintain accessibility.

**Continuous Migration**

Another challenge of digital preservation, which arises from the challenge of rapid technological obsolescence, is the need for continuous migration. Migration is a means of overcoming technological obsolescence by transferring digital resources from one hardware/ software generation to the next. The purpose of migration is to preserve the intellectual content of digital objects and to retain the ability for clients to retrieve, display, and otherwise use them in the face of constantly changing technology (National Library of Australia, 2003).

**Lack of Legislation, Policy and Strategy:**

According to National library of Australia (2003), lack of supportive legislation is a major challenge of preservation of digital materials. Besides, since legislators are usually neither aware nor conversant with the requirements of digital preservation, they make legislations that either ignore or inadequately cover digital preservation issues (Wamukoya & Mutual, 2005), further, internet links bring additional challenge in terms of copyright legislation in that the copyright of software required to access digital files, and the right to copy for preservation has not been adequately articulated in most national legislations. For instance, the current practice is that due to copyright requirements, a subscriber to an internet-based information service requires to continuously renew the access licence, even for materials long paid for, in order to continue accessing the same information. An additional challenge is that digital evolution has been too rapid and costly for governments and institutions to develop timely and informed preservation strategies.

**Lack of Awareness about Digital Material Preservation:**

The UNESCO draft charter on the preservation of digital heritage stresses the need for urgent awareness raising and advocacy in favour of preservation of digital materials. It proposes for the alerting of policy makers and sensitizing the public to both the potential of the digital media and the practicalities of digital preservation.

**Lack of Collaboration and Partnership:**

Another major challenge of digital preservation is lack of collaboration and partnership among stakeholders, as well as "Lack of clearly assigned responsibilities and resources for the long term preservation" of digital materials (Wamukoya & Mutual, 2005). Such absence of collaboration and partnership exists among governments, creators, publishers, relevant industries and heritage institutions. There is also need for partnerships between archivists, information technology personnel, systems analysts, records managers and other information

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management staff to come up with holistic strategies on how to deal with digital preservation issues (Lin, Ramiah and Wal, 2003).

**Deterioration of the Digital Media**

One of the challenges of digital preservation is the deterioration of the digital media. This is becoming a cause for the disappearance or inaccessibility of digital information (Lin, Ramiah and Wal, 2003), as the media usually deteriorate within a few years or decades at most. Another challenge to digital preservation is the possibility of digital media getting lost in the event of disasters such as fire, flood, equipment failure, or virus attack.

**Disaster Planning and Recovery**

The other challenge relates to lack of disaster planning and mitigation strategies for digital materials at institutional, as well as national levels. The effect of the absence of disaster planning and mitigatory measures results in unnecessary and sometimes, permanent loss of valuable information resources.

**Strategies for Digital Materials Preservation**

Russell, (1999) has identified some of the strategies or methods that could be adopted to help preserve digital materials. These strategies are briefly presented below.

**Digital Archaeology**: This includes methods and procedures to rescue content from damaged media or from obsolete or damaged hardware and software environments. Digital archaeology is explicitly an emergency recovery strategy and usually involves specialized techniques to recover bitstreams from media that has been rendered unreadable, either due to physical damage or hardware failure such as head crashes or magnetic tape crinkling. Digital archaeology is generally carried out by for-profit data recovery companies that maintain a variety of storage hardware (including obsolete types) plus special facilities such as clean rooms for dismantling hard disk drives. Given enough money, readable bitstreams can be often be recovered even from heavily damaged media (especially magnetic media), but if the content is old enough, it may not be possible to make it renderable and/or understandable.

**Analog Backups**: This combines the conversion of digital objects into analog form with the use of durable analog media, e.g., HD Rosetta or the creation of silver halide microfilm from digital images. An analog copy of a digital object can, in some respects, preserve its content and protect it from obsolescence, while sacrificing any digital qualities, including sharability and lossless transferability. Text and monochromatic still images are the most amenable to this kind of transfer. Given the cost and limitations of analog backups, and their relevance to only certain classes of documents, the technique only makes sense for documents whose contents merit the highest level of redundancy and protection from loss.

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**Migration**: This is to copy data, or convert data, from one technology to another, whether hardware or software, preserving the essential characteristics of the data. This simple definition, by Peter Graham, captures the essence of migration, as well as its ambiguity. To some, migration is used interchangeably with refreshing, but as stated by the authors of Preserving Digital Information

Migration is a broader and richer concept than "refreshing" for identifying the range of options for digital preservation. Migration is a set of organized tasks designed to achieve the periodic transfer of digital materials from one hardware/software configuration to another, or from one generation of computer technology to a subsequent generation. 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. Migration includes refreshing as a means of digital preservation but differs from it in the sense that it is not always possible to make an exact digital copy or replica of a data base or other information object as hardware and software change and still maintain the compatibility of the object with the new generation of Migration theoretically goes beyond addressing viability by including the conversion of data to avoid obsolescence not only of the physical storage medium, but of the encoding and format of the data. However, the impact of migrating complex file formats has not been widely tested. One of the most comprehensive studies to date is "Risk Management of Digital Information: A File Format Investigation." Some have criticized migration on the basis that neither the authenticity nor the integrity of a digital document can be ensured.

**Replication**: This is a term used to mean multiple things. Bitstream copying is a form of replication. OAIS considers replication to be a form of migration. LOCKSS (Lots of Copies Keeps Stuff Safe) is a consortial form of replication, while peer-to-peer data trading is an open, free-market form of replication. In each case, the intention is to enhance the longevity of digital documents while maintaining their authenticity and integrity through copying and the use of multiple storage locations.

**Reliance on Standards**: This is to software what durable media is to hardware. It seeks a way to "harden" the encoding and formatting of digital objects by adhering to well-recognized standards and favoring such standards over more esoteric and less well-supported ones. It assumes in part that such standards will endure and that problems of compatibility resulting from the evolution of the computing environment (applications software, operating systems) will be handled by the continuing need to accommodate the standard within the new environment. For example, if JPEG2000 becomes a widely adopted standard, the sheer volume of users will guarantee that software to encode, decode, and render JPEG2000 images will be upgraded to meet the demands of new operating systems, CPUs, etc. Like many of the strategies described here, reliance on standards may lessen the immediate threat to a digital

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document from obsolescence, but it is no more a permanent preservation solution than the use of gold CDs or stone tablets.

**Normalization:** This is a formalized implementation of reliance on standards. Within an archival repository, all digital objects of a particular type (e.g., color images, structured text) are converted into a single chosen file format that is thought to embody the best overall compromise amongst characteristics such as functionality, longevity, and preservability. The advantages and disadvantages of reliance on standards also apply to normalization.

**Canonicalization:** This is a technique designed to allow determination of whether the essential characteristics of a document have remained intact through a conversion from one format to another. Canonicalization relies on the creation of a representation of a type of digital object that conveys all its key aspects in a highly deterministic manner. Once created, this form could be used to algorithmically verify that a converted file has not lost any of its essence. Canonicalization has been postulated as an aid to integrity testing of file migration, but it has not been implemented.

**Emulation:** This combines software and hardware to reproduce in all essential characteristics the performance of another computer of a different design, allowing programs or media designed for a particular environment to operate in a different, usually newer environment. Emulation requires the creation of emulators, programs that translate code and instructions from one computing environment so it can be properly executed in another. A widely-known, general purpose emulator is the one built into recent versions of the Apple Macintosh operating system that allows the continued use of programs based on an earlier series of CPUs no longer used in Apple computers. However, most emulators available today were written to allow computer games written for obsolete hardware to run on modern computers.

The emulation concept has been tested in several projects, with generally promising results. However, widespread use of emulation as a long-term digital preservation strategy will require the creation of consortia to perform the technical steps necessary to create functioning emulators as well as the administrative work to assemble specifications and documentation of systems to be emulated and obtain the intellectual property rights of relevant hardware and software.

**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 critical component necessary to decode and render a digital object will be lost. Appropriate types of metadata to encapsulate with a digital object include reference, representation, provenance, fixity and context information. Encapsulation is considered a key element of emulation.

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**Universal Virtual Computer:** This is a form of emulation. It requires the development of "a computer program independent of any existing hardware or software that could simulate the basic architecture of every computer since the beginning, including memory, a sequence of registers, and rules for how to move information among them. Users could create and save digital files using the application software of their choice, but all files would also be backed up in a way that could be read by the universal computer. To read the file in the future would require only a single emulation layer-between the universal virtual computer and the computer of that time."

**Methodology**

This study adopted a descriptive survey research design to examine the technological methods used in the preservation of information resources in academic libraries, with specific reference to Southern Delta University Library. The study combined both primary and secondary sources of data. Primary data were obtained through observations and structured interviews conducted with library staff involved in information resource management and preservation activities, while secondary data were obtained from textbooks, journal articles, conference papers, and other relevant scholarly publications on digital preservation and library conservation practices.

The population of the study comprised professional librarians, para-professional staff, and ICT personnel working in Southern Delta University Library, Ozoro. A purposive sampling technique was used to select respondents who possessed adequate knowledge of preservation practices within the library. Data collected were analysed descriptively using simple percentages and narrative explanations.

The study focused on identifying the technological preservation methods adopted by the library, assessing the effectiveness of such methods, and examining the challenges affecting preservation practices in the institution.

**Results and Findings**

The findings of the study revealed that Southern Delta University Library utilizes both traditional and technological methods in preserving its information resources. The study found that digitization, database backup systems, cloud storage, migration of electronic files, and the use of institutional repositories constitute the major technological preservation methods adopted in the library.

The findings further revealed that digitization has significantly improved access to rare and fragile materials while reducing the rate of physical deterioration caused by frequent handling. The study also discovered that electronic cataloguing systems and automated databases have enhanced information retrieval and management within the library.

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However, the study identified several challenges affecting effective technological preservation in the library. These include inadequate funding, unstable electricity supply, insufficient ICT infrastructure, shortage of trained personnel, poor internet connectivity, and the rapid obsolescence of technological devices and software. The findings also showed that the absence of a comprehensive digital preservation policy limits the effectiveness and sustainability of preservation programmes in the library.

Furthermore, the study revealed that despite the growing adoption of digital preservation technologies, traditional preservation methods such as proper shelving, environmental control, fumigation, air-conditioning, and careful handling of materials are still necessary for preserving physical information resources.

**Conclusion**

Information resources remain the foundation of library services because they support teaching, learning, research, and cultural preservation. Academic libraries therefore have the responsibility of ensuring that these valuable resources are adequately preserved for present and future generations. This study established that technological preservation methods such as digitization, cloud storage, migration, electronic databases, and institutional repositories have become essential tools for preserving information resources in modern academic libraries.

The study further revealed that although Southern Delta University Library has adopted some technological preservation practices, several challenges continue to hinder effective digital preservation. These challenges include inadequate funding, unstable power supply, limited ICT facilities, shortage of skilled personnel, and lack of comprehensive preservation policies.

The study concludes that preservation in the digital age is no longer optional but a fundamental responsibility of academic libraries and their parent institutions. Effective preservation strategies are necessary to guarantee continuous access to information resources and to safeguard documentary heritage from deterioration and technological obsolescence. Consequently, libraries should not only focus on acquiring information materials but should also prioritize sustainable preservation and conservation practices capable of ensuring long-term accessibility and usability of resources.

The study recommends that academic libraries should develop comprehensive digital preservation policies, improve funding for technological infrastructure, provide regular staff training in ICT and digital preservation, ensure stable power supply, and strengthen collaborative preservation initiatives with other institutions. Through these measures, libraries will be better positioned to preserve valuable information resources for future generations.

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