DIGITAL PRESERVATION AND ACCESS TO ARCHIVAL MATERIALS AT SELECTED UNIVERSITY-BASED ARCHIVAL REPOSITORIES IN THE GAUTENG PROVINCE

by

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ABSTRACT

The purpose of this study was to assess the readiness of selected university-based archival repositories in Gauteng for implementing digital preservation practices that facilitate access to archival materials. Employed a qualitative approach, specifically utilising an exploratory-interviews research design, the study sought to gain a comprehensive understanding of digital preservation dynamics. Eleven employees from the archival repositories and libraries of four universities in Gauteng—University of South Africa (Unisa), University of Pretoria (UP), University of the Witwatersrand (Wits), and University of Johannesburg (UJ)—were purposively sampled for their direct involvement in archival materials and library digital content management. Through in-depth semi-structured interviews, conducted with archives managers, archivists, and library digital content managers, the study explored various digital preservation issues, including digitisation workflows, challenges, policies, born-digital databases, preservation strategies, software, access, and the OAIS reference model. Thematic analysis of the data revealed significant findings, including the absence of digitisation policies, preservation strategies, methodologies, software, staffing shortages, and knowledge gaps. The study suggests that addressing these identified issues could significantly improve digital preservation effectiveness and enhance access to archival materials within these repositories.

Key words: Archival material**,** digitisation, born-digital archive, digital preservation, digital archive, digital access, preservation, university-based archives repository, digital preservation system and the OAIS reference model.

MANWELEDZO

Ndivho ya ngudo heyi yovha i u sedzulusa tshiimo tshazwino tsha kuvhulungele kha zwi vhulungeli (Archives) zwa magudedzi a ntha are Gauteng. Tshipikwa hu u todulusa u dilugisela hadzo khau thoma ndila ya kuvhulungele ine ya tutuwedza u swikelelwa ha zwithu zwo vhulugwaho. Ndila yo shumisiwaho u tshimbidza thoduluso heyi yovha ya u kuvhanganya vhutanzi hu tshi shumiswa ndila ya ku vhudzisele ku shumiswaho nga vhasedzulusi. Ngudo heyi itoda u swikelela ku pfesesele kwo angaredzaho kha dzi tshanduko na vhudzivha kha u vhulungela kha dzi khomphiyutha. Tshipikwa tshihulwane hu u tutuwedza tswikelelo ya zwo vhulungwaho. Vhashumi vha tshivhalo tsha fumi na muthihi vha shumaho fhethu ha u vhulungela (Archives) na laburari dza magudedzi a ntha mana (4), ano wanala Gauteng ri tshikatela; University of South Africa (Unisa), University of Pretoria (UP), University of the Witwatersrand (Wits) na University of Johannesburg (UJ), dzo vha dzone dzo topoliwaho nga kha ku kuvhanganyele kwa vhutanzi thwii. Havho vhathu vho nangwa ngauri vha shuma khau dzudzanya zwithu zwo vhulungwaho na kuvhulungele kwa digital kwa laburari. Vhutanzi ho kuvhanganyiwa nga ndila yau vhudzisa mbudziso kha vhathu vha re kha zwiimo zwa vhulanguli, vhudzudzanyi na vhalanguli vha zwirengomu ha laburari zwa digital. Muvhudziswa a tshitendelwa uri a fhindule o vhofholowa asa katudziwi.

Khaseledzo yo katela zwitevhelaho nga kuvhulungele kwa digital: zwo vhulungwaho nga ndila ya digitisation, mutevhetsindo wa digitisation, khaedu dza digitisation, ndayotewa; ku vhekanyelwe kwa zwithu zwo vhulungwaho zwo thomiwaho nga dzi khomphiyutha (born-digital); ndayotewa ya kuvhulungele kwa digital; Maitele; Software; Zwikhukhulisi; uswikelelea na OAIS i ambaho nga tsumbo ya kuvhulungele kwa digital. Hedzi thero dzothusa u wanulusa na u thoma mutodo musi hutshi senguluswa vhutanzi ha thoduluso nga thoho nga thoho. U tahelelwa nga usa vha na ndayotewa ya digitisation, maitele a u vhulunga zwithu nga digital, ndila ya maitele, softwares, utahela ha vhashumi na ndivho zwo vha zwinwe zwa mawanwa mahulwane. Ngudo heyi i themendela uri arali hedzi mbulungelo dza shumisa mafhungo o wanuluswaho, dzinga kona u tandulula dzi khaedu nnzhi dza kuvhulungele na uri kuvhulungele kwa digital ku do kona u shuma na u engedza uswikelelwe zwo vhulungwaho.

Maipfi a Ndeme; Zwivhulungwa (Archives); Digitisation; mbebo ya mbulungelo ya digital; kuvhulungele kwa digital, mbulungelo ya Digital, Ku swikelele kwa digital, kuvhulungele, mbulungelo dza University, ndila ya kuvhulungele kwa digital na tsumbo ire hone ya OAIS.

ISIFINGQO

Inhloso yalolu cwaningo bekuwukuhlola isimo samanje sokulondolozwa kwedijithali ezindaweni zokugcina umlando ezizinze enyuvesi e-Gauteng, ngenhloso yokunquma ukulungela kwazo ukusebenzisa izinqubo zokongiwa kwedijithali ezenza kube lula ukufinyelela ezintweni ezigcina imilando. Indlela yocwaningo esetshenziswe kulolu cwaningo bekuyindlela yekhwalithethivu, ikakhulukazi kusetshenziswa umklamo wocwaningo lwezingxoxo zokuhlola. Lolu cwaningo luhlose ukuthola ukuqonda okuphelele kokuguquguquka nobunkimbinkimbi obuhilelekile ekulondolozweni kwedijithali, ngenhloso yokugcina yokuthuthukisa ukufinyeleleka kwezinto ezigcina umlando. Isamba sabasebenzi abayishumi nanye endaweni yokugcina imibhalo kanye nomtapo wolwazi wamanyuvesi amane aseGauteng, okuyiNyuvesi yaseNingizimu Afrika (Unisa), iNyuvesi yasePitoli (UP), iNyuvesi yaseWitwatersrand (Wits) kanye neNyuvesi yaseJohannesburg (UJ) zikhethwe ngokuthatha amasampula okuhlosiwe. Laba bantu bakhethwe ngenxa yokuzibandakanya kwabo okuqondile ekuphathweni kwezinto ezigcina umlando kanye nokuqukethwe kwedijithali komtapo wolwazi. Izingxoxo ezijulile zenziwe nomhlanganyeli ngamunye. Idatha yaqoqwa kusetshenziswa izingxoxo ezingahleliwe nabantu abasezikhundleni ezifana nabaphathi bezingobo zomlando, abagcini bomlando kanye nokuphathwa kokuqukethwe kwedijithali komtapo wolwazi.

Izingxoxo zazihlanganisa lezi zindaba ezilandelayo zokulondolozwa kwedijithali: ukwenziwa kwedijithali kwezinto ezigcina umlando, ukuhamba komsebenzi wokwenza idijithali; izinselele zokusebenzisa idijithali; inqubomgomo; Imininingo egciniwe yezinto ezigciniwe zokuzalwa ezidijithali; inqubomgomo yokugcinwa kwedijithali; amasu; isofthiwe; izithiyo; ukufinyelela kanye ne-OAIS Reference Model yokugcinwa kwedijithali. Lezi zihloko zisize ekuhlonzeni nasekuthuthukiseni izingqikithi ngesikhathi sokuhlaziya ingqikithi yedatha yocwaningo. Ukuntuleka kwenqubomgomo yokwenza idijithali, isu lokulondoloza idijithali, izindlela, isofthiwe, ukushoda kwabasebenzi kanye nolwazi kwakuphakathi kwemiphumela eyinhloko. Lolu cwaningo luncoma ukuthi uma lezi zindawo zokugcina izinto zisebenzisa lezi zinkinga ezikhonjiwe, zingaxazulula eziningi zezinselele zazo zokulondoloza idijithali, futhi ukulondolozwa kwedijithali kuzosebenza kahle futhi kuthuthukise ukutholakala kwezinto ezigcina umlando.

Amagama angukhiye: Impahla egciniwe, I-Digitisation, inqolobane yedijithali ezelwe, ukulondolozwa kwedijithali, inqolobane yedijithali, ukufinyelela kwedijithali, ukulondolozwa, inqolobane yezinqolobane ezisekelwe enyuvesi, uhlelo lokugcinwa kwedijithali kanye ne-OAIS Reference Model.

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DEDICATION

This work is dedicated to Mr. Matodzi John Khameli, my father and my siblings, Masala Memory and Joyce Khameli, as well as my late mother Sarikie Mavis Mahafha, together with the Unisa Archives staff. May the name of the divine Jesus Christ be exalted and revered.

DECLARATION

Name: Lufuno Alvinah Kgamedi _____

Student number: 36908126 _____

Degree: Master of Information Science_____

"**Digital Preservation and Access to archival materials at university-based archives repositories in Gauteng Province''**

I declare that this dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the dissertation to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

_____ 30 September 2023_____

SIGNATURE DATE

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LIST OF ABBREVIATIONS AND ACRONYMYS

AIP	Archival information package
ALA	American Library Association
AtoM	Access to memory
CLIR	Council of Library and Information Resources
CPA	Commission on Preservation and Access
DIP	Dissemination information package
DPC	Digital preservation coalitions
ETDs	Electronic theses and dissertations
HPRA	Historical Papers Research Archive
IASA	International Association of Sound and Audiovisual Archives
ICT	Information Communication Technology
IT	Information Technology
JISC	Joint Information System Committee
OAIS	Open Archival Information System
OPAC	Online public access catalogues
RLG	Research Libraries Group
SAA	Society of American Archivists
SIP	Submission information package
UIR	University institutional repository
UJ	University of Johannesburg
UNESCO	United Nations Educational Scientific and Cultural Organisations
UNISA	University of South Africa
UP	University of Pretoria
WITS	University of the Witwatersrand

CHAPTER ONE

INTRODUCTION: SETTING THE SCENE

1.1 Introduction and background of the study

There is a transformation taking place as the digital era unfolds. It is altering not only the nature of archives, but also the way people and organisations in society operate, communicate, and conduct business. The very nature of archival materials, as well as archival institutions themselves, are being questioned. As per Wahid, Pribadi and Wakas (2020:336), the digital era is defined as a period in which people are connected to smart devices, as technology has revolutionised and influenced societies' lives, as people are more connected through online than physical interaction and read information from their laptops via the internet rather than purchasing a hardcopy newspaper or magazine. Digital technologies have altered the public sphere by linking people who are separated in time and geography, resulting in the creation of the digital public (Kozyreva, Lewandowsky and Hertwig 2020:106-107). As the digital era unfolds, university-based archive repositories must adapt to meet the digital era's opportunities, so that archival materials can be preserved for as long as feasible and made as accessible as possible. University-based archives are repositories housed within universities. These repositories collect, archives and make material about an institution's history available. They are not confined to preserving only their institution's archives; however, they may include external materials thus helping their community with archival information (Society of American Archivists 2021). According to IGI-Global (2021), universities are defined as cultural institutions with distinct functions and higher education institutions that inherit, examine, integrate, and innovate profound academic knowledge, while remaining connected to but separate from social, economic, and political institutions. Furthermore, IGI-Global (2021) indicates that universities are not only the result of human culture at a specific period, but they have also developed a distinct culture via long-term schooling practices, historical accumulation, self-effort, and the influence of the external environment. Therefore, in the digital era, digital preservation is critical for universities. The primary goal of digital preservation is to preserve information of lasting value to last for long and for users to access that information. Jharotia (2018:2) indicates that traditional concepts of

information preservation, access, and archiving are being transformed by digital technology. Moreover, Sandy, Corrado and Ivester (2017:40) point out that digital and software application platforms that enable the creation and use of digital content have become an integral part of people's daily lives. Masenya and Ngulube (2020:52) assert that, as all information becomes digital, digital preservation is becoming more important in ensuring that digital materials remain accessible in the long run.

Digital preservation, in this case, refers to the series of managed activities necessary to ensure continued access to digital materials for as long as necessary, which includes all the actions required to maintain access to digital materials beyond the limits of media failure and technology change (Digital Preservation Coalitions (DPC) 2015:1). In addition, according to Lavoie (2021), digital assets provide both opportunities and challenges for archival repositories in their traditional role as caretakers of materials. Although digital archival material offers numerous advantages such as ideal reproduction, computerised processing, and online distribution, it also poses challenges in terms of access and preservation. One such challenge is the relatively brief lifespan of digital storage media, which may hinder future access. Additionally, the rapid development of rendering technology further complicates the issue. Lavoie (2021) further indicates that many people have studied the possibilities and challenges of digital materials, where subsequently, the question arises as to what is necessary to preserve and sustain long-term access to digital archive materials. Following that, the Open Archival Information System Reference Model was introduced. Moreover, Lavoie (2021) describes the OAIS reference model as a conceptual framework for an archive system focused on long-term preservation and access to digital archival materials. As a result, it is the desire of this research proposal for university-based archives repositories to use the OAIS reference model strategies for successful digital preservation and access to archival materials. The aim of the study is for archival materials to be sustained for an extended period of time and be accessible online. Lavoie (2021) defines digital access as the ability to fully participate in a digital society. The package includes internet and computer access, as well as other tools and technologies. In addition, Research Data Canada (2021) describes digital access as the continuous, ongoing usability of a digital resource, retaining all qualities of authenticity, accuracy and functionality deemed essential for the purposes for which the digital material was created and/or acquired. Because the key principles

of the study involve digital preservation and access to archival materials, physical archival materials must be turned into digital archival materials before they can be used in digital preservation. DPC (2015:1) indicates that digital archival materials include digital surrogates created as the result of converting analogue materials to digital form (digitisation), as well as 'born digital' materials, for which there has never been and is never intended to be an analogue equivalent and digital records. Analogue has been defined as paper-based resource, and includes printed textbooks and manuscripts (Gutmann, Kühbeck, Berberat, Fischer, Engelhardt and Sarikas. 2015:4). Therefore, Anyaoku, Echedom, and Baro (2019:42) define digital preservation as the utilisation of born-digital and digital surrogates. Born digital material is materially manufactured electronically, whereas digital surrogates are non-digital materials that are then converted to digital form. Furthermore, DPC (2021) demonstrates that all digital information, whether born-digital or digitised, corporate or personal, is eligible for digital preservation. As a result, this demonstrates that both born-digital and surrogate digital materials ought to be preserved.

This study identified a research need in archival materials. Understanding the nature of archival materials in the digital era is required so that they may be updated to keep up with the times and reap the benefits of digital platforms that can increase access to archive materials. Most global research indicates that digital preservation of archival materials at universities has been practiced for a long time, such as American Library Association (2013), which indicates that digital preservation of archival assets began in 1938 at Harvard University in Chicago. Baucom (2019:5) indicates that the story of digital preservation of archival materials in the United States of America began in 1994 when the Commission on Preservation and Access (CPA) and the Research Libraries Group (RLG) were tasked with identifying long-term preservation challenges of electronic records. Furthermore, most studies, including that of Masenya and Ngulube (2020), Masenya and Ngulube (2019), Matlala (2020), Mensah (2015), Anyaoku, Echedom, and Baro (2018), Umana (2020) and Adjei, Mensah and Amponsah (2019), focus on university digital preservation of born-digital materials, such as preserving items in university institutional repositories and library type materials. The raw archival materials are not the main emphasis on the above-mentioned studies. Archival materials are unique, specialised or rare objects, they are the only ones of their kind. Therefore, studies of digital preservation relevant to archival materials are uncommon.

As a result, the focus of this study was on archival materials, which began with an analysis of digitisation activities, investigating the preservation methods for born-digital materials, evaluate the extent to which university-based archives repositories have implemented digital preservation. Therefore, the purpose of this study was to assess the state of digital preservation in Gauteng University-based archives repositories to determine if such repositories are ready for digital preservation, which may enhance access to archival materials.

1.1.1 Contextual Framework

The context for the study is presented in this section. Gauteng is one of South Africa's nine provinces. This study explored digital preservation and access to archival materials at university-based archives repositories in Gauteng Province. Despite being the smallest province, Gauteng has the most universities compared to other provinces, where as a result, population density has an impact. Universities in Gauteng include the University of South Africa (Unisa), Tshwane University of Technology (TUT), University of Pretoria (UP), Sefako Makgatho Health Sciences University, University of the Witwatersrand (Wits), University of Johannesburg (UJ) and the Vaal University of Technology. However, only four Gauteng universities received focus. The study investigated digital preservation at the archives repositories of the University of South Africa (Unisa), the University of Pretoria (UP), the University of the Witwatersrand (Wits) and the University of Johannesburg (UJ). These university-based archives repositories were considered due to the age of their archival materials. Unisa's history begins in 1873, when the University of the Cape of Good Hope was founded. The history has been preserved, and over the years, the Unisa Archives acquired several extremely valuable and unique collections, such as the minute books of Unisa's predecessors, the Board of Examination 1850-1859 (University of South Africa 2022). UP Archives' collections began in the early 1930s, such as Perdeby student newspapers, and Tukkie student magazines (University of Pretoria 2022). The Wits Archives house over 3300 collections of historical, political, and cultural significance, dating from the mid-seventeenth century to the present day, making it the largest and most comprehensive independent archive in Southern Africa (University of the Witwatersrand 2022). The UJ Archives houses many historical documents and has archival material dating back to 1889. It consists of collections of primary source

material and rare books, and it serves as a valuable, one-of-a-kind research resource for the UJ community, as well as all interested researchers (University of Johannesburg 2022). The three university-based archives repositories are housed within the library, Unisa Archives, Wits Archives and UJ Archives, except UP Archives which is under the Registrar of the university (University of Pretoria 2022). The three archives fall under the purview of the library, which means that university-based archives repositories constitute a wing of the library (Netshakhuma 2019:70).

1.2 Problem Statement

As we delve deeper into the digital age, a significant transition is underway, posing challenges and opportunities for university-based archives repositories. Adapting to this digital landscape is imperative to ensure the long-term preservation and accessibility of archival materials. However, this transition raises complex issues such as copyright concerns, authenticity verification, maintenance of reliable archives, technological advancements, obsolescence, financial constraints, limitations in information infrastructure, and a shortage of technical expertise. Masenya and Ngulube's investigation in 2020, examined twenty-seven academic libraries in South Africa, sheds light on the impact of these digital changes. The findings reveal that academic libraries across South Africa are grappling with numerous challenges in digital preservation. These challenges include a lack of institutional commitment and involvement, absence of digital preservation policies and standards, inadequate resources and funding, limited collaborative efforts and partnerships, and the threat of technological obsolescence. Addressing these challenges is crucial for university-based archives repositories to effectively navigate the digital era and fulfill their mandate of preserving and providing access to valuable archival materials.

The motivation behind this study stems from the distinct nature of archival materials, characterized by their originality and uniqueness, which sets them apart from library materials. While university-based archives repositories are physically housed within libraries, they operate differently, primarily due to the unique nature of archival materials. Unlike library materials, archival items are not published and can only be accessed by a limited audience. They are non-circulating, one-of-a-kind artifacts, exclusively available for consultation within the reading rooms of specific archives repositories, with access limited by operational hours. As per the Society of American

Archivists (2021), archival materials are often rare, specialised, or even unique, presenting unique challenges in their preservation and access. Most of these materials are donated to university-based archives repositories, raising concerns regarding copyright, authenticity, and reliability maintenance. The crux of the issue lies in efficiently managing the digital preservation workflow for such materials, encompassing selection, digitisation (if not born-digital), ingestion into digital platforms, data management within archival storage systems, and ensuring access. Navigating these complexities demands careful consideration and implementation of digital preservation strategies tailored to the unique characteristics of archival materials. This study aims to address these challenges and contribute to the development of effective workflows for preserving and providing access to valuable archival resources within university-based archives repositories.

Furthermore, despite the prevalence of the digital era, the researcher's observation and experience with university-based archives repositories in South Africa reveal a tendency to adhere to traditional preservation and access methods over embracing digital preservation practices. Traditional preservation methods involve preserving physical materials from degradation, encompassing measures such as shelving maintenance, protection against mishandling, pests, and environmental hazards (Feather, 2018:8). As described by Iyishu, Nkanu, and Ogar (2013:37), traditional preservation techniques include conservation and treatment, which focus on altering the item's environment for stability and employing physical or chemical alterations for repair and restoration. Traditional access methods entail physical visits to archival repositories to consult materials, as outlined by Iyishu, Nkanu, and Ogar (2013:37). Despite the digital age, many university-based archival repositories continue to rely on these traditional preservation and access approaches. However, digital preservation technologies offer opportunities to sustain archival materials and enhance accessibility online, encompassing methods such as technology preservation, emulation, migration, encapsulation, and copying or refreshing (Anyaoku, Echedom, and Baro, 2019:44). Given these circumstances, this study aimed to evaluate the readiness of Gauteng university-based archives repositories for digital preservation, recognising it as a potential avenue for improving access to archival materials amidst the challenges outlined above. Recommendations stemming from this assessment include the adoption of the OAIS reference model to guide digital preservation activities,

facilitating enhanced access to archival resources within university-based archival repositories.

1.3 Aim and objectives of the study

The aim of this study was to evaluate the digital preservation status of chosen Gauteng University-based archives repositories, aiming to ascertain their readiness for digital preservation initiatives that could potentially improve access to archival materials. The study sought to:

1. Analyse the current state of digitisation in university-based archives repositories.

2. Investigate the preservation methods for born-digital archival materials in university-based archives repositories.

3. Evaluate the extent to which university-based archives repositories have implemented digital preservation practices.

4. Examine the user access methods for digital archival materials in university-based archives repositories.

5. Recommend the use of the Open Archival Information System (OAIS) reference model in university-based archives repositories for digital preservation and access to archival materials.

1.4 Research Questions

The major research question that this study sought to address was ‘What is the current digital preservation model employed by university-based archival repositories in the Gauteng Province, and how does it impact access to archival materials? To achieve the above research objectives, the following research questions guided the study:

1. What is the present status of digitisation inside university-based archives repositories?

2. What methods are now used by university-based archives repositories to preserve archival items that were born digitally?

3. How far have university-based archives repositories gone in terms of implementing digital preservation practices?

4. How are digital archival materials accessed by users in university-based archives repositories?

5. How does the Open Archival Information System (OAIS) reference model work in digital preservation of archival materials at the university-based archives repositories?

1.5 Justification of the study

This study is critical for South Africa, Gauteng Province university-based archives repositories, as well as for entire African university-based archives repositories. The findings of this study will help in the long-term preservation of archival materials as well as improve access to archival items that are now inaccessible. This study promotes the digitisation of archival materials, digital preservation (strategies) and digital access to archive assets. Most African university-based archives repositories are failing. They continue to preserve and give access to archive contents conventionally, and users cannot access archival items online because they have not been digitised (Adjei 2020:4). Furthermore, the research significantly contributes to the current body of knowledge. There have been very few related studies in Southern Africa, which means that studies focusing on archive materials are scarce.

Gauteng Province is a South African province with many universities. However, for this study, only four university-based archives repositories were chosen based on their age, size, and kind of materials. These universities were chosen to represent other university-based archives repositories well. As a result, the study's findings must enable excellent digital preservation, which keeps archive items preserved for a long time, to be made available online. As a result, the purpose of this study was to assess the state of digital preservation in Gauteng university-based archives repositories to determine whether such repositories are ready for digital preservation, which digital

preservation could be a way to enhance access to archival materials. Subsequently the recommendations for solutions be established that include using the OAIS reference model to guide digital preservation activities and improve access to archival materials.

1.6 Scope and delimitations of the study

Delimitation, according to Simon and Goes (2013), is a characteristic that limits the scope and defines the boundaries of the study. Delimitation is, therefore, under the researcher's control. Although this study examines digital preservation and access of archival materials in the context of archives, it is only looking at university-based archives repositories within the four Gauteng Province universities in South Africa, namely: Unisa, UP, Wits and UJ. Gauteng Province was chosen for this study, because it is the only province in South Africa with many universities and they have well established archives repositories. The four universities mentioned above were chosen as the best representation of other university-based archives repositories based on their age, size and type of materials. The three universities' archives repositories (Unisa, UJ and Wits) are reporting to the library (Netshakhuma 2019:70). While, UP resorted under the Registrar and the Department of History that had been instrumental in its establishment, however, some of its digital content is integrated with the library digital content (University of Pretoria 2023). Data was collected from archives managers, archivists and library digital content manager, with the use of interview as the data collection method.

1.7 Definition of key terms

This section identified and defined key concepts used in this study. The key terms identified include archival materials, digital access, digital archive, digital preservation, digitisation, and university-based archives repositories.

1.7.1 Archival materials

Archival materials are information-bearing media that have been generated by an organisation/individual during business, and which are preserved permanently because of their value for reference and research purposes. Such materials are normally unpublished, and almost always unique or rare, unlike books or magazines

for which many identical copies exist. Some examples of archival materials are manuscripts, letters, photographs, moving images and sound materials, artwork, books, diaries and artifacts (SAA 2021).

1.7.2 Digital access

Digital access refers to the capacity to actively engage in all aspects of a digital society. It encompasses the availability of resources and technology, such as internet and computers, which enable complete engagement and involvement (Urban Institute 2022).

1.7.3 Digital archive

A digital archive is a record in a computer. As stated by Anyaoku, Echedom, and Baro (2019:46), a digital archive refers to a record that has been transformed from a physical form into a digital version, as well as a record that is originally made by a computer.

1.7.4 Digital preservation

The management and maintenance of digital materials so that future users can access and use them, is known as digital preservation. The primary goal of a digital archive is to ensure the long-term preservation of digital information, so that it can be used properly in the future (Yadav 2016:64).

1.7.5 Digitisation

Digitisation refers to the process of converting analogue material to digital material. So, according to Bandi, Angadi and Shivarama (2015:333), digitisation is the process of creating an electronic version of an item that can be stored, viewed, and changed on a computer and transferred over networks.

1.7.6 University-based archives repositories

University-based archives repositories are located inside universities. These repositories collect, preserve, and make accessible material that document the history of a given institution. They are not, however, limited to maintaining just their

institution's archives; in addition to serving their community, they may also preserve outside items that are important and accessible to the public. These types of archives preserve the institutional history and serve the academic community (SAA 2021).

1.8 Literature Review

A literature review, according to Snyder (2019, cited in Fouche, Strydom and Roestenburg 2021:101), is a review of the existing scholarship or available body of knowledge that helps researchers to see how other researchers have investigated the research problem. The literature review is discussed in further depth in Chapter 2.

1.9 Research Methodology

Research methodology is systematic approach to problem-solving and a science of research planning that provides a knowledge-gaining strategy, where a researcher discovers, selects, processes, and analyses data about a research topic (Rajasekar, Philominathan and Chinnathambi 2013:5. This aspect was explored in the following section sections: research paradigm, research approach, research design, research method, population and sampling, data trustworthiness and ethical consideration. Chapter 3 provides a more in-depth discussion of the research methodology.

1.10 Organisation of Chapters

This study is organised according to six chapters as shown below:

Chapter 1: Introduction and background to the study

This chapter introduces the research study by providing a brief background of the study as well as a detailed problem statement. It indicates the purpose of the study by presenting the study's aim and objectives, research questions, and demonstrating the scope and delimitation that is being undertaken. Furthermore, it gives the literature of studies relating to the proposed research topic, as well as the important terminology defined in this study. Finally, it describes the proposed methodology that was used in the research process, emphasising the research design, data sources, sampling techniques, data analysis, data interpretation, and ethical considerations.

Chapter 2: Literature review and Theoretical Framework

This chapter provides a detailed discussion of the theory guiding the study as well as a review of relevant literature. The study reviewed literature based on the study's objectives, which included the present state of digitisation in university-based archival repositories, the difficulties influencing digital preservation in these repositories, how well these archives have adopted digital preservation, digital access to archival materials in these archive repositories, and recommend functional strategies for OAIS reference model implementation in these repositories for successful digital preservation and access to archival materials.

Chapter 3: Research methodology

This chapter describes how the study was carried out. The chapter discusses research methodology, research approach, research design, study population and sample processes, data collecting procedures and tools, data quality, ethical issues, data analysis and presentation.

Chapter 4: Presentation of the findings

This chapter displays and examines the data acquired from the field using interviews in accordance with the study's objectives. The collected data was presented.

Chapter 5: Interpretation and Discussion of the findings

The findings of the research are analysed in connection to the objectives in this chapter. The interpretation and discussion were guided by digital preservation for access, which are covered in Chapter Two and based on the facts presented in Chapter Four and the literature reviewed in Chapter Two. In accordance with the study's objectives, the findings were interpreted and discussed.

Chapter 6: Summary Findings, Conclusions and Recommendations

This chapter provided conclusions and recommendations to answer the research questions.

1.11 Summary

This chapter provided background for this study and the contextual framework, problem statement, study purpose, research objectives, research questions, study rationale, scope and delimitations and ethical considerations were all underlined. The definition of essential terminology, as well as the arrangement of chapters. The next chapter addressed the literature review as it relates to the study's objectives.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The preceding chapter provided the background of the study that included contextual framework, problem statement, aims and objectives of the study, research questions, justification of the study, scope and delimitations, definition of key terms, preliminary literature review, research methodology and ethical considerations. Chapter One also outlined the organisation of the study highlighting the content of the different chapters. The preservation and accessibility of archival materials are essential for the documentation and sharing of cultural heritage, historical records and scientific knowledge. As the world becomes increasingly digital, the management of digital archives has become a significant concern for archives and repositories, particularly those situated in universities. This literature reviews the existing literatures and theories related to the digital preservation for access to archival materials at university-based archives. A literature review, according to Roestenburg, Strydom and Fouche (2021:101), is a review of the existing scholarship or available body of knowledge that helps researchers to see how other scholars have investigated the research problem. Creswell (2014: 64) understands a literature review as identifying and summarising studies on a certain issue, which are frequently scientific investigations, but also comprise conceptual essays or opinion pieces that give frameworks for thinking about certain themes. While Ramdhani, Ramdhani and Amin (2014:47) define the literature review as an item that addresses published information in a certain subject area, which the issue covers the necessity for a criticism and potential reconceptualisation of the topic's larger and more diverse knowledge base, as it develops and conceptual frameworks can be a useful tool in developing an understanding of a subject area. In accordance with the above definition, Mathipa and Gumbo (2015:73) define a literature review as a critical examination of research that has been conducted in a specific field of study, with the goal of evaluating and analysing the current level of knowledge about a subject in order to expand the body of research in the area.

This chapter explored and evaluated literatures on digital preservation in the following areas: digitisation of archival materials, born-digital archival materials, digital

preservation for archival materials, access to archival materials and the Open Archival Information System (OAIS) reference model, as defined by the objectives of the study. In terms of a review of digitisation, the study examines the current state of digitisation in university-based archival repositories. Moreover, literature on how born-digital archival materials are currently preserved in university-based archives repositories were reviewed. This part explored the methods used to preserve born-digital archival materials. Furthermore, the review explored digital preservation to determine how well the university-based archives repositories have adopted digital preservation. This section assessed the extent to which university-based archives repositories have implemented digital preservation practices, such as action of backup, replication, migration and emulation. In addition, the literature review considers how users access digital archival materials in university-based archives repositories. This component examined the methods used by users to discover, search, retrieve and view or use digital archival materials in university-based archives repositories. The literature review also advocated for the process of using Open Archival Information System (OAIS) reference model in university-based archives repositories for digital preservation for access to archival materials. This section explored the OAIS model, which provided a framework for the long-term preservation and access to digital archival materials. This literature review synthesised and analysed the existing literature on digital preservation and access to archival materials in university-based archives repositories, and highlighted gaps and opportunities for future research and practice. Ultimately, it seeks to contribute to the improvement of digital preservation and access to archival materials in university-based archives repositories, enabling the long-term safeguarding and sharing of valuable cultural and historical records.

2.1.1 Digital preservation concept for archival materials

Digital preservation is defined as the preservation of rare and valuable materials and objects utilising computers, electronic equipment, mobile phones, digital cameras, recorders, and digital displays (Shimray and Ramaiah 2018:46). On the other hand, Velmurugan (2013:2), describes digital preservation as a set of activities that must be completed and maintained to ensure ongoing access to digital material for as long as it is required. Moreover, Hazarika (2020:220-221) refers digital preservation to the practice of preserving information assets in digital form for future users. This includes both information assets that have never existed in print or analogue form and

documents or physical objects that have been transformed into images using scanners, digital cameras, or other imaging technologies. In simpler terms, it's the process of choosing, storing, conserving, and preserving information so that it may be accessed by future generations and digital material can last a long time. Velmurugan (2013:2) concurs, indicating that digital preservation is concern with two types of materials, namely those converted into digital (digitisation), and those born digitally. Digitally converted documents are those that were transmuted from analogue to digital form using a reproduction technique such as scanning, whereas born-digital documents are those that were created using digital technology. Mutula (2014:363) agrees as well, pointing out that over the last decade, the number of digital materials created globally through digitisation of analogue materials and/or materials being "born" digitally has grown. Digital material, as for analogue material, must be conserved in order to satisfy the unique legacy demands of its users. As a result, the focus of this research is on the preservation and accessibility of digital archival materials that have been digitised and born digital.

2.1.2 The background of digital preservation for archival materials

An account of digital preservation of archival materials started way back in 1994 in the US. According to Boucom (2019:5), in 1994, the Commission on Preservation and Access (CPA) and the Research Libraries Group (RLG) assigned the task to identify the challenges of the long-term preservation of electronic records, investigating current practices in digital material preservation, and to generate an alternative for technology refreshing. The team was to make recommendations for resolving electronic records challenges, general recommendations for digital material preservation, and technology refreshing (moving digital materials from old storage media to new versions of the same media, be replaced by migration, that is, moving digital materials to new software and hardware environments on a regular schedule). Boucom (2019:5-6) further indicated that, in 1996, the assigned team established a report entitled ‘Preservation Digital Information’. The report identified two major recommendations for the preservation of digital information, which include, the need to engage content creators in the digital archiving process, and the need for a network of trusted and certified digital archives. The first recommendation required archives office of origin to work together with the archivists to preserve the interconnected attributes of digital objects throughout the life cycle of the digital material. The second recommendation

was to establish a certification programme for digital archives so that the repositories could be trusted to store and provide long-term access to digital objects for future use.

According to Kadir and Yunus (2017:17), there has been concern regarding the preservation of primary research information and records in digital formats in the library community globally since the 1990s. The Commission on Preservation and Access (CPA) and the Research Libraries Group (RLG) in the United States released a joint study on preserving digital information in 1996, which identified challenges, provided suggestions, and indicated topics for additional research. Furthermore, Kadir and Yunus (2017:17) state that, in the United Kingdom, the Joint Information System Committee (JISC) of the Higher Education Funding Councils and the British Library addressed the issue of digital media preservation by holding a national conference in Warwick in November 1995, where a number of action points were identified (Fresco, 1996, cited in Kadir and Yunus 2017:17). Since then, the library, archives and publishing communities in the UK have conducted considerable investigations and joint efforts to preserve digital data and records (Kadir and Yunus 2017:17).

2.1.3 Key sources of digital preservation for archival materials

The research work of Baucom (2019) is one of the key sources for digital preservation and access to archival materials at university-based archives. Baucom (2019:3,17) found that digital preservation for archival materials lacked necessary policies and procedures, and there is an issue of obsolescence. They proposed that institutions must collaborate to preserve digital materials since digital preservation requires policies and procedures to actively manage digital items to assure their preservation. Digital preservationists must deal with obsolescence as file formats, hardware, and software evolve, Baucom (2019:3) stated. Baucom (2019:3) therefore suggested that one common strategy to combat obsolescence is to migrate older digital materials into new formats. To keep these digital materials available for future users, long-term digital preservation is essential, because archivists and records managers have been planning for the preservation of digital materials since there have been digital materials. Masenya and Ngulube (2020:52) found that university libraries in South Africa are significantly affected by digital changes and face many challenges, including a lack of institutional commitment and involvement; absence of established digital

preservation standards, policies, and procedures; inadequate resources; lack of skills and training; lack of funding; limited collaboration efforts; and partnerships; and technological obsolescence. Hazarika (2020:224) states that the digital preservation for archival materials suggests that university libraries ought to prioritise digital preservation to maximise access as they cannot keep all documents or recordings in their original format. Digitisation preserves data lifespan, usefulness, and intellectual purity for future generations. Other key sources include the Digital Preservation Coalition (DPC) sources that offer a unique paradigm for digital preservation of archival materials and developed Handbooks relevant to the core topics in digital preservation of archival materials (Baucom 2019:14).

2.2 Digitisation of archival materials: Global, African and South African perspectives

The word "digitisation," according to Radick (2013:14), refers to both electronic archival collections and the development and transfer of analogue materials to digital format. Shehu (2016:2) also defined digitisation as the process of converting items from physical copies to electronic versions. It is a question as to whether archival materials in university libraries should be digitised. Rafiq and Ameen (2013:37) respond by stating that university libraries are digitising print archive materials and making them accessible online for people to view from anywhere. Furthermore, Namande (2012:4) claims that one of the major advantages of creating digital archives is that digital files can be accessed or transferred via computer networks, that millions of users can access these files online via the internet regardless of their location, and that copies can be made several times without deterioration of the contents being copied. Also, the International Federation of Library Association (IFLA) 2014 expresses that digitisation makes it easy to find and utilise rare and special collections to a greater extent than for general collections, moreover, rare and special collections may stay opaque and concealed without digitisation. Hazarika (2020:220) defines digitisation as the process of converting textual materials into electronic form. The digital scanner takes and stores an image of the original analogue object, whether it be a photograph, a word-processed document, or a handwritten letter. Digitisation is used extensively in modern libraries to replace traditional libraries. One of the benefits of digital preservation is that there is no physical limit to storage.

Hundreds of university libraries and allied institutions throughout the world have been launching projects designed to digitise their collections in response to the global information sharing and wide outreach and University libraries are actively digitising books, journals, newspaper archives, artifacts, music, theses and dissertations, and other historical documents and pictures of worldwide and cultural importance (Shehu 2016:2). In support of that, Namande (2012:4) also stresses that university library archives more broadly are becoming increasingly digitally aware. Furthermore, Nneji (2018:1) suggests that in order to adapt with contemporary online learning, university libraries all over the world are rapidly embracing digitisation processes of their resources in order to improve their learning mechanisms and increase their relevance in this era of massive information explosion and accessibility mediums.

Indeed, digitisation has become an essential component of the preservation and dissemination of cultural heritage. University-based archival repositories are responsible for collecting, preserving and making accessible records of institutional, cultural and historical significance. The digitisation of archival materials has revolutionised how information is accessed and used by researchers, students, and the general public. In developed countries, the digitisation of archival repositories has advanced significantly in recent years. Studies have shown that digitisation has improved access to information and increased the number of users accessing archives. According to Tang and Wu (2012), the digitisation of archives in the United States has increased access to information, which has resulted in the creation of new research areas and a better understanding of the past. Digitisation has also enabled archives to reach a wider audience and engage with communities beyond their immediate physical location. In Europe, the digitisation of archival repositories has also been on the rise. A study by Frey (2015) found that the digitisation of archives in Germany has made it easier to access and search for information, but there are still challenges related to copyright issues and funding. Digitisation has also facilitated international collaborations between archives and enabled the sharing of resources and expertise.

In developing countries, the digitisation of archival repositories has been slow, due to various challenges, such as lack of funding, inadequate infrastructure, and limited access to technology. However, there have been efforts to digitise archives in these countries. A study by Nascimento (2017) on digitisation in Brazilian university libraries

found that the digitisation of archival materials has improved access to information and has had a positive impact on research. However, challenges such as inadequate funding, lack of expertise, and infrastructure remain significant barriers to digitisation.

In Africa, there have been efforts to digitise archives in universities, but progress has been slow. A study by Mawere (2021) found that the digitisation of archives in African universities has been hindered by various challenges, such as lack of funding, limited access to technology, inadequate infrastructure, and a lack of expertise. Despite these challenges, the study found that the digitisation of archives in African universities has improved access to information and has had a positive impact on research. Another study by Obaseki and Adetimirin (2019) on the digitisation of archival materials in Nigeria found that the lack of funding and expertise were major obstacles to digitisation. However, the study also found that digitisation has facilitated collaborations between institutions and enabled the sharing of resources.

South Africa has a well-established archival sector, with several university-based archival repositories. The digitisation of archival materials in South Africa has been a priority for many institutions, and there have been efforts made to create digital collections of significant archival materials. According to Van der Walt and Makhubu (2016), digitisation has enabled the preservation of valuable archival materials that are at risk of deterioration and has facilitated access to information for a wider audience. However, the study also noted that digitisation requires significant resources, both in terms of funding and expertise. A study by Kriel (2017), on the digitisation of the records of the University of Pretoria, found that the process of digitisation was complex, and required collaboration between different departments and stakeholders. The study also highlighted the importance of creating metadata that enables the discovery and retrieval of digital records. Another study by Mnyaka (2019) on the digitisation of the records of the University of Fort Hare found that digitisation had improved access to information and enabled the preservation of valuable records. However, the study also noted that the lack of resources and expertise remained. significant challenges to the digitisation process. According to Shelembe's (2021:4) research on digitisation at the University of Zululand, the library has a digitisation room with computers, scanners, and other equipment and shortage of staff to prepare and execute their digitisation project and a storage capacity issue caused a system crash and ended the project, where in order to digitise, they require storage capacity.

Shelembe (2021:113) advises institutions and organisations planning digitisation projects to have a well-planned strategy, a large enough storage server/capacity, adequate funds and funding, professional or sufficient staff training on digitisation, digitisation tools/infrastructure and facilities, and IT-dedicated staff. Jethro (2021:672) reports that at the University of Cape Town, digitisation has been underway for over a decade by UCT Libraries, as well as independently by research departments dealing with specialty collections. The information from the African Studies Collections has not been fully collected and made digitally accessible due to time restrictions, limited resources, and copyright difficulties. Crowther (2021) agrees with the above point, adding that because UCT had engaged in digitisation prior to the fire, a great deal of valuable material was saved for future generations. This study responds to a lacuna in the literature by highlighting the importance of archival research at university libraries. Extant literature, however, is more concerned with digitising library items in general than archival materials. Thus, this study is being done to bolster our understanding of the digitisation of archive documents.

2.3 Born-digital of archival materials: Global, African, and South African' perspectives

The literature on how born-digital archival materials are currently preserved in university-based archives repositories is reviewed. This component explored the various approaches used to preserve born-digital archival materials, including hardware and software requirements, metadata standards, and storage media. The preservation of information is one of the university library archives' fundamental responsibilities. As more information is produced electronically, the preservation of born-digital material has become a necessary activity for libraries (Velte and Wikle, 2020:3). Born-digital archival materials are materials created electronically, that have no analogue counterpart. According to Erway (2010:1-3), born-digital materials are items created and managed in digital form and examples of born-digital materials include digital photographs, digital documents, web content, digital manuscripts, electronic records (e-mails, databases, spreadsheets, presentations, and other types of files), static data sets, digital art, digital media publications, and so on. Hence, Cocciolo (2014:239) defines born-digital records as those that emerge on computers and may (or may not) have an analogue counterpart, such as a printout. Born-digital

archiving is intended to emphasise the distinction from collections established by digitisation, which generates surrogates or access copies of documents that originate on paper, film, or another analog media, and collections created through born-digital archiving. Because there is no analogue counterpart, digital archiving requires digital preservation, often known as ensuring the long-term durability of information in digital form. What's more, born-digital archives, as defined by the University of Westminster (2022), are archives that actually started their life as digital documents (for example, a spreadsheet or a digital photograph) and were used in this format throughout their life before being transferred to the archive in a digital format. According to the same source, the University of Westminster (2022), born-digital archives vary from digitised archives in that there is no original document to see in the archive. There is also the possibility of doing various types of study with them than with actual documents that have been digitised. Velte and Wikle (2020:3) describe born digital collections as containing files that were created, used, and maintained digitally throughout their lifecycle without ever being physically manifested.

Preserving born-digital materials poses unique challenges, as the technology used to create and access them is constantly changing, making it difficult to ensure long-term accessibility. As such, the preservation of born-digital materials requires a combination of technical expertise, policy development, and institutional support (Masenya and Ngulube 2022:52). One key strategy for preserving born-digital materials is migration, which involves moving records from one technological format to another in order to ensure their ongoing accessibility (Kalusopa 2018:153). According to Duranti and Thibodeau (2016) this process can be complex, as different file formats require different migration strategies, and the process must be carefully managed so as to ensure that the integrity of the original record is not compromised. However, migration can be an effective way to ensure that records remain accessible over time, as long as it is done in a way that is consistent with best practices and international standards. Another important strategy for born-digital preservation is emulation, which involves creating an environment that mimics the original software and hardware used to create and access the records (Kalusopa 2018:154). Emulation can be a powerful tool for ensuring the ongoing accessibility of digital records, as it allows users to interact with records in the same way they would have done at the time of creation. However,

emulation is a complex and resource-intensive process that requires specialised expertise and significant institutional support (Ismail and Affandy 2018:5).

Preserving born-digital materials presents a range of challenges for university-based libraries, including technical, organisational, and legal issues. One key challenge is the rapid pace of technological change, which makes it difficult to ensure that records will remain accessible over time. This challenge is compounded by the fact that many born-digital materials are created using proprietary software, which may not be supported by future versions of the software or by other software programmes (Ismael and Affandy 2018:6). Another challenge associated with preserving born-digital materials is the sheer volume of data involved. As digital technologies have become more ubiquitous, the volume of born-digital records being created has increased exponentially. This has led to concerns about storage capacity, data security, and the ability of archivists to manage and process such vast amounts of data (Jaillant, Goudarouli and Kitcher 2022:285). Furthermore, Jaillant, Goudarouli and Kitcher (2022) indicate that, despite these challenges, there are also many opportunities associated with born-digital preservation. For example, the use of born-digital materials can facilitate new research questions and methods and can allow researchers to access information that might not have been available in traditional paper-based archives. Moreover, the use of digital technologies can streamline archival workflows, making it easier to manage and process large volumes of data.

In developing countries, there has been a growing interest in the preservation of born-digital materials, although the challenges are often compounded by limited resources and infrastructure. In Africa, several studies have been conducted to explore the challenges of preserving born-digital materials in archives and libraries. For example, Anyaoku, Echodom and Baro (2018:42) examined the challenges of digital preservation in university-based libraries in Africa. The study found that most university-based libraries lacked the resources and expertise to effectively manage born-digital materials, leading to poor preservation practices. The authors recommended the need for investment in training and capacity building, as well as the adoption of digital preservation policies and strategies. Moreover, in Nigeria, Ezema (2013:792-807) conducted a study on the preservation of electronic records in university libraries. The study identifies the key challenges of preserving born-digital

materials, including inadequate infrastructure, limited expertise, and lack of funding. The study recommends a range of strategies to address these challenges, including developing digital preservation policies and guidelines, providing training and support to staff, and investing in digital preservation infrastructure and tools. Baro and Otiode (2014:114) examined the extent of Electronic Theses and Dissertations's (ETDs) adoption in university libraries in Africa as a way of making local content visible globally in open access institutional repositories (IRs). The study revealed that a good number of university libraries have already adopted ETDs in their IRs. Many universities in Africa have made it mandatory for their graduate students to submit their theses and dissertations in electronic form. It was observed that the most widely adopted software to manage ETDs in university libraries in Africa is DSpace. The study identified challenges such as lack of funds, absence of ETDs policy, lack of skills, copyright issues, and lack of metadata standards (Baro and Otiode 2014:124). Furthermore, Tapfuma and Hoskins (2021:51-58) studied an adoption of institutional repositories for electronic theses and dissertation (born-digital) in Zimbabwe university libraries. The study found that there is slow development of ETD collections, with DSpace as the software of choice across the universities. Faculty cooperation in depositing ETDs is minimal, thereby affecting progress of ETD initiatives.

Similarly, in South Africa, several studies have been conducted on the preservation of born-digital materials in university libraries. Masenya and Ngulube (2021:1-11) study the processes and technologies used by South African university libraries to preserve born-digital content. The survey found that most university libraries are using innovative digital preservation methods. Many academic institutions preserved digital assets using DSpace, E-print, ETD, digital commons, LOCKSS, DigiTool, Content Management, and Archive-IT. Masenya and Ngulube (2021:1-11) further state that university libraries ought to ensure that digital preservation technologies are compatible with archival standards and account for technological changes so that entities may be migrated to newer platforms as needed to avoid technological obsolescence. Mthembu and Mbatha (2022:176-195) investigated the use of institutional repositories in the preservation of born-digital assets at several university libraries in Kwazulu-Natal region. The study discovered that there is a need for training to provide librarians/archivists and researchers with the essential skills and knowledge for preserving born-digital data in IRs and that the most significant danger to data

preservation for most university libraries is a lack of resources. In a similar vein, Masenya and Ngulube (2019:1-9) explored born-digital preservation strategies in South African university libraries. According to the findings of the study, most university-based archives lacked the policies, resources, and competence to properly preserve born-digital content. The authors advocated for the creation of digital preservation policies and strategies, as well as investments in human and technology resources, in order to properly manage born-digital content.

Overall, the literature by Masenya and Ngulube (2022:52); Ismael and Affandy (2018:6); Jaillant, Goudarouli and Kitcher (2022:285); Anyaoku, Echodom and Baro (2018:42); Ezema (2013:792-807) and Masenya and Ngulube (2019:1-9) indicates that born-digital materials present unique preservation challenges for university-based libraries. While some repositories have established policies and strategies for digital preservation, many lack the necessary resources and expertise to effectively manage born-digital materials. This underscores the need for investment in training, capacity building, and the development of national and institutional policies and strategies to guide the preservation of born-digital materials in university-based archives. This study found that there is a gap in the existing literature on the research of university libraries in the context of archives. The literatures that are currently available are focusing on the born-digital materials of the library in general rather than specifically archives materials. Because of this, this study was conducted to add more knowledge about the digital preservation for born-digital of archival materials.

2.4 Digital preservation of archival materials: Global, African, and South African' perspectives

The review explores digital preservation to determine how well the university-based archives repositories have adopted digital preservation. This section reviewed literature on the extent to which university-based archival repositories have implemented digital preservation practices, including backup, replication, migration, and emulation. Digital preservation is the process of protecting digital content from obsolescence, loss, or degradation. This process ensures that the digital content remains accessible and usable for as long as possible (Jharotia, 2018). Similarly, Hazarika (2020:220) states that preservation may be defined as a method that uses

information technology to protect conserved information resources from degradation. University-based archives repositories play a crucial role in digital preservation as they collect, preserve, and provide access to the unique, rare, and significant materials that document the history and development of the university and its community. Therefore, it is essential to explore how well these repositories have adopted digital preservation to ensure that the digital content they hold is preserved and accessible for future generations. Studies from both developed and developing countries have been conducted to explore how well university-based archives repositories have adopted digital preservation. In developed countries, the adoption of digital preservation has been more widespread, with many university-based archives repositories implementing digital preservation strategies and technologies.

2.4.1 Global Perspective

Sophisticated countries such as Canada, Australia, the United Kingdom, New Zealand, the United States of America and India amongst others, have invested heavily in information technology and the digital preservation (Conway 2010:67). In accord with this statement, Sharma and Chauhan (2019:6) point out that the European Union, the United Kingdom, and the United States stimulated research in digital libraries via national-level policy, and India was not spared the proliferation of digital libraries at the start of the twenty-first century. Sharma and Chauhan (2019:6) note in this regard that digital preservation necessitates the use of appropriate software, hardware, and content, where their research discovered that the majority of institutional repositories and digital libraries were used open-source software such as DSpace, EPrints, and Greenstone. The obstacle discovered was the issue of copyright involved in the digitisation process and it was proposed that libraries resolve copyright related concerns before embarking on the digitisation process, as well as alter copyright laws, so that digital items may reach the end-user freely. At present, many international universities, such as in USA universities, Atlanta University, Florida A&M University, Jackson State University, Tuskegee University, and Texas Southern University, have undertaken digital preservation initiatives (Council on Library and Information Resources, 2022). According to Fabunmi, Paris, and Fabunmi (2009: 24), most of the libraries in the United States involved in digital preservation were university libraries. Many of these libraries collaborated with better-funded organisations, such

as national libraries and museums. This was critical since most of these projects were greater than the budgets of public and school libraries (Council on Library and Information Resources (CLIR, 2022). The funding observation by the CLIR (2022) highlights a key driver for successful implementation of the archives digital preservation that requires consideration here. The above literatures and theories suggest the criticality of the initiative; however, they also highlight the significant financial implications of the digital preservation. The current study is therefore critical as it investigates the implementation challenges in the South African context and the proposed solutions to both concerns. Moreover, regarding US university libraries that are involved in the digital preservation of archives, the University of Southern California Libraries, the University of Minnesota, the University of Victoria, the University of Texas, and the University of Winnipeg are all working together on a project to digitise transsexual records (CLIR 2022). This might imply that the collaboration of university-based archives can also make digital preservation succeed. Therefore, the studies above identify few universities from developed countries that implemented digital archive preservation and the collaboration of the universities and other institutions for the success of digital preservation. However, these studies do not suggest the potential reasons for delaying of the digital preservation by these first world universities. It is therefore important for this study to thoroughly investigate the prospects of successful digital preservation for South Africa.

Over the past several decades, archives, libraries, and museums have recognised the digitisation of their huge 'analogue' collections as a critical task, and their primary goal was to make the collections more accessible to the many prospective user groups, such as scholars, instructors and the public, a secondary goal of digitisation efforts was to conserve an item's original, while not limiting access to it (Yale University Library 2022). Furthermore, Yale University Library (2022) indicates that most Asian universities have been digitising archives for a long time, such as Yale University, where students, faculties, and staff now have access to a range of digital archives, as Archives have digitised numerous objects in their collections. Furthermore, Lee, Kim, and Lee (2018:311) highlight a digitisation project between the University of Toronto libraries and the National Library of Korea, the goal of which was to build and explore a deeper understanding of how to develop a digital archive for Asian historical

manuscripts as well as to investigate how to improve the accessibility of rare historical records. The University of Toronto, through digitisation, is now able to identify the content of the archival collections and has improved access to the collections. Mahesh and Mittal 2008 (cited in Sharma and Chauhan 2019) remarked that status of digital libraries in India also aligned with the development of digital libraries around the world. Several digital libraries and institution repositories were developed in India in recent past. Dhule (2018:312) stressed that several university libraries in India have a large collection of digitised records, and most libraries have a very rare collection of reading materials such as books, manuscripts, maps, letters, theses, special monographs, research papers, and so on. University libraries serve as a hub for the collecting of teaching, learning, and research materials. Digitised resources, such as theses, manuscripts, research papers, and photographs, have important academic purpose. Moreover, regarding current status of digitisation at Asian university libraries, Kuwaiti university library is currently focus more on digitising magazines, books, periodicals, dissertations and theses, photographs, and university publications. Archival materials are among most-selected materials for digitisation (Alghnimi and Chaudhry 2022:124). In the Australian university libraries, digitisation has included heritage materials for greater access and preservation, for example, Deakin University has collaborated with the National Library of Australia to digitise selected manuscripts and memorabilia of Australia's second Prime Minister, Alfred Deakin (Cathro 2007:10). Furthermore, (Cathro 2007:10) indicates that the Australian co-operative digitisation project constituted an early example of collaborative digitisation in Australia that included institutions fir which the digitised material was first published between 1840 and 1845, with the establishment of an Australian colonial culture and identity, as shown by an increase in local publishing.

Even though most international university libraries have been conducting the digital preservation of archives, there are challenges identified with digital preservation. In the Asian countries, Sharma and Chauhan (2019) raised a concern about the copyright issues involved in digitisation process in the university libraries and suggested that university libraries address copyright-related issues before going for digitisation process. Therefore, they further suggested there is a need to amend copyright laws so that digital libraries can openly reach the end user. While Dhule (2018:314) and Pandey and Misra (2014:39-40) stress that the digital preservation in

most of the Indian university libraries are experiencing funding challenges, changing software and hardware, legal aspects, technical expertise, technophobia, and technological obsolescence. On the other side, Mandelsson, Falk and Oliver (2014:318-318) indicate that the challenges of digital preservation at the Hebrew University of Jerusalem include the planning and implementation of a digitisation process; one that requires technology know-how, a significant budget, manpower planning, and developing IT capabilities, including both hardware and software. Furthermore, the process necessitates organisational collaboration and engagement inside the university institution as well as with external stakeholders. In the USA, most university libraries face unmanageable budgetary demands and financial constraints. The problem is that of the inadequate fund, not that of technology, as it is identified that most university libraries are collaborating with other institutions for funding matter for the success of digital preservation. The unprecedented expansion of digital content, according to Mutula (2014:364), creates a variety of challenges for digital heritage preservation management. These challenges are best understood in the perspective of a developed country, such as the United States, which has the requisite infrastructure and administrative framework for implementing digitisation initiatives. According to Microsoft TechNet 2012 (quoted in Mutula 2014:364), of the 30 billion documents used in the United States each year, 85% are never retrieved, 50% are duplicates and 60% are obsolete, where, for every dollar a company spends to create a final document, ten dollars are spent to manage the document creation process. Mutula (2014:364) adds that the United States, as the world's leading economic superpower, is believed to have the most established infrastructure and capacity to handle digital material than any other country. In the global university-based archives, the adoption of digital preservation has been more widespread, with many university-based archives repositories implementing digital preservation strategies and technologies. As a result of the impact of this, the concern of this study is that there is a gap in the literature on the research of university libraries in the context of archives. The literatures focus on the digital preservation of library materials in general rather than specifically archives materials, which is why this study is being conducted in order to add to extant knowledge about the digital preservation of archival materials.

2.4.2 African Perspective

Universities in the developing countries, notably in Africa, have already begun integrating digital technology into their operations. Digital technology is used as a tool for development and improvement, particularly when it comes to university libraries contents. Therefore, in Africa, most of the university libraries are completely engaged in this development since they are the heart of the university, housing the intellectual contents of the institution (Okeke, Udem and Onwurah 2015:36). However, Kanyego 2006 (cited in Emmanuel Baro, Oyeniran and Ateboh 2013:21) is of the view that digital preservation of university library archives worldwide varies from that of Africa, where in Africa digital preservation is still in its early stages, and struggling to create and sustain such projects. Digital preservation has been hampered by a host of issues, including infrastructure development, hardware, software, and internet connectivity. Asogwa (2011) on the other hand stresses that the preservation of physical materials in Africa is fast changing, owing to the effects of improvements in computer technology. Asogwa (2011) further added that physical materials progressively give way to electronic print, and online public access catalogues (OPAC), which are replacing the necessity for users to physically visit library or archives facilities to access their holdings. Anyaoku, Echedom and Baro (2019) assert that, because the African Continent has yet to fully integrate the use of new information technology, university libraries in Africa face significant digital preservation issues, whereas university libraries worldwide may have long solved the constraints of maintaining essential information through digital preservation. In support of the above assertion, Mabe and Potgieter (2021:2) claim that African universities are unprepared to undertake digital preservation initiatives due to a lack of required skills and competence.

There is evidence that most of the university library archives have embarked on the digital preservation initiatives in Africa for example, university libraries in Ghana. Dzandza (2019:69) indicates that seven of the nine libraries in Ghana have initiated digital preservation activities and main hurdles shared by all of these libraries studied, include a lack of suitable and current technology, a lack of skilled workers, and a lack of collaboration amongst faculty members. In Nigeria, Baro, Oyeniran and Ateboh (2013:25) report that only a few university libraries have digitised their information

assets for digital preservation and the major purpose of present digital preservation activities is to enable international access to local content. However, digital preservation initiatives confront obstacles such as unreliable internet access, a lack of finance, erratic power supply, gathering resources for digitisation, a lack of IT staff, a lack of digital preservation policies and copyright concerns. Furthermore, Usman, Abdussalam, and Adesina (2018:8) affirmed this, stating that the University of Ilorin Library's digital preservation project in Nigeria had encountered several difficulties, including the lack of a dependable power source, which makes computerisation and digitisation impossible. In Zimbabwe, various universities, including Zimbabwe Open University (ZOU) and Harare Institute of Technology (HIT), are digitising archives for digital preservation, as, according to the conclusions of Tsvuura and Ngulube (2020:20) both state universities are now engaged in developing policies and processes for the digital preservation of records and archives in their business activities. Their study also revealed that the two state universities were digitising their archives with unskilled employees and legislation, regulations, and standards, while procedures were not strictly followed. As a result, the archives are exposed to significant hazards and risks in terms of their integrity, security, and authenticity. Namibia also has evidence that university libraries have begun to engage in digital preservation of archives, as indicated by the Southern African Digital History Journal (2015), where there is a collaboration between the Polytechnic of Namibia, The National Archives of Namibia, Brigham Young University and Utah Valley University in digitising parts of the National Archives of Namibia in Windhoek. The project has digitised tens of thousands of images, documents, and films since 2004 and continues to do so today. Though the archives do not have a huge, official website for external scholars, they do have a well-organised intranet where digital objects may be viewed.

Namande (2012:4) has, however, warned that the elementary IT and basic utility infrastructures, lack of skills, and funding challenges in Africa may become a bottleneck for effective implementation of the digital preservation projects. Namande further highlighted that a combination of challenges such as outages and power failures can result into the interruption of stable file uploads and transfers during digital preservation and errors when users try to access the digital materials. Studies on the adoption of digital preservation in Africa have highlighted the unique challenges faced by university-based archives repositories in the region. Many African countries lack

the necessary resources and infrastructure to implement digital preservation strategies and technologies effectively. This observation signals the need for the current study as there is an existence of a literature gap on the research of university libraries in the context of archives, the literatures are focusing on the digital preservation of library materials in general, rather than specifically archives materials.

2.4.3 The South African Perspective

Khanya and Dikotla (2021:2) observe that many libraries in South Africa are adopting digital preservation. According to Masenya and Ngulube (2020:52), developments in the digital world have a substantial impact on South African university libraries. Ezema (2011) states that South Africa universities are far ahead of other African countries in the digital preservation of archival materials from Africa universities. However, to the contrary, Crowther (2021) is of the view that South African universities are sitting on treasure troves of precious documents and manuscripts that have yet to be digitised. Consequently, these historically valuable records are not readily accessible to historians and other academics for study, and they are also in danger of being destroyed in event of fire or civil disturbance.

Masenya and Ngulube (2020:52) studied digital preservation at 27 South African institutions and found that digital developments are affecting university libraries. Most of these institutions struggle to preserve their digital materials due to a lack of institutional commitment and engagement, digital preservation standards, policies, and procedures, resources, skills, training, financing, cooperation, and technology obsolescence. Thus, Masenya and Ngulube (2020: 60-61) suggest that good governance, participation and collaboration, knowledge of preservation software, tools, and metadata systems, staff education and training, awareness, commitment, and outreach in preservation activities, technical expertise, and knowledge of copyright and intellectual property rights could all affect digital preservation sustainability. Moreover, Matlala (2020:105), revealed that the University of Kwazulu-Natal archives system confronts a variety of concerns and obstacles that limit its capacity to maintain digital record preservation.

Most of the studies consulted in exploring digital preservation to determine how well university-based archives repositories have adopted it identified similar digital

preservation concerns such as technological obsolescence, continuous migration, lack of legislation; policy; strategy and awareness, lack of collaboration and partnership, deterioration of digital media, and disaster planning and recovery. As a result, this study found that there is a literature gap on the research of university libraries in the context of archives, as the literatures focus on the digital preservation of library materials in general rather than archival materials. This study was conducted to increase knowledge about archival materials.

2.5 Access to archival materials: Global, African, and South African' perspectives

The literature reviews deliberate on how users access digital archival materials in university-based archives repositories. This part examines the methods used by users to discover, search, retrieve, and view digital archival materials. The primary goal of archival repositories is to preserve and make available stored information. As university-based archives repositories adopt digital preservation and access to archival materials, there are ever greater advantages to accessing digital archival materials. According to Mosako and Ngoepe (2021:19), the acceptance and use of digital platforms enable 24/7 open access to archives from anywhere in the world with minimal commuting and physical human touch, where institutions must reshape themselves for 21st-century audiences. DPC (2021) asserts that the primary goal of digital preservation programmes is to offer access to digital archive resources. Digital access is the principal means through which digital preservation accomplishes its commitment to making archived material available to the user community (Beagrie 2014:4-2). Hochla (2018:5), simply indicates that digital access enables locating and delivering the archived content in a suitable format to the consumer. It provides interfaces for the lookup and access to data, as well as access control mechanisms. Times Higher Education (2021), points out that there is a demand for universities to make available content in digital form from archives and collections that include books, primary sources, and multimedia material. However, the cost of this type of digital transformation is considerable.

Several studies have investigated how users access digital resources in university libraries. These studies have examined various aspects such as user behaviour,

preferences and needs in accessing and using these materials. A study by Kabel, Zhou, Zotoo and Sue (2021) on the adoption in archive management in Djibouti's university libraries in China, barriers and the role of information sharing argues that information sharing should be practiced along with capacity development of librarians in order to enhance perceived adoption use in Djibouti's libraries. University libraries in the United States found that the majority of university libraries had implemented digital preservation strategies and technologies, such as digital asset management systems and digital preservation policies to enhance access to archival materials (Noonan 2014). Kato, Kisangiri and Kaijage's (2021:1) research on Education Research International journals analysed those characteristics that enhance access to library digital content and electronic library information technology was detailed. In terms of user behaviour and preferences, a study by Davis, Sapp, and Van Tuyl (2016) on the use of digital archival materials in academic libraries in the United States found that users preferred to access these materials remotely, through online catalogues and digital repositories. However, they also valued the physical experience of using original materials and appreciated the convenience of digitisation and reproduction services. The study also found that users faced various challenges in accessing and using digital archival materials, such as navigating complex interfaces, understanding copyright and usage restrictions, and finding relevant materials. A study by Duarte, Dias and Barroso (2018) on the use of digital archives in Brazilian universities found that users preferred interfaces that were intuitive and easy to navigate, with clear search functionality and relevant metadata. Similarly, a study by Li and Li (2019) on user behaviour in digital archives in China found that users were more likely to engage with digital archives that had clear and comprehensive metadata, as well as multiple access points to materials.

In African countries, the adoption of digital preservation and access strategies for archival materials has been developing. A study by Mohammed, Saka, Babalola and Ahmed (2019:93-94) about access to digital materials on research output regarding the experience of Federal Universities Libraries users in northern states of Nigeria, recommended that access and use of digital materials be prioritised for service effectiveness and efficiency on digital platforms supported by the libraries in the zone. Choice of metadata types ought to be based on possessing modules that support administrative, structural, technical, transformative procedures and preservation.

According to a study conducted by Echezona and Ugwuanyi (2010) on African university libraries, there is a poor state of internet connectivity in African university libraries, which affects users' information needs by preventing access to library resources. Additionally, the high cost of internet connectivity and bandwidth, as well as low speed internet connectivity, pose a threat to African universities' participation in the digital information world, where knowledge and research findings are accessed digitally. A study by Sejane (2017) regarding the access to and use of e-resources in university libraries of Lesotho exposed budget cuts and lack of funding to procure up-to-date equipment, lack of awareness of the available e-resources and lack of policies in place. Recommendations were put forward to enhance access to and use of e-resources. Therefore, these studies have highlighted the unique challenges and opportunities for improving access and use in this context.

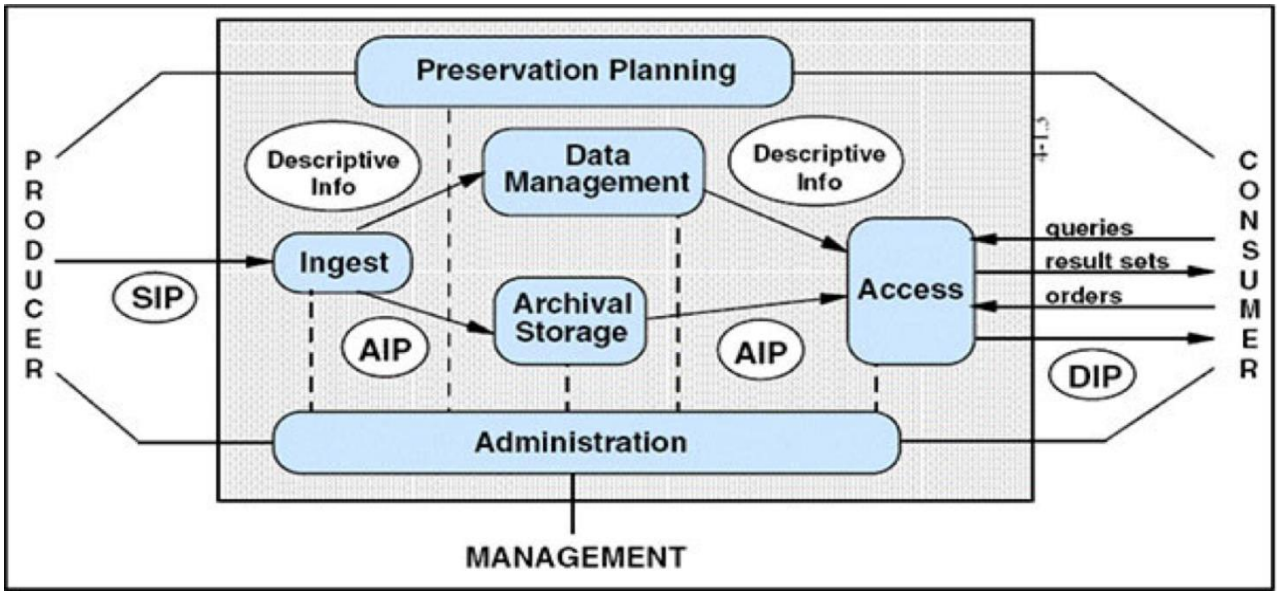
In South Africa, Masenya and Ngulube (2021:2) state that South African university libraries cannot permanently access their digitised contents. Masenya and Ngulube (2021) found that university libraries are developing new methods and technologies to generate, collect, categorise, store, preserve, track, and retrieve digital materials in any format. DSpace, Fedora, E-prints, Greenstone, Innovative, I-T, Archivematica, Rosetta, and Tesella are examples. The study found that academic institutions use methods and technologies that fit their budget and digital content preservation needs. A study by Tlakula and Fombad (2017:861) on the use of electronic library resources. The findings revealed that the level of usage of these resources is limited to SABINET and EBSCO host and awareness of the different electronic resources is low.

Overall, the literature demonstrates that technological infrastructure, digital literacy, and interface design all impact user access to digital resources in university libraries. User-cantered design is important in the creation of digital archive interfaces, according to studies from both developed and developing countries, as is investment in technological infrastructure and digital literacy initiatives to promote user access. Studies from Africa, particularly South Africa, illustrate the difficulties that users encounter in accessing digital resources, owing to poor technological infrastructure and connection constraints.

2.6 The OAIS Reference Model: Global, African and South African' perspectives

The literature review established advocating the OAIS reference model in university-based archives repositories for digital preservation and access to archival materials. This section explored the OAIS reference model, which provided a framework for the long-term preservation and access to digital archival materials. The OAIS reference model was established as an abstract reference model so that the archival repositories would be able to implement it to meet the needs of the user group and it became a guide for the establishment of repositories, assessing existing repositories, creating new metadata schemas, and standardising the metadata that is unique to digital material (Baucom 2019:6). However, Lee (2010:4020) describes the OAIS Reference Model as components and services required to develop and maintain archives, in order to support long-term access to and understanding of the information in those archives. According to Lavoie (2014:2) this reference model revolves around the concept of an open archival information system with the following primary duties: ingest, archival storage, data management, preservation planning, access, and administration (Lavoie (2014:2). The various key constructs of the OAIS reference model are reflected on the below figure:

Figure 2.2: OAIS Reference Model



(Bodleian Libraries 2021).

This model became an ISO Standard in 2002 and is responsible for most of the language used in digital preservation. The OAIS reference model defines the environment, functional components, and information items associated with a system in charge of long-term preservation (Beagrie 2014:5). According to Lavoie (2021), this Reference Model for OAIS describes components and services required to develop and maintain archives, to support long-term access to and understanding of the information in those archives. As reflected in Table 1 above, the three components of the OAIS reference model were elaborated by Lavoie (2021) and Bodleian libraries (2021). The first component is the OAIS environment, which is made up of four different parts, three of which are explicitly external to the OAIS archive: management, producer, and consumer. The second component is the functional component. Among the functional components are ingest, archival storage, data management, preservation planning, access, and administration. The last component of the OAIS model is information objects, which consist of data objects, representation information and preservation description information (DPC 2022).

Numerous studies have been conducted globally that have advocated the OAIS Reference Model in university libraries for digital preservation and access to archival materials, for example, Lee (2010:2027) indicates that the OAIS is the global standard for digital preservation, acting as a "galvanising force" and key role in the growth of digital archiving activities. Furthermore, according to Lee (2010:2027-2028) the Digital Preservation Coalition (DPC) in the UK, Cornell University Library, Inter-University Consortium for Political and Social Research (ICPSR), Duke University, Stanford University, UNESCO (United Nations Educational, Scientific and Cultural Organisations) and other numerous university libraries have either directly based their work on the OAIS, or claimed that their final products conform to it. According to research conducted by Sawyer, Reich, Mazal and Peccia (2001), a rising number of organisations have chosen the OAIS as a starting point for their digital preservation initiatives. The Networked European Deposit Library (NEDLIB), the Research Library Group, and the Online Computer Library Center are among those with programmes in France and the United States. A study by Wang, Sun and Cheng (2011:57-58) report that several Chinese universities have begun archives digital preservation construction using the OAIS reference model to enhance archives administration. Furthermore, Wang et al. (2011:58) indicate that OAIS reference model is an

international standard for archived information management with six modules and three packets that explain the change process of archives information during ingestion, storing, maintenance, and accessing. Wang et al. (2011) concluded that any system or effort dedicated to long-term digital information preservation can employ the OAIS as a starting point. However, the study of Srirahayu, Harisanty and Su'adaa (2020) examined the use of OAIS in digital preservation initiatives in Indonesia. They found that OAIS was not widely used in Indonesian universities, and that there were significant challenges to implementing effective digital preservation strategies in this context.

In Africa, various scholars, such as Gbaje and Mohammed (2017), Magama (2018) and Umana (2020), have already utilised the OAIS paradigm to address long-term digital preservation issues (Umana 2020:42). According to Umana (2020:42), Gbaje and Mohammed (2017) utilised the OAIS model to investigate concerns related to long-term digital preservation in Nigeria from an information and process standpoint. Magama (2018) has utilised the OAIS Reference Model to investigate digital preservation techniques applied in Zimbabwe's Masvingo region to preserve digital data. While Umana (2020) employs the OAIS paradigm to provide a complete framework for digital preservation operations in institutional repositories in Namibia university libraries, focusing on acquisition, archival storage, data management, preservation planning, access and preservation. The study found that without comprehensive methods and preservation techniques as suggested by the OAIS Reference Model, Institutional Repository digital content at the two Namibian university libraries may be at risk of technological obsolescence. As a result, it is critical that university libraries utilise the OAIS reference model for digital preservation and access. Furthermore, a study by Gbaje and Mohammed (2011) employed the OAIS reference model to analyse challenges relating to long-term digital preservation from information centres in Nigeria and supported the adoption of OAIS reference model by any institution. In South Africa, Masenya and Ngulube (2020) examined university library digital preservation elements. The study suggested a conceptual model for university libraries to preserve digital resources, aligned with the OAIS reference model, and found it suitable because it helps to comprehend preservation needs and long-term digital information access.

Overall, the OAIS reference model is relevant for this study because it provides a comprehensive framework for digital preservation functions, while keeping in mind the primary mission of preserving information through six functional entities, viz.: inject, archival storage, data management, preservation planning, access and preservation, for the effectiveness of digital preservation for accessibility to archival materials in university-based archives repositories. However, this study discovered a literature gap on the research of university libraries in the setting of archives, since the literatures focus on the digital preservation of library resources in general, rather than archival materials. This study was being undertaken to expand understanding about archival materials using the OAIS reference model.

2.7 Conclusion

In conclusion, this literature review has explored the state of digital preservation and access to archival materials in university-based archives repositories. Through the examination of existing literature, the study has addressed five study objectives that include the digitisation of archival materials, born-digital archival materials, digital preservation for archival materials, access to archival materials and Open Archival Information System (OAIS) reference model, as defined by the objectives of the study.

The review highlighted the need for university-based archives repositories to prioritise digital preservation for access to archival materials, particularly in the context of the increasing digitisation of archival materials. The findings indicated that, while some repositories have made significant progress in digitising their collections, there is still much work to be done to ensure that digital materials are preserved and accessible for future generations. Moreover, the review also underscores the importance of implementing digital preservation best practices, including backup, replication, migration, and emulation, as well as metadata standards and storage media to ensure the long-term accessibility of digital materials. Finally, the review advocated for the adopting of the OAIS Reference Model, which provides a framework for the long-term preservation and access to digital archival materials. This model ensures that digital materials remain accessible, even as technologies and standards change over time. Overall, this literature review provides relevant insight into the state of digital preservation and access to archival materials in university-based archives repositories. It underscores the need for continued research, collaboration, and

investment in digital preservation to ensure the long-term safeguarding and sharing of valuable cultural and historical records for future generations.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter reviewed the existing literatures and theories related to the digital preservation and access to archival materials at university-based archives. The review of the literature was guided by the objectives of the study. This chapter describes the research methodology used to carry out this study. Kothari (2018:1) refers research methodology as the systematic scientific methods and procedures used to collect and analyse data in order to arrive at conclusions and answer research questions. Hence, according to Singh (2021:1), research methodology is the framework that outlines in detail the procedures or strategies utilised to carry out a research activity, where the process comprises of approaches and methods for establishing the problem statement, collecting data and drawing conclusions. Moreover, the process includes developing a study design, scope, sample, instruments, testing for validity and reliability, and analysing the results. Pandey and Pandey (2021) indicate that research methodology is an important part of any research project. It is the process of collecting, analysing and interpreting data to answer a research question. Research methodology involves a variety of techniques and approaches, including surveys, interviews, experiments and case studies.

The university-based archives preserve vast amounts of archival material. The digital preservation of such kind of materials is important for the continued functioning of many universities and its loss can result in significant negative consequences. Digital preservation refers to the process of ensuring that digital data remains accessible and usable over long periods of time (Yadav 2016:64). The digital preservation process involves a range of activities, including the selection of materials to be preserved, the creation of digital surrogates (digitisation), the storage of digital data, and the management of digital data over time. The purpose of this methodology chapter is to outline and describe the methods and procedures used to conduct the study. Therefore, it is important to understand the different types of research methodology and how they can be used to answer research questions regarding digital preservation

of archival materials and promotion of access to such kind of materials. This chapter describes the research paradigms, research approach, research design, study population, sampling, data collection tool, data analysis and interpretation, establishing trustworthiness in qualitative research, scope and delimitations of the study and ethical considerations.

3.2 Research Paradigms

Research paradigms are worldviews, which are specific beliefs that guide the research (Creswell 2018:46-47). According to Saunders, Bristow, Lewis and Thornhill (2019:133), three types of research assumptions to distinguish research philosophies include ontology, epistemology and axiology. Alharahsheh and Pius (2020:39) indicate that a paradigm is made up of ontology, epistemology, methodology and methods. While Denzin and Lincoln (2018:195) point out that there are three major viewpoints from which research paradigms may be viewed: ontological, epistemological and methodological.

Ontology, according to Hiller (2016:99), refers to the study of being, or the nature of existence. In other words, it is the study of what exists, what is, what is real, or, to put it simply, "what is." Ontological ideas, often known as assumptions in philosophy, govern the sorts of questions that a researcher may ask about how the world works or how individuals behave or interact. In the natural sciences, for example, basic assumptions about reality come under the ontology of realism. According to Saunders (2019:133), ontology is defined as the assumptions about the nature of reality. Ontological assumptions shape the way in which you see and study your research objects. Relevant to this study, this means that the researcher's ontology therefore determines how she sees the world of digital preservation and access in the university libraries, and therefore, the researcher's choice of archival materials to research about. Furthermore, Alharahsheh and Pius (2020:40) stress that ontology is mainly concerned with the phenomenon in terms of its nature of existence. It seeks an answer or reality to a research question through indicating to existing type of knowledge can be found. Denzin & Lincoln (2018:195) indicate that the ontological viewpoint is concerned with the study of being and the nature of existence. Ngulube (2015:27) therefore defines ontology as the essence and presence of social reality. Epistemology is another paradigm. Saunders et al. (2019:133) refers epistemology to assumptions

about knowledge, what constitutes acceptable, valid and legitimate knowledge, and how we can communicate knowledge to others. While, Alharahsheh and Pius (2020:40) indicate that epistemology is concerned with how a researcher is aiming to uncover knowledge to reach reality, moreover, it is considered an internal factor within the researcher as it is also concerned with how a researcher can distinguish between wright and wrong and it is about how a researcher is viewing the world around them. Furthermore, Denzin & Lincoln (2018:195) point out that the epistemological viewpoint is concerned with the study of the nature of knowledge. Hence, Ngulube (2015:27) sees epistemology as knowledge of how to know. According to Hiller (2016:99-100), epistemology may be defined as a theoretical framework that explores many perspectives on the acquisition of knowledge. It specifically focuses on the process of generating legitimate knowledge and understanding how individuals come to possess what they believe to be knowledge. Other paradigms mentioned above include axiological and methodological knowledge. Axiology refers to the role of values and ethics (Saunders et al. 2019:134). Methodological viewpoint is concerned with the process of knowing, that is, the methodical stages involved, and the procedures used in attaining information (Denzin & Lincoln, 2018:195).

According to Creswell and Creswell (2018:46-47), some research paradigms include positivism, participatory or transformative, constructivism and pragmatism. Saunders et al. (2019:144) identified five major philosophies, which include positivism, critical realism, interpretivism, postmodernism and pragmatism. A positivist worldview is linked to the quantitative research approach (Creswell and Creswell 2018:47). According to Antwi and Hamza (2015:223), quantitative research paradigms assume that existent phenomena can only be explained from a positivist paradigmatic viewpoint, which can only be known via experimental methodologies. Saunders et al. (2019:144) indicated that a positivism's ontology is a real, external, independent one true reality (universalism), its epistemology is scientific method observable and quantifiable facts, and positivism's axiology is value-free inquiry, in which the researcher maintains objective viewpoints. Furthermore, positivism employs quantitative techniques of analysis. The second worldview mentioned above is critical realism, Bogna, Raineri and Dell (2020:467-468) note that critical realism has a realist ontology based in an objectivity independent of individual perception that seeks phenomena-generating systems via empirical experiences. It has wide-ranging,

interpretivist epistemology, using cause-and-effect relationships, concepts, and knowledge frameworks. Critical realism holds that the researcher is objective and that social theory may criticise and propose change. Saunders et al. (2019:144) define critical realism as stratified, external, independent, intransient objective structures causal processes (ontology). Epistemological relativism views knowledge as socially constructed and historically located. Value-laden research recognises worldview bias and minimises it (axiology) and critical realism uses mixed methods. The third paradigm mentioned is that of interpretivism. According to interpretivism, reality is socially created and has a relativist ontology based on the investigation of conceptual frameworks held by individual study participants. It has subjectivist epistemology, which means that the researcher engages with study participants, interprets and cocreates their own meaning of the data. It employs a qualitative technique. Regarding an interpretivism axiology, the researcher allows for an interpretation of the world as seen by study participants. The researcher is taken as an actor, not merely a data processor (Bogna, Raineri, and Dell 2020:467-468). Creswell and Creswell (2018:47) also indicate that the qualitative research approach is associated with the interpretivism worldview. The fourth worldview mentioned is postmodernism. The postmodernism ontology is nominally complex, rich socially constructed via power relations. Some meanings, interpretations and realities are controlled and silenced by other flux of processes, experiences and practices. Postmodernism's epistemology bases reality and knowledge on dominant ideologies' focus on absences, silences and oppressed. Value-constituted research and qualitative analysis are its techniques (Saunders et al., 2019:145). Saunders et al. (2019:145) concludes with pragmatism. Pragmatism's ontology refers to the practical effects of ideas, processes, and experiences. Pragmatism uses knowledge settings, of which true theories and knowledge concentrate on issue solutions, relevance and informed future practices. A pragmatism axiology is value-driven research and uses linked with mixed methods. According to Creswell and Creswell (2018:47) a mixed-method approach is associated with the pragmatism worldview because it arises from actions, situations, and consequences, rather than antecedent conditions.

3.2.1 Interpretivism paradigm

This study's research paradigm is interpretivist in nature. In interpretivism, the researchers seek an understanding of the world in which they live and work (Creswell & Creswell, 2018:48). The research's purpose is highly reliant on the participants' perspectives on the subject under study. According to Boyland (2019:30), interpretivism provides an investigative thinking paradigm in which the researcher journeys with participants into a space of interpreted reality that is as personal and individual as each person in the collective sampling and as diverse as the multiplicity of lived experiences profiled. Furthermore, Kim (2014:539-540) asserts that the interpretivism paradigm views research, particularly qualitative educational research, as a means of finding meaning and understanding via the researcher's active participation in the construction of meaning.

The interpretivism paradigm, according to Saunders et al. (2019:149), has a subjectivist perspective, with interpretivist researchers attempting to account for this complexity by collecting what is meaningful to their study participants. Interpretivism has different strands, including phenomenologists, hermeneuts and symbolic interactionists. Furthermore, Saunders et al. (2019:149) emphasises that phenomenologists are those who study existence, with an emphasis on participants' lived experiences i.e., the participants' recollections and interpretations of such events. Hiller (2016:115) indicates that phenomenological research seeks out an understanding of lived experiences and the meanings that emerge as individuals experience phenomena in their everyday lives in the lifeworld. Hermeneuticists, on the other hand, analyse cultural artefacts such as texts, symbols, tales, and pictures (Saunders et al. 2019:149). And symbolic interactionists, whose philosophy is rooted in pragmatic thinking and who consider meaning as something that emerges from interpersonal relationships, concentrate on the observation and study of social interactions such as discussions, meetings, and collaboration (Saunders et al. 2019:149). This study's researcher is a phenomenologist, concerned as it is with existence with an emphasis on participants' experiences with digital preservation. It aims to explore digital preservation in university-based archives repositories and would depend on information from archivists, archives managers, and digital content managers.

3.2.1.1 Ontology, epistemology, axiology and methodology in interpretivism paradigm

Ontology in interpretivism paradigm

The interpretivism's ontology is complex, rich, socially constructed through culture and language, multiple meanings, interpretations, realities, flux of processes, experiences and practices (Saunders et al. 2019:144). Hiller (2016:103) indicates that interpretivism rejects objectivism's idea that knowledge is simply there to be found and collected by people. Interpretively, all knowledge is subjective and connected to the natural circumstances in which we live, making it ontologically relativist.

Epistemology in interpretivism paradigm

Interpretivism's epistemology allows a person or group to assign meaning to phenomena or experiences based on empirical encounters with real objects and people, but explicitly understood via their interpretations. Knowledge efforts include relativism and subjectivity (Hiller 2016:111). Hence, Saunders et al. (2019:144) emphasise that interpretivism's epistemology is simple, based on narratives, tales, perceptions, interpretations, new understanding and worldviews.

Axiology and methodology in interpretivism

Interpretivism constitutes value-bound research in which researcher interpretations are critical to contribution and the researcher is reflective. The methodology is often inductive, with small samples, in-depth research, and qualitative data analysis, however data from a variety of sources may be interpreted (Saunders et al., 2019:144).

3.2.1.2 Justification of the interpretivism paradigm

From the above explanations and considering the research objectives, the researcher adopted an interpretivism paradigm in exploring digital preservation for access archival materials in the university-based archives repositories of the Gauteng Province in South Africa. According to Hiller (2016:111), interpretivism is a perspective according to which an individual or group may ascribe meaning to phenomena or experiences based on encounters with actual objects and people,

meanings that are empirically based encounters but explicitly understood through an individual's or a group's interpretations. Relativity and subjectivity are natural and advantageous features of such knowledge efforts. The researcher assumes the existence of a reality out there, independent of the social world and the researcher's knowledge, which needs to be viewed through qualitative methodologies. The researcher sets out to gain further depth of insight through seeking experiences and perceptions of the reality of archivists, archives managers and digital content managers of the library in the university-based context. According to Saunders et al. (2019:144) reality is socially constructed. The researcher of this study depended upon the participants' (archivists, archives managers and library digital content managers) views regarding the digital preservation for access archival materials. The study objectives are centered on questioning if the digital preservation can influence the access to archival materials. Therefore, the researcher employed a qualitative research methodology to test this hypothesis and answer satisfactorily the research objectives centered on it.

3.3 Research Approach

A research approach refers to the general methodological and theoretical perspective that a researcher adopts to conduct their study. It encompasses the researcher's overall research philosophy, research design, data collection and analysis techniques, and interpretation of results (Aspers and Corte 2019). Plonsky (2017:21) defines a research approach as an overall strategy chosen to integrate different components of a study in a coherent manner to answer a research question. According to Creswell (2014:32) the research approach refers to a study plan and process that includes stages ranging from broad assumptions to data collection, analysis and interpretation techniques. Furthermore, Creswell and Creswell (2018:3) state that the strategies and procedures used in a research study are referred to as research approach and further indicate that the researcher's ideology of the research problem, the research procedures followed, and the specific research methods of data collection and interpretation all influence a study's research approach. According to Creswell (2014:32), the research approach is comprised of three basic approaches: quantitative, qualitative, and mixed method. Also, Creswell and Clark (2017:34) and Leedy and Ormrod (2020:28) indicate that there are three main research approaches:

quantitative, qualitative, and mixed methods. A quantitative research approach is a research approach that emphasises the use of numerical data and statistical analysis to measure and analyse phenomena (Creswell (2014:4). This approach typically involves the use of standardised questionnaires or surveys to collect data from large samples of participants and the data is then analysed using statistical techniques to identify patterns, relationships, and associations (Creswell and Creswell 2018:4). A qualitative research approach is a research approach that emphasises the collection and analysis of non-numerical data such as words, images, and observations to explore and understand phenomena (Van Bavel and Dessart, 2018:7). This approach typically involves the use of methods such as interviews, focus groups, and observation to collect data and the data is then analysed using techniques such as thematic analysis or discourse analysis to identify themes and patterns (Van Bavel and Dessart 2018:7). Mixed method research combines components of both qualitative and quantitative research methodologies to gain range and depth of insight and verification (Flick 2014:36). According to Ngulube and Ngulube (2015:1), the third methodological trend that encourages methodological variety is mixed method, which entails the use of quantitative and qualitative methodologies inside a single research. Overall, the research approach is an essential aspect of the research process, as it determines the type of data that is collected, the methods used to analyse the data, and the interpretation of the findings. The choice of research approach depends on the research question, the nature of the phenomenon being studied, and the researcher's epistemological and theoretical perspectives (Reiter, Stewart and Bruce 2011:36). The purpose of this study was to assess the state of digital preservation in Gauteng university-based archives repositories to determine if such repositories are ready for digital preservation, which may enhance access to archival materials. A qualitative research approach was used in the study. Van Bavel and Dessart (2018:7) noted that the qualitative approach refers to research that produces descriptive data, people's own spoken or written words, and observable behaviour. This methodology employs typical methods such as in-depth interviews, focus groups, and ethnography. Hence, according to Haven and Van Grootel (2019:232), qualitative research seeks to address the "how," "why," and "what" questions about a phenomenon. It often employs language as its data, whether written or spoken, but it may also use images, videos, or other sorts of behavioral records. Qualitative data are often acquired via interviews, focus groups (structured group discussions) or observation. A study by Sutton and

Auston (2015:226) found that qualitative research may assist researchers in accessing the ideas of study participants, allowing for the creation of an understanding of the meaning that individuals assign to their experiences. As a result, this study investigated the significance of a situation from the perspectives of participants. This entails investigating digital preservation issues in university-based archives repositories. The managers and archivists are chosen. Interviews were used to collect data.

3.3.1 Justification for Using Qualitative Research

Qualitative research is a method of inquiry that seeks to understand people's experiences, beliefs and perspectives by examining their thoughts, feelings and behaviours. There are multiple advantages that come with using qualitative research (Antwi and Hamza, 2015:220). Firstly, qualitative research allows for an in-depth analysis of a phenomenon. There are situations where it is important to determine why a phenomenon is happening instead of how frequent it is happening, which is usually covered by a quantitative methodology. While using qualitative methodology, it is possible to ask to follow up questions to ascertain when a phenomenon happened, who was involved and what were their motivations or inspirations. All this can be determined using qualitative methods and is not possible while using a quantitative methodology. This flexibility allows the researcher to get a more nuanced data exploration.

The other advantage of employing a qualitative study is that the data obtained by researcher is much detailed. This is due to the narratives, anecdotes and quotes which make up the qualitative data collection process. These stories provide an insight into the lived experiences of the research participants, as well as their perspectives on various matters. Additionally, the data can still be analysed in a variety of ways using trends, themes or patterns (Chauvette, Schick-Makaroff and Molzahn, 2019). Moreover, an argument can be made that when it comes to data validity, using qualitative data collection methods can also improve the validity of the data (Lemon and Hayes 2020). This is because a qualitative methodology can offer a more comprehensive understanding of the environment in which the data is collected. This provides for richer and better-quality data than using a coded questionnaire (Sutton and Austin 2015:226). Additionally, due to the nature of qualitative research allows the

researcher to build a rapport with the research participants, which leads to more honest and open responses that provide the researcher with high quality data (Alase 2017:9). When using a mixed methods research methodology, qualitative research can also be used to generate assumptions and hypotheses, which can then be tested using quantitative data. Therefore, starting with qualitative research can also help researchers to identify key variables on which they might need to focus when collecting numerical data (Almalki, 2016:289).

3.4 Research Design

A research design refers to a systematic plan or strategy that outlines the procedures, methods, and techniques that a researcher will use to collect and analyse data in order to answer a research question or test a hypothesis. It is a blueprint or roadmap for conducting research that provides a clear and structured framework for the research process (Siedlecki 2020). The research design is developed based on the research question, objectives and the nature of the data that needs to be collected. It includes several key elements, including the research approach (quantitative, qualitative and mixed methods), the research method (survey, experiment, case study, etc.), the sampling strategy, the data collection and analysis procedures, and the timeline for conducting the research (Denzin and Lincoln 2018:58). Researchers utilise study designs to explain research techniques such as data collection, processing and presentation, as well as data interpretation (Creswell & Creswell, 2018:11). The research design helps to ensure that the research is conducted in a rigorous, systematic and transparent manner and that the data collected is reliable, valid, and relevant to the research question, and it also helps to ensure that the research process adheres to ethical standards and best practices (Asenahabi 2019:76). Overall, the research design is an essential component of any research study as it provides a clear and structured framework for conducting research, which helps to ensure that the research is conducted in a rigorous and transparent manner, and that the findings are credible and valid.

Research designs fall within the qualitative, quantitative and mixed methodologies approaches that give direction for processes in a research project (Creswell & Creswell 2018:53). According to Kivunja and Kuyini (2017:37), there are five main research designs in quantitative approach, which include experimental research

design, descriptive research design, correlational research design, survey research design, and comparative research design. Rahi (2017:2) meanwhile indicates that there are three basic forms of research designs that include exploratory research, descriptive research and explanatory research. According to Rahi (2017:2) exploratory research seeks new knowledge and answers. Questions and fresh perspectives are sought. When ideas are unclear, this form of study is used. This kind of inquiry seeks fresh insights into present circumstances and concerns using a qualitative method. Hence, descriptive research seeks current knowledge and explanatory research seeks to discover study problems and relevant variables, where quantitative methods benefit from descriptive and explanatory research designs. Akhtar (2016:73-75) classifies research designs into four types, namely: exploratory research, descriptive research, explanatory research and experimental research. Akhtar (2016:73-75) further describes exploratory research as the first stage in research, with the purpose to obtain new insights on a phenomenon when there is minimal research information about an issue and the phases in exploratory research include a survey experience and a case study. While descriptive research is statistical research, it describes phenomena as they exist. The research design is called explanatory when the goal of the study is to explore a new universe that has not been studied previously. The research is primarily concerned with the causes or "why" factor of a phenomenon. Experiment design refers to a research design that is used to test a causal relationship under controlled conditions (Akhtar, 2016:73-78). According to Bhat (2023), numerous strategies may help researchers choose the appropriate study design, data collecting methods and subjects. Figure 3.1 describes the exploratory design: Types and characteristics.

Figure 3.1: The Exploratory Design

Bhat (2023)

Figure 3.1 shows exploratory methods, including primary and secondary research. Primary research is acquired directly from the source by a group or individual. Primary research uses surveys/polls (quantitative approach), interviews (qualitative method — interviews may provide in-depth information about the subject being investigated), focus groups, and observations to investigate a particular issue. Online, literature, and case study research are examples of secondary research (Bhat 2023).

This study employed an exploratory research design to delve into the realm of digital preservation and access within university-based archival repositories. The research design serves as the blueprint for executing the study, outlining the necessary data sets, collection methods, and analytical procedures essential for addressing the research questions (Maree, Creswell, Ebersohn, Ferreira, Ivankova, Jansen, Nieuwenhuis, Pietersen and Plano-Clark 2016). This study opted for an exploratory design to facilitate qualitative methods. Specifically, qualitative techniques such as interviews, focus groups, observations, and analysis of textual sources are deemed suitable for data collection, aligning with the research objectives (Carr, Zhang, Ming and Siddiqui 2019:307). To delve deeper into the subject matter, in-depth interviews were conducted with purposefully selected participants, allowing for a comprehensive exploration of their perspectives (Pacho, 2015:48). Hybrid interviews, combining face-to-face and online modalities, were conducted with key participants including archives managers, library digital content managers, and archivists from four institutions (Unisa, UP, Wits, and UJ).

3.4.1 Justification of the exploratory research design

The exploratory design is useful for gaining background information on a subject. It is flexible and can address research questions of all types (what, why, how). Moreover, it provides an opportunity to define new terms and clarify existing concepts and exploratory design is often used to generate formal hypothesis and develop more precise research problem (Crescenzi, Zhang and Capra 2019:1093). According to Bhat (2023) exploratory research is done in order to understand a subject, particularly if it hasn't been done previously. Such studies investigate the issue without drawing conclusions. This manner of research will help a researcher explore his ideas, choose the correct study design, and uncover variables that matter for analysis. Most

significantly, such a study may assist researchers to save time and money by determining whether it is worth pursuing.

3.5 Population

Research population refers to a group of elements sharing some characteristics that the researcher is interested in (Majid 2018:3). It is from this research population that the researcher will pick their research participants. This is because by having the right research population, the researcher is likely going to answer their research questions. Stockemer (2019:58) defines research population as the entire subject group for whom the researcher needs information. According to Blaikie and Priest (2017), a population is defined as an accumulation target population to be investigated, from which the results (participants) are intended to be generalised and viewed as representative of the total population. Furthermore, Maree et al. (2016) say that research may encompass a large population, making it hard to investigate it in its totality. This would require choosing the proper elements from the sample. The sample must be representative for the findings to be generalisable. Therefore, the study's target population comprised library employees from three universities, Unisa, Wits and UJ. The population of UP consists of employees from the office of the university registrar, since the UP Archives is part of the office of the university registrar rather than the library (University of Pretoria 2024).

3.6 Sampling

Sample refers to the process of selecting a subset from a predetermined sampling frame or the complete population and a sampling is a collection of real instances from which a sample will be selected. The sample frame must be population representative. (Taherdoost 2016:19-20). Sampling in research is classified into probability and non-probability sampling. Stratified random samples, simple random samples, cluster samples, and systematic samples are types of probability sampling used in employed in quantitative research studies, while the non-probability sampling employed in qualitative research studies includes, purposive, judgmental, and convenience sampling (Neuman 2014:195). Lopez and Whitehead (2013:24) indicate that

qualitative research uses non-probability sampling. Non-probability sampling involves researchers selecting just certain groups to investigate a problem and four kinds of this sampling include convenience sampling, purposive sampling, snowball sampling and theoretical sampling. Furthermore, Lopez and Whitehead (2013:124) also justify that sampling in qualitative research is non-probability sampling. It is unlike the probability sampling used in quantitative research, where researchers recruit the population with characteristics that represent a wider community. With non-probability sampling in qualitative research, the researchers recruit only specific populations to investigate a specific topic or when the total population unknown or unavailable. There are four main types of non-probability sampling, namely convenience sampling, purposive sampling, snowball sampling, and theoretical sampling. Taherdoost (2016:20) states that sampling may be utilised to draw inferences about a population or to generalise regarding current concept. This is determined by the sample strategy used. In general, sampling procedures are classified as probability or random sampling or non-probability or non-random sampling. According to Taherdoost (2016:20), probability sampling includes simple random, stratified, cluster sampling, systematic sampling and multistage sampling and Probability Sampling Probability sampling means that every item in the population has an equal chance of being included in the sample. While non-probability sampling includes quota sampling, snowball sampling, judgment sampling, and convenience sampling and non-probability sampling are often associated with qualitative research.

3.6.1 Purposive (Judgement) Sampling

This study's sampling technique is non-probability. Non-probability sampling refers to a method in which not all participants of the population have an equal chance of participating in the research. This differs from probability sampling, where each member of the population has a known chance of being selected (Leedy & Ormrod 2020:200). Ayhan (2011:1) indicates that non-probability sampling uses subjective judgement and utilixes convenient selection of units from the population. There are several methods of non-probability, including convenience (haphazard) sampling, purposive (judgement) sampling, expert choice, snowball sampling, quota sampling, etc. (Ayhan 2011:1-2). This study applied purposive sampling. According to Ayhan

(2011:1), purposive sampling involves the researcher subjectively selecting participants. The researcher's judgement is used to make the selection. Respondents are not chosen at random, but rather based on the interviewers' choice. As a result, the likelihood of inclusion for each given sample unit is uncertain. Creswell (2014:204) indicates that purposive sampling involves the selection of sites or participants for a research problem, while purposive sampling helps focus on specific characteristics of a population that are of interest, allowing participants to best answer the research question, thus considering and sharing insights on the subject being studied. Etkan, Musa and Alkassim (2016:2) point out that purposive sampling is based on the assumption that the researcher needs to purposefully select individuals, groups, and settings because they are likely to be knowledgeable and informative about phenomena the research is studying.

One of the advantages of purposive sampling is that of saving time. This is because the researcher already knows the people that need to be interviewed, negating the need for a random sample. Considering that the researcher already knows the people that are going to provide the data, this allows for greater accuracy in the data that is collected (Acharya, Prakash, Saxena and Nigam, 2013:332). This is unlike a random trial where some of the people who provide responses are not well versed in the issue at hand. Purposive sampling can help researchers gain an in-depth understanding of a specific population or phenomenon by selecting participants who have unique experiences, perspectives, or knowledge. Lastly, purposive sampling is flexible and can be adapted to suit different research questions, contexts, or situations. It allows the researcher to select participants who are most likely to provide the necessary data for the research question (Sharma, 2017:751).

3.6.2 Sample

Sample size refers to the number of participants or observations included in a research study. It is the size of the subset of the population that is selected for inclusion in the study (Boddy 2016:429). The size of the sample can vary depending on the research question, study design, and statistical power required to make meaningful inferences from the data. A larger sample size generally increases the statistical power of the study and reduces the risk of errors due to chance. However, larger samples may also

increase the time, cost and complexity of the research study. Therefore, the sample size must be chosen carefully to balance statistical power and practical considerations (Vasileiou, Barnett, Thorpe and Young 2018:2).

The sample for this study comprised 11 participants drawn from four Gauteng-based university archives repositories: Unisa, Wits, UP, and UJ. These repositories were chosen because they preserve archival materials within their libraries, with the exception of UP, which falls under the office of the registrar. Additionally, all four repositories have initiated digital preservation activities through existing university repositories (UIR). The participants include archives managers, archivists, and library digital content managers. From Unisa, four participants were selected: one archives manager, two archivists, and one library digital content manager. Wits University provided one archives manager. Three participants were selected from UP: one archives manager and two archivists. Lastly, UJ contributed three participants: one archives manager, one archivist, and one assistant archivist. This sample size was considered sufficient to gather the necessary data to meet the study objectives.

3.7 Data collection tool

The process of acquiring varied data that is relevant to a research is referred to as data collection (Saunders, Lewis and Thornhill 2009:159). Bhandari (2020) defines data collection as the systematic collecting and measurement of variables of interest to answer research questions, test hypotheses and assess results. All data gathering aims to gather high-quality evidence for rich data analysis and compelling answers to inquiries. According to Kairuz (2007:371), data can be gathered from interviews of varying depth and in different contexts e.g., face-to-face interviews, individual semi-structured, or in-depth interviews, and focus groups discussions. Data can also be gathered from surveys that elicit narrative feedback from the analysis of texts to explore a specific concept (Kairuz 2007:371).

Therefore, in-depth interviews were used as a qualitative data collection tool. In-depth interview is a semi-structured extended interview where the interviewer uses predefined open-ended questions (Kairuz 2007:371). The open-ended questions are invaluable in collecting specific data, where interview guides are designed as a conversation around a specific topic, instead of probing questions. This allows for the researcher to gather more contextual data on a given topic instead of direct questions

receiving direct answers (Adams 2015:492). The single biggest advantage of qualitative data is that it is not constrained by predetermined response options. This is the tool that was administered to all the research participants. One of the advantages of using open-ended interviews is that it allows for the collection of detailed and rich data. This allows the researcher to understand some of the research participants' experiences, feelings, and thoughts (Queirós, Faria and Almeida 2017:377-379). Secondly, open-ended interviews allow the interviewer to adapt their questions and follow-up questions based on the participant's responses. This can lead to a more thorough exploration of the topic and can help to identify unexpected themes or issues (Queirós, Faria and Almeida 2017:377-379). Additionally, open-ended interviews allow the interviewer to adapt their questions and follow-up questions based on the participant's responses. This can lead to a more thorough exploration of the topic and can help to identify unexpected themes or issues. Open-ended interviews allow participants to share their experiences and perspectives in their own words, which can increase their engagement and investment in the research. This can lead to more honest and detailed responses from participants (Adams 2015:492). Lastly, open ended interviews can improve the validity of the data by reducing researcher bias. By allowing participants to share their experiences in their own words, researchers can gain a more accurate understanding of the participant's perspective, reducing the risk of the researcher imposing their own assumptions or biases on the data (Glazier, Boydstun and Feezell 2021:1). Kairuz (2007:371) suggests that five to ten in-depth interviews are more than enough to probe beyond a simple answer, clarify ambiguous responses, and explore people's perceptions and views on issues. Unlike experimental studies, there is no mathematical rule for calculating the sample size for in-depth interviews. Overall, open-ended interviews can provide researchers with rich and detailed data that can lead to a deeper understanding of the topic being studied. They allow for flexibility and participant engagement and can improve the validity of the data.

3.8 Data collection procedures

Data collection procedures involved setting up appointments for both face-to-face and virtual interviews, to which all eleven participants consented. Prior to the interviews, a list of pertinent questions was emailed to the participants, along with a brief explanation of the study's purpose, and consent and information forms were provided.

On the day of the interview, the purpose was reiterated to the participants, who were informed that the interviews would be audio-recorded, and an informal rapport was established. All interviews were conducted in English, varying in duration from 60 to 120 minutes. Variances in interview length were attributed to participant personalities; some delved deeply into topics, using examples and anecdotes, while others responded more succinctly. The interview questions are provided in appendix A. Once the face-to-face and MS Teams interviews were concluded, the audio recordings underwent transcription. The interview method was chosen as the primary data collection tool for this study to ensure the highest quality of research in terms of reliability and validity.

3.9 Data analysis

Data analysis is described as the process of analysing data by applying analytical and logical reasoning to each component of the data presented. The purpose of data analysis is to extract meaningful information from data and make decisions based on that information (Islam 2020:10). This study included a qualitative data analysis. According to Brown and Hale (2014:203), the fundamental objective of qualitative data analysis is to identify patterns, themes, and trends that are as similar to the original data as feasible, in a process known as pattern matching. For qualitative analysis, a systematic study of written or spoken words is necessary. Lester, Cho and Lochmiller (2020:96) state that there are several methods for analysing qualitative data, each with its own theoretical assumptions and expectations. Therefore, some qualitative analysis methods include content analysis, thematic analysis and discourse analysis. Warren (2020) lists the six most prevalent qualitative analysis methods as: content analysis, narrative analysis, discourse analysis, thematic analysis, grounded theory (GT), and interpretive phenomenological analysis (IPA). A thematic analysis was done in this study. Data derived from semi-structured interviews with selected university-based archives/library staff who participated in this study.

3.9.1 Thematic analysis

Thematic analysis is a qualitative research method that researchers use to systematically organise and analyse complex data sets. It is a search for themes that

can capture the narratives available in the account of data sets. It involves the identification of themes through careful reading and re-reading of the transcribed data (Dawadi 2021:62). According to Caulfield (2022), a thematic analysis is a process of dealing with data that works from raw verbal or visual data. Thematic concepts should emerge from the research question, sample selection, and data collection process. The data for this study was acquired through semi-structured interviews with selected university-based archives/library staff, who participated in the study, and was analysed using a thematic analysis method. The data was thoroughly reviewed against the study's objectives, from which the themes were decided. The analysis included fifteen themes generated from the study's objectives and distinct parts of the interview questions, which were given in tables 1–15. The following codes were granted: University of South Africa: Code-USA - Manager: Code USA1; Archivist 1: USA2; Archivist 2: USA3; and Library Digital Content Manager: USA4. University of Pretoria: Code-UPA - Manager: Code UPA1; Archivist 1: UPA2; Archivist 2: UPA3. University of Witwatersrand: Code- UWA – Manager: UWA1 and University of Johannesburg: Code-UJA – Manager: UJA1; Archivist: UJA2; and Assistance Archivist: UJA3. Recurring words, phrases, and topics may be used to code themes. In qualitative data coding, according to Crosley (2020), is the process of creating and assigning codes to categorise data extracts or it the process of labelling and grouping similar types of data to make generating themes and analysing the data more manageable. Furthermore, it is one of numerous strategies for working with and developing knowledge about data, it should be used in combination with annotating, connecting and modelling. According to Crosley (2020), there various types of coding, which include, in vivo coding, process coding, open coding, descriptive coding, structural coding, and value coding. Therefore, this study applied in vivo coding. When using in vivo coding, the researcher makes use of a participants' own words, rather than their interpretation of the data. In other words, the researcher uses direct quotes from participants. By doing this, the researchers avoid trying to infer meaning, rather staying as close to the original phrases and words as possible.

3.10 Establishing trustworthiness in qualitative research

Data trustworthiness refers to the state of believing the study's findings and is measured using four key criteria: credibility, transferability, dependability, and

confirmability (Leedy 2015:138). The term "data credibility" refers to "true value" in data collection and analysis (Caddy 2015). According to Munich Business School (2017), credibility is dependent on the richness of data and analysis and may be improved by triangulation. Creswell (2014:251) distinguishes four forms of triangulation, namely data triangulation, methodological triangulation, investigator triangulation, and theoretical triangulation. Data triangulation refers to the use of multiple data sources, methodological triangulation refers to the use of more than one method, investigator triangulation refers to the use of more than one researcher to increase the credibility of a study, and theoretical triangulation refers to the use of more than one theory as a conceptual framework. Transferability refers to the extent to which qualitative research findings can be generalised or transferred to other contexts or settings (My Dissertation Coach 2020). According to My Dissertation Coach (2020), transferability is primarily the responsibility of the individual generalising qualitatively, which means that teh qualitative researcher can increase transferability by clearly outlining the study's context and assumptions and the person wishing to "transfer" the findings is responsible for judging the propriety of the transfer. Yin (2016:241) defines transferability as the degree to which the phenomenon or finding of the research described in one study is applicable or useful to theory, practice, and future research. This is the extent to which one study's findings may be transferred to another. Data dependability is the ability to ensure that the research findings are consistent and reliable and the standard at which the research is presented (Kalu and Bwalya 2017:51). Furthermore, Kalu and Bwalwa (2017:51) indicate that dependability involves participants' evaluation of the findings, interpretation, and recommendations of the study, such that all are supported by the data as received from participants of the study, transparently describing the research steps taken from the start of a research project to the development and reporting of the findings. The records of the research path are kept throughout the study (Kalu and Bwalya 2017:51). Confirmability is demonstrated when the research findings are based on participants' thoughts and experiences, rather than on the researcher's bias (Kennedy-Clark 2012:5).

Therefore, the researcher took all measures necessary to assure the trustworthiness of this study. Data dependability and confirmability were used in this study. According to Kalu and Bwalwa (2017:51), dependability involves participants' evaluation of the findings, interpretation and recommendations of the study, such that all are supported

by the data as received. Kenneth-Clark (2012:5) indicates that confirmability is demonstrated when the research findings are based on participants' thoughts and experiences rather than the researcher's biases (Kennedy-Clark 2012:5). To establish the study's validity, the researcher relied on participant validation. One of the strategies used to demonstrate the credibility of the study results and interpretations is participant validation. Data and interpretations are made accessible to participants in order for to corroborate the authenticity of their reports by ensuring that both the data and interpretation are confirmed, and that the researcher has appropriately comprehended the participants' environment (Bryman 2012:391). To verify that the researcher grasped the context, the researcher allowed interview participants to corroborate the data that was received from them and analysed.

3.11 Ethical considerations

According to the study undertaken by Arifin (2018), many aspects must be considered when carrying out research. However, one of the most important is the ethical concerns that might arise. By considering the ethical protocol, the researcher can ensure to uphold the highest ethical norms, which enhance the research’s reliability and validity. When carrying out this study, the researcher took into consideration several issues. Flick (2014:54), asserts that ethical considerations must be considered by the researcher at every step of the methodology, from choosing the study subject to defining the research population and sample size, to communicating research results. Leedy and Ormrod (2020:135) list ethical considerations as informed consent, voluntary involvement, clearance to conduct research in an organisation or institution, participants' privacy and self-esteem, confidentiality, and top discretion over participant identities, and general risk assessments.

During the collection of data for the study, there are some considerations that the researcher ought to accommodate. The following ethical issues were considered: informed consent, confidentiality and privacy. The researcher respected participants’ autonomy, rights and dignity (University of South Africa Research Ethics Policy 2016:9). Anonymity and confidentiality were maintained. Interview reports were kept confidential. According to Kumar (2014:286), it is unethical for a researcher to exchange information about participants with others for purposes other than research.

To ensure that participants' safety and privacy were not jeopardised, the researcher asked them to sign an informed consent form before participating in the study. The consent form also duly provided information about the research. Furthermore, the researcher ensured that all the necessary ethical clearance protocols from the university are met before data collection.

3.12 Chapter summary

This chapter presented and discussed the research methodology used in this study in detail. The discussions covered the research paradigms, research approach, research design, population, sampling, data collection tool, data analysis and interpretation, establishing trustworthiness in qualitative research, scope and delimitations and ethical considerations. The study adopted interpretivism paradigm, qualitative research approach, exploratory research design, purposive (judgement) sampling, interview data collection tool, thematic and in vivo coding analysis, the trustworthiness was established by data dependability, and confirmability. The next chapter presented this study’s findings obtained from the interviews. The discussions entail presentation of the findings

CHAPTER FOUR

PRESENTATION OF THE FINDINGS

4.1 Introduction

The previous chapter discussed the research methodologies adopted for this study. This chapter present the findings. The research study adopted a qualitative research approach. The data was gathered using in-depth interviews and open-ended questions to answer the research questions and achieve the research objectives. The data gathered were analysed using qualitative data analysis, thematic analysis and vivo coding was employed, wherein researchers utilize participants' own words rather than interpreting the data, thus maintaining fidelity to participants' perspectives (Crosley 2020). In all, the research conducted in-depth interviews with 11 selected employees from Unisa, Wits, UP, and UJ. The researcher conducted interviews and administered interview questions to a sample of 11 individuals. All 11 participants took part in the interviews, leading to a response rate of 100%. Despite the researcher's desire to have face-to-face interactions with all 11 participants, this was not possible. Only 9 participants were interviewed in person, while 2 individuals were questioned via MS Teams sessions. The data collection instrument (i.e., the interview questions) was designed to answer the following research questions:

- What is the present status of digitisation inside university-based archives repositories?
- What methods are now used by university-based archives repositories to preserve archival items that were born digitally?
- How far have university-based archives repositories gone in terms of implementing digital preservation practices?
- How are digital archival materials accessed by users in university-based archives repositories?
- How does the Open Archival Information System (OAIS) reference model work in digital preservation of archival materials at the university-based archives repositories?

4.2 Response Rate

The percentage of the study sample that participated in the actual research study is referred to as the response rate in the research (Bryman 2016:141). A low response rate may indicate a threat to the research outcomes because non-respondents are likely to differ from respondents in ways other than simply refusing to participate in the research survey (Babbie 2016:264). For this study, a sample of 11 employees of Unisa, Wits, Up and UJ was selected because those employees were working at the university-based archival repositories and libraries. A response rate of 100% was achieved as all the 11 selected participates participated in the interviews and the interview questions were distributed to the respondents before face-to-face interview, and were completed, during the interview it was a matter of confirming data filled and to add more information. Table 4.1 below shows the sample size across the four university-based archival repositories of the four universities selected for the study and the corresponding response rate.

Table 4.1: Response Rate for interview questions

University-Base Archives Names	Sample	Response rate
Unisa Archives	4	100%
Wits Archives	1	100%
UP Archives	3	100%
UJ Archives	3	100%
Total	**11**	**100%**

Source: Field data (2023)

This study used theme analysis to evaluate data from in-depth interviews and open-ended questions with university-based archives/library staff. After reviewing the data against the study's objectives, themes were selected. Tables 1–15 show the fifteen themes from the study's goals and interview questions. The following codes were granted: University of South Africa: Code-USA - Manager: Code USA1; Archivist 1: USA2; Archivist 2: USA3; and Library Digital Content Manager: USA4. University of Pretoria: Code-UPA - Manager: Code UPA1; Archivist 1: UPA2; Archivist 2: UPA3. University of Witwatersrand: Code- UWA – Manager: UWA1 and University of

Johannesburg: Code-UJA – Manager: UJA1; Archivist: UJA2; and Assistance Archivist: UJA3. This study used in vivo coding. Instead of interpreting data, researchers utilise participants' statements in in vivo coding. Thus, the researcher cites people directly. Instead of inferring meaning, researcher remained as near to the original sentences and words as feasible.

4.3 Data presentation

Data presentation, according to Jupr (2020), is a key step in the analytical process. Data are summarised and presented in data presentation, enabling researchers to identify essential parts of the data and gain insight into the kind of model and analysis that should be used. They are shown using tables, charts, histograms, frequency curves, line graphs, pictography, and other visual aids. The study findings were provided in the following parts, which were generated from the study objectives: (a) Digitisation of archival materials; (b) Born-digital archival materials; (c) Digital preservation of archival materials; (d) Access to archival materials; and (e) The Open Archived Information System model (OAIS) reference model.

4.3.1 The digitisation of archival materials

Digital archival materials encompass both digitised and born-digital materials, each with distinct characteristics and origins. Digitised materials undergo a transformation process from analog to digital format, typically through techniques like scanning, which is an integral component of the digitisation process. In contrast, born-digital materials originate from digital technologies, such as documents created directly on computers or digital photographs captured with digital cameras (Velmurugan, 2013:2). The conversion of analog materials to digital formats, as highlighted by Pandey and Kumar (2020:26), empowers archives to modernize their collections and enhance accessibility. Digitized materials, once created, are preserved within digital preservation storage systems, ensuring their longevity and accessibility for future generations. Therefore, the first objective of the study sought to determine the present status of digitisation in the selected university-based archives repositories in Gauteng

Province. The findings to this objective are presented under the following sub-headings:

(i) Present status of digitization in the selected university archives

(ii) Digitisation workflow processes

(iii) Digitisation challenges encountered

(iv) Availability of Digitization Policies

4.3.1.1 Present status of digitisation in the selected university archives

This subject sought to determine the current state of digitising, such as how many collections have already been digitised and at what percentage level. The findings of the study revealed the following:

Participant USA1, representing repository USA, provided valuable insights into the digitization status of their archival holdings. According to USA1, the repository boasts an extensive collection, amounting to approximately 4,000 linear meters of archival materials. However, despite the considerable volume of materials housed within the repository, only a mere 10% of these holdings have undergone digitisation. USA1 attributed this relatively low digitisation rate to a multitude of factors that collectively impede progress in this area. One prominent obstacle highlighted by USA1 is the limited capacity of human resources dedicated to digitisation efforts. The repository appears to face challenges in mobilising personnel with the requisite skills, expertise, and time commitment necessary to undertake digitisation projects effectively. This shortage of skilled manpower likely hampers the repository's ability to accelerate the pace of digitisation and achieve broader coverage of its archival collections. Additionally, USA1 pointed to organisational boundaries and divisions as another contributing factor to the sluggish pace of digitisation. It is evident that within the repository's operational framework, there exist delineated responsibilities and divisions that may inadvertently impede collaboration and coordination across departments or units involved in digitisation initiatives. Such organisational silos could result in inefficiencies, duplication of efforts, or bureaucratic hurdles, thereby hindering the smooth progress of digitisation projects.

UPA2, representing repository UPA, provided a candid update on the digitisation progress within their collections, revealing both accomplishments and ongoing challenges. With commendable efforts, UPA2 reported that approximately 12% of the repository's collections have been successfully digitised. However, the onset of the COVID-19 pandemic has prompted a renewed sense of urgency and determination within the repository to accelerate digitisation efforts. The global health crisis brought about by COVID-19 has disrupted traditional modes of operation across various sectors, including archival institutions like repository UPA. In response to the pandemic's impact, UPA2 emphasised the repository's commitment to adapt and innovate, leveraging available resources to overcome obstacles and advance digitisation initiatives. Despite the operational challenges posed by COVID-19, UPA2 conveyed a resolute determination to persevere and maximize digitisation efforts, recognizing the critical role of digital access in meeting the informational needs of clients and stakeholders. UPA2's remarks reflect a proactive approach to addressing the evolving demands of archival management in the face of unprecedented circumstances. By prioritising digitisation activities, repository UPA demonstrates its responsiveness to the changing landscape of information access and dissemination. Furthermore, UPA2's acknowledgment of the repository's role in providing essential information to clients underscores the significance of digitisation as a means of enhancing accessibility, relevance, and resilience in archival services.

UWA1, representing repository UWA, provided valuable insights into the digitisation efforts within the Historical Papers Research Archive (HPRA), a vital component of the University Libraries. With an extensive archival holding comprising over 3,400 collections, HPRA stands as a repository of immense historical significance. However, UWA1 revealed that despite the repository's substantial holdings, only a modest fraction—estimated at approximately 7-8%—has undergone digitisation. The revelation underscores the significant strides made by repository UWA in digitising a portion of its archival materials.

AJA1 from repository AJA said '*Our digitisation status is at the lowest level of the whole collection, with a proportion of 6 percent. The digitisation is at a small scale since only one person is doing it and the scanner, we are using can only scan A4 and A3 size, larger documents such as maps, building plans cannot be scanned. As a result, a*

digital outsourcing tender has been finalised. This implies that the outside company will focus on to digitisation and pass expertise to archivists, meaning an increase in digitised archival materials.

The above findings are summarised in Table 4.2:

Table 4.2: Present status of digitisation

Repositories and Staff codes	Responses	The participants
USA: USA1	'The repository possesses ±4,000 linear metres of archival materials, however barely 10% has been digitised'.	• USA1 • USA2 • USA3 • USA4
UPA: UPA2	'We are 12% of the collections that have been digitised'	• UPA1 • UPA2 • UPA3
UWA: UWA1	'The Historical Papers Research Archive (HPRA) has around 3400 collections. Approximately 7-8% of our collections have been digitised'.	UWA1
UJA: UJA1	'Our 6% digitisation rate is the lowest in the collection. Only one person is digitising, and the scanner we use can only scan A4 and A3 papers, not maps or architectural plans. Thus, a digital outsourcing tender was completed. This means that the outside firm will concentrate on digitization and train archivists, increasing digitised archive resources'.	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.1.2 Digitisation workflow processes

This subject sought to determine the digitisation workflow processes. The findings revealed the following:

Participant USA2 said '*Digitising archival materials requires various processes to preserve archival materials efficiently and accurately. Donors or funders prioritise certain collections when selecting materials for digitisation. Since most of these collections come from the donors, the repository seeks copyright clearance after selecting them. After approval, scanning technical standards are set to ensure digitisation uniformity and quality. Archival materials are carefully prepared before scanning. A comprehensive quality assurance check ensures the digitised content's accuracy. Access derivatives enable user engagement with digitised content. Finally, the master files are transferred to a secure server to preserve and make the digitised archive available to future generations*.'

UPA1 stated '*First, the process commences with the selection of materials for digitization. Archival collections or files are chosen based on their usage frequency, consultation rates, or user requests. Next, it's crucial to ensure that the selected materials are appropriately arranged and described for efficient digitization. Once arranged, the materials are then taken for scanning to convert them into digital format. Lastly, since all archive collections are owned by UPA, copyright concerns are not applicable in this context.'*

UWA1 responded that *'After identifying collections for digitisation, they undergo further assessment to determine whether they should be digitised internally at the UWA Digitisation Centre or outsourced to a larger service provider. This assessment informs the subsequent workflow for preparation, scanning, and post-production processes.'*

UJA2 said '*The selection of archival material relies on various factors, such as the condition of the material. For instance, if a book shows signs of deterioration, it is scanned and stored to preserve its content. Additionally, remote users play a role in material selection; if a user requests specific material, they are scanned and delivered to the user via email. Furthermore, a digitisation tender has been approved and awarded to a single service provider. The process may commence before the conclusion of 2023, thereby shaping the digitisation workflow*'.

The above findings are summarised in Table 4.3:

Table 4.3: Digitisation workflow processes

Repositories and Staff codes	Responses	The participants
USA: USA2	• Decision on archival materials to digitise, the selection is determined by sponsors/donors, such materials are prioritised. • Obtain copyright clearance since the vast of the collections are donated from outside sources and Unisa does not hold the copyright • Set technical/scanning specifications • Prepare archival materials • Scanning of archival materials • Quality assurance • Create access derivatives • Load master files to secure server	• USA1 • USA2 • USA3 • USA4
UPA: UPA2	• Selection of materials for digitization based on usage, consultation frequency, or user requests. • Ensure proper arrangement and description of materials. • Materials taken for scanning. • Copyright not applicable as all archive collections are owned by UPA	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Collections identified for digitisation. • Further assessment of suitability and need	UWA1

	• Decision between in-house digitization or outsourcing to a larger service provider • Informing workflow for preparation, scanning, and post-production processes	
UJA: UJA2	• Selection of archival material based on condition, such as deteriorating books being scanned and stored for preservation. • Remote users influence material selection; requested materials are scanned and sent via email. • Digitization tender approved and awarded to a single service provider. • Process potentially starting before the end of 2023, shaping the digitization workflow	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.1.3 Digitisation challenges encountered

The subject sought to establish the digitisation challenges encountered. The findings of the study showed the following:

USA1, USA2 and USA3 stated the information below:

- *The digitisation process faces obstacles due to inadequate human resource capacity within the Archives section, consisting of only three archivists, and a shortage of digital specialists, with only two contract positions available.*
- *Without a clear digitisation strategy in place, the archival material's conversion into digital format lacks direction and cohesion, hindering efficient progress.*

- *Copyright and privacy issues pose significant challenges to the digitisation effort, requiring careful consideration and compliance with legal regulations to safeguard intellectual property and individual rights.*
- *The failure of management to grasp the intricacies of digitisation exacerbates the challenges. Merely scanning documents without implementing proper indexing or metadata procedures falls short of true digitization, undermining the effectiveness and usability of the digital archive*.

UPA3 said that '*Due to a staff shortage, there is no dedicated expert solely focused on digitization. Instead, the archivists handle digitization alongside their other duties, leading to potential inefficiencies in the process. Additionally, the institution lacks appropriate storage for digital files, as digitized materials are currently stored on Google Drive. However, due to misuse of Google Drive for personal purposes by employees, the institution is considering removing it as a storage option'.*

UWA1 indicated that *the digitisation of archival materials presents a challenge as it is carried out either at the UWA Digitisation Centre or through an outsourced service provider. This poses a risk to the materials because no archivist is directly involved in the process, leading to potential mishandling, and endangering the integrity of the materials.*

UJA2 and UJA3 said that due to a shortage of staff responsible for digitisation, only one individual is currently tasked with this responsibility. Consequently, if this employee is absent, the digitisation process comes to a halt. This scarcity of manpower has resulted in the digitisation of archival materials being at a low stage. However, the institution is contemplating the engagement of an outsourced service provider to address this issue.

The above findings are presented in Table 4.4:

Table 4.4: The challenges of digitisation

Repositories and Staff codes	Responses	The participants
USA: USA1, USA3 and USA3	• Insufficient human resource capacity in the Archives section (three archivists) and digital specialists (two contract positions) hampers the process. • Lack of a digitisation strategy leads to a lack of direction and coordination. • Copyright and privacy issues pose significant challenges that need to be addressed. • Failure of management to understand the complexity of digitisation results in ineffective practices, such as bulk scanning without proper indexing or metadata.	• USA1 • USA2 • USA3 • USA4
UPA: UPA3	• Workforce shortage with no dedicated digitisation expert, resulting in archivists handling digitisation alongside other tasks. • Digitised materials stored on Google Drive due to lack of suitable storage options. • Contemplation of removing Google Drive due to employee misuse for personal purposes.	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Digitisation of archival materials conducted at either the UWA	UWA1

	Digitization Centre or an outsourced service provider. • Lack of archivist involvement in the digitisation process poses a challenge. • Risk of improper handling of materials due to absence of archivist oversight.	
UJA: UJA2 and UJA3	• Shortage of staff responsible for digitization, with only one individual assigned to the task. • If the assigned employee is absent, the digitization process comes to a halt. • Consequently, the digitisation of archival materials is at a low stage due to this reliance on a single individual. • Considering an outsourced service provider to address the challenges posed by limited internal resources.	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.1.4 Availability of Digitisation Policies

The review of digitisation policies aimed to assess their availability and efficacy within the respective repositories. The findings revealed a spectrum of experiences and approaches across the selected repositories. Participants from repository USA, namely USA1 and USA4, reported that although a policy had been drafted and shared for external review, delays in receiving feedback necessitated a reevaluation. Legal Services recommended adopting a new template, prompting the repository to restart the approval process from scratch. This setback underscores the complexities and bureaucratic hurdles often associated with policy development and implementation. In

contrast, participant APA1 from repository UPA conveyed a concerning lack of formalised policies, plans, or procedures for digitisation. This absence suggests a potential gap in governance and strategic direction, posing challenges in standardising practices, ensuring accountability, and mitigating risks associated with digitisation initiatives. Conversely, repository UWA1 affirmed the availability and utilisation of a Library Digitisation Policy, indicating a proactive approach to governance and compliance within the digitization framework. By adhering to established policies, repository UWA1 demonstrates a commitment to aligning digitisation practices with institutional objectives, legal requirements, and industry best practices. On the other hand, participant UJA1 from repository UJA reported the absence of a digitisation policy, reflecting a similar situation to that of UPA repository. This lack of formal policy raises concerns about consistency, quality control, and risk management in digitisation activities within the repository. These findings are summarised in Table 4.5:

Table 4.5: Availability of Digitisation Policies

Repositories and Staff codes	Responses	The participants
USA: USA1 and USA4	• The policy was finalized and shared for external review. • Due to a delay in receiving feedback, Legal Services suggested using a new template. • Consequently, we must restart the entire approval process from the beginning.	• USA1 • USA2 • USA3 • USA4
UPA: UPA1, UPA2 and UPA3	• There is no policy, plan, and procedures for digitisation	• UPA1 • UPA2 • UPA3
UWA: UWA1	• The Library Digitisation Policy is available and active.	UWA1
UJA: UJA1 and UJA2	• There is no digitisation policy in place	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.2 Born-digital archival materials

Born-digital records, according to Cocciolo (2014:239), are those that develop on computers and may (or may not) have an analogue equivalent, such as a printout. Born-digital archiving is meant to highlight the contrast between collections produced by digitisation, which creates surrogates or access copies of records that originated on paper, film, or another analogue medium, and collections generated through born-digital archiving (Hawkins 2022:321). Therefore, the second objective of the study sought to determine methods for preserving born-digital archival materials in the selected university-based archives repositories in Gauteng Province. The findings to this objective were presented under the following sub-headings:

(i) Preservation of born-digital archival materials

(ii) Databases for born-digital archival materials

(iii) Challenges associated with born-digital archival materials

4.3.2.1 Preservation of born-digital archival materials

This subject tried to determine how born-digital archival materials were preserved. The findings of the study revealed the following:

Participant USA1 said that "*Born-digital materials are stored on hard drives and one network drive, where archives must contend for space alongside the Institutional repository (DSpace). Some born-digital archival materials are managed through MS Teams, lacking a centralized location or system for administration. Departments and staff tend to retain their born-digital documents on their systems rather than transferring them to the archives*."

UPA3 stated that "*When dealing with born-digital archival materials, the institution operates in silos. Due to system constraints, information cannot be transferred across*

departments that use siloed applications. Consequently, no born-digital archival materials are transferred to an archive repository."

UWA1 said "*We don't receive much born-digital archival material from the institution, but if we do, these digital files are integrated into our secure archival storage system."*

UJA1 expressed that *"The only institutional born-digital archival materials they oversee are their own documents, stored on their computers. This implies that no born-digital materials from the institution are stored in the archives repository".* These findings are summarised in Table 4.6.

Table 4.6: Preservation of born-digital archival materials

Repositories and Staff codes	Responses	The participants
USA: USA1	• Born-digital materials stored on hard drives and one network drive. • Archives compete for space alongside the Institutional repository (DSpace). • Some born-digital archival materials managed through MS Teams. • Lack of centralized location or system for administration. • Departments and staff often retain born-digital documents on their systems rather than transferring them to the archives.	• USA1 • USA2 • USA3 • USA4
UPA: UPA3	• Institution operates in silos when handling born-digital archival materials. • System constraints prevent information transfer across	• UPA1 • UPA2 • UPA3

	departments using siloed applications. Consequently, no born-digital archival materials are transferred to an archive repository.	
UWA: UWA1	• Limited born-digital archival material received from the institution. • If received, digital files are integrated into the secure archival storage system.	UWA1
UJA: UJA1	• Institutional born-digital archival materials overseen are their own documents stored on their computers. • Implies no born-digital materials from the institution are stored in the archives repository.	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.2.2 Databases for born-digital archival materials

This subject was brought upon in order to determine the databases utilised for born-digital archival in those selected university-based archives repositories. According to the findings of the investigation, the following were discovered:

ASA1 and ASA2 said the following:

- *The University Institutional Repository (UIR) serves as a bastion for storing born-digital archival materials, including meticulously crafted theses and dissertations.*
- *Embracing modern technological solutions, MS Teams stands at the forefront, facilitating the storage of select born-digital materials within the university's repository.*

- *While once a cornerstone in the management of digital materials, the utilisation of InMagic DB/TextWorks has transitioned into a bygone era.*

UPA 3 stated that "*due to our non-administration of born-digital archival materials, the absence of a database is conspicuous, reflecting our current stance on managing such resources*".

UWA1 said "*born-digital archival materials find their secure abode within the University Institutional Repository (UIR), ensuring accessibility for scholarly endeavors. In alignment with our commitment to preservation and accessibility, we operate an ongoing digitisation program. This initiative is complemented by our active digital repository, powered by the open access application Access to Memory (AtoM), as showcased through our online platform. This repository not only hosts our born-digital materials but also integrates various other archives and archival projects, fostering a comprehensive resource hub for researchers and scholars alike."*

UJA1 and UJA2 stated that "while lacking a centralized database, we ensure access to select archival materials by supplying them to the library website, enhancing accessibility and facilitating research endeavors for our patrons." These findings are presented in Table 4.7.

Table 4.7: Databases for born-digital archival materials

Repositories and Staff codes	Responses	The participants
USA: USA1 and USA2	• The University Institutional Repository (UIR) stores important born-digital archival materials, including theses and dissertations. • MS Teams is utilized to store born-digital materials within the repository. • InMagic DB/TextWorks, once a key tool for digital material management, has become outdated.	• USA1 • USA2 • USA3 • USA4

UPA: UPA3	• Lack of administration for born-digital archival materials highlights the absence of a database. The situation underscores current approach to managing these resources.	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Born-digital archival materials are securely stored in the University Institutional Repository (UIR), ensuring accessibility for scholarly endeavors. • An ongoing digitisation program aligns with our commitment to preservation and accessibility. • The active digital repository utilizes the open access application Access to Memory (AtoM), showcased through our online platform. • This repository hosts born-digital materials and integrates various other archives and archival projects, creating a comprehensive resource hub for researchers and scholars.	UWA1
UJA: UJA1 and UJA2	• Despite lacking a centralised database, we provide access to select archival materials through the library website. This approach enhances accessibility and facilitates research endeavors for our clients.	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.2.3 Challenges associated with born-digital archival materials

The study sought to determine the challenges related to the management of born-digital archival materials. The findings showed the following: Participant ASA1 stated that "*multiple versions of electronic documents exist, but there is no single repository for born-digital materials. Additionally, there is no policy in place to regulate born-digital archival material or electronic document management software*". UPA3 said that "*audio-visuals, audio recordings, and microfilms are deteriorating and are currently stored on shelves alongside paper-based materials*". UWA1 stated that *"there is currently no system in place to manage born-digital materials. Additionally, materials stored in formats such as audio and video cassettes, VHS tapes, and floppy discs are considered obsolete mediums of storage, and there are no efforts underway to emulate them*". Lastly, UJA1 said "*there isn't a centralised system established for managing born-digital archival materials*". The above findings are summarised in Table 4.8.

Table 4.8: Challenges associated with born-digital archival materials

Repositories and Staff codes	Responses	The participants
USA: USA1	• Multiple versions of electronic documents exist • Lack of a single repository for born-digital materials • Absence of policy to regulate born-digital archival material • No guidelines for electronic document management software	• USA1 • USA2 • USA3 • USA4
UPA: UPA3	• Deterioration of audio-visuals, audio recordings, and microfilms stored alongside paper-based materials on the shelves • Need for preservation measures for audio-visual materials	• UPA1 • UPA2 • UPA3

	• Potential risk to long-term accessibility	
UWA: UWA1	• Lack of system for managing born-digital materials • Obsolete storage mediums like audio and video cassettes, VHS, and floppy discs • Absence of emulation efforts for outdated storage formats	UWA1
UJA: UJA1	• Absence of a centralised system for managing born-digital archival materials • Need for a unified approach to handle digital archival content	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.3 Digital preservation of archival materials

The study sought to determine how well the university-based archives repositories have adopted digital preservation. The findings to this subject are presented under the following sub-headings:

(i) Digital preservation policy

(ii) Digital preservation strategies

(iii) Digital preservation software

(iv) Digital preservation challenges

4.3.3.1 Digital preservation policy

The study sought to find out if the selected university-based archives repositories in Gauteng Province have digital preservation policy. The findings of the study revealed the following: Participants ASA1 and ASA2 stated that "*the digital preservation is available. It is indeed approved in January 2023; however, its applicability is confined*

solely to the library's operations and does not extend to the management or preservation of archival materials". UPA1, UPA2 and UPA3 all said
"*There is no digital preservation policy in place, however the archives section is actively involved in the process of the formation of the UPA policy on how to handle digital information*". Lastly, Both UWA1 and AJA1 stated that *they don't have digital preservation policy in place*. These findings are shown in Table 4.9.

Table 4.9: Digital preservation policy

Repositories and Staff codes	Responses	The participants
USA: USA1 and ASA2	• Digital preservation system approved in January 2023 • Limited applicability restricted to library operations • Exclusion of archival material management and preservation	• USA1 • USA2 • USA3 • USA4
UPA: UPA1, UPA2 and UPA3	• Absence of digital preservation policy • Archives section actively participating in UPA policy formation for digital information handling • Efforts towards establishing guidelines for digital information management	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Absence of digital preservation policy	UWA1
UJA: UJA1	• Absence of digital preservation policy	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.3.2 Digital preservation strategies

The study sought to establish if digital preservation strategies exist in the selected university-based archives repositories in Gauteng Province. The findings revealed the following: Participant ASA 1 and ASA4 stated that *"the Library Digital Preservation Curation strategy was developed in 2022, primarily tailored to address the needs of library materials rather than archival materials"*. APA1 said that "*We do not have digital preservation strategies in place"*. Participant UWA1 stated that "*we adhere to the principles of archival digital storage of the university. Moreover, in 2022, the UWA University Library became a member of the Digital Preservation Coalition (DPC), benefitting from the valuable guidance and support offered by its structures*". Lastly, participant UJA1 said that "currently*, we do not have digital preservation strategies in place*". The above findings are summarised in Table 4.10.

Table 4.10: Digital preservation strategies

Repositories and Staff codes	Responses	The participants
USA: USA1 and ASA4	• Library Digital Preservation Curation strategy developed in 2022 • Primarily focused on library materials, not archival materials • Tailored approach to address specific needs of library content	• USA1 • USA2 • USA3 • USA4
UPA: UPA1	• Absence of digital preservation strategies • Lack of established methods for preserving digital content	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Adherence to principles of archival digital storage of the university • UWA University Library joined Digital Preservation Coalition (DPC)	UWA1

	in 2022. Benefits from guidance and support provided by DPC structures	
UJA: UJA1	• Absence of digital preservation strategies currently	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.3.3 Digital preservation software

The study sought to find out if the selected university-based archives repositories in Gauteng Province have the digital preservation software in place. The findings of the study showed the following: Participants ASA1 and ASA4 said that "*currently, we do not have digital preservation software. We have been investigating several products, but hands-on testing remains a challenge"*. All, UPA1, UPA2 and UPA3 stated that "*we currently lack any digital preservation software to manage our digital archival materials. Instead, we store these materials on hard drives and on Oracle - Web Centre Content. It's worth noting that this content management system houses all the university's data, not solely archival materials*". The participant UWA1 said "*we employ Archivematica, a standard-based digital preservation system utilized by numerous institutions for preserving digital materials".* UJA1 said "our *primary method of maintaining digital archival materials is by storing them on external hard drives. Unfortunately, we currently lack access to suitable software for digital preservation. However, we aspire to acquire Preservica for this purpose, despite its high cost*. These findings are shown in Table 4.11.

Table 4.11: Digital preservation software

Repositories and Staff codes	Responses	The participants
USA: USA1 and ASA4	• Absence of digital preservation software currently • Ongoing investigation into various products, but hands-on testing poses a challenge	• USA1 • USA2 • USA3 • USA4

UPA: UPA1, UPA2 and UPA3	• Lack of digital preservation software for managing digital archival materials • Storage of materials on hard drives and Oracle - Web Centre Content • Content management system hosts university's entire data, not just archival materials	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Use of Archivematica digital preservation system, which is a standard-based solution and widely utilized by various institutions	UWA1
UJA: UJA1	• Primary method: storing digital archival materials on external hard drives • Lack of suitable software for digital preservation • Aspiration to acquire Preservica despite high cost	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.3.4 Digital preservation challenges

The study sought to find establish the digital preservation challenges encountered by the selected university-based archives repositories in Gauteng Province. The findings of the study indicated the following: Participant ASA1 stated that "*The concept of digital preservation remains unfamiliar to our ICT and top management. They currently equate digital preservation with activities such as backups and digitisation. Furthermore, the task of scanning digital archival materials is often carried out by librarians rather than archivists, posing a significant problem in terms of the proper handling of such materials"*. The UPA1, UPA2 and UPA3 said "*due to the absence of requisite software, our involvement in digital preservation operations is infrequent. Instead, we store our digital archive documents on hard drives and on Oracle - Web Centre Content. It's important to note that this content management system hosts the*

entirety of the university's data, not solely archival materials, with oversight from the university's ICT department. Participant UWA1 stated that "*digital preservation heavily relies on hosting structures, which encompass various systems, protocols, and infrastructures. Its scope is extensive, requiring substantial resources in terms of time, finances, and expertise. Moreover, Archivists often do not engage with digital archival materials, such as those stored in the University Institutional Repository (UIR). Consequently, the responsibility for administering the contents of the UIR falls within the purview of the University's Information and Communication Technology (ICT) department*. UJA1 said "*our sole method of retaining digital archival materials is by storing them on external hard drives. Consequently, we prioritize the preservation of these hard drives to ensure their longevity and integrity*. The above findings are summarised in Table 4.12.

Ultimately, it was identified that the university's ICT department is solely responsible for digital contents, without enlisting archivists who possess specialised knowledge in managing archival materials. As a result, there is a lack of sufficient attention being given to the management of digital archival materials. As noted by Code-Unisa and Code-Wits, the following responses were made:

Table 4.12: Digital preservation challenges

Repositories and Staff codes	Responses	The participants
USA: USA1	• Digital preservation concept unfamiliar to ICT and top management, they equate digital preservation with backups and digitisation • Librarians commonly perform the scanning of digital archival materials instead of archivists. This practice poses a notable challenge regarding the appropriate management of these materials.	• USA1 • USA2 • USA3 • USA4

UPA: UPA1, UPA2 and UPA3	• Infrequent involvement in digital preservation due to lack of software • Storage of digital archive documents on hard drives and Oracle - Web Centre Content • Content management system hosts all university data, not just archival materials • Oversight by university's ICT department	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Digital preservation depends on hosting structures: Encompasses diverse systems, protocols, and infrastructures Extensive scope necessitates significant resources Resources include time, finances, and expertise • Archivists do not typically handle digital archival materials in the University Repository (UIR) - Responsibility for managing the UIR's contents rests with the University's Information and Communication Technology (ICT) department.	UWA1
UJA: UJA1	• Sole method: storing digital archival materials on external hard drives	• UJA1 • UJA2 • UJA3

	• Priority on preservation to ensure longevity and integrity of hard drives	

Source: Field data (2023)

4.3.4 Access to archival materials

The study sought to find out how digital archival materials are accessed in the selected university-based archives repositories in Gauteng Province. Archival repositories' principal aims are to preserve and make accessible stored information. As more university-based archives repositories embrace digital preservation, the benefits of accessing digital archived documents grow. According to Mosako and Ngoepe (2021:19), digital platform adoption and utilisation offer 24/7 open access to archives from anywhere in the globe with minimum commuting and physical human contact, and institutions must reinvent themselves for 21st-century audiences. The findings to this objective are presented under the following sub-headings:

(i) Access to digital materials

(ii) Digital archival materials accessibility

4.3.4.1 Access to digital materials

The study sought to find out how digital archival materials are accessed in the selected university-based archives repositories in Gauteng Province. The findings of the study indicated the following: Participant ASA1 said that "*digital archival material is accessible online through the ContenDM User interface. Master copy images (TIFFs) are stored on a network drive (DSpace). Curiously, the archivists do not have access to this network drive*". Participants UPA2 and UPA3 stated that "*digital materials are currently stored in Google Drive; however, clients do not have access to this platform. Instead, they request and receive archival materials via email or phone*". Furthermore, participant UWA1 said "*through our archival digital platform, we maintain an active digital repository utilising the open access application Access to Memory (AtoM). This platform not only includes our own archives and projects but also integrates with other archives. It serves as a comprehensive repository for all our archival finding aids and digital objects. Digital objects are systematically uploaded and linked to their corresponding archival descriptions. These objects can be accessed through*

comprehensive searches across our entire holdings or directly within the display of each collection". Lastly, UJA1 and UJA2 stated that "*currently, only inventories are accessible on the library's website, with no archival materials available online. Clients who seek archival materials must make requests via email or phone, and they subsequently receive the requested materials through these communication channels".* These findings are shown in Table 4.13.

Table 4.13: Access to digital materials

Repositories and Staff codes	Responses	The participants
USA: USA1	• Digital archival material accessible via ContenDM User interface • Master copy images (TIFFs) stored on network drive (DSpace), hence the Archivists lack access to DSpace network drive	• USA1 • USA2 • USA3 • USA4
UPA: UPA2 and UPA3	• Digital materials stored in Google Drive • Clients lack access to Google Drive platform • Archival materials requested and received via email or phone	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Utilization of open access application Access to Memory (AtoM), which is integrated with other archives and projects and it is a comprehensive repository for archival finding aids and digital objects. Systematic upload and linking of digital objects to archival descriptions	UWA1

	• Accessibility through comprehensive searches across holdings or within collection displays	
UJA: UJA1 and UJA2	• Only inventories accessible on library's website and absence of archival materials online • Clients request archival materials via email or phone. Materials received through requested communication channels	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.4.2 Digital archival materials accessibility

The study sought to determine the level of ease with which users access digital archival materials in the selected university-based archives repositories in Gauteng Province. The findings of the study showed the following: Participant USA1 stated that "*the reduced PDF versions are accessible, with the link provided on the Library's main landing page under "Services for Academics and Researchers". However, there is a challenge in linking the digital image with the original hard copy in certain cases where users wish to compare them. Initially, the naming convention corresponding to the hard copy was not consistently used on each scanned image, but this practice was later adopted in subsequent digitized versions*". Participant UPA1 said "*digital archival materials are easily accessible via UPA web page*". UWA1 participant stated that "*our digital repository operates under an open access framework. However, being an archival platform, it necessitates users to possess a degree of familiarity with archives, online searching, and archival collection structures. Text-based items are available for full download in PDF format. Each digital object is uploaded alongside its corresponding archival description, providing comprehensive metadata about the digital object*". UJA1 said that "*only inventories are available online, conveniently accessible through the library's website".* These findings are shown in Table 4.14.

Table 4.14: Digital archival materials accessibility

Repositories and Staff codes	Responses	The participants
USA: USA1	• Reduced PDF versions accessible via link on Library's main landing page under "Services for Academics and Researchers" • Challenge in linking digital image with original hard copy for comparison in some cases • Initial inconsistency in naming convention corresponding to hard copy on scanned images. Naming convention adopted in subsequent digitized versions	• USA1 • USA2 • USA3 • USA4
UPA: UPA1	• Digital archival materials easily accessible via UPA web page	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Digital repository operates under open-access framework • Users need familiarity with archives, online searching, and archival structures • Text-based items available for full download in PDF format • Each digital object uploaded with corresponding archival description, offering comprehensive metadata	UWA1
UJA: UJA1	• Only inventories accessible online, convenient access via library's website	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.5 The OAIS reference model

The study sought to recommend and advocate the use of OAIS reference model in the selected university-based archives repositories in Gauteng Province. The OAIS reference model provides a framework for the long-term preservation and access to digital archival materials. According to Baucom (2019:6), the OAIS Reference model was established as an abstract reference model so that the archival repositories ought to implement it to meet the needs of the user group, and it became a guide for the establishment of repositories, assessing existing repositories, creating new metadata schemas and standardising the metadata that is unique to digital material. The findings to this objective are presented under the following sub-headings:

(i) Digital preservation model used

(ii) OAIS Reference Model for digital preservation

4.3.5.1 Digital preservation model used

The study sought to establish which model is employed in the selected university-based archives repositories in Gauteng Province. The findings of the study determined the following: Participants USA1 and USA4 said "*none of the digital preservation models that we are currently using in USA are adequate. Digital preservation in USA is still in its infancy*". All three participants UPA1, UPA2 and UPA3 stated that "*we lack a digital preservation model because we do not actively participate in digital preservation operations*". Participant UWA1 said "*since we don't employ any digital preservation models at present, we decided to subscribe to the Digital Preservation Coalition*". UJA1 stated that "*we don't use any digital preservation models, and moreover, we're not even aware of their existence*". These findings are shown in Table 4.15.

Table 4.15: Digital preservation model used

Repositories and Staff codes	Responses	The participants
USA: USA1 and USA4	• Non digital preservation models used are currently used. Digital	• USA1 • USA2 • USA3

	preservation in USA is still in its early stages	• USA4
UPA: UPA1, UPA2 and UPA3	• Absence of digital preservation model • Lack of engagement in digital preservation operations	• UPA1 • UPA2 • UPA3
UWA: UWA1	• Absence of current digital preservation models • Decision to subscribe to Digital Preservation Coalition stood out	UWA1
UJA: UJA1	• Non-usage of digital preservation models • Lack of awareness regarding their existence	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.3.5.2 The OAIS reference model for digital preservation

The study sought to recommend and advocate the use of the OAIS reference model in the selected university-based archives repositories in Gauteng Province. The findings of the study determined the following: Participants USA1, USA2, USA3 and USA4 said that "*yes, we aim to adhere to the OAIS model as much as possible, recognising that digital preservation is still in its early stages of development*". UPA1. UPA2 and UPA3 indicated that "*if we establish digital preservation practices, we might consider implementing the OAIS model*". Participant UWA1 said that "*the OAIS Model serves as a universal framework for preservation and should ideally inform the workflow of many archival institutions, especially regarding the systems and applications utilised for digital preservation. Consequently, our subscription to the DPC signifies our commitment to upholding the principles of the OAIS model. Furthermore, any efforts to establish a digital archive of our physical holdings must prioritise sustainability*". Participant UJA1 stated that "*we currently lack extensive knowledge*

about the OAIS model, but we are keen to deepen our understanding and utilise it for digital preservation purposes". These findings are shown in Table 4.16.

Table 4.16: The OAIS reference model for digital preservation

Repositories and Staff codes	Responses	The participants
USA: USA1, USA2, USA3 and USA4	• Aim to adhere to the OAIS model • Acknowledge digital preservation's early developmental stage	• USA1 • USA2 • USA3 • USA4
UPA: UPA1, UPA2 and UPA3	• Consideration of OAIS model if digital preservation practices are established	• UPA1 • UPA2 • UPA3
UWA: UWA1	• OAIS Model as universal preservation framework should inform workflow of archival institutions, particularly in digital preservation systems • Subscription to DPC indicates commitment to OAIS principles and digital archives establishment prioritises sustainability	UWA1
UJA: UJA1	• Lack extensive knowledge about OAIS model • Keen to deepen understanding • Intend to utilise OAIS model for digital preservation	• UJA1 • UJA2 • UJA3

Source: Field data (2023)

4.4 Summary

This chapter displayed the analysis process used and presented the data collected through the administration of the semi-structured interviews with selected Gauteng university-based archives/library staff who participated in the study. The chapter has presented the study findings according to the following sections derived from the study objectives, which included digitisation of archival materials; born-digital archival materials; digital preservation of archival materials; access to archival materials; and the Open Archived Information System model (OAIS) reference model.

The findings indicated that Gauteng's university-based archives repositories have not yet been set up for digital preservation. Though digitisation has already begun in all four university-based archives repositories, it is still at the lowest stage, however, digitisation constitutes the initial part of digital preservation. There is no digital preservation software in place in all four university-based archives repositories, no systems for born-digital archival materials, archival materials are supplied through emails, there is a shortage of staff and digital skills, and the repositories are unfamiliar with the OAIS reference model. The next chapter will interpret and discuss the findings of study.

CHAPTER FIVE
INTERPRETATION AND DISCUSSION OF THE FINDINGS

5.1 Introduction

Chapter four displayed the analysis process used and presented the data collected through the administration of the semi-structured interviews. The current chapter provided an interpretation and discussion of the findings, addressed the research objectives and research questions that guided the study. The findings interpretation and discussion in this chapter were based on the data presented in Chapter Four.

This chapter describes the relevance of the findings and how they relate to the research questions (Dunton 2021:1). According to Bavdekar (2015:40), the discussion section of a research paper is used to analyse the results, present the benefits and limitations of the study, and hence has been compared to the closing arguments. Creswell (2014:281) defines interpretation as a summary of the key results and how the study concerns were addressed; own research evaluation refers to the significance of the facts in this study and personal perspectives in comparison to or contrasted with the literature. The interpretation and discussion of this study were generated from the study objectives: (a) Digitisation of archival materials; (b) Born-digital archival materials; (c) Digital preservation of archival materials; (d) Access to archival materials; and (e) The OAIS reference model.

5.2 Digitisation of archival materials

The first objective of the study sought to determine the present status of digitisation in the selected university-based archives and repositories in Gauteng Province. The interpretation and discussion to this objective were presented under the following sub-headings:

(i) Present status of digitisation in the selected university archives

(ii) Digitisation workflow processes

(iii) Digitisation challenges encountered

(iv) Availability of Digitization Policies

5.2.1 Present status of digitisation in the selected university archives

This subject sought to determine the current state of digitising, such as how many collections have already been digitised and at what percentage level. Based on the interviewees' responses, it was determined that all four universities have already begun digitisation activities for archival materials. However, they are all in the early phases of digitisation, with archival items already digitised accounting for less than 15%, with Code-USA accounting for 10%, Code-UPA for 12%, Code-UWA for 7-8%, and Code-UJA for 6%. Therefore, it is possible to conclude that all four universities have already begun digitisation activities for archival materials, confirming what was stated in the literature review Chapter 2 (section 2.3), as Shehu (2016:2) states that hundreds of university libraries and allied institutions around the world have launched projects designed to digitise their collections in response to global information sharing and wide outreach and university libraries are active. However, the available literatures focus on the digitisation of library materials in general, rather than archival materials. This study is concerned with the digitisation of archival materials, which might explain why digitisation of university-based archives repositories is still in its early stages, as evidenced by the four Gauteng universities that digitisation of archival materials is at less than 15%.

5.2.2 Digitisation workflow processes

This subject sought to determine the digitisation workflow/process of archival materials and to confirm whether the digitisation activity has already commenced at the university-based archives repositories. The responses in section 4.3.1.2 confirmed that digitisation activity has already commenced, as all four universities indicated that the digitisation workflow within their repositories begin with the selection and preparation of archival materials for digitisation.

Although all four university-based archives repositories indicated that the digitisation workflow within their repositories begins with the selection and preparation of archival materials for digitisation, they do not have defined or formalised selection criteria for

digitisation and formal document for digitisation workflow, except code-USA. There is no official document for the digitisation workflow for the three codes. Code-USA revealed that donors determine or influence the collections to be digitised, whereas Code-UPA stated that archival collections/files are selected based on use, how frequently the materials are consulted, or by user request; Code-UWA was meanwhile unsure of the selection criteria, and Code-UJA stated that the selection of archival material is determined, for example, by the condition of the material. If a book seems to be deteriorating, it is scanned and saved to preserve it. Furthermore, remote users influence material selection; for example, if a user requests certain resources, those documents are scanned and sent to the user. Code-UJA statement was supported in chapter 2 (section 2.3) by Van der Walt and Makhubu (2016), who indicated that digitisation has enabled the preservation of valuable archival materials that are at risk of deterioration and has facilitated access to information for a wider audience. Regarding this subject, the researcher found that there is absence of established selection criteria for digitisation and a codified document for digitisation workflow for archival materials in the selected Gauteng university-based archival repositories.

5.2.3 Digitisation challenges encountered

The subject sought to establish the digitisation challenges encountered in the university-based archives and repositories in Gauteng Province. The interviewees in section 4.3.1.3 revealed the challenges of digitisation they are facing. All the respondents mentioned that the major issues constraining the digitisation is the shortage of staff and lack of digitisation skills and knowledge. Hence, Code-USA also mentioned a lack of digitisation strategy and copyright issues; Code-UPA brought up the issue of inadequate storage facility; Code-UWA alluded to the fact that no archivist is engaged in the process of digitisation, that put archival materials at risk due to improper handling, as the outsourced service provider and UWA Digitisation Centre are not trained as archivists, they do not know how to handle archival materials.

It may be concluded that these challenges align with those that emerged from the literature review chapter 2 (section 2.3) in the study. The major challenges found from the above four university-based archives repositories noted by Shelembe (2021:4) and Jethro (2021:672). According to Shelembe (2021:4), digitisation at the University of

Zululand, the library has a digitisation room with computers, scanners, and other equipment and shortage of staff to prepare and execute their digitisation project and a storage capacity issue caused by a system crash and ended the project. Therefore, in order to digitise, they have to have storage capacity. Shelembe (2021:113) advises institutions and organisations planning digitisation projects to have a well-planned strategy, a large enough storage server/capacity, adequate funds and funding, professional or enough staff training on digitisation, digitisation tools/infrastructure and facilities, and IT-dedicated staff. Jethro (2021:672) reports that at the University of Cape Town, digitisation has been underway for over a decade by UCT Libraries, as well as independently by research departments dealing with specialty collections. The information from the African Studies Collections has not been fully collected and made digitally accessible due to time restrictions, limited resources, and copyright difficulties.

5.2.4 Availability of Digitisation Policies

The subject assessed the status of digitisation in the selected university-based archives repositories to evaluate whether these repositories had a digitisation policy in place. Although the researcher intended to review the policy that guides digitisation, it was the case that all the interviewees in section 4.3.1.4 confirmed that there is no formal documented digitisation policy guiding the digitisation of archival materials in place.

All the selected university-based archival repositories do not have formal digitisation policy in place. It can be concluded that although they embarked on digitisation activities of archival materials, the digitisation is following unplanned approach and decision-taking affecting the digitisation activity does not follow an established plan or procedures. The university-based archives repositories should recognise that a digitisation activity of archival materials cannot be effectively run and be sustained without a digitisation policy. All the respondents however acknowledged the importance of formal digitisation policy and the recognised the need to formulate a digitisation policy.

5.3 Born-digital archival materials

The second objective of the study sought to determine methods for preserving born-digital archival materials in the selected university-based archives repositories in Gauteng Province. The interpretation and discussion to this objective were presented under the following sub-headings:

(i) Preservation of born-digital archival materials

(ii) Databases for born-digital archival materials

(iii) Challenges associated with born-digital archival materials

5.3.1 Preservation of born-digital archival materials

This subject sought to determine how born-digital archival materials were preserved in the selected university-based archives repositories in Gauteng Province. Based on the responses of the interviewees in 4.3.2.1, it was determined that all four university-based archives repositories lack a system or centralised location to administer born-digital archival materials, which means that no born-digital archival materials are received or donated from outside sources other than those created by the repositories. For instance, the participant USA1 revealed that the available born-digital archival materials at the USA repository are stored on external hard drives and one network drive where archives must compete with the University Institutional Repository (UIR) and certain born-digital archival materials are stored on MS Teams. UPA3 highlighted operational challenges in managing born-digital archival materials, noting siloed operations within the institution. System limitations prevent the transfer of information across departments, hindering the migration of born-digital materials to archive repositories. The participants UWA2 and UPA1 also mentioned that they don't manage born-digital archival materials. Therefore, as all four university-based archives repositories confirmed their stance on the preservation of born-digital archival materials, it was clear from the responses that born-digital archival materials (electronic archival materials) are not presently managed at these four repositories,

which may have a detrimental influence on the prospects of the digital preservation efforts.

5.3.2 Databases for born-digital archival materials

This subject was brought upon in order to determine the databases utilised for born-digital archival in those selected university-based archives repositories. A database, according to Peterson (2023), is a systematic collection of data that is organised and structured electronically. It enables electronic data storage and manipulation. Based on the detailed findings gathered from the interviewees in section 4.3.2.2, it became evident that none of the four university-based archives repositories had established databases specifically designed for managing born-digital archival materials. This lack of dedicated infrastructure signaled a significant unpreparedness for undertaking a digital preservation initiative geared towards preservation and enhancing accessibility to archival resources stored in digital formats.

5.3.3 Challenges associated with born-digital archival materials

The study sought to determine the challenges related to the management of born-digital archival materials. This subject' s findings, as detailed in section 4.3.2.3, revealed a unanimous lack of a common system or database for born-digital archival materials among all participants: USA1, UPA3, UWA1, and UJA1. USA1 noted the scattered storage of data across multiple platforms like MS Teams files, UIR, and external hard drives, resulting in disparate versions of information. Moreover, both UPA3 and UWA1 highlighted the issue of deteriorating audio-visuals, audio recordings, microfilms, and floppy discs, which were stored alongside paper-based materials without any efforts toward emulation or migration. UJA1 added that there is no centralized management system for born-digital materials. The collective responses underscored the lack of management of born-digital archival materials across all four university-based archives repositories, posing significant challenges for digital preservation initiatives. Establishing well-organized systems for managing born-digital materials would streamline digital preservation endeavors.

5.4 Digital preservation of archival materials

The primary objective of the study was to assess the level of digital preservation adoption within university-based archives repositories. As outlined by Ismail and Affandy (2018:2), digital preservation encompasses the comprehensive actions necessary to sustain access to digital archival materials despite potential media failure or technological advancements. These materials encompass both born-digital content and items resulting from digitization initiatives. Digital preservation involves a series of processes aimed at ensuring ongoing accessibility to digital resources. Additionally, it entails the long-term, error-free storage of digital information, complete with mechanisms for retrieval and interpretation throughout the entire duration of its relevance (Osedo 2013:3). The interpretation and discussion of this subject are structured under the following subheadings:

(i) Digital preservation policy

(ii) Digital preservation strategies

(iii) Digital preservation software

(iv) Digital preservation challenges

5.4.1 Digital preservation policy

This subject of the study was to investigate the existence of digital preservation policies within the selected university-based archives repositories located in Gauteng Province. As emphasized by Masenya and Ngulube (2020:56), the implementation of policies is crucial to provide a structured framework for digital preservation procedures. These policies should encompass various aspects, including the development and management of digitisation and preservation content, formulation of collection disaster plans, delineation of guidelines for open access to digital resources, establishment of protocols for storage, security, and intellectual property management, as well as references to copyright and metadata policies.

As detailed in section 4.3.3.1, all respondents unanimously confirmed the absence of a guiding digital preservation policy within the selected university-based archives repositories. The exception noted was repository ASA, where participants USA1 and

USA2 indicated the presence of a digital preservation policy, albeit one designed for the library rather than specifically for archival materials. This differentiation arises because university-based archives repositories are integral parts of the library system rather than distinct entities. Consequently, it becomes evident that none of the four university-based archives repositories possess a dedicated digital preservation policy. This deficiency poses a significant challenge since the development of digital preservation policies should serve as the foundational step in ensuring effective preservation measures. While library digital preservation policies exist, this study advocates for the establishment of comprehensive digital preservation policies tailored to the unique requirements of archives, encompassing diverse content types and specifying criteria for selection, retention, and duration of preservation. Within the context of digital preservation projects, the significance of policy formulation cannot be overstated. Its absence within university-based archives repositories indicates inadequate preservation practices for their digital archival materials.

5.4.2 Digital preservation strategies

The aim of the subject was to ascertain the presence of digital preservation strategies within the selected university-based archives repositories in Gauteng Province. As outlined by Ismail and Affandy (2018:2), the successful implementation of digital preservation within an organisation necessitates the development of comprehensive strategies to support and ensure the effective design and management of the entire preservation process. These strategies should be organisation-wide and focus on identifying, managing, preserving, and ensuring continued access to digital archival materials. According to Oguche and Aliyu (2020:148-149), digital preservation strategies encompass methods aimed at preservation of stored digital archival materials to ensure their enduring availability for long-term reuse. Matlala (2019:99-102) delineated various strategies for the digital preservation of archival materials, including migration, emulation, digitization, refreshing, backup and byte replication, preservation metadata, and encapsulation. Moreover, Ismail and Affandy (2018:3) categorised digital preservation strategies into two distinct stages: the initial stage and the implementation stage. The initial stage involves crucial activities such as policy formulation, cost modeling, staff configuration, collaborations, and partnerships. These foundational steps lay the groundwork for effective digital preservation

initiatives. Subsequently, the implementation stage encompasses practical measures like migration, emulation, technology preservation, refreshing, and data archaeology. These strategies are instrumental in ensuring the longevity and accessibility of digital archival materials over time.

The findings of this investigation, as detailed in section 4.3.3.2, reveal a notable absence of digital preservation strategies across all four university-based archives repositories, except for the USA repository. Participants from the USA repository, namely USA1 and USA4, disclosed the existence of a digital preservation curation strategy established by the USA library in 2022. However, it primarily addresses library materials rather than archival resources. This strategy encompasses crucial facets such as content selection, acquisition, preservation, maintenance, and delivery. Nevertheless, it is apparent that while this strategy exists, it is not specifically tailored for archival materials but rather serves the library. Consequently, the absence of dedicated digital preservation strategies for archives repositories is evident.

The deficiency of digital preservation strategies within the four university-based archives repositories poses a significant challenge to the effective implementation of digital preservation initiatives. The strategy adopted by the USA repository focuses on content selection, acquisition, preservation, management, and delivery, yet lacks essential initial phases such as policy development, cost modeling, staff configuration, collaborations, and partnerships. Similarly, it overlooks crucial execution stages such as migration, emulation, technology preservation, renewal, and data archaeology.

Ismail and Affandy (2018:2) emphasize the crucial role of digital preservation strategies in ensuring the meticulous design and management of preservation procedures and processes. These strategies are essential for sustaining the accessibility of digital archival materials over time. Therefore, it is imperative for all university-based archives repositories to develop tailored digital preservation strategies to ensure the effectiveness of their preservation endeavors. The absence of such strategies results in poorly maintained digital materials and undermines efforts to ensure the long-term preservation and accessibility of digital resources within archives repositories.

5.4.3 Digital preservation software

The study aimed to assess the digital preservation practices within university-based archives repositories in Gauteng Province, particularly focusing on the availability and utilisation of digital preservation software. Understanding that digital materials require specialised software for preservation and accessibility, the researchers sought to determine the extent to which these repositories have integrated such technology into their operations. Rosa, Craveiro, and Domingues (2017) conducted an extensive examination of eleven open-source digital preservation software solutions including Archimede, Archivematica, DAITSS, DSpace, EPrints, Fedora, Greenstone, Invenio, LOCKSS, RODA, and Xena. They employed a rigorous selection criterion that considered various factors crucial for identifying current, versatile, and reliable systems. Their findings revealed that out of the eleven solutions evaluated, only five stood out as most significant for repositories planning digital preservation implementation: RODA, DSpace, Fedora, Greenstone, and EPrints. These software solutions were noted for their rich features and widespread user base. Importantly, four of them adhered to the OAIS reference model, with Greenstone being particularly notable for its extensive usage among UNESCO nations. However, research conducted by Masenya and Ngulube (2021) highlighted a slightly different landscape within South African university libraries, identifying digital preservation software such as DSpace, E-print, ETD (Electronic Theses and Dissertations), Digital Commons, LOCKSS, and DigiTool being adopted. It's worth noting that their study, while relevant, primarily focused on library materials rather than archival materials specifically. Thus, while there is overlap in the software utilised, the distinct focus on archival materials in the initial study underscores the need for specialised solutions tailored to the unique preservation requirements of archives.

According to the responses documented in section 4.3.3.3, all four university-based archives repositories have affirmed their utilisation of the University Institutional Repository (UIR), which is centrally managed by the library across all repositories. The UIR, as defined by Nunda and Elia (2019:1), serves as a digital storage facility for materials owned by the university. This encompasses a wide array of electronic publications, including theses, journals, books, and conference papers. Functioning within an open access framework, the UIR facilitates free access to its digital content,

ensuring widespread dissemination. Notably, among the participants, namely USA1 & USA2; UPA1, UPA2 & UPA3, and UJA1, there's a prevailing trend of reliance solely on the UIR without the integration of specialist digital preservation software for archival materials, except for UWA1, who stated that at UWA repository they have adopted Archivematica software. Archivematica, as described by Jordan (2013:2), is an open-source digital preservation platform characterised by its use of "format policies" to convert data into preservation-friendly formats and its adherence to Open Archival Information System (OAIS) standards through the creation of Archival Information Packages (AIPs). Leveraging a microservices architecture, Archivematica incorporates various open-source tools such as FITS, OpenOffice, FFmpeg, and Clam Antivirus, while embracing open and standardised formats like METS, PREMIS, and Bag. Its primary aim is to ensure the sustained, standards-compliant management and retrieval of both material and metadata encapsulated within AIPs. Additionally, the participant UWA1 also noted the use of the AtoM application for description and access of digital archival materials, underscoring its relevance in the digital preservation landscape. Noteworthy is the proactive stance taken by UWA repository, which is effectively engaged in digital preservation initiatives, alongside UJA1's identification of a need for Archivematica implementation and USA1 expressed interest in exploring Preservica and Archivematica. These developments signify the readiness of university-based archives repositories to partake in digital preservation efforts. However, despite these strides, a crucial aspect that remains lacking is the requisite motivation. Hence, the outcomes of this study endeavor to address this existing gap in digital preservation for archival materials, ultimately enhancing the efficacy of preserving such materials and facilitating user access.

5.4.4 Digital preservation challenges

The study aimed to comprehensively explore the digital preservation challenges faced by university-based archives repositories in Gauteng Province. Several significant factors have been identified as hurdles threatening the preservation of digital archival materials within these repositories:

(i) Lack of Policies, Strategies, and Software: One of the primary challenges is the absence of formalized digital preservation policies, strategies, and dedicated software

solutions. This deficiency hampers the effective safeguarding of digital materials over time.

(ii) Integration with UIRs and ICT Control: Digital archival materials are often stored alongside library materials within University Institutional Repositories (UIRs). However, this arrangement can introduce complications since the management of digital content within UIRs is typically overseen by the university's Information and Communication Technologies (ICTs), rather than by archivists. This division of responsibility may lead to gaps in proper preservation practices.

(iii) Lack of Understanding and Confusion: There is a prevalent lack of understanding regarding digital preservation, with confusion often arising between digital preservation and digitization. This misunderstanding can impede efforts to implement effective preservation strategies and protocols.

(iv) Media Deterioration: Digital content is stored on various types of media, including audio and video cassettes, CDs, DVDs, floppy discs, and microfilms, all of which are susceptible to deterioration over time. This deterioration poses a significant risk to the long-term accessibility and integrity of digital archival materials.

(v) ICT Department Oversight: Responsibility for digital content preservation typically falls under the purview of the university's Information and Communication Technology (ICT) department, rather than involving archivists who possess specialized expertise in digital preservation practices. This division of responsibility may result in inadequate attention to the specific needs and challenges associated with preserving digital archival materials.

The findings outlined in section 4.3.3.4 shed light on critical deficiencies within the digital preservation practices of university-based archives repositories. All respondents across the repositories revealed a glaring absence of guiding digital preservation policies, strategies, and software specifically tailored for digital archival materials. This absence underscores a fundamental gap in the repository's approach to preserving digital materials effectively. As a consequence of the lack of formalised digital preservation frameworks, the repositories primarily prioritise digitisation projects for both storage and access purposes. However, this emphasis on digitisation often occurs at the expense of neglecting the broader concept of digital preservation. Consequently, confusion persists among stakeholders regarding the distinction

between digitisation, which involves converting physical materials into digital formats, and digital preservation, which encompasses strategies for maintaining the integrity and accessibility of digital materials over time. The prevailing prioritisation of digitisation over digital preservation manifests in the storage practices employed by the repositories. Digital archival materials are predominantly stored on internal and external hard disk drives as well as network storage spaces. While these storage methods offer convenience and immediate accessibility, they are inherently inadequate for ensuring the long-term preservation of digital objects. The reliance on such storage methods poses a significant risk of permanent loss or degradation of digital materials. Without established preservation policies, strategies, and software to systematically monitor and address potential degradation issues, the integrity and authenticity of both the master digital materials and their derivative copies are jeopardized over time. The absence of proactive measures to safeguard against deterioration increases the likelihood of irreversible loss, undermining the repository's ability to fulfill its mandate of preserving cultural and scholarly heritage for future generations.

The challenges highlighted by UPA1 and UWA1 underscore the vulnerability of digital content stored on various mediums such as audio and video cassettes, CDs, DVDs, floppy discs, and microfilms. These mediums are susceptible to deterioration over time, posing a significant risk to the integrity and accessibility of the stored data. Compounding this issue is the absence of plans for migrating the contents to digital preservation software due to the lack of existing digital preservation strategies within the repositories. Digital obsolescence is a looming threat in this context, wherein records created with outdated decoding technologies or hardware devices no longer in production become inaccessible, leading to potential loss. As Osedo (2013:4) notes, the degradation of digital data recording mediums can occur rapidly, resulting in data loss once the deterioration process begins. Given the limited temporal window provided by digital formats, there is an urgent need for proactive decision-making and the implementation of preservation strategies to mitigate these risks. The absence of defined policies, standards, protocols, and strategies further compounds the challenge of preserving digital material effectively. Historically, data and files were stored on physical media like CDs, DVDs, memory cards, and floppy discs. However, these media standards have evolved significantly over time, leading to uncertainties

regarding their future readability. As a result, migration of media assets into digital preservation software emerges as a crucial strategy for ensuring the long-term preservation of digital materials over extended periods.

The delineation of responsibility within the university's framework places the entirety of digital content management squarely under the jurisdiction of the Information and Communication Technology (ICT) department, sidelining archivists who possess specialized knowledge in the curation and preservation of archival materials. This exclusion of archivists from digital activities pertaining to archival materials results in a lack of dedicated attention to the management of digital archival materials. This oversight was particularly evident in the responses from USA1 and UWA1. The absence of archivists' involvement in digital endeavors related to archival materials presents a significant challenge. Archival materials have distinct characteristics and preservation requirements that differ from those of library materials. Digitizing physical archival materials demands meticulous care due to their delicate nature. These materials, often aged, may be fragile or composed of delicate onion paper, necessitating careful handling. Special attention must be paid to removing staples to prevent any tearing of the paper. Therefore, the issue underscores a critical challenge that must be addressed in the preservation of digital versions of archival materials. The distinct characteristics and preservation need of archival materials mandate the involvement of archivists in digital preservation efforts to ensure the integrity and longevity of these invaluable resources for future generations. Integrating archivists into the digital preservation process will not only enhance the effectiveness of preservation strategies but also ensure the proper care and handling of archival materials during digitization processes.

The challenges highlighted underscore the nascent stage of digital preservation initiatives within university-based archives repositories, indicating a significant journey ahead. Several key obstacles contribute to this realisation: Absence of Policies, Strategies, and Software; Integration with UIRs and ICT Oversight; Lack of Understanding and Ambiguity; Susceptibility of Storage Media; ICT Department Oversight. These challenges align with Yadav's (2016) findings, which also identify hurdles such as the constantly evolving nature of technology, the threat of technological obsolescence, the absence of suitable policies, and the degradation of digital material. Collectively, these challenges pose a severe threat to an institution's

digital preservation endeavors, underscoring the critical need for concerted efforts to address these obstacles and advance digital preservation practices within university-based archives repositories.

5.5 Access to archival materials

The study aimed to investigate the accessibility of digital archival materials within selected university-based archives repositories in Gauteng Province. Central to archival repositories' objectives is the dual mandate of preserving stored information while ensuring its accessibility to users. With an increasing number of university-based archives repositories adopting digital preservation practices, the advantages of accessing digital archived documents are becoming more pronounced. Thus, the study sought to evaluate the mechanisms through which users access digital archival materials in these repositories, with the overarching goal of assessing the readiness of these institutions for digital preservation initiatives, which have the potential to significantly enhance access to archival materials. The importance of digital preservation in facilitating access to archival materials cannot be overstated. As noted by Mosako and Ngoepe (2021:19), the adoption and utilization of digital platforms enable round-the-clock open access to archives from any location worldwide, minimizing the need for physical commuting and human interaction. Institutions are urged to adapt to the expectations of 21st-century audiences by reshaping their archival practices to embrace digital accessibility. Moreover, the Digital Preservation Coalition (DPC) (2021) highlights that the primary objective of digital preservation programs is to provide access to digital archive resources. Beagrie (2014:4-2) further asserts that digital access is the primary mechanism through which digital preservation fulfills its commitment to making archived material readily available to the user community.

Section 2.6 highlights various research endeavors examining how university library users navigate and utilise digital resources across different contexts. Davis, Sapp, and Van Tuyl's (2016) study focused on US academic libraries and unveiled a preference among users for online catalogs and digital repositories to access digital archive items remotely. However, despite this preference, users encountered challenges such as complex interfaces, copyright restrictions, and difficulties in discovering relevant items within digital archives. Similarly, Zhao and Yang (2019) found that Chinese digital

archive users gravitated towards resources with clear metadata and multiple access points, suggesting the importance of user-friendly interfaces and robust metadata systems in facilitating access. In African countries, including South Africa, research conducted by Echezona and Ugwuanyi (2010) highlighted challenges related to inadequate internet connectivity in university libraries, hindering users' access to digital materials. Furthermore, a study by Sejane (2017) on Lesotho university libraries identified financial constraints, technological limitations, and policy gaps as major barriers to e-resource access and utilisation. Recommendations included enhancing access through updated equipment, improving user understanding of e-resources, and implementing relevant policies. In South Africa specifically, Masenya and Ngulube's (2021) research showcased efforts by university libraries to adopt new methods and technologies for generating, categorising, storing, and preserving digital materials. Examples of platforms utilised include DSpace, Fedora, E-prints, and Greenstone, among others. Importantly, institutions tailored their approaches based on budgetary constraints and specific preservation needs. Additionally, Tlakula and Fombad's (2017:861) study on electronic library resource usage emphasised limited awareness among users of available resources beyond platforms like SABINET and EBSCOhost. This underscores the importance of enhancing awareness and accessibility of diverse electronic resources within academic communities. Therefore, the interpretation and discussion to this objective are presented under the following sub-headings:

(i) Access to digital materials

(ii) Digital archival materials accessibility

5.5.1 Access to digital materials

The study aimed to investigate the accessibility of digital archival materials within selected university-based archives repositories in Gauteng Province. Drawing from the findings in Section 4.3.4.1, USA1 provided insights into the methods through which users access digitized archival materials within their repository. One primary method highlighted by USA1 is the use of the online ContentDM user interface, which allows users to access digitised archival materials remotely. However, despite this platform's availability, the quantity of archival materials accessible remains limited, suggesting that only a fraction of the repository's materials have been digitised thus far. This

limitation implies that users may only access a restricted range of content due to the incomplete digitisation process. Another method discussed involves users accessing archival materials via email. In this approach, users navigate a user interface within the University Institutional Repository (UIR) to view inventories of the archival collection and subsequently request specific information. Once requested information is identified, it undergoes scanning and is then sent to users via email. This method underscores the reliance on emails as a makeshift means of accessing digital archival materials, primarily driven by the absence of a dedicated system for preserving such content. Furthermore, USA1 raised concerns regarding the storage of master copy pictures in TIFF format on a network drive named DSpace-Workspace. Notably, it is highlighted that archivists lack access to this network drive, indicating a disconnect between archivists and the digital preservation activities within the DSpace system. The exclusive management of the system by the University ICT further exacerbates this issue, as they may not fully grasp the requirements of users seeking access to archival materials. This lack of archivist involvement in digital preservation activities and limited access to the storage network signifies a potential gap in the preservation efforts within the repository, ultimately hindering user access and compromising the integrity of the archival materials.

As per insights provided by participants UPA2 and UPA3, digitised archive records within the university-based archives repositories are stored on Google Drive. However, access to these digital resources is restricted for clients, indicating limitations in user accessibility. Despite these access constraints, users can still obtain digital archival materials through UPASpace, albeit with potentially limited availability. UPASpace serves as an alternative avenue for accessing digital archival materials within the repository, potentially offering broader access compared to Google Drive. Moreover, an additional method for accessing digital archive documents involves utilising email as a retrieval mechanism. This approach is necessitated by the limited digitisation of archival materials, implying that a significant portion of archival resources remains in non-digitised formats. Therefore, users' resort to email communication to request and retrieve specific archival materials, circumventing the constraints posed by limited digitization efforts.

UWA1 highlighted their utilization of AtoM (Access to Memory) and Archivematica, two open-source software programs specifically designed for describing and accessing

digital archival resources. AtoM serves as a robust platform capable of not only facilitating access to digital archival materials but also integrating seamlessly with numerous other archival repositories. This integration feature enhances interoperability and facilitates broader access to archival resources across multiple platforms and institutions. The adoption of AtoM and Archivematica by UWA1 indicates a proactive approach to digital preservation, demonstrating the repository's commitment to ensuring the long-term accessibility and integrity of its archival materials. By leveraging these specialised software programs, UWA1 is equipped with the necessary tools to effectively manage, describe, and provide access to its digital archival collections.

Participant UJA1's approach to accessing digital archival materials closely mirrors that of USA1, UPA2, and UPA3. However, there are some distinctive features in their method. Unlike some other participants, UJA1 primarily offers inventories of digital archival materials on their library website, serving as a catalog of available resources. Users can browse these inventories to identify materials of interest and subsequently request access to specific items. Upon receiving a request for materials, archivists at UJA undertake the task of scanning the requested materials and sending them to users via email. This approach allows for a tailored response to user requests, ensuring that users receive access to the specific materials they require. However, it also implies a manual process for accessing digital archival materials, which may be more time-consuming and resource-intensive compared to automated systems.

In conclusion, the study has identified various methods for accessing digital archival materials and highlighted how archivists are successfully facilitating access to these materials for users. Across the three codes – USA, UPA, and UJA – commonalities were observed in the means for accessing digital archival materials, primarily through the DSpace user interface on the library website and via email communication. However, a significant concern arises from the absence of robust preservation methods within these repositories, indicating potential risks to the long-term integrity and accessibility of digital archival materials. In contrast, Code-UWA stands out for its proactive approach to digital preservation, evidenced by the implementation of the AtoM web application and Archivematica. These specialised software solutions not only streamline access to archival materials but also contribute to the preservation of digital content. By leveraging AtoM and Archivematica, Code-UWA demonstrates

commendable performance in the realm of digital preservation, ensuring that users can conveniently access and engage with archival materials while preserving their long-term accessibility and integrity. Overall, this underscores the importance of investing in robust preservation strategies to ensure the sustainability of digital archival materials.

5.5.2 Digital archival materials accessibility

The study aimed to assess the accessibility of digital archival materials within university-based archives repositories in Gauteng Province. Findings from section 4.3.4.2 suggest that all four codes assessed are effective in facilitating swift access to these materials. Feedback from participants USA1, UPA1, and UJA1 underscored the ease of access through the library website, highlighting its user-friendly interface. Furthermore, UWA1's utilisation of archivematica software and the AtoM web application was noted, with recognition of their efficacy in digital preservation. Notably, the adoption of non-proprietary and open formats by UWA1 enhances accessibility, enabling users to promptly retrieve archive PDFs. In conclusion, the study successfully gauged the accessibility of digital archival materials across the selected university-based archives repositories, affirming their satisfactory performance in this regard.

5.6 The OAIS reference model

The study embarked on advocating and recommending the utilisation of the OAIS (Open Archival Information System) reference model within university-based archives repositories in Gauteng Province. The OAIS model, elaborated upon in detail in section 2.7, serves as a foundational framework for guiding the long-term preservation and accessibility of digital archival materials. According to Baucom (2019:6), the OAIS reference model offers a structured blueprint for archival repositories, aiding in the establishment of repositories, evaluation of existing ones, development of metadata schemas, and standardization of digital material metadata.

Globally, the OAIS framework has garnered widespread recognition and adoption as a benchmark for digital preservation. Lee (2010:2027) highlights its pivotal role in advancing digital archiving initiatives worldwide. Esteemed institutions such as the Digital Preservation Coalition (DPC), Cornell University Library, and UNESCO, among others, have either directly adopted the OAIS framework or aligned their practices with

its principles. In Africa, researchers like Gbaje and Mohammed (2017), Magama (2018), and Umana (2020) have utilised the OAIS paradigm to address long-term digital preservation challenges. Umana (2020), for instance, developed a comprehensive framework for digital preservation operations within Namibian university libraries, emphasising the critical importance of adhering to OAIS principles to prevent obsolescence of digital information. In South Africa, Masenya and Ngulube (2020) conducted a study focusing on digital preservation within university libraries, proposing a theoretical framework aligned with the OAIS reference model. This approach was deemed essential for effectively preservation of digital materials and ensuring sustained access over time. By embracing the OAIS model, university libraries can enhance their capacity to meet the evolving demands of digital preservation and facilitate seamless access to valuable archival materials for current and future generations.

The research conducted by the scholars has convincingly demonstrated the effectiveness of the OAIS reference model in the realm of digital preservation. However, it's worth noting that their investigations primarily focused on the library setting. In contrast, the present study endeavors to extend the application of the OAIS reference model to the domain of archives. This shift in focus reflects a recognition of the unique challenges and requirements inherent in archival preservation, necessitating a tailored approach to digital stewardship within archival repositories. Therefore, the interpretation and discussion of this objective are delineated under the following sub-headings:

(i) Digital preservation model used

(ii) OAIS Reference Model for digital preservation

5.6.1 Digital preservation model used

The study sought to establish which model is employed in the selected university-based archives repositories in Gauteng Province. Based on the responses in section 4.3.5.1, the participants USA1 and USA4 acknowledges that they are not currently employing any digital preservation models, signaling that digital preservation efforts are still in their early stages of development within the institution. The participants UPA1, UPA2 and UPA3 admitted to not having a digital preservation model in place and further reveals that they do not actively engage in any digital preservation

operations, suggesting a significant gap in digital stewardship practices. UWA1 confirmed that they do not utilise any digital preservation models at present. However, they mentioned their affiliation with the Digital Preservation Coalition, indicating a recognition of the importance of digital preservation but a lack of concrete strategies or frameworks in place. UJA1 echoed the sentiment of their counterparts, stating that they neither employ nor are aware of any digital preservation models. This admission underscores a fundamental lack of preparedness or awareness regarding digital preservation practices within the repository.

In summary, none of the selected university-based archival repositories have established a designated digital preservation model, indicating a collective lack of readiness for digital preservation endeavors. This absence of structured frameworks or strategies suggests a critical need for these institutions to prioritise digital preservation initiatives and invest in the development and implementation of robust preservation models to preserve their valuable digital archival materials for future generations.

5.6.2 OAIS reference model for digital preservation

The study embarked on advocating for the adoption of the OAIS (Open Archival Information System) reference model within the university-based archives repositories in Gauteng Province. To facilitate understanding and promote the utilisation of the OAIS model, the researcher initiated a comprehensive presentation, highlighting its underlying principles, functionalities, and significance as a standard for evaluating the effectiveness of digital preservation practices. The OAIS model, as delineated by the International Association of Sound and Audiovisual Archives (IASA) in 2023, serves as a conceptual framework extensively utilized in digital repositories and archive systems worldwide. A pivotal milestone in affirming the credibility and relevance of the OAIS framework came with its official recognition as an International Standard, ISO 14721:2003. This formal endorsement underscores the model's robustness, reliability, and applicability in guiding digital preservation efforts across diverse institutional settings. By embracing the OAIS reference model, university-based archival repositories in Gauteng Province can leverage its proven methodologies and best practices to enhance the accessibility, integrity, and longevity of their archival materials.

To facilitate comprehension and visual representation of the OAIS reference model, a comprehensive diagram was devised, figure 5.1, serving as a visual aid to elucidate the intricate interplay of its core components and functions. This diagram offers a structured overview of the OAIS framework, enabling stakeholders to grasp its conceptual underpinnings and operational implications with clarity and precision. In essence, the study's advocacy for the OAIS reference model underscores a commitment to advancing digital preservation practices within university-based archives repositories. By promoting the adoption of this internationally recognized standard, the study aims to empower repositories in Gauteng Province to effectively steward their digital collections, ensuring their accessibility and usability for future generations. The OAIS Reference Model, seen in Figure 2.2, is available for viewing on page 37.

The OAIS framework, according to DPC (2022), comprises three main elements: the OAIS environment, functional components, and information items. The OAIS environment includes the producer, management, and consumer, with the latter three being external to the OAIS archive. The functional components encompass various activities such as ingest, archival storage, data management, preservation planning, access, and administration. Lastly, information items consist of data objects, representation information, and preservation description information. Additionally, IASA (2023) highlights that OAIS specifies the structure of data management information packages, including Submission Information Package (SIP), Archival Information Package (AIP), and Dissemination Information Package (DIP), based on the digital life cycle. These packages contain content information and preservation description information necessary for preserving digital content.

Figure 5.1 describes the process of digital preservation illustrated in a diagram. It begins with the digitisation of analog or paper-based archival materials, converting them into a digital format. This marks the producer stage, where a Submission Information Package (SIP) containing the material and metadata is generated and ingested into the system. In the management stage, the SIP is used to create an Archival Information Package (AIP), which stores and preserves the materials. Finally,

in the consumer stage, the Dissemination Information Package (DIP) enables users to access and understand the archival materials.

Based on the responses in section 4.3.5.2, all four university-based archives repositories concurred that the OAIS reference model is a viable approach for the preservation of digital archival materials. Additionally, they acknowledged its capacity to improve the accessibility of archival materials and deemed it comprehensible. Consequently, the researcher asked about the feasibility of using the OAIS reference model. it is evident that all selected four university-based archives repositories have expressed their ability to use the OAIS Reference Model as a standard for evaluating the efficacy of digital preservation methods for archival materials. In order to enhance comprehension of the OAIS Reference Model, the participants USA1 and UWA1 have expressed that USA and UWA repositories subscribed to the DPC. According to DPC (2021:4), the DPC is an organisation that serves as an advocate and catalyst for the field of digital preservation. Its primary objective is to ensure that its subscribing members are able to provide durable and sustainable long-term access to digital information and services. The major goal of this initiative is to increase awareness about the significance of preserving digital materials, along with the associated strategic, cultural and technical aspects. The DPC's aim is to ensure the accessibility of digital memory in the future. Consequently, the DPC has conducted an examination and implementation of the OAIS reference model, ultimately determining it to be the most suitable framework for the preservation of digital archival materials. According to DPC (2021:29), it has been widely acknowledged that the OAIS reference model has achieved significant recognition as the predominant standard for communication and understanding in the field of digital preservation. The inclusion of this section of the OAIS reference model in the four university-based archival repositories is indicative of a positive attitude towards the digital preservation of archival materials, despite the challenges they may encounter. The presence of the OAIS reference model suggests that digital preservation is feasible and has the potential to enhance access to digital archival materials.

5.7 Summary

This chapter delves into discussions and interpretations of the study's findings, which revolve around digitization efforts, management of born-digital materials, digital preservation practices, and user access methods within university-based archival repositories. Regarding digitisation, all four repositories are engaged in initiatives, yet less than 15% of collections have been digitized, signaling a significant gap. Born-digital materials suffer from scattered storage and lack of management policies, hindering preservation efforts. Digital preservation practices are largely absent, with only one repository utilizing dedicated software. User access methods vary, with one repository standing out for its efficient implementation of software.

Despite these findings, none of the repositories currently adhere to a dedicated digital preservation model. However, they unanimously acknowledge the potential of the OAIS reference model. The chapter concludes by indicating that further discussion on conclusions, recommendations, future studies, and final remarks will be provided in the subsequent chapter.

CHAPTER SIX
SUMMARY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The preceding chapter interpreted and discussed the findings of the study. This chapter presented summary findings, conclusions and made recommendations for consideration and possible future action by the university-based archives repositories and other stakeholders. The chapter further outlined areas for further research. The purpose of this study was to assess the state of digital preservation in Gauteng University-based archives repositories to determine whether such repositories are ready for digital preservation, which may enhance access to archival materials. In order to address the research questions, the summary findings, conclusions and recommendations presented here were generated from the study objectives:

1. Digitisation of archival materials
2. Born-digital archival materials
3. Digital preservation of archival materials
4. Access to archival materials
5. The OAIS reference model

6.2 Summary Findings

This section provides a comprehensive overview of the study's findings, which aimed to evaluate the current state of digital preservation within the selected university-based archives repositories in Gauteng. The primary objective was to ascertain the repositories' readiness for digital preservation initiatives, recognising the potential of such endeavors to improve accessibility to archival materials. In alignment with the study aims, the findings have been synthesized to present a cohesive understanding of the qualitative data gathered during the study. By doing so, this section offers

valuable insights into the preparedness of these repositories and sheds light on the role digital preservation could play in facilitating broader access to archival materials.

6.2.1 Digitisation of archival materials

The first objective of the study sought to determine the present status of digitisation in the selected university-based archives repositories in Gauteng Province. The researcher achieved this key objective by establishing that the state of digitisation within the selected archival repositories is currently at a nascent stage, with less than 15% of the vast archival collections having been digitised thus far. Despite efforts to embark on digitisation projects, several significant hurdles impede progress. The workflow typically commences with the selection and preparation of archival materials for digitisation; however, this process lacks established criteria for selection and a formalised workflow document. Consequently, repositories face challenges in prioritising materials and maintaining consistency throughout the digitisation process. Compounding these issues is a notable shortage of staff, with archivists often not actively participating in digitisation activities due to resource constraints. Furthermore, there is a clear deficiency in digitisation skills and knowledge among existing personnel, hindering the effective execution of digitisation projects. Additionally, the absence of a formal documented digitisation policy exacerbates these challenges, as it leaves repositories without clear guidance on decision-making and standard practices for digitising archival materials.

6.2.2 Born-digital archival materials

The second objective of the study sought to determine methods for preserving born-digital archival materials in the selected university-based archives repositories in Gauteng Province. The study revealed the absence of a cohesive system or centralised repository for managing born-digital archival materials, which poses significant challenges to archival institutions. Notably, this lack of infrastructure limits the acquisition of born-digital materials from external sources, restricting repositories to only housing materials they themselves have created. Additionally, the absence of dedicated databases for born-digital materials further complicates access and organisation, leading to fragmented storage across disparate platforms. This results in multiple versions of records scattered across various locations, including MS Teams files, UIR, and external hard drives, further exacerbating the problem of data

management and retrieval. Compounding these issues is the absence of a comprehensive policy to regulate the handling and preservation of born-digital archival materials, leaving institutions without clear guidelines for managing these resources. Furthermore, the challenge extends to obsolete storage mediums such as audio and video cassettes, VHS tapes, and floppy disks, where no efforts are being made to emulate or migrate their contents to more accessible formats, risking the loss of valuable historical data.

6.2.3 Digital preservation of archival materials

The study revealed that university-based archives repositories are facing significant challenges in implementing digital preservation practices. Firstly, there is a notable absence of digital preservation policies and strategies, leaving institutions without clear guidelines for preserving digital materials. Additionally, reliance on the University Institutional Repository (UIR), managed externally by the Library and University ICT, limits the repositories' control over their digital holdings. While one repository has employed Archivematica software and AtoM web application for digital preservation, this remains an exception rather than the norm. Furthermore, there is a pervasive lack of understanding regarding digital preservation, with confusion persisting between preservation and digitisation processes. The physical media used for storing digital content, including audio and video cassettes, CDs, DVDs, floppy discs, and microfilms, are at risk of deterioration without any migration plan in place. Compounding these issues, the responsibility for digital content primarily rests with the university's ICT department, sidelining archivists who possess crucial expertise in digital preservation. As a result, the effective management and preservation of digital archival materials remain inadequately addressed within university-based archives repositories.

6.2.4 Access to archival materials

The study found that users engage with digital archival materials primarily through the DSpace user interface on the library website, as well as via email. While this serves as a basic means of access, one repository stands out for its more robust infrastructure, featuring an AtoM web application and Archivematica implementation. These tools significantly enhance user convenience by offering streamlined access to archival materials. Despite these advancements, there remains room for improvement

in ensuring swift and efficient access to digital archival materials across all repositories.

6.2.5 The OAIS reference model

The study revealed a notable absence of a designated digital preservation model, suggesting a lack of preparedness for digital preservation efforts. Subsequent discussions with university-based archives repositories supported the notion that the OAIS reference model presents a viable solution for preserving digital archival materials. These repositories recognised its potential to enhance the accessibility of archival materials and found its principles comprehensible and applicable to their preservation goals.

6.3 Conclusions

This section presents the conclusions from the findings. The conclusions in this section are discussed based on the objectives and research questions of the study. In drawing up the conclusions for each of the objectives, the findings from the qualitative data were combined and synthesised to provide a brief and coherent conclusive response to each of the research questions. The following conclusions have been drawn from the research:

6.3.1 Digitisation of archival materials

In conclusion, this study reveals a critical insight into the current state of digitisation efforts within the selected university-based archives repositories in Gauteng Province. Despite the recognition of the importance of digitisation, the findings underscore a significant gap between the existing progress and the desired level of digitisation within these repositories. Less than 15% of archival collections have been digitised, indicating a nascent stage in digitisation initiatives. Several obstacles, including the absence of established criteria for material selection, a formalised workflow document, staffing shortages, and a lack of digitisation skills among personnel, impede progress in this area. Moreover, the absence of a documented digitisation policy exacerbates these challenges, leaving repositories without clear guidance on decision-making and standard practices. Addressing these hurdles is imperative for advancing digitisation efforts and ensuring broader access to archival materials. Strategic interventions

aimed at enhancing infrastructure, providing training, and implementing comprehensive policies are essential to overcome these obstacles and propel digitisation initiatives forward in university-based archives repositories.

6.3.2 Born-digital archival materials

This study highlights significant challenges in the preservation of born-digital archival materials within the selected university-based archives repositories in Gauteng Province. The absence of a cohesive system or centralised repository for managing such materials impedes the acquisition of external born-digital resources, limiting repositories to housing only self-created materials. This lack of infrastructure, coupled with the absence of dedicated databases, results in fragmented storage across disparate platforms, complicating access and organisation. The proliferation of multiple versions of records across various locations further exacerbates data management and retrieval issues. Additionally, the absence of a comprehensive policy to regulate the handling and preservation of born-digital materials leaves institutions without clear guidelines. Moreover, the challenge extends to obsolete storage mediums, where no efforts are made to migrate their contents to more accessible formats, risking the loss of valuable historical data. Addressing these challenges will require strategic interventions, including the development of robust infrastructure, implementation of dedicated databases, formulation of comprehensive policies, and efforts to migrate data from obsolete mediums to ensure the preservation and accessibility of born-digital archival materials for future generations.

6.3.3 Digital preservation of archival materials

As the study revealed the challenges facing university-based archives repositories in implementing digital preservation practices. Key issues include the absence of clear digital preservation policies and strategies, limited control over digital holdings due to reliance on external management systems, and a lack of widespread adoption of digital preservation tools. Moreover, there is a pervasive misunderstanding of digital preservation, compounded by confusion between preservation and digitisation processes. Physical media storing digital content are at risk of deterioration without migration plans, further complicating preservation efforts. Additionally, the predominant responsibility for digital content falls on ICT departments, sidelining archivists with expertise in digital preservation. Overall, these challenges underscore

the need for urgent attention and strategic interventions to enhance the management and preservation of digital archival materials within university-based archives repositories.

6.3.4 Access to archival materials

In conclusion, the study highlights the predominant use of the DSpace user interface and email for accessing digital archival materials among users, with one repository demonstrating a more advanced infrastructure through the AtoM web application and Archivematica implementation. These tools notably enhance user convenience by providing streamlined access to archival materials. However, there is still considerable room for improvement in ensuring swift and efficient access to digital archival materials across all repositories. Moving forward, efforts should focus on further enhancing infrastructure and implementing user-friendly tools to facilitate seamless access and maximize the usability of digital archival materials for researchers and other stakeholders.

6.3.5 The OAIS reference model

The study exposes a significant gap in the presence of a designated digital preservation model, indicating an unpreparedness for digital preservation endeavors within university-based archives repositories. However, subsequent discussions underscored a consensus among these repositories regarding the viability of the OAIS reference model as a solution for preserving digital archival materials. Recognizing its potential, repositories acknowledged the model's capacity to improve accessibility and found its principles comprehensible and applicable to their preservation objectives. This collective recognition suggests a promising path forward for enhancing digital preservation efforts within university-based archives repositories, leveraging the OAIS reference model as a guiding framework.

6.4 Recommendations

The following recommendations aim to enhance accessibility to archival materials via digital preservation in university-based archives repositories. These recommendations have been formulated based on the current study's findings while considering its scope and limitations. The study recommends the following:

6.4.1 Recommendations for the digitisation of archival materials

- To guide and lead all digitisation activities, processes and practices, the university-based archives repositories should develop and execute a digitisation policy expressly for archival materials. In order to get the appropriate institutional attention and support, the policy should be linked to the library strategic plan and created with permission from the relevant authorities. Creating and executing a guiding policy will be critical to achieving a long-term archival repositories digitisation activity.

- In order to facilitate practical work of digitisation, it is recommended that a comprehensive digitisation workflow process document be created. This document should outline the step-by-step procedures involved in the digitisation process, beginning with the selection and preparation of archival materials for digitisation and concluding with the conversion of the physical format into a digital one. This will facilitate and provide guidance for digitisation personnel or archivists in determining the appropriate steps to be followed, hence ensuring a seamless digitisation process.

- To address the issue of shortage of staff in digitisation, it is essential for university-based archives repositories to prioritise the allocation of adequately staff and archivists to carry out digitisation activities. The current practice of assigning digitisation tasks to just one or two individuals at university-based archival repositories is not ideal. Digitisation activities need a collaborative effort involving several individuals. In order to secure the proper allocation of digitisation staff, university-based archives repositories should engage in consultation with the university library and the relevant human resource department. This collaborative effort will facilitate the attainment of the desired number of staff required for digitisation activities.

- Regarding lack of digitisation skills and knowledge, the university should train digitisation staff and expose them to seminars, workshops, conferences, etc. to learn about other digitisation activities and other professionals to help them master digitisation. Digitisation refresher courses and on-the-job training should

be prioritised. Digitisation staff should have active formal continuing professional courses to upgrade their abilities.

6.4.2 Recommendations for the management of born-digital archival materials

- The collaboration between the Records Management Department and the Archives Division of the university is essential for the effective management of born-digital archival materials. It is recommended that a connection system be established to facilitate connectivity between these two divisions. The optimal organisation of the records management system or database necessitates its division into two distinct components: active records management and archival records management. This will facilitate the migration of records from the current database to an archival digital preservation system. Hence, it is essential for the Archives Divisions and Records Management Divisions to collaborate in order to develop an integrated system that can effectively connect them.

- Once the integrated records management system has been implemented, it is advisable to encourage the various departments within the university to migrate their records. This includes records such as emails, meeting minutes, reports, and other relevant documentation. Instead of storing these materials on individual MS Teams accounts, desktops and laptops, they should be transferred to the centralised records management system. This will address the current issue of inadequate management of the university's born-digital materials.

- It is imperative to give significant attention to archival materials, including audio and video cassettes (VHS), floppy discs, microfilms and others, which are present in archival collections. Information contained within these mediums should be transferred to alternative storage mediums, such as external hard drives and Google drives, until a digital preservation system is implemented.

- As it is imperative to establish a comprehensive digitisation policy and workflow process document for the conversion of analogue archival materials, it is

equally important to establish a policy and workflow process to govern the management of born-digital archival materials. These measures will greatly assist university staff in effectively handling born-digital archival materials.

6.4.3 The recommendations for digital preservation of archival materials

- For the purpose of guiding and directing all actions, procedures and practices pertaining to digital preservation, university-based archives repositories should develop and execute a master digital preservation policy. This policy should include the digitisation of archival materials and born-digital policies. To accomplish this, a collaborative effort on the part of the University Archives, the University Library, and the University itself would be required; nonetheless, the University Archives ought to take the initiative in this matter. In order for the policy to gather the required amount of university attention and support, it should be linked to the strategic plan of the Library, and it should be prepared with permission from the relevant authorities. When it comes to realising a sustainable digital preservation endeavors, developing and putting into action a guiding policy will be necessary.

- In addition to implementing a comprehensive digital preservation policy, it is essential to have a well-defined plan or strategy for digital preservation of digital archival materials. In order to guarantee the sustained accessibility and preservation of their digital archival materials in the long term, it is essential for university-based archives repositories to develop and establish a comprehensive digital preservation plan or strategy. The archives repository will, however, require the assistance of the University's Central IT in order to offer the essential digital ecosystem as well as the technical infrastructure and capabilities that are required to enable the digital preservation and long-term access to digital archival resources. The successful implementation of digital preservation requires the utilisation of fundamental resources such as technology, infrastructure, facilities, policy, finances, human resources, and skills in order to effectively accomplish its objectives. University-based archival repositories should proactively devise sustainable plans to effectively manage and tackle the many issues associated with the operations and advancement

of their digital preservation endeavours. This will aid in guaranteeing an efficient and enduring digital preservation initiative.

- Digital preservation encompasses the use of software that is specifically designed to fulfil its intended function. In order to effectively manage digital archival materials, it is advisable for university-based archives repositories to engage in collaborative efforts with the University Library and University IT departments. This collaboration should focus on the exploration and acquisition of digital preservation software, such as Archivematica, Preservica, AtoM and similar solutions. Archivematica is an open-source application that operates on web and standards-based platforms. Its primary purpose is to enable institutions to effectively archive digital information, ensuring long-term access to materials that are trustworthy, genuine and dependable (Artefactual Systems, 2023). According to Preservica (2023), their Active Digital Preservation archiving solution offers enhanced data integrity, security, and sustainability, hence mitigating the risks associated with unreadable files and long-term data loss. The acronym AtoM represents Access to Memory. The application being referred to is a web-based, open-source platform designed for the purpose of facilitating archive description and access in a multilingual and multi-repository setting (Aetefactual Systems, 2023). According to the Wits Archives, they have implemented the use of Archivematica and AtoM web-applications. This suggests that other repositories could consider adopting Wits Archives as a baseline for their own practices.

- The University Institutional Repository (UIR) is currently being used by university-based archives repositories for digital archival materials to be accessed by users. However, these archives repositories do not have any influence over the UIR since it is controlled by the University Library and University ICT. There is no digital preservation that takes place inside the UIR, as it is not solely created for archival materials. Therefore, it is recommended that the archival materials in the university-based archives repositories should be segregated from the library resources inside the UIR and put at the digital

preservation system. This will ensure that the archival materials will be protected, maintained and made accessible for users.

- Given the prevailing confusion surrounding the distinction between digital preservation and digitisation, it is advisable to utilise this study to enhance comprehension and enable individuals to discern between these two concepts. This will ultimately contribute to the effective management and preservation of archival materials.

- When a digital preservation system is in place, the information that is stored on physical media, such as audio and video cassettes, CDs, DVDs, floppy discs and microfilms, will be migrated and kept secure within the digital preservation system, rather than being allowed to deteriorate with the information as it is stacked on shelves with archival collections. This is because the physical media that contains the information will be digitised.

- Currently, in the university-based archives repositories, the responsibility for digital content lies with the university's ICT department, rather than involving archivists who possess expertise in this domain. Consequently, the handling of digital archival materials is not being adequately addressed. It is recommended that the archivists be given the chance to devise the necessary standards for the digital preservation of archival materials and that the university ICT simply perform what the archivists need. Developing collaborations with identified stakeholders is an effective strategy to progress effectively with digital preservation efforts. The primary goal of these collaborations is to successfully support and satisfy the resource needs of digital preservation efforts.

6.4.4 The recommendations for access to archival materials

- To guarantee long-term preservation and access to archival materials, university-based archives repositories should create and institutionalise digital preservation systems (software) expressly for archival materials. The university-based archive repositories, on the other hand, will need the assistance of the University's Central IT to offer the essential digital ecosystem

and technical infrastructure and capabilities to enable digital preservation and long-term access to digital archival materials.

- It is recommended that digital archival materials should not be combined with library materials in the library system (software), such as the DSpace user interface/UIR for access. This is since digital archival materials differ from library materials. As a result, a preservation system needs to be put into place so that archival materials are protected, preserved and made available to users. This will guarantee that the materials fulfil all three requirements.

6.4.5 The recommendations on OAIS reference model

- In order to ensure the efficacy of digital preservation initiatives and facilitate the retrieval of archival materials, it is advisable for university-based archives repositories to adopt the OAIS reference model as a standard. According to Lavoie (2023), this model serves as a conceptual framework designed to guide the development of archival systems that are specifically geared towards the long-term preservation and accessibility of digital information. Furthermore, Kim, Nakamura and Watanave (2022) indicated that applying specific standards such as the OAIS reference model is ideal when considering the long-term preservation, as the OAIS reference model is an international standard (ISO 14731:2012) that defines a high-level conceptual model for a digital repository.

- Hence, it is vital for digital preservation systems to possess connectivity, implying the capacity of a computer hardware or software system to successfully interact and collaborate with another system for the purpose of data exchange. Typically, this involves systems of dissimilar types that are created and manufactured by distinct vendors. The attainment of connectivity may be realised by adherence to the OAIS compatibility, which necessitates that digital preservation systems conform to the standards outlined by the OAIS reference model.

- It is recommended to use open-source digital software systems, such as Preservica and Archivematica Systems. Preservica (2015) states that it is an exemplar of a digital preservation system that has been purposefully designed to fulfil the specifications of the OAIS reference model and also adhere closely to the recommended practices of Trusted Digital Repositories (TDR). The system offers a wide range of automated processes that cover many roles inside the OAIS framework. It also seamlessly interacts with other systems, including indexing and cataloguing systems, Enterprise Content Management (ECM) platforms, Records Management applications (RMAs) and Digital Libraries. Furthermore, as said by Kim, Nakamura, and Watanave (2022), Archivematica is a software application that is open source in nature and serves the purpose of facilitating the long-term preservation of digital content. The system has many notable characteristics. Firstly, it demonstrates proficiency in effectively managing data in accordance with the OAIS reference model. Additionally, it can execute crucial preservation functions, such as normalisation, characterisation, and format identification. Lastly, it proficiently packages the Submission Information Packages (SIPs), Archival Information Packages (AIPs), and Dissemination Information Packages (DIPs).

6.4.6 Further and overall recommendations

Below are the summary and further recommendations for best practices for the digital preservation of digital archival materials at the university-based archives repositories within the digital preservation system.

6.4.6.1 Documentation and Policies

- Clear digital preservation policies, strategies, responsibilities and workflow should be established.

- All processes, procedures and decisions related to digital preservation should be documented for future reference.

6.4.6.2 Digital archival materials management

- Digital inventory of archival collections should be created, including metadata such as file formats, creation dates and rights information.

- Digital archival materials should be organised logically using standardised naming conventions and folder structures for easy retrieval.

- Metadata standards should be implemented such as Dublin Core to describe digital archival materials accurately.

6.4.6.3 Data Integrity and Security

- Strict access control should be implemented to ensure that only authorised staff/archivists can modify or delete digital archival materials.

- Encryption can be applied to protect sensitive information and communication channels.

- Checksums can be used to verify the integrity of digital files. If a file is altered, its checksum will change and alert the potential issues.

6.4.6.4 Legal and Ethical Considerations

- It is important to comply with copyright laws and intellectual property rights when preserving and providing access to digital archival materials.

- It is advisable to safeguard sensitive personal information and adhere to data privacy regulations.

6.4.6.5 File Formats and Migration

- Regularly assess file formats and migrate content to newer formats to prevent obsolescence.

- Digital files should be stored in open, non-proprietary formants to avoid dependence on specific software or vendors.

6.4.6.6 Backups and Redundancy

- Regular backups should be scheduled for digital archival materials and should be stored in geographically separate locations.

- Multiple copies of critical digital archival materials should be maintained to safeguard against hardware failures or data corruption.

6.4.6.7 Collaboration and Partnerships

- Collaboration with other university-based archives repositories or institutions is important to share knowledge.

- To engage with other organisations such DPC (Digital Preservation Coalition) it is recommended to stay updated on the latest developments and research in the field. Good enough Unisa library and Wits library are already members of DPC.

6.4.6.8 Training and Education

- Staff training for those involved in digital preservation should be provided regularly for best practices and new technologies.

- To educate archival users about the importance of digital preservation and encourage good data management practices is necessary.

6.4.6.9 Monitoring and Assessment

- It is important to have a regular monitoring the digital repository for signs of data degradation, format obsolescence and unauthorised access.

- It is recommended to conduct periodic assessments and audits to evaluate the effectiveness of digital preservation strategies and make necessary improvements.

6.5 Suggestions for Further Studies

This study delved into the potential of digital preservation to amplify accessibility to archival materials within Gauteng university-based archives repositories. Through a comprehensive evaluation, it aimed to grasp the current aspect of digital preservation practices, encompassing digitisation procedures, born-digital preservation, and avenues for enhancing overall efficacy. The findings underscored the indispensability of digital preservation policies, strategies, specialised software, and the adoption of frameworks like the OAIS reference model to ensure the success of preservation endeavors for digital archival materials. However, it also highlighted areas warranting further investigation. Future research endeavors should delve deeper into the intricacies of digital preservation software systems, exploring their functionalities and suitability for diverse archival materials. Moreover, there is a pressing need for the development of uniform digital preservation strategies tailored to the specific contexts of university-based archival repositories. Additionally, subsequent research endeavors should focus on gauging the impact and intrinsic value of digital preservation efforts on archival materials, shedding light on their long-term significance and the benefits they confer to users and stakeholders alike. By addressing these research gaps, the field can advance towards more effective and sustainable digital preservation practices, ensuring the continued accessibility and preservation of invaluable archival resources for future generations.

6.6 Final Remarks

This study provides a comprehensive examination of enhancing accessibility to archival materials in Gauteng province's university-based archives repositories. It covers digitization, born-digital materials, digital preservation, access mechanisms, and the OAIS reference model, offering insights into challenges and opportunities in preserving digital archives.

Beyond analysis, the study offers actionable recommendations to sustain digital preservation efforts, stressing the need for a cohesive strategy to enhance accessibility. Its implications extend nationally and globally, potentially catalyzing positive change in cultural heritage institutions. This research represents a significant stride towards preserving our collective heritage in the digital age, emphasizing the importance of proactive measures for future generations' access.

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