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Challenges of Digital Preservation of Manuscripts to the Nigerian Education and Information Systems

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Knowledge, as the engine that drives human civilizations and existence, must continue to be eternally preserved. However, the challenges that face the achievement of this essential objective have always been daunting. Languages, like all units of human knowledge and culture, need to be preserved and conserved because of their role in human societies. Fortunately, technological advancement has led to innovations in the field of data and manuscript conservation and preservation. This article, therefore, focuses on the digital preservation of manuscripts and the challenges posed to the Nigerian educational and information systems, highlighting the concepts of digital preservation and digital conservation strategies necessary for preserving language manuscripts. The plausibility of strategies such as technology emulation, migration, encapsulation, and restoration was identified. Furthermore, the challenges facing the use of these and other strategies were explored. Finally, the article proposes ways of overcoming the challenges for effective conservation of knowledge and information.

KEYWORDS *Arabic manuscripts, conservation strategies, digital preservation, educational systems, information systems, Nigeria*

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INTRODUCTION

The advent of information and communication technologies (ICTs) has revolutionized the processes involved in information generation, organization, preservation, and dissemination. With modern technologies, libraries and information centers are now faced with the challenges of embracing and adequately using these technologies to preserve and disseminate information. The means of recording knowledge and information have evolved over time, from stone, wood, metal, clay, to paper, which served as knowledge/information storage media. The written heritage of humankind found in libraries, museums, temples, monasteries, and private collections, consists of different types of cultural materials incised or written with ink on palm leaf, bark, wooden tablets, and traditional papers. These information media, however, posed different challenges at efforts to preserve them in the face of harsh elements of nature (1).

However, owing to developments in science and technology over the past century, there is now a transition from essentially output of information in paper format to output in a variety of media. The world is now increasingly in the multi-media era, where information is output as pictures, sound, text, or a combination of these and increasingly being stored in electronic media (2). The effects of this development have informed the present need for digital preservation of manuscripts. Manuscripts play a significant role as records of human knowledge; they are firsthand original documents found in individual, institutional, and organizational collections. The need for manuscript preservation is, therefore, paramount to the cultural heritage of the past and for future generations. As noted by Nirankari (3), manuscripts have survived all odds, defying time and age, even as they are not entirely secured from the natural tendency of decay and deterioration (3). In the absence of digitization, therefore, the originals would have long ago and completely disappeared. Thus, with digitization as a means of information preservation nowadays, relevant strategies for achieving this objective should attract research attention.

Hence, the thrust of this study is to examine the current preservation procedures of digital manuscripts and other information/knowledge materials. The study particularly reviews the preservation strategies in the management of knowledge and information materials. It also discusses its challenges to education and information systems in Nigeria.

THE CONCEPT OF DIGITAL PRESERVATION

In general, two major processes are involved in digital preservation: creating an image file of the documents and scanning the documents while using the Optical Character Recognition (OCR) process for making the text file

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error-free. The files are then stored in different secondary storage devices. "Digital preservation combines policies, strategies, and actions to ensure access to reformatted and born digital content regardless of the challenges of media failure and technological change. The goals of digital preservation is to accurately render authentic content over time" (4). According to Jantz and Giarlo (5), digital preservation is the managed activities necessary for the long-term maintenance of a byte stream (including metadata) sufficient to reproduce a suitable facsimile of the original document and for the continued accessibility of the document contents through time and changing technology (6).

Digitization involves the creation of multimedia databases enhanced by digital information, thus providing easier access to cultural materials for a variety of users. It encompasses the conversion of non-digital materials to digital formats. Quite a number of cultural entities, including the Arabic language, aside from maps, manuscripts, moving objects, and audio materials, can be digitized (7).

According to Zulu and Kalusopa (7), the term *preservation* is an umbrella concept used to amalgamate all the policies and options for the management, including conservation treatments of different formats of information materials (8). The Inter-University Consortium for Political and Social Research (8) stressed that digital preservation ensures that "the digital content designated for long-term preservation is maintained in usable formats for as long as access to that content is needed or desired, and can be made available in meaningful ways to current and future users." According to Digital Preservation Coalition Handbook (9), digital material preservation is a way of preserving information materials, referring to digital surrogates created as a result of converting analog materials to digital form (digitization) and those that are "born digital" for which there has never been, and is never intended to be, an analog equivalent, digital records. Thus, the term *digital preservation* encompasses two main classes, the process by which the digital materials came into existence or were created (10).

Born digital refers to materials that were not intended to have an "analog equivalent," either as the originating source as a result of conversion to analog form, whereas "made digital refers to creating digital files by scanning or otherwise converting analog materials, with the resulting copy classed as "digital materials" (10). Preservation encompasses a wide variety of interrelated activities designed to prolong the usable life of books, archives, manuscripts, and artifacts. Preservation is a core function of librarians, archivists, and information professionals. Today, according to Alegbeleye (11), "preservation" and "conservation" are not interchangeable in usage. *Preservation* is an umbrella term for the many policies and options for actions including conservation treatments. This assertion is corroborated by Roberts and Etherington in Ngulube (12), who defined conservation as a field of knowledge concerned with the coordination and planning for the practical

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application of the techniques of binding, restoration, paper chemistry, and other material technology and other knowledge pertinent to the preservation of archival resources. Vinas and Vinas (13) also defined conservation as the operations that are intended to prolong the life of an object by forestalling or remedying deterioration (13). Though preservation entails maintenance of access to documents and records through the study, diagnosis, treatment and prevention of damage, conservation, conversely, is the treatment/repair of an individual manuscript, artifact, or document to slow its decay or restore it to usable state. Thus, preservation is the acquisition, organization, and distribution of resources to prevent further deterioration or renew the usability of selected groups of materials (14).

The major goal of a preservation technique is to hand over the society's civilization to another generation. Therefore, transmission of the cultural heritage of a people is paramount to library and information professionals and records managers. Banjo (15) noted that a people's cultural heritage is "a way of life and, in a broader sense, their traditional behavior, including the ideas, acts and artifacts, which are passed on from one generation to another." In any society, the heritage materials play very important roles in establishing the identity, the accomplishments, and the values of the people (16). Masakazi (17) equally posited that in the present information society, every nation has to ensure the preservation, promotion, and dissemination of its arts, culture, and the overall heritage using the tools in the present age (17). This is because heritage is a source of strength and confidence that puts the changes of the society into perspective and therefore enables the society to build a better future.

Arabic Manuscripts and Digital Preservation

The Arabic language is among the most widely and often spoken languages in the world today. Culturally and intellectually, it has become a very important language that connects a substantial proportion of humanity. It is obvious not only that Arabic is a living language but that its relevance and influence in human development and existence would continue to soar. It is, thus, imperative to effectively manage the historical and contemporary heritages of Arabic for posterity. An important step in this direction is the preservation of Arabic manuscripts. Umar (18), in Adekunle (19), defined Arabic manuscripts as source materials that could be in the form of prose, poetry, correspondences, and administrative and are written in Arabic. The vast and versatile nature of Arabic manuscripts that transcend all human fields of knowledge in many countries is particularly noteworthy.

In Nigeria, there is an abundance of Arabic manuscripts that predated the country's contact with Western civilization. Adekunle (19) stated that the origin of Arabic manuscripts in Nigeria could be traced to the ninth-century contact of Muslim North Africa with West Africa via the trans-Saharan trade

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routes culminating in the accumulation of Arabic manuscripts in cities such as Kano and Katsina. The tradition of Arabic manuscripts collection and generation in Nigeria continues until today. However, like every other manuscript and heritage material, Arabic manuscripts continue to face the risk of damage, loss, and deterioration. Fortunately, like every other manuscript also, the Arabic manuscript lends itself to all scientific and technological management practices, including digital preservation (20). It is therefore imperative for libraries, archives, and other stakeholders in Arabic manuscripts and the education and information systems in Nigeria to maximize the potentials of digital preservation.

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Digital Preservation Strategies

A digital preservation strategy is an action plan to preserve a valuable human heritage from total extinction. Over the years, researchers in the area of information preservation have identified various strategies considered capable of preserving the life span of human heritage for the benefit of generations yet unborn. Generally, preventive care of human heritage is a major strategy toward preserving valuable human knowledge through quality control, stabilization, and protection of documents against chemical, biological, and physical damage or deterioration. The agents of deterioration of human heritage are forces that act upon objects causing chemical and physical damage (direct physical forces; thieves, vandals, or careless individuals; fire; water; contaminants; radiation; magnetic pole; incorrect temperature and relative humidity; media software and hardware failure; communication errors, failure of network services, media software and hardware obsolescence, operator error; natural disasters; external/internal attacks; economic and organizational failure). When prevention care techniques are not implemented or objects are inherently unstable, conservation treatment is necessary (20). It is safeguarding the information content of any digital resources from the effect of the technological changes (hardware, media, and software). It also include the transfer of information to another medium and tracking existent file formats and their features (e.g., PRONOM, global digital format registry). Russell (22) in Zulu and Kalusopa (7) identified some of the strategies that could be adopted to help preserve digital materials (23).

Reliance on hard copy media

This strategy, also known as "change media," involves printing out digital materials and preserving the hard copy. This is to ensure that the valuable data on the digital media are retrievable in the event of media software and hardware failure/obsolescence. This strategy can be very useful in preserving language materials, especially Arabic manuscripts.

Technology preservation

This involves preserving the technology that was used to create the digital materials, including hardware and software. This strategy ensures access to the digital materials. Technology preservation also involves good housekeeping, air conditioning, and purification of the storage environment of digital collection. Thus, the original hardware and software used in creating a digitized Arabic manuscript should also be preserved.

Technology emulation

This involves using the existing technology that is able to mimic the old technology, thereby creating the original technical environment for the preserved items to be read or viewed. Hence, it is the replication of obsolete original technology with a new technology that can perform the same function as the old and obsolete one.

Migration

Whereas both technological preservation and technology emulation focus on the environments of the object preserving the resources through recreating/preserving the necessary operating environment, a different strategy for digital preservation is what has been called "migration." It is a means of overcoming technological obsolescence by transferring digital resources from one hardware/software generation to the next. This is a process by which we can consolidate numerous historical file formats into limited numbers of contemporary programs, thereby simplifying the process of access in the future. However, there are monetary, organizational, and authenticity issues involved with migration that make it an imperfect option.

Encapsulation

Another preservation strategy is encapsulation, which involves the grouping together of resources and whatever is necessary to maintain access to them. This can include metadata, software viewers, and discrete files forming the digital resources (24).

Restoration

This preservation strategy intends to return objects to a known/assumed former state. The treatment of damaged/deteriorated documents (corrupt file, unreadable file, corrupt media, corrupt shadow area and main area,

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complete loss of data, etc.) is intended to return degraded areas to an approximation of the original condition by repairing degradation and rescuing digital resources, which have become inaccessible as a result of technological obsolescence and/or media degradation.

Initiatives in Digital Preservation of Manuscripts

The major responsibility of preserving human heritage is usually charged to the national library, museums, and archives of a nation. As government establishments, national libraries, museums, and archives are charged with responsibility of collecting recorded knowledge of human society through various policies of the parent government. Mazumdar (22) noted that one of the major functions of the national library of a country is to collect and preserve the nation's intellectual and cultural heritage. This is in line with the the UNESCO's Draft Charter on the preservation of the digital human heritage. The Charter contained principles designed to assist member states in preparing national policies to preserve and provide access to digital heritage (23). As follow-up to this declaration, a pilot project for digitization of rare manuscripts had been initiated by the National Archives of India, in collaboration with Department of Science and Technology and National Institute of Advanced Studies, Bangalore (22).

In South Africa, the Digital Imaging project of South Africa was established in 1977 with the objective of investigating and implementing digital technologies to enable scholars and researchers from around the world to access South African materials of high socio-political interests that would otherwise be difficult to locate and use. In Nigeria, the very first initiatives toward preserving human heritage dated back to 1951. According to Yusuf (24), Dr. K. O. Dike, who was then a lecturer in the history department, University College, Ibadan, was appointed in 1951 by the then-Governor General of Nigeria as supervisory of public record with the following terms of references:

1. To undertake part-time duties in connection with preservation of ancient documents of public interests in Nigeria
2. To ascertain the nature of available records and the scale of the problem
3. To preserve those records, if they are not to be lost for all time
4. To obtain the interest and cooperation of non-officials who may have documents in their possessions, which were of historical value
5. To set up a public record office in Lagos in due course (27)

It was this initiative that gave birth to the National Archives in 1957 with responsibility to preserve government records but, with its expansion, it now

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keeps other records including Arabic manuscripts and private papers. Efforts toward digital preservation of materials in the National Archives of Nigeria is still in the pipeline. However, some institutions have started initiating digital preservation policies to cater for their born digital and analog collections. For instance, a study of preservation techniques employed by 15 Nigerian university libraries revealed that digitization was rarely a favored technique by the libraries (25).

CHALLENGES TO THE NIGERIAN EDUCATION AND INFORMATION SYSTEMS

Preservation of cultural materials, such as language, continues to pose serious challenges in African countries (26). Popoola (27) observed that contemporary African education and information practitioners cannot afford to discountenance the fact that the continent is at the risk of losing a substantial part of her cultural entities due to poor level of preservation activities. Mnjama, Wamukoya, and Mutula (28) observed that the challenges faced by East and Southern Africa member countries in the capture and preservation of records include absence of organizational plans for managing records; low awareness of the role of records management in support of organizational efficiency and accountability; lack of stewardship and coordination in handling records; absence of legislation, policies, and procedures to guide the management of records; absence of core competencies in records and archives management; absence of budgets dedicated for records management; poor security and confidentiality controls; lack of records retention and disposal policies; and absence of migration strategies for records (31).

The obvious repercussions of Africa's inability to preserve cultural materials include loss of identity and influence in the global community (16). In today's world, preservation of recorded knowledge is basically through digitization (6,17,29). Challenges facing Nigeria's educational and information systems in digital preservation and conservation generally include the following:

1. *Lack of evaluation policies:* The impact caused by the definition of selection criteria is very crucial in the digital environment. The digital document, which is not selected in the initial phases of its life-cycle, is likely to be lost or become useless in the future. It is thus imperative on libraries and archives nationwide to evolve clear evaluation policies in defining appropriate selection criteria.
2. *Lack of descriptive policies:* The complex nature of technology demands a rather detailed descriptive approach (metadata to digital objects for maintenance). Metadata for both internal/external documents elements become crucial.

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3. *Physical vulnerability:* Hardware and storage media are inherently unstable, and without the appropriate installation and maintenance, they can deteriorate very quickly, even if they do not seem to be damaged externally.
4. *Logical vulnerability:* The digital environment is sensitive to changes (some emerge from the management needs itself, which can compromise the integrity, authenticity, and the history of digital objects).
5. *High technological obsolescence:* The technology renewal cycle is short (3–5 years) as opposed to decades and centuries associated with the preservation of physical objects.
6. *High technological dependence:* All digital objects require specific hardware and software to be accessed, and each of these elements generally requires contract agreements, which are commonly difficult to negotiate.
7. *Difficulty in recruiting properly qualified staff:* The technology involved in accessing digital objects requires a significant diversity of activities that can be performed by scarce specialists.

In Nigeria, the major challenges of digital preservation have been classified into four parts, according to Alegbeleye (11):

1. *Lack of expertise and experience in digital preservation:* The glaring dearth of experience and appropriate skill is a vital impediment in the use of digitization as manuscript preservation procedure. Ezeani and Ezema (16) concluded that the skills needed for the job, especially in the area of bookmarking, characterization of scanned documents, and equipment troubleshooting were pathetically lacking among preservation practitioners in Nigeria. Alegbeleye (11) added that the few institutions adopting digital preservation did so as a "bandwagon" reaction, without adequate consideration for the requisite "standards" and "long-term implications."
2. *Economic:* Digital preservation of heritage materials has been found to be more capital-intensive than the traditional modes of preservation (11,32). The financial implications of digital preservation must be a priority adequately ascertained and assured to have a meaningful and sustainable digital preservation project. Indeed, Alegbeleye (11) advocated the need to generate models and empirical information on the financial implications of digital preservation in Nigeria.
3. *Lack of organizational infrastructure:* Many educational and information institutions in Nigeria lack organizational infrastructure necessary for meaningful digital preservation programmes. Alegbeleye (11) rightly echoed the necessity to restructure and reposition existing organizational infrastructure in our information and educational systems to accommodate the requirements for effective digital preservation initiatives.
4. *Legal copyright laws:* Legal copyright laws are often a constraint to the preservation of digital information, even in developed countries. For

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example, in the United States, the Digital Millennium Copyright Act restricts what libraries and archives are permitted to do to preserve digital information. The same is the licensing agreements with publishers. The often-conflicting rights of different nations may cause further problems. Intellectual property issues will be difficult to address and laws will be difficult to change (11).

Arabic manuscripts, however, face some other peculiar digital preservation challenges, apart from those previously listed. These include the fact that a substantial proportion of them is still under private ownership. Unfortunately, most of these owners are unwilling and/or unable to make the manuscripts available for digital preservation. Another problem is the low level of ICT appreciation among users and holders of Arabic in Nigeria.

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CONCLUSION AND RECOMMENDATIONS

The challenges previously listed are not insurmountable. The onus is rather on the education and information centers in Nigeria to exert concerted efforts toward the application of modern technology to the preservation of our written cultural heritage, including, of course, Arabic manuscripts. Information media (print and electronic), Archives, national libraries, and libraries in institutions of higher learning nationwide should vigorously intensify the efforts aimed at digital preservation. The following recommendations are hereby proffered to achieve meaningful digital preservation of our heritage, including Arabic manuscripts.

1. *Curriculum:* Arabic language departments and institutions should revise their curriculum at sub-graduate, undergraduate, and postgraduate levels to incorporate ICT appreciation in general and digital preservation of Arabic manuscripts in particular.
2. *Training:* There should be determined and invigorated financial, policy, and institutional commitment towards having an expanded crop of highly trained and competent staff in the area of digital preservation of Arabic and, indeed, all manuscripts of heritage significance.
3. *Collaboration:* There should be well-planned and coordinated collaboration between all stakeholders in digital preservation projects in Nigeria. This is necessary, as noted by other authors such as Zaid and Abioye (26); Gibson, Morris, and Cleeve (30); Geber (31); and Aina (32) to be able to:
   a. find new ways of enhancing cultural heritage preservation;
   b. attract new advances and break traditional boundaries;
   c. foster better practices among institutions;

d. exchange experiences and expertise in resources and policies in preservation and collection of cultural heritage manuscripts;
e. avoid unnecessary competition; and
f. attract more funding opportunities locally and internationally.

4. *Clearcut standards and guidelines:* A well-articulated framework outlining acceptable guidelines and internationally recognized standards in the practice of digital preservation is imperative. The framework should also incorporate appropriate measures to ensure compliance, innovation, and motivation.

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