SUSTAINABLE DIGITIZATION OF VALUABLE COLLECTIONS OWNED BY THE ERITREAN RESEARCH DOCUMENTATION CENTRE

Mini-dissertation by

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Submitted in partial fulfilment of the requirements for the degree of

MASTER OF INFORMATION TECHNOLOGY (B)

in the

FACULTY OF ENGINEERING, THE BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

UNIVERSITY OF PRETORIA

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October 2015

DECLARATION

"I declare that *Sustainable digitization of valuable collections owned by the Eritrean research documentation centre* is my own work and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references".

Signed: ----------

Kiflom Michael Kahsay

Date: October, 2015

Acronyms

CLIR: Council on Library and Information Resources.

DATAD: Database of African theses and dissertations.

DISA: Digital imaging project in South Africa.

EPLF: Eritrean People's Liberation Front.

ERDC: Eritrean Research and Documentation Centre.

IFLA: International Federation of Library Associations.

RDU: Research and Documentation Unit.

RICE: Research and Information Centre of Eritrea.

Dedication

To Mr. Zemhret Yohannes for his vision on digitization and accessibility of the Eritrean National Archive to public and scholarship.

Acknowledgment

This research paper is made possible through the help and support from everyone, including: the Eritrean Board of Higher Institute, Eritrean Research Documentation Centre, and Eritrean Embassy in South Africa, Carnegie Corporation of New York, University of Pretoria (Department of Information Science –MIT-Stream-B), parents, lecturers, family and friends.

Especially, please allow me to dedicate my acknowledgment of appreciation toward the following significant advisors and contributors:

First and foremost, I would like to thank my supervisors, Dr. MJ van Deventer and Dr Heila Peinaar for their most support and encouragement. They kindly and thoroughly read my research and offered invaluable detailed advices on concepts, grammar, organization, and the theme of the paper.

Secondly, I would like to thank Mr Zemhret Yohannes, the Head of Eritrean Research Documentation Centre (ERDC), for all his support in making me realize this dream. I would also love to thank you Carnegie Corporation of New York, specifically, Prof Bothma and his team for considering and taking care of me within that program during my arduous time.

My sincere thanks go to Ambassador Saleh Omer, Embassy of Eritrea in South Africa, and his staff, Azeb Towelde, Head of ERDC, and her staff for providing me relentless support of all kinds and encouragement until I finish the program.

I would also like to gratefully and sincerely thank Dr Martie for providing me the opportunity to gain experiential work in her work place; Council for Scientific and Industrial Research (CSIR).

Finally, I sincerely thank to my wife; Yodit Yemane for taking care of our children, parents, family, and friends, who provided the advice and financial support. The product of this research paper would not be possible without all of them.

Abstract

This piece of work reflects on the state of digitization at the Eritrean Research and Documentation Centre (ERDC) which manages several valuable heritage collections. The purpose of the research was to evaluate the current selection process followed when digitizing these collections and to advise on the sustainability of a digitization programme. The recommendations captured as part of the research will be used to prepare a digitization policy as well as to develop essential guidelines and manuals necessary at the start of a sustainable digitization initiative.

The research followed a qualitative approach and a case study research design was adopted. A thorough literature study was conducted to identify appropriate procedures for digitizing valuable collections, the associated challenges and to find solutions to these problems. The core purpose of the literature was to inform the research on how an institution can sustainably digitize its collections. In-depth interviews were then conducted with ERDC managers and the current operations staff. Semi-structured interviews were used to collect data from the ERDC employees. Seven managers and operations staff of the digitization program were purposively selected for interviews. During the interviews the following were addressed: the policy, selection criteria, processes, challenges and solutions for digitization constraints. The main goal of the interviews was to understand the current digitization progress at the ERDC and to then compare these findings with the available literature. The research data were analysed to identify themes/ related issues that would need to be addressed. These themes were used to develop recommendations to share with ERDC.

The recommendations specifically address the digitization policy, critical challenges, required resources, selection issues, standards and formats, workflow, quality control, access to users and evaluation of the digitization programme.

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Chapter One
Research context

1.1 Introduction

Eritrea has a history of colonial occupation. It has never had a national archive for the preservation of its own cultural heritage. All its colonizers attempted to destroy its documents and heritage to erase its identity (RDC 2005). Eritreans, however, were aware of that, and so, during the war for national liberation, Eritreans buried books and documents underground, hid them in caves, or moved them out of the country, out of the reach of the perpetrators (RDC 2005). This reality affected the preservation of the country's indigenous heritage. After a 30-year long armed struggle for independence against the occupation by Ethiopia, the country is now able to regain its heritage and history. The Eritrean People's Liberation Front (EPLF), which protected the Eritrean people against the occupying force of Ethiopia, managed to continue documenting the history of the people during these 30 years.

In 1975, the EPLF established a Research and Documentation Unit (RDU). Then, in 1979, another department, named the Research and Information Centre of Eritrea (RICE) was established. These units were responsible for the collection and dissemination of information. To facilitate the process of collection building, RICE branches were set up within Eritrea, Europe and the US. Scholars living in exile and within the country contributed greatly to the activities of RICE. The automation technology used during that time was simply a manual type-writer. Tremendous work was, however, done during the armed struggle in document collection and preservation (RDC 2002).

When Eritrea received its independence in 1991 most of the country's physical infrastructure had been destroyed. According to the standards of Cousin (1997), Eritrea was classified as one of the poorest countries in the world. Its economy was badly hurt in the 30 years of armed struggle (AIR 2011).

The EPLF continued as a provisional government and wished to improve and transform the country in all aspects. One of its foremost programmes was to preserve the history, as it was documented during the armed struggle, so that generations to come would remember the history. For that purpose, the RDU and RICE joined together in 1992 and formed the Eritrean

Research and Documentation Centre (ERDC). That institution is now serving as the *de facto* institution of the National Archive and National Library (RDC 2005).

Currently, ERDC's collections have grown considerably. Some of the documents date back to 1790, and an archival collection reflecting the Italian period is also intact (RDC 2005). Its collections are available in a range of formats, including print materials, photographs, video cassettes, audio cassettes and microfilm. The ERDC has digitized only a small percentage of its holdings and it is not currently able to make these digitized collections available and accessible to the public for education or research (Abraha 2011).

It is a mission of the ERDC (Abraha 2005) to make these valuable/special collections accessible to the public. It has recognized digitization as a strategy that leads to the accessibility of these materials for teaching, learning and research purposes without causing usage damage to the original items. To achieve its mission, the institution is trying to identify, organize, classify, digitize and make accessible selected collections online.

Digitization, however, cannot be done sustainably unless proper planning is done and resources are put in place. In addition, policies and guidelines have to be developed to document the processes and practices (Eze Asogwa 2011). This research study is designed to advise the ERDC to come up with the standard guidelines for a sustainable digitization initiative and make its valuable collections accessible.

The author is encouraged by the vastness of the collection of literature on digitization. A thorough literature review, as background to the research, was conducted to compare the digitization activities done by ERDC and finally to recommend appropriate guidelines for digitization that could ensure a sustainable programme of work at the ERDC. In addition the site visits, arranged by University of Pretoria to the Library of Congress, the Smithsonian Museum, Milwaukee Library (Wisconsin University), and the Memorial Library of Madison, have contributed to the knowledge and exposure of the researcher with regard to digitization initiatives.

The next section presented the research problem, the main research question and sub-questions that the researcher sought to investigate.

1.2 Problem statement and research questions

This section clarified the main problem area of the ERDC, and it poses the questions and sub-questions that were needed to be addressed during the research.

1.2.1 Problem statement

One of the key goals of the Eritrean Research and Documentation Centre (ERDC) is to make the country's valuable historical collections accessible to scholars and the general public to be used for research and education. Sharing the physical formats is not feasible, and the ERDC also appears not to be succeeding with its digitisation programme. As a result, with the exception of a few scholars and researchers, these materials are not accessible. This could be due to policy, political interference, management problems, technology and infrastructural issues and/or a lack of skilled manpower. The challenge is how to digitize and make the collections accessible and visible to the public sustainably despite all the possible challenges. This research study aims to establish what the actual issues are and to advise on a way forward. To be able to address the aim, the research problem was broken down into several questions that need to be answered. These questions are listed in the next section.

1.2.2 Research questions

The research study was addressed using the following main and sub-questions:

Main research question:

With due regard to the Eritrean context, as well as the possible constraints at the ERDC, how could the factors that inhibit the digitisation of the ERDC collections be mitigated so that access to valuable collections could be optimised and promoted?

Sub-Questions:

1. What are the critical challenges that define the general operative environment (context) of digitisation in Eritrea?
2. What are the factors that promote or hinder digitisation in the ERDC?
3. What are all the issues associated with digitising valuable collections?
4. What are the benchmarks and success indicators of sustainable digitization?

5. What guidance could be gained from selected successful and established digitisation initiatives?
6. Which ERDC collections should be made accessible?
7. What is a feasible and sustainable digitisation strategy for the ERDC to digitise its valuable collections?

1.3 Scope and limitations

The target of the research is to give advice to the ERDC on how it can digitize its valuable collections. The ERDC's special collection is huge and the formats diverse. They include several handwritten manuscripts, maps, newspapers, audio clips, books, photographs, monographs, journals, microfilms, video cassettes and audio cassettes.

The ERDC classified a large portion of these materials as valuable (collections that it regards as rare, fragile and of high value). These collections are currently locked away from public use and research. The ERDC is aware of the fact that exposing the items to the public and for research will lead only to their demise owing to overuse and even theft.

This research study has focused on the digitization of text documents and photographs only. This was a limitation because the videos, audio cassettes, maps and other materials including texts and photographs that were left out of the selection of the valuable collections might have important information to contribute to the collection. Although these formats were more 'at risk', the task was also more complex, and a decision was made to concentrate on that which was feasible to accomplish given the time constraint.

Another significant limitation was the evolving nature of technology. It was very difficult to predict appropriate technologies for digitization because some technologies go into obsolescence even as this research is being undertaken.

1.4 Rationale for the study

Digitalization of rare and endangered documents has important attributes towards preserving historical and cultural values for generations. The Eritrean people have come to cumulate their own history which is unique to them across all generations. Their history is full of struggle for independence, resistance, perseverance and resilience against colonialism (RDC 2005).

If this history could not be digitized, made available and accessible to the public and research communities with current technology, the people will not only be denied their basic right to information but also the opportunity to learn from history issues that they should not repeat.

1.5 Overview of the literature

Digitization for collection can have different approaches. It could be user driven or collection driven (Smith 2001). The goals could also be either for preservation or to give access to an audience. Literature was investigated to look at digitization in more detail. Accordingly, the following subheadings were utilized to categorise the essential information.

1.5.1 Introduction

Libraries, institutions and organizations have been digitizing collections for decades. These years have given them opportunities to develop a collective experience and technical expertise in practical digitisation (CLIR 1998). That body of knowledge has led to an emergence of clear selection policies that take cognisance of the physical nature of the source materials, the number and location of current and potential users, the current potential nature of use, the format and nature of the proposed digital product and how it will be described, delivered, and archived, how the proposed product relates to other digitization efforts, and projections of costs in relation to benefits (Smith 2001).

This research study reviewed existing selection practices in institutions and libraries. It could, however, not comprehensively investigate all research done previously on selection practice but it made a general analysis of significant achievements and came up with possible guidelines that could serve as a benchmark for the success of a sustainable digitization programme.

1.5.2 Defining a sustainable strategy of digitization

One of the biggest challenges facing digital library projects today is that of the long-term sustainability of their digitisation programmes (Roegel 2013). The Digital Library Federation (Jewell 2001) launched an informal survey to identify the major challenges confronting research libraries. The results predominantly show that digital collection development is their single greatest challenge (Smith 2001). Though a number of libraries and research institutions have undertaken the project of digitization, only a few are able to do the job completely. In the world of digitization, sustainability is a word used sparingly. Little is known regarding the ways and means to ensure sustainable digitization (Roegel 2013). Still 'sustainability' is an important subject associated with digitization projects. Sustainability entails the continued provision of institutional commitment, funding, the availability of skilled human resources, and regular updating of the technological infrastructure (Rafiq and Ameen 2014). This research study will try to identify sustainable digitization programmes that consider certain intrinsic features.

To examine the issue of sustainability this paper referred to the study done by the Council on Library and Information Resources (CLIR 1998) and Association of Research Libraries(Maron and Pickle 2013).

The study also investigated what digitization projects were done at the Eritrean Research and Documentation Centre (ERDC) in the past and evaluated their performance against the intrinsic features and sustainability criteria provided by other institutions.

A sustainable digitization programme is required to be integrated into a collection development process. Carefully conceived life cycle management is another factor that affects the sustainability of the digital collections. Budget allocation for the creation of the digital scans, metadata, storage capacity, preservation tools (e.g. refreshing, migration and emulation), and user support are significant for the sustainability of the digitization programme (Smith 2001).

This study tried to investigate the ERDC's challenges in the digitization process with the perspective of sustainability, the life cycle management of its digital collections and the major issues that it needed to address in order to achieve sustainability.

1.5.3 Digitization challenges

The major issues waiting to be solved before a digitization project is initiated rotate around money, infrastructure, scalability and sustainability (Tanner and Deegan 2002). In most early cases the question of sustainability was attended to only towards the end of projects but now it has become an integral part of any project's development. It is important to obtain a regular flow of grant funding, continuous development of technical expertise and the regular replacement of the required equipment. The key to sustainability, therefore, is to reach a position where the digitisation (in effect, to create a digital library) is no longer regarded as an add-on, but is seen as part of this integral core of the service (Zorich 2003).

1.5.4 Valuable collections and digitization

Defining what should be seen as "Valuable collections" was the focus area for the study. It is anticipated that these collections would be collections that are threatened, special collections that are rare or significant collections with much demand and research value. The following authors have addressed the issue of valuable collection identification, (Smith 2001),(Palmer 2004), and (Maron and Pickle 2013).

In addition, the idea of the coordinated collection development of digital objects also contributed a significant part to the growth of research collections (Smith 2001). This research addressed the ERDC's valuable collections, digitization approach and goals.

1.5.5 Selection criteria for digitization

There are certain factors that may be considered before selection. Collections exist in different media formats which include audio, video, photograph and document, and each of them follows its own digitization processes (Ashraf, Sharma et al. 2010).

Selection policy is fundamental to any institutional digitization policy. Many institutions and consortia initiatives have guidelines (McIlwaine, ICA et al. (2002), (Ayris (1998) and (UNESCO (n.d).

Two of the most widely used guidelines considered in this paper are the Northeast Document Conservation Centre's Handbook for digital projects (Sitts 2000),(Gould, Ebdon *et al*. 1999) and the Harvard guidelines(Ayris 1998). These documents are used as a foundation for what to digitize. Other examples, such as a decision matrix for a digitization project that came from Oxford University (Lee 1999) and the Library of Congress which developed a useful

'guide of methodology' for selection and digitization, assessing value, use and risk factors of collection building (CLIR 1998), were also considered.

Added to that, a survey of special collections based on the Association of Research Libraries was consulted to help with collection assessment based upon user needs, cost/benefit analysis and the consideration of strategic institutional issues (Hughes 2004).

The questions of pre-selection tasks, the process of selection phases, why selection and who selects (Long 2000) are all issues that were considered for this study.

1.5.6 Digitization for access

Librarians and research institutes see increased access to collections as the main benefit of digitization (Maron and Pickle 2013). One of the main priorities of digitization should, therefore, be to increase access to collections. Providing greater access to collections may bring together vast, disparate collections and may inspire new scholarly work (McKay 2003). To this end, the Internet (via the web) will be the most appropriate mechanism for reaching the public (Lee 1999).Although many research libraries and research institutes have succeeded in posting their digitized collection for the public to access, less is known about what happens after a launch (Maron and Pickle 2013). Lee (1999) and Smith (1999) provided some ideas on this matter.

1.5.7 Previous studies on assessment and selection criteria

Selection involves choosing from among a number of options using informed judgment and selection criteria (McKay 2003). Factors that influence selection for conversion include the uniqueness of the materials, synergy with other activities in custodial divisions (such as preservation), the availability of suitable digitizing technology, and the value of the materials for education (Lee 1999).On these bases a number of libraries and institutions have tried to provide assessment and selection criteria for proposed digitization projects.

The research thoroughly discussed Harvard University's 'Selection for Digitizing: A Decision-Making Matrix', (CLIR 1998), University of California's 'Selection Criteria for Digitization', (UoC 2004), 'Guidelines for Selection' compiled by P. Ayris (UCL) as part of the joint RLG and NPO Preservation Conference, Warwick, (Ayris 1998), National Library of Australia (NLA 2006), Vogt-O'Connor, "Selection of Materials for Scanning" *(Sitts 2000),*Cornell University Library, "Selecting Traditional Library Materials for Digitization,"

Report of the CUL Task Force on Digitization, (CUL 2005) and *Selecting Research Collections for Digitization.* Council on Library and Information (CLIR 1998).

The Harvard Model of conducting a digitization project (Brancolini 2000) was also investigated. According to Lee (1999), a number of academic libraries have developed criteria and models for selecting research collections for digitization, including Harvard (1998), University of California (1997), and Oxford University. These studies were also reviewed.

Collections for digitization involve the following factors: "the intellectual and physical nature of the source materials; the number and location of current and potential users; the current and potential nature of use; the format and nature of the proposed digital product and how it is described, delivered, and archived; how the proposed product relates to other digitization efforts; and projections of costs in relation to benefits"(Brancolini 2000).

It appears that selecting materials for digital preservation depends mainly on the following three criteria:

- Whether the materials are both valuable and endangered;
- Appropriate digitization procedures and standards for these materials exist; and
- Copyright allows reasonable access for educational and research purposes (Rahman and Mezbah-ul-Islam 2012).

The ERDC has a different context in terms of infrastructure, administrative system, funding issues, manpower skill and technology from the context for any other digitization project. The study looked into the ERDC's selection criteria and analysed that against the backdrop of the literature. The literature analysis for this study is expected to lead to an informative recommendation that could be of use to ERDC, libraries and research institutes engaged in digitization projects.

1.5.8 Similar African initiatives

This section covered similar digitization initiatives taken across Africa that may be of use to the ERDC. The initiatives included are, the project undertaken by Aluka on Struggles for Freedom in Southern Africa (Isaacman, Lalu et al. 2005), the digital imaging project in South Africa, DISA, which covers South Africa's Struggle for Democracy (Peters and Pickover

2001), Anti-Apartheid Periodicals and Selected papers from the Nordic Africa Documentation Project workshop on the Liberation Struggles in Southern Africa (Svärd 2009).

Summary: This section provided a brief description of the literature that was reviewed in–depth in Chapter two of the research. The research study also covered the main research areas in sustainable digitization, valuable collections and selection criteria for digitization. Its main intention was to find the trends on how sustainable digitization could be undertaken for valuable or special collections.

1.6 Research methodology

An in-depth literature review was done on digitization standards, sustainable digitization, selection criteria, technology for digitization, cost of digitization, steps to be taken for digitization, issues of visibility and accessibility and challenges of digitization.

The interpretation of this literature was meant to assist in finding answers for the research question and sub-questions. Semi-structured interviews were also employed as the data collection instrument to collect information from the ERDC managers and operational staff. Semi-structured interviews come between structured and unstructured interviews where one can have some predetermined topics and questions, but one can also leave some space for following up interesting topics which arise and can be discussed (Petre 2007). Finally, the findings of the interviews were compared against the background of the literature to develop appropriate guidelines for digitization that could work for the ERDC.

The nature of the research is qualitative. This is a research study in which a researcher tries to understand specific organizational contexts from the perspective of those involved (Jonker and Pennink 2010).

A purposive sampling technique was followed in the selection of the interviewees. This is an arbitrary method with a good representation of the total population. It helps to pick a sample in relation to certain criteria and is important when placing special emphasis on certain specific variables of the study (Singh 2006).

A detailed description of the methodology for this research, which also provides an outline of the research design, problem statement, selection of the target group and the data collection instruments, is presented in Chapter 3.

1.7 Value of the study

The ERDC will be the first to benefit from this research. The findings of the research study will help it to digitize its valuable collections and make these collections accessible to the public for education and research. Since other institutions, such as public libraries, school libraries, and government departments, have been involved in the activities of digitization, the findings will be of great use to them should they also wish to establish a sustainable digitization programme for their valuable collections.

However, since different institutions follow different standards, the recommendations that emerge from this research might not serve all equally. So some may only be able to consult it as a general framework that could be adapted to their needs.

1.8 Clarification of key terms

Digitization: This is the process of converting original physical material (e.g. paper) from its original analogue format to digital format (e.g. an image file or preferably an editable text document) using a scanner linked to a computer facility or a digital camera (Zhang and Gourley 2014).

Sustainable digitization: A sustainable digitization programme is viewed as sustainable if it contains the intrinsic features that integrate it into the fabric of library services, that focus on achieving mission related objectives, that obtain funding from predictable sources and have plans for the long-term maintenance of its assets (Smith 2001). Digitization projects require continued provision of institutional commitment, funding, availability of skilled human resources, regular updating technological infrastructure, etc.(Rafiq and Ameen 2014).

Valuable collections: These are special collections that are rare and fragile and archival materials that offer access to users and unique value to the institutions (ARL 2009).

Selection Criteria: These criteria are used when involved in the process of selecting material for digitization. Selection criteria could be seen as the checklist for digitization. They involve choosing from a number of options using informed judgements (Zhang and Gourley 2014) and (Anderson and Maxwell 2004).

Access: This is the process of digitization or scanning documents and making the digital copy available to end users via the Internet or other means for a sustained length of time (NARA 2008).

1.9 Division of chapters

The research study contained five chapters. The **first chapter** served as an overview and introduction to the research study and highlighted the background of the ERDC, its valuable collections, a statement of the problem, the main research question and sub questions, the scope and limitation of the research, the rationale for the research, an overview of the literature, the research methodology, the value of the study and the clarification of key terms.

Chapter 2 reported on the literature that covers the area of reasons for digitization, valuable collections and digitization, digitization process, resource requirements, challenges in digitization, developing selection criteria, similar African initiatives, digitization challenges in Africa and sustainable digitization. The literature is consulted in order to find solutions for the main question and sub-questions posed in chapter one.

Chapter 3 covered the methodology used to collect empirical data. This chapter provided a detailed outline and discussion of definition of methodology, research paradigm, research design, data collection method, data collection tools, rationale for the questions to be asked, target group and sampling, methods of data analysis and interpretation.

Chapter 4 covered the research findings, discussions and interpretations, suggested solutions and precautions. Both the literature review and empirical study findings are used as the basis for advising the ERDC in drafting an appropriate guideline for digitization.

Chapter 5 summarized the findings and provides the conclusion and recommendations for a sustainable digitization effort at the ERDC to provide access to public and research. In addition, the research made recommendations to other government and non-government institutions, public libraries, colleges and schools to adopt the guidelines to use within their own context.

Chapter Two
Literature review

2.1 Introduction

The goals and objectives for digitization can vary from institution to institution. The focus can be on access, preservation or a combination of the two. In addition, the approach taken towards digitization can be either user-driven or collection-driven (Smith 2001). The author highlighted that it is unrealistic and uneconomical for an institution or its library to undertake a digitization project without due consideration of the factors that influence the project's sustainability.

According to Smith (2001), a reliable budget, storage capacity and preservation tools are significant for the creation of a sustainable digitization project. Ashraf, Sharma et al. (2010) on their side suggest that sustainability can be improved by taking components, such as collection development, selection process, usage of the collection and life cycle management of the documents, into consideration. Several digitization projects, however, have not seen their completion as a result of a failure to consider sustainability (Ashraf, Sharma et al. 2010).

Generally, maintaining a sustainable digitization programme is one of the greatest challenges facing libraries today (Ashraf, Sharma et al. 2010) and formed the major thrust of this chapter. This literature review, therefore, tried to identify the reasons for digitization, provided a description of valuable collections, described the digitization process, identified resource requirement, explained digitization challenges, considered selection criteria, recognized African digitization initiatives, discussed African digitization challenges, explained sustainable digitization, and, finally, presented a conclusion.

2.2 Reasons for digitization

As was mentioned at the start of this chapter, institutions usually initiate digitization based on either collection-driven or user-driven approaches. When libraries or institutions initiate a digitizing initiative on the basis of their existing collections, serials and research use, they are

following the collection-driven approach digitization process. On the other hand, if they base their digitization procedures on the needs of their users, they adhere to a user-driven approach. It appears that, in most cases, digitization is a collection-driven initiative (Smith 2001).

In whatever case, the reasons given for digitization are diverse and as numerous as the number of institutions involved in the project of digitization. The common ones discussed in this chapter are, however, covered by the International Federation of Library Associations (IFLA) (McIlwaine, ICA et al. 2002). In general, these reasons can be clustered in to three categories. Firstly there is access, secondly preservation, and, thirdly, reasons for institution based-services and partnerships. These categories are discussed in the following sections.

2.2.1 Digitization for access

According to the findings of research which was carried out in Oxford University, access seemed the overriding justification for digitization, and, consequently, over 80% of the recommended material relative to the collection for digitization ranked it as being most required for access purpose (Lee (1999). The era of the internet itself paved the way for access and played a multiplying factor for providing access to a huge number of users to the digitized valuable materials at a time (Lee (1999).

Valuable materials, such as manuscripts, rare books, and musical records from special collections have received the highest demand for digitization for research and education purposes (Sitts 2000). The same author, however, questioned the level of access and its need to be addressed by digitizing institutions. He further emphasized that these institutions are supposed to address the issues of managing and controlling the digitized materials, giving free access of these materials to users, deciding on the quality of digitized materials, and accommodating users' needs and the level of access.

McKay (2003), in turn noted that the digitizing of rare collections and making them accessible to public enhances research and scholarship. On similar grounds, the institute of The Smithsonian (2010) views digitisation as enhancing globalisation crossing geographical, cultural and economic constraints and so putting humans on an equal democratic footing.

From that point of view, various works of literature focus on the importance of digitizing these valuable collections which are scattered and, so, making them available online to be accessed by researchers based in remote areas (Eze Asogwa 2011; Namande 2012). Maron

and Pickle (2013) also highlighted the fact that libraries and institutions that engage in the digitization of special collections advance the relevance of the digitized materials for greater access to users.

2.2.2 Digitization for preservation

Digitization helps the development of digital surrogates of the rare and fragile documents that an institution owns. Institutions can provide a service to users through these surrogates and keep the original documents safe from damage which could be caused by handling and display (Hughes and Green 2004).

Preservation, however, is still a challenge and not yet manageable as digital objects, but institutions that engage in digitization and preservation are actively working to find a solution for data integrity, validity, technological obsolescence and sustainable accessibility (Arthur, Byrne et al. 2004; Hughes 2004); Hughes and Green (2004), highlighted that digitization alone could not serve as a solution to the problems of preservation.

The factors that affect digitization for access and preservation are more or less similar (Rieger 2008). The author underlined the preservation challenges as technical infrastructure, technology, institutional policy, strategies of the institution and funding as the fundamental challenges that have a direct impact on digitization for preservation.

As testified by (Deegan and Tanner 2013), preservation is a secondary objective since its contribution is realized by the physical reduction of access to the original material. The need for access and the role of preservation in digitisation can, however, be looked at as being distinct. That is that susceptible documents may require preservation before they can be made accessible. In the event that access is put before preservation, it could then be guaranteed for only a few users.

2.2.3 Digitization for institution-based services and partnership

Digitization for access and preservation services can transcend the objectives of an institution. Some digitization benefits are, however, more localized to an institution. For instance, digitized materials can be helpful for an institution to improve its long-term teaching and learning services. Digitization can also reduce the wear and tear of the original documents by providing copies of the originals. In addition, it exposes institutions to technical, technological, infrastructural, financial and human support both locally and internationally.

Apart from IFLA's findings, this present research study has considered the inclusion of other digitization purposes mentioned by other authors which are relevant to this literature. One of these is digitization for the purposes of collection development accentuated by Hughes and Green (2004).

According to Hughes and Green (2004), digitization for the development of collections can also create the opportunity for the re-purposing of the resources. Some rare books, documents or manuscripts that may be considered of low value and importance might become recognised as significant assets of research owing to new angles realized in digitization.

In addition, Hughes and Green (2004) are of the opinion that institutions that digitize rare materials for access and research gain prestige and raise their own profile. They receive a number of visitors to their collections and become centres of research. Such institutions can use this leverage to attract funders to invest in digitization for the purposes of education, research and scholarship.

For instance, the Arnamagnaean Institute can be mentioned as an example which is heading towards achieving successful digitization (Hughes and Green 2004). This has been accomplished through the creative ways of virtualization opportunities for the amalgamation the contents of institutions in one repository and providing services to users from different locations.

The focus of the next section is the issue of the digitization of these valuable collections.

2.3 Valuable collections and digitization

A large number of researches have tried to cover the nature of special collections, e.g. the size, type of collections, activities and assignment of staff, relationship with digitization, funds required for carrying out the digitization programme of these collections, and, finally, the issue of the preservation and storage of these collections (Panitch 2001).

For instance, Smith (2001) tried addressing fundamental issues of special collections based on the University of Michigan policy of digitization for collection development. According to his findings, special collections are supposed to be original in content and substantial in

quality, matching the institution's needs, satisfactory to users' needs, affordable to digitize, and useful for long-term research purposes.

According to Palmer (2004), special collections are materials or documents that are fragile, unique, valuable and primarily selected for digitization in libraries. The author further noted that digitizing special collections has a paramount importance for researchers and offers a digital alternative to the original valuable materials (Palmer 2004).

Valuable collections are special collections that are rare, of significant demand and of research value for the institution that owns them (Maron and Pickle 2013). Owning a digitized material of valuable collections is, however, not easy without putting the necessary digitization policy, legal issues of copyright, digitization process, digitization standards and resources in place. The subsequent section addresses the process of digitization.

2.4 Digitization process

Ordinarily, digitization is regarded as the process of converting analogue information, such as books, manuscripts, audio and video tapes, photographs, films, models and maps, to electronic format (Ashraf, Sharma et al. 2010). Each of these formats follow a separate digitization process (Ashraf, Sharma et al. 2010).

The process of digitization follows certain procedures considering what needs to be digitized and what factors to consider before selection. There are several models that suggest the digitization processes of various materials. From the literature reviewed, they can be presented systematically as follows.

a. Selection policy

The first process in digitization centres on developing and owning a selection policy (which is the fundamental instrument of digitization) that is applicable within the specified environment (Ayris 1998; Sitts 2000; Alhaji 2009; UNESCO n.d). A selection policy is vital for making selections from a list of valuable collections to be digitized.

b. Planning and registering

Several authors, (Anderson and Maxwell 2004; Alhaji 2009; GoA 2013; UNESCO n.d), stated that institutions which engage in digitization are supposed to plan ahead of the practical process and register the valuable collections that they consider for conversion. According to these authors, planning involves the identification of material, assessment of resources needed, decisions on standards and definition methods, and assessment risks.

c. Copyright clearance

Sitts (2000) and Alhaji (2009) noted that securing copyright clearance before the actual digitization takes place, either from the authors or publishers, is a vital procedure that needs to be considered in the process of digitization. The reason behind this is that copyright clearance is essential for avoiding legal consequences and adhering to academic ethics (Mothutsi n.d) .

d. Scanning and metadata creation

The process of scanning follows copyright clearance. Institutions are expected to scan their valuable collections based on a standard format that could be used for access purposes. Text documents are digitized as pdf (portable document file) and images as jpeg (image file formats). Then the complete administrative and technical metadata is linked to the documents

e. Storing images and quality control

Digitized images need to be stored in devices such as an external hard disk, server and local area network to be accessed by patrons. They also need to be cross checked to ensure the quality of the documents for accessibility (Sitts 2000; Alhaji 2009; GoA 2013; UNESCO n.d)

f. Data integration and management

According to (Sitts 2000; GoA 2013); UNESCO (n.d), institutions are required to document their digitized materials in databases such as Dspace, manage the contents, and ensure the integrity of the images to their metadata. This means that, if proper database recording and content management is not done, it would be unreasonable to achieve the target of accessibility of these materials.

g. Delivery and follow-up

Delivery and follow-up appears to come after data integration and management. At this stage, digitized materials are meant to reach the users. Sitts (2000); (GoA 2013; UNESCO n.d) noted that, after the process of the documentation of images, institutions work on different levels and mechanisms to make them accessible. Websites and local area networking are the appropriate channels of delivery. Continuous promotion and follow up are, however, demanded from the institution to ensure the sustainability of their access (Sitts 2000; GoA 2013; UNESCO n.d).

In conclusion, the process of digitization can be clustered into three stages as follows:

Table 1. Customized process of digitization

S/N	Steps	Details
1	Pre-digitization	Identification of material, assessment of resources needed, decisions on standards, definition of methods, assessment of risks, selection of materials, quality control and assessment of preservation need.
2	Digital conversion	The creation of the digital master and the availability of professional equipment and quality control procedures are important.
3	Post-digitization process	Control of metadata, quality control, submission of information to repository systems, data management, making digitized copies and metadata available online, assessment and evaluation of the project.

To realize the process of digitization, any institution is expected to own the fundamental resources. These resources are categorized below as technical, human and budget requirements. The following section deals with these classifications.

2.5 Resource requirements

Digitization requires a number of resources, among which technical infrastructure, human resources and funding can be stated as being the most important to maintain the sustainability of the programme (Alhaji (2009).

2.5.1 Technical infrastructure

The technical aspect is an important factor of digitization criteria that an institution is supposed to consider (Sitts 2000). This factor tried to address whether the institution responsible for digitization is technically capable of undertaking the digitization, capturing the materials, feeding the materials with necessary metadata, storing them and making them accessible to users. The relevant questions that arise on the technical aspect relate to:

- The technical details of organizational structure and process of workflow;
- The technical equipment to capture the materials to the desired quality and standards;
- The preparation of manuals for feeding the technical, structural and metadata;
- Owning the expertise to manipulate the captured materials to the desired quality and specifications;
- Preparation of website with its features and management issues to give access to users; and
- A preservation plan for the digitized materials and future use.

According to Alhaji (2009); (Namande 2012), the most important technical requirements of digitization are:

- Hardware, such as desktops, external hard disks, uninterrupted power supply (UPS), printers and scanners;
- High-speed local networks;
- Fast connections to the internet;
- Robust databases that can keep the digitized materials and provides easy access for users;

- Servers, including Web and FTP servers; and
- Electronic document management software.

In brief, the technical infrastructure requisite for digitization can be summed up in two categories, namely hardware and software. The next requirement for digitization is the human resource.

2.5.2 Human resources

Different institutions, considering their size, economy, goals, size of their collection and capacity, can have different human resource obligations. The basic human resources requirements are, however, more or less similar. According to Sitts (2000), the following roles require at least one person for an institution to function in the digitization process:

- Project manager;
- Selector;
- Conservator or curator;
- Preparations technician;
- Cataloguer to create or enhance bibliographic records;
- Scanning technician or photographer;
- Quality control technician;
- Metadata analyst;
- Data entry technician;
- Programmer or other database expert who integrates metadata and images;
- Systems administrator;
- Network administrator to implement security and other access requirements; and
- Developer or designer of the user interface.

Based on the above list, the human resource requirement for digitization can be classified as managerial, preservation and technical. Although the list above is a long one, it is not

necessarily true that the associated tasks cannot be done by one person. These are roles that need to be performed and the actual number of staff required will be determined by the volume of work to be completed.

The third digitization condition is the budget.

2.5.3 Budget

A digitization programme is expensive and demands intensive financial resources (McIlwaine, ICA et al. 2002). Institutions are required to make a detailed cost analysis before embarking on a project. The costs that should be budgeted for include equipment and technology, salaries of employees, digitizing software, digital storage, training of staff, management of software and maintaining the security of the collections (Boughida, Chudnov et al. 2011).

Yet, even with all these requirements in place, the digitization programme has a myriad of challenges. The next section discusses some of the major challenges of digitization.

2.6 Challenges in digitization

Libraries and institutions which engage in digitization face a number of challenges, among which the most significant ones are noted by Hughes and Green (2004); Namande (2012) to be as follows:

Low internet connectivity: Institutions or libraries involved in digitization need high bandwidth of internet connection to share their digitized resources, download documents, search and retrieve data from the internet.

Low level of ICT literacy: Institutions face a serious problem of delivering services if their staff lack adequate ICT skill to search data, retrieve documents, digitize and manage documents, and assist customers to access and browse the computer.

Power cuts: Most developing countries suffer from power cuts or power surges. Institutions that undertake digitization projects can easily be frustrated in such situations. As a consequence this can hamper their services.

Information security: Institutions and libraries need to secure their digitized documents from deletion, alteration, theft and illegal access. Maintaining a secured information system is, therefore, important in digitization programmes.

Proffitt (2015), from her perspective, specified the challenges of digitization in asset management system or institutional repositories as storage and preservation, metadata treatment, process management or workflow, selection (specifically prioritizing for users over funders) and finally providing access to patrons.

From the discussions above, the challenges of digitization fall into technical requirements, knowhow of technology, management and the security of data. It is obvious that digitization challenges vary in scope and nature, and, apart from that, institutions often encounter other challenges in their digitization programme (Proffitt 2015). Institutions are, however, expected to follow certain guidelines or steps of digitization that would help them resolve these challenges. One important guideline is the standardization of selection criteria. The next section, therefore, elaborates on what these criteria are and the reasons behind them.

2.7 Developing selection criteria

Selecting items for digitization should be done using selection criteria. The criteria are a set of 'rules' that help select items, which may be taken from rare, fragile and valuable collections, to be digitized (Smith 2001). This section presents the reasons for selection, how selection is done, what criteria are employed and the experiences of libraries and institutions in the selection of documents for digitization.

2.7.1 Reasons for selection

There could be a several reasons for selection when it comes to digitization. On top of that institutions cannot afford to digitize all the materials that they come across. They, therefore, engage in selection from the collection, and they have to identify the most important documents that will satisfy the needs of their users (Gertz 2012).

Sitts (2000) highlighted the following reasons of selection for digitization:

Web access: Digitized materials posted on a web can reach a large and diverse number of audiences. Institutions which look to providing wide access of their collections and making users aware of their collections, therefore, undertake the process of selection. Once the audience is aware of the availability of the material on the web, they frequently visit and place their requests for more material.

Cost and limited budget: Most institutions, libraries and organizations may have digitization plans for materials they have on hand to enhance access. This may, however, not be achievable owing to budgetary and resource constraints. Considering their limitations, they may undertake the selection process to focus on their priority.

Digital mortgage: Managing digitized files is not easy. Institutions face continuous refreshing, emulation and migration of these files owing to changing technology, infrastructure and software. The budget required for expertise and for these changes is enormous. Some institutions, therefore, may focus on selected materials that they think they can manage within their budget.

Legal issues: Institution are not authorised to post digitized material without securing permission from owners. Posting materials that do not have copyright permission can lead to legal action against an institution. Institutions are, thus, required to seek permission after selection.

Stakeholder concern: An institution may not publish all material it gets, even if it has secured permission. It needs to ensure that the material is ethically acceptable and culturally non provocative to stakeholders. To guarantee this, an institution should make a thorough selection process.

Supporting documentation: A large number of materials are found to be without adequate information or captions that are essential for metadata and cataloguing. Institutions can face difficulties with regard to creating accurate metadata for these materials and also incur unnecessary costs. In this sense, institutions are obliged to implement a selection process and identify relevant material that has full and accurate information.

Institutional credibility: If materials that an institution posts are not credible, that institution can lose its reputation and also be discredited by its users. This condition automatically decreases its visitors. The selection process for materials is, therefore, important because it

gives the institution an opportunity to identify what is relevant and to weed out the inaccurate materials from its collections.

2.7.2 How selection is done?

In the selection process there are significant issues to be considered; these are: making considerable note of the appropriateness of the selected material to the overall mission and goal of the institution; the value to the organization; the users' demand for the material the legal issue of that material; and its availability for use (Sitts 2000). According to Sitts (2000), the following phases are followed to deal with the above mentioned issues:

> ***Nomination:*** This is the first phase/stage where the staff involved in collection development, researchers, the digitization department, donors and other stakeholders assemble together to decide which materials to select for digitization and which to exclude on a rational basis.
>
> ***Evaluation:*** At this stage the selection committee, based on set criteria, tries to evaluate the list of the selected materials, weighs the values of the materials included, and weeds out what it considers to be irrelevant.
>
> ***Prioritization:*** Finally, the committee tries to prioritize the materials according to their value, use, cost and risk to the institution.

The main factors to be considered when adhering to the above phases are: ensuring the materials are under the public domain or not copyright protected; evaluating the value of the material to the user; and, finally, the accuracy of information and condition of the material (CSL 2009).

Selection is not an easy job since it requires knowledge and skill of every subject or discipline that the collection demands. It cannot be done with one person alone. A committee is, therefore, required to be formed to undertake such a mammoth task. According to Sitts (2000) and (Vogt-O'Connor 2000), the committee can be formed from different categories of people including:

- Discipline specialists;
- Education specialists;
- Digitizing specialists;

- Librarians, archivists, and curators;
- Researchers;
- Conservators and preservation specialists; and
- Lawyers.

Long (2000) remarked that pre-selection tasks are imperative for the selection committee, before the actual work of selection takes place. These tasks include meeting all kinds of groups, institutions, libraries, departments and digitization managers that handle digitization projects to obtain their goals, objectives and plans at large. Next, is knowing what kind of audience the materials being considered will have and evaluating such an audience. Finally, there is a need to search for proper selection criteria and to check which one such criterion have been used in a similar institution and audience.

Once the selection criteria are put in place, the next process that follows is 'the nomination'. During this phase, librarians, users, staff members of libraries, archivists and curators should be involved in the selection of the materials which are later to be evaluated by the selection committee. The phase of evaluation follows. During this phase, the selection committee evaluates the materials that have been selected, writes letters to owners to get copyright permission and approves the materials for digitization. If, however, the materials are not selected, the committee puts them aside for further investigation or weeding (Long 2000). At this juncture, it is important for one to be cognizant of the fact that the selection reasons of all institutions are not alike.

Every institution has its own way of making a selection and its reason for doing so. Based on the literature, however, the main phases can be put as pre-selection, identifying users, material nomination, evaluating of the selected material, getting copyright permission and approval for digitization. Based on that, the next section discusses the selection criteria employed by different institutions and libraries.

2.7.3 The criteria for selection

Institutions and libraries have different selection criteria. As Ayris (1998) has noted, Harvard adopted a decision-making matrix that would help it to go through the process of selection and digitization. A decision matrix is a graphic representation that allows one to analyze and systematically work out and find relationships between bits of information. It is especially useful when large numbers of factors need assessment and decision making.

Ayris (1998) further classified the decision-making matrix issue into four manageable categories:

Assessment: This category measures what support the target users can gain, checks the alignment of the digitization programme with the collection policy, evaluates the contribution of the digitized material towards national resources, checks whether other means are available that meet the users' need, and ascertains whether the digitization programme is for preservation or access purposes.

Gains: This category evaluates whether the digitization programme reduces the handling of the originals, analyzes whether the digitized material could enhance its academic use, checks whether the navigation is easy, helps at uniting fragmented units and enriches the damaged images and texts.

Standards: The category checks whether the standards used are compatible with national and international standards, ensures the availability of the digitized materials on a variety of hardware and software formats, makes sure that the software easily delivers the digitized materials, adheres to international standards of metadata, and checks the compatibility of the hardware and software requirements during data migration.

Administrative: This category addresses the issue of finance, ensures the availability of copyright permission evaluates the capacity of an institution's expertise to undertake the project, analyses whether the digitized material can create commercial opportunities and assesses the cost benefit analysis of the project.

In a similar way, the decision matrix of Oxford University on selection criteria can be summarized as identifying the collection, making sure the materials answer the needs of users, securing copyright permission and finally proceeding with the process of digitization (Lee 1999). These selection criteria provided by Lee (1999), however, are not as greatly detailed as those of Ayris (1998). On the top of that, Ayris (1998), unlike Lee (1999), clarifies the decision making matrix of selection by providing an additional four categories that elaborate on the implementation of the selection criteria and their impact.

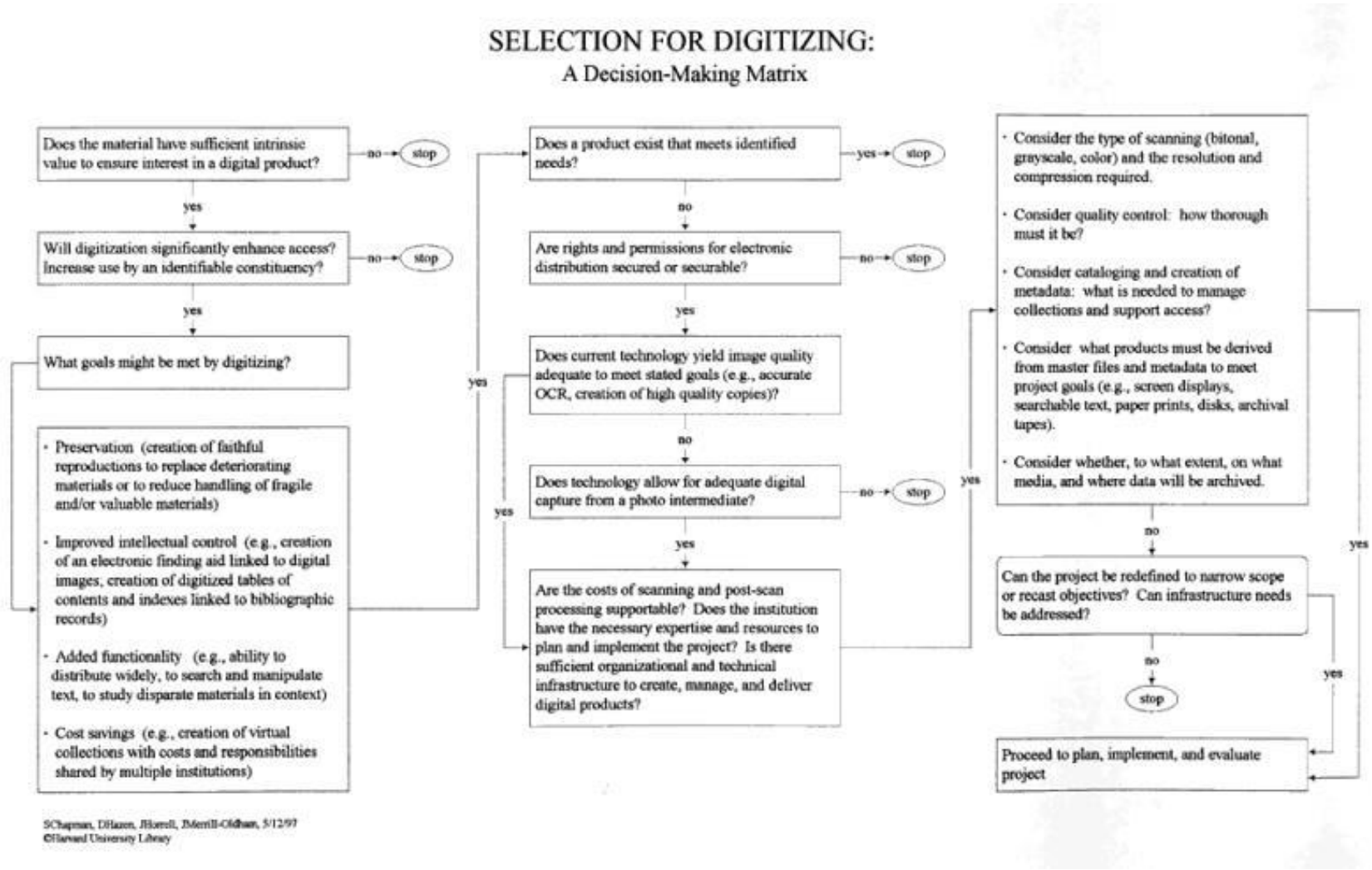
The matrix (see figure 1 on page 35) contains some important issues to be addressed. These are:

- The intrinsic value of the materials;

- Significance of enhancing access and use;
- The target goals to be achieved;
- Materials that meet identified needs;
- Materials that have secured copyright and permission;
- The technology to be involved to meet the desired quality;
- Cost rationality and fairness; and
- The adequacy of organizational and infrastructural structure.

According to Brancolini (2000), the selection criteria can be summed up as follows: goals of the institution; value of the material; needs of the users; access and use; copyright clearance; available technology; organizational structure and infrastructure; and, finally, availability of budget.

Figure 1. A decision making matrix (Brancolini 2000)



Some other authors, such as Sitts (2000), give more weight to the value of the material as a prominent criterion of selection. According to Sitts (2000), institutions might have different definitions of the values, but the common ones should have answers to the following issues:

- The alignment of the content to the overall policy;
- The uniqueness of the material;
- The contribution of the material towards knowledge and its accuracy;
- The copyright issue and the accessibility of the material;
- The aesthetic quality of the material;
- Potential users of the material; and
- The possibility of adding value to the material.

Rahman and Mezbah-ul-Islam (2012) and (Maron and Pickle 2013), from their point of view, tried to propose general criteria for selection. According to the authors, the material should be both valuable and endangered, digitization procedures and standards need to be in place, and legal permission should be secured for the collections which an institution wants to digitize. These authors have also emphasized the importance of the selection criteria mentioned by Ayris (1998) and Sitts (2000). They both, however, fail to provide details of the criteria, such as the issue of delivery, security, and the preservation of the digitized documents.

From the literature reviewed, selection criteria can be summed up as involving the intrinsic value of the material, the users' need, the possibility of enhancing access, the copyright issue, and available technology for quality digitization, organizational infrastructure and the availability of an adequate budget. The value of the material is given outstanding priority in the selection criteria. Assessment is done on the material to check whether it aligns with the policy of the organization and contributes towards national resources. A thorough evaluation is carried out on the material to check whether there is anything to be gained from its digitization, and whether it adheres to international standards and has copyright permission.

Poor criteria can, however, endanger the position of any organization by creating unusable and less valued collections. To ensure the owning of valuable collections, therefore, organizations are required to follow certain procedures such as appraising collections, prioritizing them and finally selecting the contents.

The next section tries to present the experience of world libraries at standardizing selection criteria and digitizing their collections.

2.7.4 The experience of a few world libraries at selection and digitization

The Harvard University library designed a decision-making matrix (see Figure 1 on the previous page) that would help it make a selection from its own collections. The selection criteria follow a logical order. The first criterion poses the question of whether the documents have intrinsic value or not. The second criterion investigates whether digitization can support access. The third looks at what kind of goals can be achieved as a result of digitization. The fourth one checks to see whether the material can respond to the needs of users. The fifth criterion highlights the importance of copyright clearance before proceeding to digitization. The sixth and seventh ones emphasize the importance of technology in digitization and their cost implications respectively. The final criterion deals with the issues of quality control, metadata creation and their preservation.

Brancolini (2000) tried to adapt the Harvard decision-making matrix of selection for Indiana University. The author summarized his view of selection criteria as follows:

> *"the intellectual and physical nature of the source materials; the number and location of current and potential users; the current and potential nature of use; the format and nature of the proposed digital product and how it will be described, delivered, and archived; how the proposed product relates to other digitization efforts; and projections of costs in relation to benefits."*

The University of Illinois also classified the selection criteria as being both obvious and subtle. The obvious factors are copyright and permission, cost endured in selection and digitization, and the physical condition of what is to be digitized. The subtle criteria are the purpose of the digitization, the intrinsic value of the material and the type of audience (Carli 2012).

The University of California also put its selection criteria into the categories of collection development, access and preservation. A full description of its criteria is presented below in a tabular form:

Table 2. Selection criteria in the University of California

S/N	Category	Description
A	Collection Development	• The material should meet the needs of UC community and beyond. • The material should get support from a number of stakeholders to be digitized. • It should meet the interest of funders. • It should add value to the prestige of UC. • It should have an economic value and linkage to other sources to benefit UC. • It should increase the existing general information of UC.
B	Access	• The selected material must be something that can easily be integrated into the UC library services. • The digitized materials should be in accordance with standards and be accessed in the network and platforms of UC. • The digitized material should be easily accessible and retrievable from the database of UC. • The process of the digitization should facilitate solving the problems of fragile and large formats that are difficult to access. • Accessing the digitized material is made easy

		through friendly interfaces. • The digitized material has relevant metadata such as document identification, technical capture information, provenance and navigation. • Works in partnership with national initiatives to widen the available content.
C	Preservation	• UC has to check its preservation facilities and services such as poor housing, risk of damage or loss owing to high usage. • The library of UC should be committed to refresh and migrate the digitized materials when the technology changes to ensure the sustainability of the collections and their services. • UC library should make sure that it digitizes the selected materials without any damage to the original.

Source: University of California (UOC 2013)

On similar ground, the National Library of Australia and Cornell University put the following guidelines as the main criteria for selection respectively:

National Library of Australia

- Cultural and historical significance of the material;
- Uniqueness of the material;
- The issue of copyright status to digitize;
- The demand of the material by users;
- Whether the material is at risk because of the physical deterioration; and
- Whether the format of the material is at risk of obsolescence (NLA 2006).

Cornell University Library

The selection criteria are presented in two different sections:

1. Project criteria: these are the criteria used by library staff or subject specialists to prioritize what to be digitized from the collections.
2. Production criterion: this signifies digitization undertaken at the demand of the librarian, researcher or faculty but not a selector-driven criterion (CUL 2005).

Considering the discussions of the above mentioned examples from world university libraries, the common selection criteria can be summed up as collection, access, delivery and preservation. The next section tries to address African initiatives of digitization and their experiences particularly.

2.8 Similar African initiatives

In general, there are numerous digitization initiatives taken across Africa to be used as experiences for ERDC. The experience of the developed world in digitization can be used only as a general guide for ERDC because the levels of civilization, economic development and technological advancement there are far from what exists in Eritrea. Even the African level of digitization is too diverse (Molawa 2010) to be of any use as a bench mark of digitations. They are, however, more or less similar to the Eritrean context.

According to Mutula (2004), African digitized libraries need to focus on three relevant issues during digitization. The first one is to digitize relevant local collections so that they have a democratic access. Second is the issue of the sustainability of the programme? The third issue relates to the owning of legal permission of the collections of the institution. Detailed discussions of these issues are presented as follows.

Access: The main objective of keeping digital material in Africa is for educational purposes. The existing technological, infrastructural and telecommunication problems are, however, the factors that create the digital divide within the societies.

Sustainability: Africa is suffering from a lack of information. To solve this problem it needs to engage in regional and international co-operation to share resources. In

addition, it requires the establishment of open access repositories to develop its research and ensure the sustainability of the services.

Legal issues: The monopolization of information has become a factor of digital divide. African countries have become victims of this. Moreover, government and private interference in information censorship, copyright laws, and property rights is stifling the progress of open access within African countries.

As the literature reveals, digitization is gradually showing progress in Africa for the purposes of publishing online, providing access and aiming for preservation (Limb 2005). What has been digitized is, however, little and it has been providing services to certain elites within society owing to low internet penetration. As a result, digital inequality is created (Limb 2005).

To overcome such problems, Africa has been working with international organizations. Aluka, for instance, which was founded in 2002 by the support of Melon Foundation, is one of the successful examples. Part of its mission is to digitize the history of the liberation struggle of the South African countries and to provide online digital library services for African research and teaching (Isaacman, Lalu et al. 2005). As Garaba (McNulty 2010) remarked, the African digitization initiatives were taken to embrace the digitization of archives of the national liberation struggles of eastern and southern Africa that lacked standardization because of their deficiency in regulation and policy.

Other prominent digitization initiatives undertaken in Africa are the projects of the Digital Imaging project in South Africa (DISA) which covers South Africa's Struggle for Democracy (Peters and Pickover 2001), Anti-Apartheid Periodicals and Selected papers from the Nordic Africa Documentation Project workshop on the Liberation Struggles in Southern Africa (Svärd 2009), Kwetu.Net, an institution that includes African governments and universities and a Database of African Theses and Dissertations (DATAD) that represents a range of African universities (Eke 2011; Eze Asogwa 2011), and eGranary (Amollo 2012) which provides e-resources offline on intranet to African institutions.

The followed section discusses the common challenges that the African institutions encounter while digitizing their valuable collections.

2.9 Digitization challenges in Africa

The major challenges of any digitization project rotate around the availability of funds, infrastructure, scalability and the sustainability of the programme (Tanner and Deegan 2002). In most cases the sustainability issue was addressed at an end of a programme but now things are starting to change. Projects of digitization are commencing and taking, as an integral part of the programme and work, the securing of a regular flow of funds, technical expertise and equipment (Zorich 2003).

Apart from this, digitization projects entail management challenges too. These challenges are policy formulation, setting priorities for activities, and planning for budgeting and implementation. Moreover, convincing staff to change their old way of doing things and guiding users of the new system are also significant challenges (Sitts 2000).

Isaacman, Lalu et al. (2005) from their perspective noted that the Aluka project had come up with the following technical challenges in its process of digitization (Isaacman, Lalu et al. 2005):

a. **Deciding what to digitize:** This is the process and framework of selection, decision and estimating the budget for carrying out the digitization task.

b. **Obtaining legal permission:** The project is supposed to secure legal permission from authors, publishers and other copyright holders for the materials it wants to digitize and make available to the public.

c. **Locating the material:** Aluka has also to conform where the materials are, be able to access them, ensure that they are not fragile, get what permission is required and request how the digitization process could take place?

The African digitization challenges are, however, more thoroughly discussed by Eze Asogwa (2011) than by Aluka project as presented below.

The revolutionary process of software and hardware

The constantly changing nature of hardware and software puts archives, repositories, national libraries and other institutions that undertake digitization and preservation under pressure. These institutions also encounter the obsolescence of hardware and they struggle to move their documents to a new platform for long term access.

Funding

Running a digitization programme is expensive because it demands a considerable amount of money for software updating, hardware upgrading, data entry and subscriptions for electronic documents.

Resistance to technology

A number of digitization staff would not easily accept the introduction of new technology into their system. It becomes a threat to their status and job. They want to keep doing things the old way and do not have any motivation to shift to the modern way of doing things (Ojedokun 2008).

Technical Expertise

The shortage of technical expertise is one of the several challenges that digitization projects encounter. As a result, institutions that are undertaking the responsibility of digitization suffer when the computers break, network dysfunctions or software corrupts.

Inadequate Technological Infrastructures

According Zulu, Aina et al. (2008), most African countries do not own a reliable power supply which is vital for any digitization programme. In addition, their telecommunication services are yet in a poor condition but data transfer on a network of computers is important for the digitization process.

Technological Obsolescence

The obsolescence of technology is one of the critical challenges that African digitization projects are facing. This is usually caused by the upgrading of the hardware or software, applications, programmes and operating systems. As a consequence, access is denied to users and this makes it hard for staff to accomplish the work of digitization.

Refreshing

Files need to be transferred from one device to another or from one platform to another to avoid the obsolescence of technology. 'Refreshing' is the process of transferring files to new media to prevent them from decay and make them accessible. A number of digitization projects suffer from loss of format as files are transferred between programmes and platforms.

Emulation

This is the ability to run and access original data or software on a new platform that emulates the original. To make datasets sustainable in their formats, therefore, digitization staffs must double check that the data are in their desired format when transferring them from one environment of software to the other.

Continuous Migration

As technology keeps changing, digitization staffs are required to maintain their users' usage of the data. Migration is the process of actively moving or transporting digital data across different formats and technologies. According to Eze Asogwa (2011), only few African countries have the financial capacity to maintain and handle the technological and software problems created during migration.

Lack of Legislation/Policy

The legislation or policy of digitization of most African countries lacks clarity such as the issue of copyright. As a consequence, their progression on digitization and preservation is hampered. The DISA project was, however, able to overcome the hurdles of copyright and intellectual property issues by giving away the intellectual rights and so making their collections free to all patrons (Peters 2001).

Deterioration of Digital Media

One of the greatest challenges of digitization is the deterioration of the digital media. No digital media can last forever. As time goes by, the digital media become inaccessible and will be the reason for re-digitization. In addition, African countries face the loss of digital media owing to improper media organization, viruses and poor environmental conditions (Eze Asogwa 2011).

Security of digital information

The issues of the security of digital documents and the virus attacks on computers are among the great concerns that African institutions encounter. The piracy of documents and the corrupting of scanned files with viruses are issues that still need to be addressed (Eke 2011).

The above-mentioned digitization challenges of Africa appear to be unique when compared to those of other continents. According to Proffitt (2015), the digitization problems in North America, England and Ireland include: copyright issue; born digital; web archiving; digital asset management; institutional repository; storage and preservation; item level and collection level descriptions; workflow; selection; and access issues.

Considering the above discussion, African digitization challenges can be categorized as being budgeting, infrastructure, technology, management, human skill, and policy.

Apart from these discussed challenges, African institutions encounter the illegal migration of their valuable collections to the developed world (Pickover and Peters 2004). The following section tries to address how African valuable collections have been robbed by western institutions under the cover of Aid.

Other challenges

ICT has helped in digitizing and maximizing access to the African archives and collections by making collections available for research and teaching. Concerns have, however, been raised by authors such as (Pickover and Peters 2004) and (Limb 2005) that western aid for digitization in Africa has forms of "cultural imperialism" which is evidenced by the controlling, commercializing and domination of the flow of information.

For this reason, some African countries, such as South Africa and Egypt, are striving to liberate themselves from the global dominance of digitization and advocate the social equality and ownership of their information. On the contrary, western donors maintain the path of commercialization of African documents and exacerbate the inequality of the digital divide (Cogburn 2004).

The global powers, including their funding institutions, are to be blamed for the African loss, of its heritage. Namibia, for instance, lost its collections owing to the consecutive powers (Germany, Britain and South Africa) robbing it of its heritage (Limb 2005). It is, however, reality that the funders' support is vital with regards to investment in digitization. African countries must be cautious and vigilant with respect to the programmes that are designed to weaken them as institutions and abrogate their own heritage (Limb 2005).

Even under those circumstances, however, substantial progress has been made in African universities and institutions in digitizing their collections and making them available to users. Yet the African institutions are under continuous challenges with regard to digitization, and they have a long way to go to reach the stage of sustainability.

The followed section deals with the sustainability issues and general and minimal factors that determine sustainability.

2.10 Sustainable digitization

Sustainable digitization is a variedly discussed among scholars. A major topic in this regard has been the factors of sustainable digitization. The following points outline views by different authors.

Funding

Funding has been noted as a key determinant of sustainable digitization (CLIR 1998) , Smith (2001) and Rafiq and Ameen (2014)]. These authors identify funding as being one of the core factors for sustainable digitization. Technology is unpredictable and ever changing, requiring a consistent and reliable source of funding for the present but also in order to keep abreast of new technology and expertise for sustainable digitization.

Planning and maintenance

Planning and maintenance have been cited as important by CLIR (1998), Smith (2001) and Maron and Pickle (2013). Planning is significant for directing one's mission and goals for achieving a sustainable digitization programme. Similarly, maintenance of the digital objects and ensuring their accessibility by patrons is a vital issue to ensure sustainability.

Setting mission, objectives and guidelines

When undertaking digitization, its mission, objectives and guidelines need to be outlined. According to CLIR (1998) and Smith (2001), mission, objectives and guidelines are worth considering for the achievement of sustainable digitization. Institutions involved in the process of digitization are unlikely to achieve the target of sustainable digitization without clear vision, mission and guidelines that will lead them down the course. A strategic view and standard framework by CLIR (1998) and institutional commitment, cited by Rafiq and Ameen (2014), could also be treated as vital factors of sustainable digitization.

Potential marketing and intrinsic value

The factors of potential marketing and its intrinsic value are recorded by Jewell (2001) and Smith (2001). Documents that are valuable and considered to have a high intrinsic value are the ones that have potential for marketing. Institutions that have a valuable collection of intrinsic value are, therefore, likely to make money out of these collections and ensure the sustainability of their digitization programme.

Other factors

Other factors for sustainable digitization have technical and service aspects noted by various authors including the life cycle of the collection by CLIR (1998), user support and selection process by Smith (2001), producing permanent objects, long life span of content and copy of the original document by Maron and Pickle (2013), technology, infrastructure, collaboration and partnership by Rafiq and Ameen (2014).

Authors such as (Naicker 2013) tried to present the minimum criteria required for sustainable digitization during the actual technical document conversion. A tabular presentation of (Naicker 2013) is provided as follows.

Table 3. Minimal technical criteria for sustainable digitisation

S/N	Archival files	Access files
1	At least 600 dpi	resolution of 200 dpi (dots per inch)
2	TIFF (tagged image file format)	PDF (portable document format) or JPEG (image file format)
3	Bit depth: 24-bit colour, 8-bit greyscale	Bit depth: 24-bit colour, 8-bit greyscale
4	Metadata schema: Dublin Core	Metadata schema: Dublin Core
5	Photographic materials - Pixel dimensions: long side of 3000 pixels.	Photographic materials - Pixel dimensions: long side of 3000 pixels.
6	Resolution: sufficient to achieve desired pixel dimensions	Resolution: sufficient to achieve desired pixel dimensions

(Source: (Naicker 2013)

The next section concludes the chapter by highlighting the synthesized discussions.

2.11 Conclusion

The main factors for the initiation of digitization can be collection driven or user driven. Along with that, the reasons for digitization are classified as access, preservation, and/or institution based service and partnership. Usually institutions identify/select the items to be digitized from their valuable collections. These valuable items selected for digitization from the collections are the materials owned by the institution that are unique and often fragile.

The creation of a digitized collection is relatively easy (because all the technical difficulties have been resolved) and, as long as the digitization unit adheres to standards, legal compliance, policy and procedures of digitization, the task is manageable. Keeping the project sustainable, however, is not easy!

The selection of items is done on the basis of criteria and the reasons for selection are varied across all kinds of institutions. All these institutions, however, focus on the selection of relevant documents. The selection task is usually done by a committee. The committee is formed from different field units of an institution. The main phases of selection to be followed are pre-selection, identifying users, material nomination and evaluation of the selected material, security, copyright approval and permission for digitization.

To give effect to these phases, the prominent selection criteria to be considered are consolidated under collection, access, delivery and preservation. Today, many African institutions are undertaking digitization initiatives which could be relevant experience for the ERDC, for instance, the Aluka project which digitized the history of the liberation struggles of South African countries, and DISA that covered South Africa's struggle for democracy.

The digitization process itself can be subdivided into three phases, classified as pre-digitization, digital conversion and post digitization. To bring the process of digitization to reality institutions require resources such as technical infrastructure, human competence and funding. Even with the availability of these resources, however, institutions encounter a myriad of challenges. These challenges could be clustered as technical, technological know-how, managerial and security of data issues.

African institutions often struggle to manage these challenges. Acquiring sufficient funding, developing and maintaining infrastructure, updating technology, skilled manpower and policy aspects all contribute towards ensuring that projects are often not sustainable. The main factors that will ensure that the project will remain sustainable are funding, planning and maintenance, a clear mission and objectives, marketing prospects and the intrinsic value of the materials to be digitized.

Chapter 3
Research Methodology

3.1 Introduction

The literature part of chapter 2 discussed the issues of valuable collections and sustainable digitization programmes. It covered the literature discussing efforts at several institutions that had embarked on digitization programmes and dealt with their policies of collection, selection, digitization, their challenges and sustainable digitization programmes.

In this chapter a brief definition is provided of the methodology, general characteristics of a research paradigm, research design, data collection methods, data collections tools, rationale of the questions to be asked, target population and sampling, methods of data analysis and interpretation and, finally, a brief conclusion.

3.2 Definition of Methodology

Methodology is the framework that helps the conducting of research on a scientific basis (O'Leary 2004). Kothari (2004), defined methodology as being a blueprint that supports a systematic way of solving problems. Jonker and Pennink (2010), on their side refer to it as a way of conducting research to answer a question or solve a problem. This research study is meant to answer certain questions posed in chapter one. The intention of the work is to advise the ERDC on the sustainability of the ERDC digitization programme.

3.3 Research paradigm

Kothari (2004) stated that there are two broad basic approaches to research, namely quantitative and qualitative. Quantitative research is the measurement of quantity or occurrences that can be expressed in terms of quantity (in other words numbers). On the other hand, qualitative research deals with a qualitative phenomenon that comprises quality or 'in-

depth' analysis of the problem. When these two approaches are used together, for instance to collect quantifiable data and qualitative data such as texts and images, it is known as a 'Mixed Methods' approach and gives a better understanding of the research problem than either quantitative or qualitative data do by themselves (Creswell 2012).

Qualitative study is more appropriate in an environment where little of an issue is known. Typical tools used in a qualitative study are interviews and/or observations. A case study, which is an in-depth examination of one person, institution or organization, is a typical form of a qualitative research method (Hancock and Algozzine 2011).

The quantitative and qualitative approaches differ in many ways, but they also have a common intersection in a number of areas (Hancock and Algozzine 2011). In the next section, the advantages and disadvantages of quantitative and qualitative research are discussed.VanderStoep and Johnston (2009), Hancock and Algozzine (2011), Choy (2014) put some of the advantages and disadvantages of quantitative and qualitative research as follows.

Advantages:

Quantitative research	**Qualitative research**
❖ More appropriate when time and resources are scarce for research ❖ Helpful to employee instruments with little investment on material and personnel ❖ Requires only a few variables for investigation ❖ Can be completed with minimum involvement from the researcher ❖ Helpful for formulating hypothesis that leads to speculation of outcomes ❖ Helpful in eliminating bias	❖ Easy to get the required information from interview ❖ Rich information can be gained through interviews and observations ❖ Important for issues that are less known ❖ Less dependent on instruments ❖ Can bring change in institutions and societies

From the table above it is possible to compare the advantages of each of the approaches and come to the following conclusion, that qualitative research is relevant to this research as it helps to get easy information from the interview, discover issues that are less known and does not depend much on instruments for getting the required information.

Disadvantages

Quantitative research	**Qualitative research**
❖ Can only be used when data can be measured by numbers and quantified ❖ The method is sometimes subjective and depends on the instrument used ❖ Could lack independent thought by the researcher	❖ Requires considerable time and resources ❖ Demands considerable involvement of the researcher ❖ Strong dependency on the sample population ❖ Depends much on convenience sampling ❖ Lack of objectivity

From the table above, it is possible to compare the disadvantages of each of the approaches and come to the following conclusion, viz. qualitative research has significant limitations because it depends much on the sample, lacks objectivity and demands greater time, resources and involvement of the researcher. Being aware of these issues already assists the researcher in making sure that the disadvantages as controlled as far as are possible.

Considering the objectives of the study, the nature of the research, the advantages and disadvantages of the paradigms, research questions and literature of the research, the researcher decided to make use of a qualitative approach. This was the obvious choice because this research is concerned with the assessment of personal experiences, attitudes, opinions and behaviour. In addition, the approach creates room for the researcher's insight and impressions.

3.4 The research design

According to (Kothari 2004), research design is important for facilitating research operations that help the completion of work at minimum cost and time. W. Creswell (2009) defined 'research design' as a plan of action and procedure that depicts decisions from broader assumptions to detailed methods of data collection and analysis. Some of the prominent qualitative research designs are ethnography, phenomenology, case study, grounded theory and biography (Hancock and Algozzine 2011). A brief description of each of these designs follows.

(Hancock and Algozzine 2011) briefly defined each of these as follows:

- The ethnographic method places more emphasis on cultural practices for common values, attitudes, and believes that these define a certain group of people.
- The phenomenological approach looks for the very nature of a phenomenon and investigates the nature of people's lives to find the central meaning that binds them.
- Case study is another type of qualitative research that helps when making an intensive analysis of individuals, events or groups to gain in-depth understanding or meaning.
- In a grounded theory the researcher tries to create a theory of a certain action, interaction or process.
- The biographical study deals more with the life, history or experience of a single individual and indicates the important points in that individual's life.

This research study should be regarded as being a case study because it helps to make an intensive analysis of the 'digitization' event in order to gain an in-depth understanding or meaning of the activity at the ERDC.

The advantages and disadvantages of a case study, as noted by (Blaxter 2010), are as follows:

Advantages

- ❖ Data are drawn from people's experience and practices and are based upon reality;
- ❖ Allows generalization from specific to general; and
- ❖ The data drawn from the experience of people are more persuasive and accessible.

Disadvantages

- A complex case study can be difficult to analyse; and
- In a case study it is very difficult to determine where context starts and ends.

In summary, a case study is helpful in making a generalization from specific information drawn from the experiences of people but if that information is complex it can be difficult to analyse. The next section presents the data collection method.

3.5 Data collection method

Data collection is an essential component of the research design. In a qualitative research design the data collection methods available to the researcher are numerous. The most relevant are any of the following, interviews (ranging from unstructured, semi-structured to very structured), focus group discussions, observations, diaries and document analysis (Kothari 2004), (Yin 2010), (Dahlberg and McCaig 2010).

For this research, interviewing, specifically semi-structured, telephonic interviews, is the preferred data collection method. The semi-structured interview is a qualitative method that requires a researcher to set a list of questions, called an interview schedule. Semi-structured interviews allow the researcher to use predetermined topics and questions to ask but also leave some space for follow up and for discussing interesting topics that could arise (Petre 2007). Although all the participants are, therefore, asked the same questions, there is flexibility in the approach where the researcher can intervene and direct the conversation (Dahlberg and McCaig 2010).

These interviews have both advantages and disadvantages. The next section presents the advantages and disadvantages, as stipulated by Creswell (2012), of interviewing.

Advantages

- Useful information can be gained from participants when the researcher is unable to observe them.
- The interview provides an opportunity to participants to describe detailed personal information.

- The interviewer has better control over the information drawn.
- The interview provides room for the interviewer to ask specific questions to get more information.

Disadvantages

- Interviews provide only filtered information that serve the needs of the interviewer.
- The researcher summarizes the participant's view according to his/her perceptions.
- The interview data may be deceptive because there is a tendency from participants to provide what the researcher wants to hear.
- An interviewee may not be articulate or clear.
- Equipment issues, such as recording devices, may be a problem.

3.6 Data collection tools

According to (Wilkinson 2002), data collection instruments are tools used to collect and structure data thus converting them to useful information. These instruments include interview schedules, questionnaires, ethnography, diaries and content analysis.

This research study will employ a semi-structured interview schedule with open ended questions. Owing to geographic constraints, interviews will be conducted making use of a telephone and a voice recorder. According to Creswell (2012), one drawback of the telephone interview is that the researcher does not have direct contact with the participants and lacks the understanding of the participants' perception. In addition, the author considered that, in this case, telephone interviews would attract substantial costs. Considering the distance to the research area, however, the costs of flights, and the limited time of the researcher and the data collection process, making use of the telephone was the best option available.

According to Kothari (2004), the following features can be listed as advantages and disadvantages of telephone interviews:

Advantages of telephone interview	Disadvantages of telephone interview
❖ Flexible compared to mailing methods; ❖ Easy and fast to obtain information; ❖ Cheaper compared to travelling costs; ❖ There is a higher response rate than for mail method; ❖ Responses of the participants can be tape recorded without any embarrassment to the participants; ❖ The researcher can explain the requirements more easily to the participants; ❖ It is easy to contact participants via phone at any time when required; ❖ No staff is required to collect data; and ❖ It is quite easy to include representatives of all kinds in a sample.	❖ Participants are given little time to answer a certain question and proceed to the next; ❖ Telephone interview is possible only with those who have telephone facilities; ❖ Considering the cost of telephone expenses, the interview may not cover a large geographical area; ❖ It is not suitable for conducting an intensive survey where the questions address a large number of issues; ❖ There is a high possibility of bias from the interviewer/ researcher; and ❖ It is very difficult to conduct probes, so questions are required to be short and to the point.

Using the literature review as background, interview schedules were developed to address research questions stipulated in section 1.2.2 on page 10. The researcher critically looked at each question and formulated the questions that would seek in-depth information from the participants. Based on the nature of the questions and the required information, the researcher categorized the respondents into two categories. Subsequently two interview schedules were developed. The first schedule lists questions to be put to ERDC decision makers, and the second is meant for the operational staff (see appendix A and appendix B for details).

A formal consent letter, prepared for and validated by the ethical committee of the University of Pretoria, was sent to all participants by email (see Appendix C) before the interview was conducted. Respondents were required to respond by email prior to the interview. In addition, a personal phone call was made to each of them to solicit verbal consent and provide clarification on the purpose of the interview.

Audio recording is one the prominent aids to be used for data collection in an interview (Denscombe 2007). Audio recording has its own advantages and disadvantages. Dahlberg and McCaig (2010) listed the following:

Advantages of audio recording

- It helps to keep a permanent record to refer back to if necessary;
- The interview can flow without interruption; and
- A full record of the discussion can be obtained.

Disadvantages of audio recording

- Some participants might not feel comfortable at the thought of their voices being recorded, and this could affect the flow of the conversation;
- An audio recording creates a large dataset that requires transcribing and analysing; and
- An audio recording cannot capture the body language and gestures of the participant.

The next section deals with the rationale of the questions to be asked to the participants.

3.7 Rationale for the questions to be asked

The rationale behind the interview schedules (Appendix A and Appendix B) is summarized below.

The interview schedule for management was subdivided into three sections. The first section related to digitisation and selection criteria and contained four questions. The purpose of these questions was to find out whether the ERDC has a digitization policy, the impact of the policy on digitization, what it is missing and how the ERDC uses selection criteria, which selection criteria are currently used when selecting items from the valuable collections for digitisation , to gain an insight into the selection process.

The second section addressed the resources that enable digitization in ERDC. It contained six questions meant to provide insight into the critical challenges facing the institution, suggested solutions, finding out the commitment of employees in digitizing collections, discussing the

allocation of available funds for digitization, future plan of managing funds, and identifying who makes decisions for infrastructure and equipment of digitization in ERDC.

In the third section, emphasis was placed on access to the digitized collections. There were three questions to be addressed as part of this section. These questions addressed the issues of users gaining access to the digitized collections, the major constraints that block them from accessing and how these could be tackled.

Similarly, the interview schedule for operational staff was sub-divided into three sections. The first section was about the process of selection and included six questions. These questions addressed how selection is done, who does the selection, what criteria are followed, the critical challenges faced in selection, the workflow followed in digitization and how the digitized materials are made accessible to users.

The second section tried to find out the required skills for digitization and asked three questions that address what standards the ERDC uses to digitize texts and images, the skill challenges of its employees and the perceived main challenges that hinder its digitization programme.

The third section dealt with the required technology for digitization in the ERDC and also included three questions. The questions related to the critical technological challenges that the institution faces and how these issues are tackled. Finally, it tried to discover what precautions could be put in place by the institution to ensure the quality of the digitization work.

The followed section discusses the target group and sampling methods of the research.

3.8 Target group and sampling

The ERDC was chosen for study because it is the only institution in the country (Eritrea) that undertakes the work of digitization and the training of digitization skills for other institutions. The total number of staff (target population) who work in the department of digitization in ERDC is twenty-seven. Five of them are managers and twenty-two are operational staff.

The population of the study are employees of the ERDC, specifically from the department of digitization. The total number of employees of the digitization section is twenty-seven; the sample size, however, consisted of only seven respondents. A purposive sampling technique was used in the selection. Formal consent to participate in the research was collected from the participants by email before the actual data collection started. Data were collected through telephonic interviews. In-depth interviews were conducted with both management and operations staff. The interview questions were based on both the research questions and literature.

Accordingly, this research study undertook purposive sampling when selecting the sample population. Purposive sampling is one of the non-probability sampling methods and has its own advantages and disadvantages. For instance, Singh (2006) noted the advantages and disadvantages of purposive sampling as follows.

Advantages

- Use of the best available knowledge concerning the sample subjects;
- Better control of significant variables;
- The data from sample groups can be easily matched; and
- Homogeneity of subjects used in the sample.

Disadvantages

- Reliability of the criterion is questionable;
- Knowledge of the population is essential;
- Errors in classifying sampling subjects;
- Inability to utilise the inferential parametric statistics; and
- Inability to make generalization concerning total population.

According to Kothari (2004); (Blaxter 2010), purposive sampling is a deliberate handpicking of participants to represent the population. Considering the nature of the research environment, research questions and research participants, therefore, the purposive sampling method was appropriate to use. Accordingly, the research targeted 30% of the target population as the sample. Seven interviews, therefore, were conducted. The sample targeted three people from the management body and four people from the operational staff.

3.9 Methods of data analysis and interpretation

According to Braun and Clarke (2006) and Creswell (2012), qualitative data can be analysed and interpreted using six steps, though not necessarily in sequence. Accordingly, this research tried to make use of these steps. As a first step, data transcription of the audio tapes and initial note taking of important ideas were executed. During the second step, based on the questions, themes were organized for analysis. In the third step, a dip search for themes and collating of these themes was undertaken. In the fourth stage, a review of all the organized themes was conducted to check whether the themes worked in relation to the extracted data of the interview and generated a map of analysis. In the fifth and sixth stages a detailed and representative analysis and interpretation of the themes of the qualitative findings were reported.

For the purpose of analysis, codes were created from the findings of the research study. Coding is used by many researchers as a way of classifying data and drawing themes from it (Wilkinson 2002). For proper analysis and interpretation, therefore, data are supposed to be coded and categorized. As Dahlberg and McCaig (2010) put it, codes are the most basic labels for the data because they help researchers to identify and categorize the data that is useful for their research.

Richards and Morse (2012) offered three different kinds of coding, namely the descriptive, topic and analytic. The first deals with description only. The second and the third have much to do with data grouping and making sense of them to achieve a deeper analysis. Polit and Beck (2008) treated data analysis as the process of separating data into smaller and manageable parts with the intention of finding meaningful answers to the research questions.

Following the analysis, an in-depth interpretation of the themes was provided. Interpretation is the process of looking at the categories of data, identifying patterns within these categories and trying to see the meaning behind them in a simplified diagram or model (Richards and Morse 2012)

In this research, the identification of themes followed by categories was used as a coding system of the data (Dahlberg and McCaig 2010). A combination of the deductive and inductive approaches of coding was followed as this research depended greatly on both the literature and the data collected.

3.10 Conclusion

This chapter has dealt with the methodology of this research. Accordingly, a brief introduction and definition of the methodology, research paradigm and research design, data collection methods and tools, development of data collection tools, rationale of the questions asked to the participants, target group and sampling, methods of data analysis and interpretation and finally a brief conclusion were provided in this chapter.

The next chapter presented the data analysis and an interpretation of the findings that subsequently lead to the final chapter providing conclusions and recommendations.

Chapter 4
Data findings, analysis and interpretations

4.1 Introduction

The methodology described in the previous chapter provided the base line for data gathering. This chapter focuses on the analysis and interpretation of the data collected. Wilkinson (2002) remarked that the purpose of analysis is to bring data together in a meaningful way and to enable researchers to interpret or make sense of it.

Throughout this chapter, the following pattern was used to present the results: (1) main findings; (2) discussions and interpretation of results; (3) suggested solutions and recommendations; (4) conclusion.

The researcher used two interview schedules (see Attachments 1 and 2), one for management staff and one for the operations staff. The managers were questioned about the ERDC digitization policy and selection criteria, resources to enable the ERDC digitization programme and access to the digitised collection. The operational staff members, on the other hand, were asked about what ERDC processes to follow when selecting items to digitise, skill levels and the ERDC digitization programme and technologies that support the sustainability of the ERDC digitization programme. In most cases, however, the questions overlapped and had an impact on the responses too.

4.2 Research findings

For the convenience of analysis and interpretation, similar responses collected from both the managers and operational staff were considered together. The rest were addressed separately considering the issues and their respective respondents. Accordingly, after transcribing the interviews, the data analysis resulted in a table which captured the themes, categories and sub-categories (see Table 4) that could be identified. In total, eight themes and twenty-one categories were identified (see Table 4 on (pp.61-63) & Table 5 on (p.78)). The first six themes dealt with the findings of the research study and the following two themes present the

recommended solutions by the respondents and the resources required to enable the digitization programme of the ERDC. These themes are addressed in detail in section 4.3 of this report. Participants were also asked for advice with regard to addressing the challenges that they identified. The responses were captured in Table 4 (p.78) and analysed in section 4.4 on pp.79-83.

Table 4. Summary for themes, categories and sub-categories that emerged from the research

Theme	Categories	Sub-categories
1. Digitization policy and selection of valuable collections	1.1 Policy aspects to address	▪ No documented policy ▪ Stakeholders not clearly identified ▪ Centralized system
	1.2 Current Selection criteria	▪ Important to the country and region ▪ Endangered material of the armed struggle also during the Italian and British administration ▪ Magazines and Newspapers of the armed struggle ▪ Value/ Significance of the material ▪ Users' need ▪ Age of the material ▪ Condition of the material
	1.3 Selection criteria to be added	▪ Involvement of stakeholders ▪ Themed research projects
	1.4 Selection process	▪ Internal policy ▪ Condition of the items ▪ Value of the material
	1.5 Selection related challenges	▪ Getting a reliable database ▪ Images with no captions ▪ Delay in decision making ▪ None availability of access to the Internet ▪ Lack of knowledge ▪ Poor quality of work
	1.6 Current selectors	▪ Senior officials ▪ Director of ERDC ▪ Heads of units/middle managers ▪ Catalogue section ▪ Scanning unit

Theme	Categories	Sub-categories
2. ERDC digitization workflow	2.1 Workflow	▪ No documented consistent workflow ▪ No central networking environment ▪ Process from identification to scanning is not clear
3. ERDC standard of digitization and the formats used	3.1 Digitization standards 3.2 Formats used	▪ Internal standards ▪ 300 dpi and pdf for text ▪ 600 dpi and tiff for image
4. ERDC resources	4.1 Identified resource challenges	▪ Insufficient funds ▪ Lack of trained manpower ▪ Outdated technology ▪ Unreliable electrical power ▪ National service obligations disrupts work ▪ Infrastructure does not support isolated sites of digitization ▪ Management skills are lacking ▪ Network not stable ▪ Issues of security not addressed/ Security of the materials ▪ Poor quality of work
	4.2 Skill challenges	▪ No exposure ▪ No training ▪ Re-digitizing often required
	4.3 Technological challenges	▪ OCR problems ▪ Digitized materials not searchable ▪ Lack of a centralized system ▪ Local language scripts not recognized ▪ Software outdated ▪ Server storage insufficient
5. Decision making process of ERDC in the digitization of valuable collections	5.1 Decision making	▪ Capital budget controlled by the government and operational budget controlled by middle managers of the institution
6. Access to digitized materials	6.1 Access to digitized material	▪ No soft copy ▪ No access at all ▪ Only a list of items ▪ No policy for access

Theme	Categories	Sub-categories
		▪ Not allowed to take copy – user may only view ▪ Currently users are allowed to physically come to ERDC and have access ▪ Currently, the digitized materials are only available on local network ▪ Some respondents said they have not reached the level of providing the access to users
	6.2 Further constraints on access	▪ Infrastructure inadequate ▪ Internet not available ▪ Technology outdated ▪ Trained manpower lacking ▪ Electrical power not reliable ▪ No guiding policy ▪ Security inadequate

Detailed contents and discussions of each theme are provided below respectively.

4.3 Discussions and interpretations

This section presents the discussions and interpretations of the research study in detail based on the themes reported in Table 4.

Theme 1: Digitization policy and selection of valuable collections

Theme one explores and describes the digitization policy and selection of valuable collections of the ERDC. This theme thoroughly analyses and interprets categories such as digitization policy, current selection criteria, selection criteria to be added, selection process, challenges of selection and responsible selectors based on the sub-categories of each theme.

Category 1.1 Policy aspects to address

The respondents confirmed that there is no recognized legislation or policy for the ERDC that can be helpful for digitization or the selection of material to be digitized. Currently, the

institution is handling selection and digitization based on its internal manual or working document. The respondents recognised the importance of the inclusion of selection criteria, a central networked system of digitization and the involvement of stakeholders to be considered in the policy.

The importance of stakeholders' involvement in the selection and digitization of important material was emphasized by the respondents. Much of the ERDC's collection comes from these stakeholders, and, according to the ERDC staff, the stakeholders are the people who know the documents' history and who could, therefore, complete the required metadata.

The importance of a centralized system was also noted by the respondents. Currently, ERDC digitization work is conducted at different institutions and sites. This is because the ERDC has no legislation and policy which legitimizes its status and provides it with the authority to compel institutions to cede their documents to it. As a consequence, selecting the right objects to digitize, and even the digitization process itself, is difficult. Moreover, quality control and the security concerns of the digitized material have become hard to manage.

Based on the responses of the participants, it can be concluded that the ERDC has several challenges owing to the fact that it does not have appropriate legislation or a policy. These documents are the fundamental instruments required before an institution should undertake digitization (Ayris 1998; Sitts 2000; Alhaji 2009; UNESCO n.d). The next category of concern relates to the selection of material to digitise.

Category 1.2 Current selection criteria

The respondents mentioned that the following are the criteria currently being used for selecting valuable collections.

Importance of the material (both to the country and region)*:* The respondents explained that materials that have direct impact to the country and the region, especially with regard to the historical aspect have top priority in the selection criteria.

Fragile materials or the condition of the material*:* According to the interviewees, the materials from the time of the Italians, the British administration, and, mostly, documents relative to the armed struggle are all treated as being endangered. The ERDC uses simple Excel format on its local database for completing the profile of an item. That profile provides a detailed description, such as the title, author, place of publication, date of publication,

condition of the item and age of the material. Firstly, the selectors look at the significance of the material for the country and region, they then check to see whether its condition is right, and, if so, recommend it for immediate digitization if they consider that it is 'at risk'.

Value of the material: The participants explained that historical documents, such as newspapers and magazines of the armed struggle, have important historical value and command a high level of consideration in the selection criteria.

Significance of the material: Valuable collections are also selected on the basis of their significance. The respondents stated that they check the significance of the materials for research or historical purposes that could be of use to both the country and the region and then consider them for digitization. None of them, however, mentioned what criteria they use for identifying significant material. That implied that the institution lacks a set of criteria for selection and depends on the common sense of its employees for identifying significant material in its collections.

Users' need: According to the respondents, the selection process in the ERDC also takes into consideration the needs of users, such as researchers, institutes and project initiators. These criteria are, however, mentioned only by the management group and not by the operation group. The management group could neither provide a list of users' need criteria nor tell which document contains them. That indicates that the institution lacks detailed selection criteria that also include users' needs.

Age of the material: All respondents recognized the age of a material as one of the components of selection criteria used in the ERDC. They stressed the importance of old documents from the time of the Italian and British Administrations being digitized before they lose their content.

In summary, it can be said that, although the ERDC does not have a legitimate policy for digitization, it uses an internal working document for selection. As *per* the current selection criteria, all respondents confirmed that the institution depends on the importance, condition, value, significance and age of the material. Palmer (2004), (Rahman and Mezbah-ul-Islam 2012) and (Maron and Pickle 2013) (as was reported in Chapter 2, section 2.7.3 of this report) also identified valuable or special collections as materials owned by an institution that are rare, of significant demand, fragile, unique and valuable.

'Users' need' as a criterion, however, was mentioned only by the management group. This indicates that the institution is not yet at a stage of acknowledging the importance of providing access to users. In addition, the respondents noted that there is significant interest in digitizing the historical documents of the armed struggle, and Italian and British administration records. This confirms that the institution adheres only to collection-driven criteria and not to user-driven criteria in its selection approach (Smith 2001) as was discussed in Chapter 2 section 2.1.

Category 1.3 Selection criteria to be added

The participants commented that the current selection criteria are not adequate. They, therefore, suggested the addition of the involvement of stakeholders and themed research projects as criteria for selection. According to them, the ERDC collects its materials from different institutions, ministries and organizations. These bodies know the material better than anyone else and consider that their involvement in the selection will have a positive impact on the identification of the important documents and the application of the correct metadata.

Similarly, the participants also recommended the inclusion of themed research projects as selection criteria. Researchers, institutions, and sometimes even individuals, come to the ERDC for certain information. On such occasions, it would be more appropriate to follow a theme based or project based selection. For instance, Pavia University came in 1997 to digitize a particular history on the Italian colonization period. That project provided an opportunity to for the identification and selection of the items that are relevant to Italian history.

In broad-spectrum, it appears that the ERDC is actually maintaining a standard selection criteria policy. It also seems important, however, to include the involvement of stakeholders and themed research project as criteria for selection to ensure the quality and relevance of the digitized materials of the institution.

Category 1.4 Selection process

The responses of the participants do not align on this issue. Some of them stated that they use the internal policy 'guide' as a basis for the selection but could not explain the real stages of selection. The rest mentioned criteria for selection instead of explaining the process. It appears that the institution either lacks direction with regard to the real stages to be

undertaken in the selection or that the employees do not have a clear understanding of the process.

As a result, the institution needs to follow three phases in the selection process. The first phase is 'nomination', where all ERDC staff and stakeholders come together and select the materials that they need to digitize. The second phase is 'evaluation', where the selection committee evaluates the selected materials on the basis of the selection criteria. The third phase is 'prioritization'. During this phase the committee prioritizes the materials according to their value, use, cost and risk for digitization (Sitts 2000).

Category 1.5 Selection related challenges

The critical challenges mentioned by the operation group are varied, ranging from the non-availability of a reliable database, through images with no caption, administrative delays in decision making for digitization, slow internet connection, lack of knowledge to the poor quality of work. Some of the respondents, however, claimed to have no problem at all with selection. The differences in responses could be due to the separate units of the ERDC (for images and texts) as most of these challenges are experienced in digitizing images.

The respondents also mentioned not owning a reliable database for selection which the ERDC can rely on. Unnecessary delays in decision making and authorization for digitization, a poor internet connection that could be a resource to increase their knowledge, and the poor quality of work are among the critical challenges of selection that the institution is passing through.

The institution's selection challenges are numerous, but none of them align to those noted in the literature examined during the study. General selection criteria are expected to follow digitization procedures, standards and secure legal permission for the collections that an institution wants to digitize (Rahman and Mezbah-ul-Islam 2012); (Maron and Pickle 2013). None of these standards, however, was mentioned by the respondents, and none seems to be a challenge in the ERDC.

Category 1.6 Current selectors

There is no consensus in the responses of the respondents as *per* the people responsible for selection. Some of respondents said that the scanning unit was responsible and others that the cataloguing unit was responsible. Some also mentioned that it is the involvement of all the

unit heads or middle managers and that final authorisation of given by the director. Others also mentioned the role of senior government officials in the selection.

It is clear from their responses that there is involvement by different actors in the selection process, but yet there is no clear task description with regard to the sequence of work to be followed. The institution should, therefore, formally form a committee for selection from different categories that include education specialists, digitization specialists, librarians, archivists, curators, researchers, preservation specialists, lawyers and other stakeholders (Sitts 2000) and (Vogt-O'Connor 2000).

Theme 2: ERDC digitization workflow

This theme primarily covers the digitization setup environment of the ERDC, the workflow and the overall working milieu of digitization in the institution.

Category 2.1 Workflow

These are the general stages that the ERDC follows to digitize its valuable collections from start to finish. Almost all respondents from the operation staff confirmed that the ERDC does not have any workflow; as a result the employees do not work in a central networked system. One of the respondents, however, claimed that the institution follows an appropriate workflow from identifying to scanning of the materials but he/she was not able to describe the details that are involved in a workflow in terms of assessment value of the material, copyright clearance, document preparation, and scanning.

According to most of the respondents, the work of digitization takes place in different institutions and sites, and this makes it hard to control, manage and maintain. As a result, this kind of setup puts the institution in a difficult situation to work in one platform of workflow.

There is no evidence that shows that the institution follows the appropriate digitization process. From the summarized literature on page 17, it can be seen there are three phases in the digitisation of valuable collections: The first phase is pre-digitization that includes identification of material, assessment of resources needed, decisions on standards, definition of methods, assessment of risks, selection of materials, quality control and the assessment of preservation needs. The second phase is digital conversion that involves the creation of the digital master and the availability of professional equipment and quality control procedures. The third and final phase is post-digitization and this phase includes the control of metadata,

quality control, submission of information to repository systems, data management, making digitized copies and metadata available online, assessment, and the evaluation of the project.

Theme 3: ERDC standard of digitization and the formats used

In digitizing texts and images there are certain formats that an institution should follow. This section presents what standards the ERDC adheres to in digitizing its valuable collections.

Category 3.1 Digitization standards

The main objective of ERDC is preservation. As *per* the operations groups' responses, the institution is undertaking the basic standards of digitization. None of the respondents, however, pointed out clearly what the standards are except by claiming that the institution has internal standards.

Initially, the institution seemed to be on the right track but loopholes are revealed by one the remarks of one of the respondents:

> *"We don't know what kind of standard to follow in digitization; as a result we failed to digitize all our text in OCR. Currently, we are redoing the work to make the texts searchable".*

The ERDC appears to have basic standards of digitization; however, either there is a lack of details in its standard guide or in the knowledge of its employees in understanding that guide. As a consequence, this negatively affected the quality of the work and led to the redoing of the work. This will certainly have labour and cost implication for the institution. The ERDC, therefore, needs to digitize its valuable collections with regard to both preservation and access using the minimum requirements as were discussed by Naicker (2013) on page 27.

Category 3.2 Formats used

The institution is able to digitize its texts with 300 dpi at pdf format and images with 600 dpi at tiff format.

Theme 4: ERDC resources

This theme basically looks at the critical challenges to the ERDC. It discusses the categories of critical, skill and technological challenges.

Category 4.1 Identified resource challenges

Both the management and operation groups mentioned the following critical challenges that the ERDC is encountering.

Budget: The ERDC's budget comes from both the government and external bodies. There is, however, no consensus within the management group on this aspect. Some of them noted that the biggest share is covered by the government while the others disagreed with that and claimed that the lion's share comes from the external bodies such as UNESCO. One respondent of the management group stated,

> *"It is very frustrating, we plan every year but we only get around 5% of what we requested from the government budget. However, we depend much on external bodies such as UNESCO to purchase new technologies that we require".*

The researcher feels that the respondents were not willing to disclose the budget allocated to the ERDC every year although they agreed that the budget is limited. In general, it appears that the ERDC is crippled by its budget with regard to purchasing new technology and equipment, establishing an efficient network system, training its manpower and producing quality work.

In summary, it should be noted that budget is one of the main factors that affects sustainable digitization where the ERDC needs to invest seriously if it really wants to make progress in its digitization programme (CLIR 1998), (Smith 2001) and (Rafiq and Ameen 2014).

Trained manpower: All the respondents confirmed that they lack proper training but try to manage at work through trial and error. In addition, the management group remarked that the institution suffers from a lack of technically qualified people especially in IT and management areas. Similarly, the operation group explained that they lack exposure and a number of them are temporarily employed in the national service.

Some of the management group further clarified that customized training is provided to those in the national service, but they leave the institution at some time. This is creating an extra burden on the budget and negatively affecting the ERDC's output. Retaining a qualified staff is, therefore, another challenge which the institution is experiencing.

Technology: There are mixed feelings and explanations about this issue. Some of the respondents, particularly those from the operation's group, claim that their technology is up to date and they reject the idea of purchasing additional equipment. They emphasize that the weakness is not in the technology but in technological know-how. Others claim the opposite and complain about the obsolete technology that the institution owns.

The management group explained that the limitation is both from the technology side and the know-how of the employees which is hampering the digitization progress of the ERDC.

In summary, it can be said that the institution is carrying on with obsolete technology and this is critical and an issue that most African digitization projects are facing (Eze Asogwa 2011). The ERDC, therefore, needs to update its technology to ensure that it has a sustainable digitization programme.

Electrical Power: The power issue was raised by all respondents as the most critical issue affecting the institution. Power interruptions and surges have delayed the progress of digitization and damaged equipment. Apart from that, power outages became an excuse for the staff to be absent from work. According to the management group, the effect of intermittent power does more damage to the discipline of work of the employees which will take a long time to reverse.

Zulu, Aina et al. (2008) remarked that most African countries are suffering from the shortage of a reliable power supply which is vital for any digitization programme. The ERDC's power problem can, therefore, be solved through two approaches. The first is to wait for the national power solution programme which is long-term plan. The second phase is to buy standby generators and maintain the work of digitization.

National services: The ERDC does not have enough employees. It also lacks technically qualified staff. To complement this gap it takes in those in the national service for internship and provides them with a customized training that runs for three-six months. The interns, however, do not serve for long periods after being trained. They leave as soon as their national service duration of 18 months ends. Based on the respondents' explanation, it looks as if the institution is struggling with both the securing of the yearly budget for the purposes of training new internees and, at the same time, maintaining the quality of its digitization work. As the management group commented, the only way out of this crisis is to retain and

recruit permanent employees. These issues are peculiar to Eritrea, and the ERDC could mitigate these challenges by providing adequate training and motivating workers.

Infrastructure: The ERDC does not have a central national archive or national library building as its working space. All the respondents explained that most of the ERDC digitization activities take place at different institutions and sites. Such an arrangement hampers the work progress, the workflow of digitization, the security of the digitized materials, and the management and quality control of the output.

One of the major challenges of any digitization programme is the availability of infrastructure, (Tanner and Deegan 2002). The ERDC, therefore, has to invest in building a national archive to do all its activities in one place to ensure the quality, management and security of its digitization programme.

Internet: The operation group and some of the management group remarked that the Internet is almost non-existent in the ERDC. The connection is very slow and this makes it difficult to upload and download documents. They, furthermore, stated that it is difficult to upgrade their knowledge through reading online or downloading important materials that could be of use to the institution.

A fast internet connection is one of the most important technical architecture requirements of digitization (Alhaji 2009; Namande 2012). According Zulu, Aina et al. (2008), a number of African countries are encountering huge problems in telecommunication services on which data transfer on a network of computers is dependent for the digitization process. On a similar front, the Eritrean Telecommunication Service, which is responsible for providing internet service to the whole country, is providing an extremely slow internet service which is not adequate for the ERDC for its uploading, downloading and data transfer of its valuable collections [Hughes and Green,2004), Namande (2012b)].

Management skills: One of member of the management group claimed that the ERDC has a critical management skill shortage while the others rejected that opinion and gave more weight to the lack of exposure and know-how of the employees as the major factors that detract from the progress of digitization in the ERDC.

It appears that the institution does not clearly understand where the challenge lies. It, therefore, needs to make an institutional evaluation to find a solution. In addition, it needs to

recruit the basic human resources required for digitization listed by Sitts (2000) in the literature chapter.

Network and security: There was no consensus on this issue from the respondents. The operation group claims to have an efficient network system to depend on while some of the management group remarked that the current network system is not mature enough to provide the service expected and that they do not trust it enough to rely on it for reliable information.

Contrary to their own statement, the operation group explained that they could not put their digitized materials online because of security problems. In addition, they expressed their security concern about the physical collection of the digitized materials from different sites. This indicated that the current network system is not reliable.

According to (Alhaji 2009; Namande 2012), high-speed local networks, robust databases servers, including Web and FTP servers, are among the most important technical architecture requirements of digitization.

Poor quality of work: Both groups of the respondents agree on the poor quality of work that is being experienced considering the low level of knowledge and less exposure of employees, old technology, inefficient servers and storage system, and the more isolated digitizing sites that are used by the ERDC.

According to Hughes and Green (2004), Namande (2012b) and Proffitt (2015), the poor quality of digitization work is attributed to the low level of ICT knowledge of the employees, information security problem, lack of management in repositories, meta data and workflow managements.

The ERDC recognizes that its digitization work is of poor quality and that poor quality cannot be sustainable for either preservation or access purposes. It, therefore, needs to upgrade the knowledge of its employees in digitization for preservation and access, and introduce new technology, servers and storage system. Moreover, it should strive to work its digitization projects from one central network system to be able to work on one workflow.

Policy: According to the management group, the ERDC could not make progress in its collection, selection and digitization of its valuable collections as well as making them available online for education and research because it lacks policy.

The first process in a digitization programme is to possess a selection policy which is a vital instrument (Ayris 1998; Sitts 2000; Alhaji 2009; UNESCO n.d). The ERDC, therefore, needs to have a policy to make proper selection and digitization and provide a service to users.

Category 4.2 Skill challenges

This section covers the skill challenges faced by ERDC.

Some of the interviewees in the operation group confirmed that the institution suffers from a lack of skilled employees. They noted the example of failing to know how to convert pdf to OCR and make them searchable. As a consequence, they are re-digitizing all the work. Yet, the institution appears to fail to know how to convert pdf to OCR because there is no need to re-digitize while there is a feature of converting these files to OCR easily on adobe acrobat pro.

These respondents claim that these failures are due to a lack of proper training and exposure. , there are some of them who deny the existence of challenges in the institution. Their denial, however, could be ascribed either to a lack of knowledge or to not feeling comfortable with revealing the weaknesses of the organization.

Hughes and Green (2004); Namande (2012) noted, among other things, that institutions that undertake digitization face serious problems in delivering services if their staff do not have adequate ICT skills to digitize and manage documents, search data, and retrieve documents. The ERDC, therefore, needs to invest in upgrading the skills of its employees and providing them with some exposure to what other similar institutions are doing.

Category 4.3 Technological challenges

This category deals with the general technological challenges that the ERDC encounters in its digitization activities. Some of the operational group, however, claim that the ERDC does not experience any technological challenges.

This indicates that either the institution does not clearly know its technological challenges or its employees do not want to reveal that they have limited technological knowledge. The institution, therefore, needs to make an internal assessment of its technological use, its effectiveness and efficiency.

According to the respondents who acknowledged the existence of the challenges, the challenges are diverse and cover issues such as a centralized network system, security issues, local language scripts, software, server and storage obstacles.

Lack of a centralized system: The respondents highlighted the lack of a central network system in the ERDC which makes it hard to work in one workflow which would otherwise have been easy for productive work, quality control and management. There is only a local network which is basically configured to share folders on home group. The institution does not have a higher level of management software or work group software such as 'group-wise' that is useful for accomplishing work in a workflow set up.

Security of the materials: It is noted by the respondents that the ERDC has not reached a stage where it can post its digitized material online. One drawback is security.

The existing infrastructure does not allow for a secured online service. In addition, the manual work of collecting digitized materials from digitization sites through external hard disk is also not secure. Moreover, the valuable collections of the ERDC are kept only in temporary prefabs without proper ventilation and cooling systems. The above circumstances indicate that the digitized materials of the ERDC are not secure.

Local language character scripts unrecognized: The operation group explained that they encountered a critical challenge at digitizing local language scripts. These languages have code recognition problems.

The denial that there are technological problems by some operational staff can be refuted against this background and it can safely be said that the ERDC faces real technological problems with regard to digitization.

Software, Server and Storage: limitations of the ERDC with regard to software, servers and storage are highlighted by both groups. This indicates that the institution is struggling with its preservation objectives. The work of digitization without a proper server, storage and software is impossible. This implies that ERDC's digitization initiatives will suffer if further upgrading and equipping measures are not taken.

In conclusion, it can be confirmed that ERDC encounters security and some technical requirement challenges (Hughes and Green (2004); Namande (2012). Digitization challenges, however, vary in extent and nature and institutions encounter other challenges in their

digitization programme (Proffitt 2015). Similarly, ERDC's technological challenges, such as lack of a central networked environment and character recognition problems for the local language scripts, are unique and do not align with the study's literature.

Theme 5: Decision making process of ERDC in the digitization of valuable collections

This theme primarily discusses the decision making process that takes place in the ERDC during digitization of valuable collections.

Category 5.1 Decision making

According to the management group, decisions are made in the institution at different levels considering the magnitude and financial impact of the decisions. For instance, the management group explained that decisions that incur heavy investment such as the construction of buildings for the institution are treated by the government, while recurrent budget requests that involve small amounts are left to the management of ERDC.

The operational group, and some of the management group, also confirmed that decisions are made at their level too. None of the respondents, however, clarified how the procedures of decision making unfold within the system. The respondents also reported that the institution follows collective decision making processes and commended the culture of collective decision making that the institution adheres to.

In general, the institution seems to follow a hierarchical decision making process but does not have a guide to pursue that shows a clear line and level of decision making for effective and efficient digitization work. It, therefore, needs to try a decision-making matrix as proposed by Ayris (1998).

Theme 6: Access to digitized materials

This theme examines the process of users' access to the digitized materials of ERDC. It discusses two categories, namely access to users and the main constraints of access.

Category 6.1Access to digitized material

Some of the operation and the management group confirm that there is no policy at all that allows for access, and, as a result, the institution is not providing any access to users. Some respondents of the management group even clarified that the institution has not reached a stage of providing access to users. They further commented that the institution provides

access only to scholars, researchers or institutions that are interested in research and physically go to the institution's premises to collect data from the local network.

In contrast, some of the operational group claimed to provide access to users. Yet, they also confessed that they do not allow users to take soft copies of their digitized material but only to view the material on the local machines. From further conversation with these respondents, it was proved by the same respondents that the users do not have any access to the soft copies even at the local machines. According to these respondents, users have access only to the list of digitized material on Excel and have to ask for the material that they want. Accordingly, a hard copy is provided for them to read in one corner of the ERDC reading rooms by the referencing unit staff.

It can, therefore, be deduced from the discussion that the main objective of the institution is still on preservation. It has not reached the level of providing access to users. It appears that some of the operational group do not even have a clear understanding of what access means. Access is the provision of digitized materials online for the purposes of education and research (Sitts 2000). The ERDC, therefore, needs to digitize its valuable collections and make them available online to be accessed even by researchers based in remote areas (Eze Asogwa 2011; Namande 2012).

Category 6.2 Further constraints on access

There appears to be large gaps between the respondents in identifying what the constraints of access are. Some of the management group listed constraints such as infrastructure, trained manpower and technology as bottle necks that need attention.

The operation group, as well as some of the management group, remarked that electric power, internet and guiding policy as account for the greatest obstacles to access within the institution. Only one of the operation group mentioned security as a constraint to access.

The constraints to access to the digitized materials of the institution seem to be diverse, and the responses of the two groups do not align much. It appears that the institution lacks a general understanding with regard to its constraints on access. As a consequence, this might have a negative impact on the institution's decision making priorities. The institution, therefore, requires an investigation into the real constraints of access and needs to address them so as to provide a service to public.

The next section is presented in table 4 and its discussions about both the themes solutions and precautions, and resources that enable ERDC digitization programme.

4.4 Suggested solutions and precautions

This section presents the solutions to be undertaken by the ERDC or recommended by respondents on the critical challenges on digitisation and technology. In addition, technological precautions that are relevant for quality work of the institution are also included. The thematic subdivision, as well as categorization, is continued from the previous section.

Table 5. Recommended solutions that emerged from the research

Theme	Categories	Sub-categories
7. Solutions and precautions of digitization	7.1 Solutions for critical challenges	▪ Training and exposure of employees ▪ Budget ▪ Up-to date technology ▪ Permanent employees ▪ Electrical power ▪ Internet service ▪ Upgrading library science from diploma to degree
	7.2 Technological application in solving problems	▪ Buying up to date technology ▪ Developed Latin scripts for the local language characters ▪ Re-digitizing ▪ Yet no big problem solved
	7.3 Technical precautions	▪ Central network ▪ Big and offsite servers, storage and powerful computers ▪ Quality of work ▪ Consult experts and online materials
8. Resources to enable the ERDC digitization	8.1 Technical staff	▪ Veteran fighters are committed ▪ Employees who are in national service are

program		irresponsible ▪ Some are committed and some irresponsible
	8.2 Funding	▪ Main financier is the government ▪ Government contribution is too little ▪ Big budget comes from other organizations – not sustainable
	8.3 Applying available funding	▪ Purchasing up to date technology and equipment ▪ Motivating employees with rewards ▪ Investing in network Infrastructure ▪ Building new premises for national archive

Theme 7: Solutions and precautions of digitization

Category 7.1 Challenges and solutions: The challenges referred to by the management group and the operation group are different. Similarly, the solutions suggested by these respondents are also diverse. Here follows the recommended solutions of the groups as follows.

Solutions for critical challenges

- *Training and exposure of employees*: ERDC employees do not have proper training and exposure. Providing adequate training and opportunity for exposure to the outside world will have a positive impact on their perspective of digitization and the quality of their work at large.
- *Budget*: A digitization programme demands huge investment for technology, equipment, infrastructure and the salaries of employees involved in digitization. The government's contribution is small and what the institution is getting from external bodies is not adequate either. The government, therefore, should bear the responsibility and make a genuine investment.
- *Up-to date technology*: The ERDC owns obsolete technology. It requires consulting experts, reading online for new technology that is available for digitization so as to

upgrade its system. The respondents warned that the institution will face migration and emulation problems, like those of 1995, if it does not upgrade its current technology. In 1995, the ERDC bought Mac Computers and was using them for working and preserving data. At a later stage, these computers became obsolete, and the institution tried to migrate these documents to a new platform of the Windows operating system. The migration was not possible for some time. As a solution, the institution decided to put all the computers into store until the issue of the migration of the data had been solved.

- *Permanent employees*: The ERDC has to stop employing people in national service if it aims to achieve quality work in its digitization programme. The selection and digitization of, and provision of access to, valuable collections are not easy tasks. They require enormous effort, investment and trained manpower to run them. The ERDC, therefore, should employ trained and permanent employees to achieve its objectives and provide the expected services to its clients.
- *Electrical power*: Digitization without electricity cannot be achieved. During the past two years (2014-2015) power has been almost non-existent. Power comes only for limited hours. Sometimes it does not even come for a whole day. The intermittent power delays the progress of digitization, it negatively affects the work time discipline of the employees, and the power surges damage the institution's equipment. Either the government should, therefore, solve the problem or the ERDC should have its own standby generator.
- *Internet service*: The Internet is essential for the ERDC to be able to put its digitized materials online. So far this stage has not been realized. As a consequence, "access", one of the main principles of the ERDC, is far from realisation. In addition, ERDC employees are not able to update information for themselves and follow technological developments closely. The ERDC, therefore, needs to negotiate with the Eritrean telecommunication authority to be given an adequate service or outsource an external service from abroad.
- *Upgrading library science from diploma to degree*: The ERDC cannot find qualified manpower to recruit in the market. The Eritrea Institute of Technology (EIT) is the only institute which provides library science in a diploma programme. The knowledge of these graduates is, however, not adequate to address the needs of the ERDC. Currently, discussions are taking place between ERDC and EIT to upgrade the

training from the diploma to degree level and ensure the inclusion of some courses on archives, preservation and digitization.

In conclusion, the ERDC digitization challenges can be summed up as being a lack of trained manpower, budget, technology, network and internet infrastructure and electrical power. It appears that no practical work has been done to solve the problems because the challenges are still there. The respondents' suggested solutions can, however, safely be said to be realistic since they are based on the actual context.

The following section presents the practical work that has been undertaken by the ERDC to solve its own technological problem.

Category 7.2 Technological application in solving problems:

The institution did not have significant technological initiative to solve its problem. Its technological problems still exist. It did, however, try minor initiatives, such as developing Latin scripts for identifying, searching and retrieving texts of the local language scripts, re-digitizing the unsearchable texts with OCR, and purchasing new technology (e.g. data storages for archives) when necessary.

Category 7.3 Technical precautions:

The operational staff emphasized four aspects with regards to technological precautions that the institution needs to consider. The first issue is ensuring that the institution establishes a sound central network infrastructure that would help the institution to work in one workspace for an efficient workflow system. The second issue is enabling the institution by providing powerful computers, storage systems and offsite servers for backup and guarantee in case of disaster. The next concern is mastering the technological skills required for digitization that ensures quality work. The final issue advises the significance of consultation and prior reading before the institution embarks on the purchasing of new technology that ends up in the storeroom.

The followed section discusses the resources that enable the ERDC digitization programme.

Theme 8: Resources to enable the ERDC digitization programme

This theme discusses resources that the institution requires to do its digitization programme. It encloses categories such as technical staff, funds, applying available funds.

Category 8.1 Technical staff

In general, the management staff confirmed that there are gaps in the commitment and work discipline among the employees. They reported that some employees are hard-working and some are irresponsible. They confirmed, however, that this was the expected behaviour from the uncommitted employees considering the poor work conditions and slow economic growth of the country.

One respondent of the management group tried to look at the commitment of employees from a different perspective and categorized employees to veteran fighters and national service employees. The respondent commented;

> *"The veteran fighters who had been working during the armed struggle are highly committed and feel the ownership of ERDC collections. On the other hand the national service employees are uncommitted and do not feel ownership of the collections we have at all".*

Category 8.2 Funding

The opinions of the management group do not align on this issue. Some state that the government's contribution to the digitization programme is the largest of all while others noted that the government's share is not bigger than 5% a year.

On the subject of external funders, some of them explained that what they get is very little while the rest consider it to have a significant input on the institution. Based on the responses of the management group, it appears that either the management do not want to disclose the contributions of the governments and external funders or are not receiving a clear budget report to make a comparison.

Category 8.3 Applying available funding

The management group differed in their opinion on how they could make use of the available funds in the future too. Some confirmed that the infrastructure is the critical issue of the institution and noted the urgency of investing in building a national archives or national library. Others remarked that investing in human beings for training and salary, and, at the same time, for technology and equipment is more significant than anything.

Considering the overall responses of the management group, it appears that the institution is struggling with infrastructure, remuneration of employees, technology and equipment issues. It looks as if the management were not able to discuss their priorities collectively. They need, therefore, to make use of the collective decision making culture of the institution to identify their priority areas of investment and to make decisions.

In conclusion, it could be said that the ERDC has employees who are committed as well those who do not have much commitment. To fix this challenge will require the institution to motivate its employees through incentives, promotion and exposure to the outside world and training.

As regards the funding issue, it seems that the institution does not have a clear yearly budget that includes contributions from both the government and external bodies. The institution should have a clear understanding of its budget to plan ahead for equipment and technology, the salaries of employees, the purchasing of digitizing software, digital storage, training of staff, management software and maintaining the security of the collections. This is a constraint that needs to be resolved as indicated by (Boughida, Chudnov et al. 2011) in Chapter 2 section 2.5.

4.5 Conclusion

In this chapter the responses of two sets of respondents were recorded. Questions were directed to management and operational staff and the responses were recorded and transcribed before they were analysed. Similar responses of the two groups were integrated for effective analysis and interpretation. Accordingly, this chapter has discussed the findings of the research grouped in eight themes. The themes include digitization policy and selection, digitization workflow, standard of digitization, current ERDC resources challenges, decision making process, access, critical challenges and solutions of digitization, and resources that enable the digitization programme in the ERDC.

The first six themes dealt with operational concerns and issues while the remaining two themes presented the suggested solutions that would make the digitization programme of the ERDC sustainable.

The most important findings were the following:

1. The ERDC does not have a policy in place that can serve it to select and digitize its valuable collections.
2. The ERDC does not follow a clear process of digitization that enables it to overcome its selection and digitization challenges.
3. The institution lacks clear workflow, standards and formats for digitizing its collections.
4. The ERDC is digitizing under critical challenges that include budget constraints, lack of trained manpower, technological obsolescence, power outages, temporary employees (those who are doing their national service), lack of proper infrastructure, poor internet connection, low management skills, low standard network and security, reduced quality of work, unrecognized characters of the local language scripts, and the lack of the availability of adequate and significant software, server and storage.
5. The research study found that finances, skills and the means to address the technological challenges of digitization are the significant resources needed for sustainable digitisation by the institution. The research also discovered that the ERDC has difficulty with regard to its lack of information about its yearly budget which is significant for it to plan ahead.
6. The institution follows a collective decision making process but there is not a clear line and level of decision making.
7. It was revealed that access to digitised material has not reached the stage where users have easy access. It is not transparently clear what is causing the constraint in access.
8. Finally, the study found that some employees have a low commitment to work that needs attention from management.

The next and final chapter discusses the conclusion reached and recommendations resulting from the research.

Chapter 5
Conclusion and recommendations

5.1. Introduction

This chapter presents the conclusion and recommendations based on the eight themes and twenty-one categories recorded in Chapter 4, as well as the literature review of the research. The most important findings are reported below.

1. The ERDC cannot digitize its valuable collections without having a formal policy in place which also considers: (1) selection criteria; and (2) the process of selection.
2. Formal processes need to be put in place to overcome the challenges related to selection and the responsibilities of selectors.
3. It was established that it is difficult to digitize the institution's collections if appropriate workflows, standards and formats are not put in place.
4. The ERDC is digitizing valuable material while facing several critical challenges. Challenges include: budget constraints; lack of trained manpower; technology obsolescence; power outages; temporary employees (those who are doing their national service); lack of proper infrastructure; poor internet connections; low management skills; low standard network and security; reduced quality of work; unrecognizable characters of the local language scripts; and the non-availability of adequate and significant software, servers and hardware for storage.
5. Sustainable resources are core requirements, finances, skills and the means to address the technological challenges of digitization. The research also found that the ERDC lacks information for its yearly budget, which is a significant challenge for it to plan ahead.
6. The institution makes use of a collective decision making process, but there is not a clear line and level of decision making.
7. It was revealed that access to digitised material has not reached the stage where users have easy access. It is not clear what is causing the constraints with regard to access.

8. Lastly, the research confirmed that some employees have a low commitment to work that needs attention from management in order to increase levels of commitment and motivation.

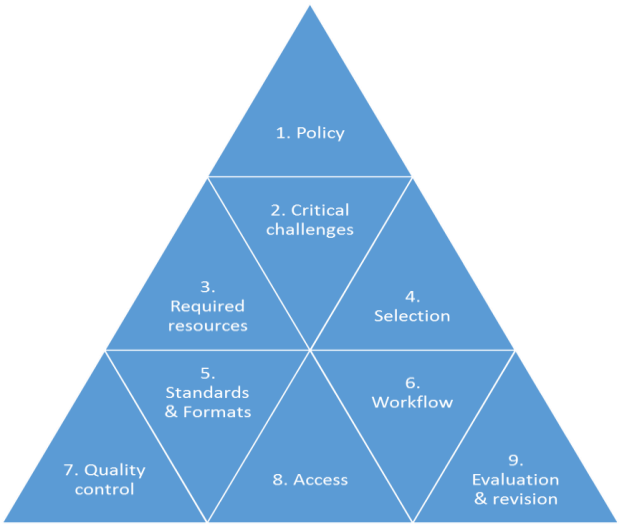
The research also collected possible solutions and precautions for the digitization challenges as suggested by the respondents.

5.2 Recommendations

The recommendations are based upon a correlation between the literature and the main findings of this research study. Accordingly, the eight main themes of the findings, presented in tables 3 & 4, are mainly used as a general guideline for the recommendations. In view of that, the recommendations for this research study are summed up in a pyramid shape where the policy takes prominence because it affects every activity that follows it, and it wraps up with evaluation and revision for making modifications or adjustments in each one of them.

The research has resulted in nine recommendations that ERDC requires to embrace in order to be able to digitize its valuable collections sustainably. These recommendations need to be addressed hierarchically to have a practical impact on the system and the output of the institution. This section clarified the recommendations of the research study based on the pyramid provided below.

Figure 2. Recommended digitization steps for the ERDC



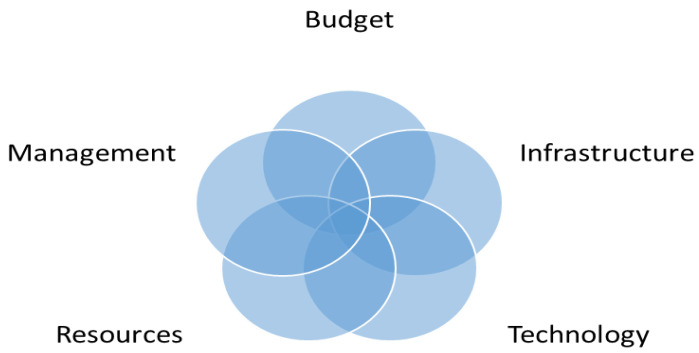
1. Digitization policy

The first priority for the ERDC is to develop a digitisation policy. A policy stipulates the expected standard and requirements for all the associated work and it affects all functions of digitization that are will be undertaken in the institution. The ERDC currently manages the selection and digitization procedures based on its internal manual. The manual could be used as a starting point for the formal policy. Without a proper policy in place it will be difficult to produce quality work and provide an efficient service to users. It is also recommended that the ERDC should call for a national symposium, attended by all ministries, NGOs, researchers, academic institutions and other stakeholders to develop and implement a guiding policy to embark on a sustainable digitization programme of its valuable collections.

2. Critical challenges

Once the institution puts the policy in place, it needs to focus on the critical challenges which it needs to face. The research study discovered that the ERDC encounters a number of challenges that can be divided into big categories such as budget, resources, technology, management, and infrastructure challenges. In summary the Figure 3 on the next page depicts what were seen as the most important challenges:

Figure 3. ERDC critical challenges



Budget: The ERDC's yearly budget is very small - it is not large enough for the institution to purchase new technology (equipment), establish an efficient network system, train its manpower and produce quality work. It is recommended that the institution should find ways of securing funds through at least three channels. The first channel could be internally, that is the government. This requires efforts at convincing senior officials and government bodies

why it is worth investing in the digitization of our valuable collections. The second channel is from external bodies, such as UNESCO, Aluku, IFLA and others that can support the ERDC to build a new national archive, update its technology, train its employees and establish efficient infrastructure. The third and final channel is to find co-funding so that the institution can initiate digitizing projects with some digitizing institutions that will create an opportunity for ERDC to gain experience, train its manpower and gain access to own modern technology.

Resources: The ERDC's limited resources are crippling it from accomplishing its mission. Having access to trained manpower and reliable Internet connections are perhaps most urgent to address. The institution can solve its manpower problem in two ways. The first route is to develop a training unit that resides under its Human Resource Development (HRD) unit and which invests in both the curriculum and training programmes. This unit should design training programmes that specifically address the needs of the institution and accordingly provide training for the existing and new employees of the institution. The second route is to enter into a contractual agreement with the Eritrea Institute of Technology (EIT) to produce new degree graduates with the special qualifications that the ERDC demands. This may be a longer term solution. In the shorter term it may be necessary to follow these two routes simultaneously.

In addition to the shortage of trained manpower, access to the Internet is another area in which the ERDC is lacking. The Internet is essential for the institution to put its collection online, share its holdings with others, and provide access to users. The institution has two options to address the problem. The first, short-term solution is to establish its own wireless network system by engaging foreign Internet service providers (ISPs). The second option, which is more long-term focussed, is to engage with the Eritrean Telecommunication Authority to provide special network services for the institution.

Management: The ERDC is suffering from a lack of management skills and subsequently poor quality of work. The institution may need to send its management staff abroad for exposure. They could, for example, attend international conferences, receive tailored training and visit international archive institutions to upgrade their management skills and knowledge. In addition, the institution needs to work on error minimization and the quality of its digitisation by focussing on two important aspects. In the first place, the institution should make sure it's operations are improved by, for example, adding technical metadata, developing standardised workflows for digitization and acquiring important software required

for digitization. Secondly the quality control unit should check the output against a set technical standard and ensure that outputs are only accepted it these standards are met.

Technology: The ERDC is struggling with some technological problems among which are difficulties in the character recognition of local language scripts, the non-availability of adequate network servers, storage and security concerns. The institution can handle these problems in two ways. The first approach is to invest in training technically qualified manpower who can handle their own robust network system with adequate storage that can accommodate the terabytes of data that will be created by the institution. The second approach is to outsource many of the technological requirements. It could be possible to encourage private internet service providers of the country to be able to give all kinds of services to the institution.

Infrastructure: The ERDC is making use of dilapidated infrastructure and at dispersed working sites. This has detrimentally affected its work output and quality. The most significant infrastructure problems unveiled by this research are the shortage of electrical power and the non-availability of a central working building for digitization. The institution can solve its power problem in two ways. One way is to wait for the long-term plan of the government that is undertaking to cover every sector of the country. The second option is a short-term plan which the institution might need to put in place until the national programme is implemented. This is where the institution purchases a standby generator and digitizes its valuable collections.

With regards to the issue of a national archive building, this can also be mitigated through two routes. The first route is to work to convince the government to allocate adequate budget and take the lead in building a national archive. The second route can be accomplished by securing funds from external bodies such UNESCO, IFLA and other international or regional institutions.

3. Required resources

The next step for the ERDC is to identify what resources will enable it to accomplish its digitization programme. The enabling resources for the ERDC can be combined into three categories. The first category is manpower, the second is technology, and the third is infrastructure. The institution, therefore, needs to recruit permanent employees and motivate them with rewards to ensure their retention and subsequently the sustainability of its

digitization programme. With regards the technology, the ERDC needs to purchase state of the art scanners, proprietary software such as adobe acrobat pro, abby fine reader and Photoshop cs6 which are relevant for editing digitised documents. The last category is updating the infrastructure, which includes the network, security, Internet access, servers, storage and acquiring the buildings that are suitable for the institution to do its digitization programme.

Infrastructure is the backbone of any digitization activity, and it is impossible to realize the objective of digitization without putting the infrastructure mentioned in place. The ERDC can develop its infrastructure in two ways. One way is to work with a partnership and cooperation with other international institutions where it can benefit from the infrastructure that they have (e.g. the institution can use the server of another institution as an offsite server and preserve its collections there). The second way is to be able to secure a huge amount of money from the government for establishing the infrastructure and managing the system.

4. Selection

Once the ERDC secures its resources for digitizing its valuable collections, it needs to work on its selection criteria. The current selection criteria of the institution are not adequate. The 'users' needs (for educational purposes and research) are given little attention in the selection criteria of the institution while the institution's significant interest in historical documents of the armed struggle, Italian and British colonial times are perhaps over-emphasized. The ERDC should perhaps consider changing from a collection-driven approach only to an approach that also includes the user-driven approach in its selection process - as was identified by Smith (2001). The institution should, therefore, create a balance between these two approaches to ensure that users' needs are considered in the creation of the selection criteria.

In addition, the inclusion of themed research projects as criteria for selection will help the institution to address the needs of users and systematically organize its valuable collections for access (e.g. documents of the armed struggle can easily be identified apart from those originating from the Italian or British administration era). The institution, however, needs a clear guideline for the selection process to be able to select the relevant materials from all of its valuable collections.

The current selection processes of the ERDC are either not clear to employees or the institution lacks the real stages. To tackle this problem, the institution needs to prepare/ develop a manual that would provide it with a proper selection guidelines and a procedure. To give effect to this the institution needs to follow three phases in its selection process. The first phase is 'nomination' where a committee that includes all of the ERDC staff, education specialists, digitization specialists, librarians, archivists, curators, researchers, preservation specialists, lawyers and other stakeholders come together and select the materials that they need to digitize. The second phase is 'evaluation' where the selection committee evaluates the selected materials on the basis of the selection criteria. The third phase is 'prioritisation'. During this phase the committee prioritises the materials according to their value, use, cost and risk for digitization.

5. Standards and formats of digitization

When the ERDC completes its selection it is required to follow a specific manual of standards and formats to digitize the selected documents. Currently, the main objective of the ERDC is preservation, and, to achieve this, the institution is undertaking the basic benchmarks of digitization. It is digitizing its texts at 300 dpi and in pdf format, images are scanned at 600 dpi in tiff format. It, however, lacks details in its standards. The institution should make use of the minimum requirement of digitization specified by Naicker (2013) on page 27 of this research study. In addition, it ought to adopt Dublin core metadata with appropriate preservation software (e.g. fedora or Dspace).

6. Workflow

Based on the provided standards and formats, the next step for the institution is to also document the digitization workflows. Currently, the ERDC does not have any formal workflow and the employees do not work in a central networked system. It is advised/ recommended that close attention is paid to the three phases of digitisation (refer to Table 1). These phases should be included in its workflows. The first phase is pre-digitization that includes the identification of material, the assessment of resources needed, decisions on standards, the definition of methods, the assessment of risks, the selection of materials, quality control and the assessment of preservation need. The second phase is digital conversion that includes the creation of the digital master and the availability of professional equipment and quality control procedures. The third phase is post-digitization and this entails the control of metadata, quality control, submission of information to repository systems, data

management, making digitized copies and metadata available online, and the assessment and evaluation of the project.

7. Quality control

After setting the workflows for digitization the next step is to also define quality control. This activity can be implemented in the ERDC at three levels. The first level needs to be on pre-digitization where the institution ensures that the appropriate technical metadata, software, technology, filenames and directories are followed. The second level is undertaken while the process of digitization is going on. The quality control unit could intervene in the middle of the digitization work and take random samples of the work to see whether things are being done according to the already set standards. The third and final level of quality control is undertaken when the work of the digitization is complete and before the digitised object is submitted to the repository.

8. Access to users

When the digitized materials are uploaded in the repository it is expected that they are ready for access. The research discovered, however, that the main objective of the ERDC is currently preservation and that it has not the level of providing users with access. Users currently have access only to the list of digitized materials on Excel and they may request the material that they want. The institution provides access to scholars, researchers or institutions that are interested in accessing documents for research and who physically come to the institution's premises to collect data from the local network. A hard copy is provided to them to read in one corner of the ERDC reading rooms by the referencing unit staff. Access is, however, not only the provision of a list of materials or digitized items locally. It is about the provision of these materials online for the purposes of education and research. The ERDC should, therefore, work beyond preservation and make sure that its material is accessible to the public so that citizens will be aware of their history so as not to repeat it.

The institution appears to lack a general understanding of the constraints it is placing on access. As a consequence, this might have a negative impact on the institution's decision making priorities. It is recommended that the institution needs to investigate the real constraints to providing online access and address them - so as to provide a service to public.

9. **Evaluation and revision**

The final step for the ERDC to undertake is evaluation and revision. The institution needs to continuously monitor the nine steps and processes and evaluate them to assess their effectiveness within the system. If it is discovered that improvements are possible these should be implemented.

5.3 Further studies required

The ERDC has been working for preservation and not for access. Once the issues of policy and critical challenges are solved, however, access will be the priority of the institution. Access is one of the prominent benchmarks of sustainable digitization. It will, therefore, be interesting to chart how the ERDC will be delivering its digitized material online in the years to come to its users for educational and research purposes. Research, therefore, needs to be done regarding the appropriate dissemination systems for heritage material.

On top of that, the research findings of this study could broaden the understanding of the African armed struggle literature and enrich the research material relative to African heritage considerably. The findings of this research study, furthermore, are expected to have an impact on a shared repository of the African armed struggle literature projects undertaken by some institutions, such as Aluka and DISA.

5.4 Final remarks

This research study has developed a comprehensive list of recommendations that could be of use for the preparation of digitisation guidelines for the valuable collections of the ERDC. The scope is extensive and includes a policy for digitization and selection, the digitization process, the standard of digitization, challenges of digitization, decision making of selection and digitization, access to digitized materials and resources that enable sustainable digitization.

It is important to be reminded that the practical implementation of this research can be ensured if the digitization policy is in place and the critical challenges of digitization of the ERDC are dealt with. The findings of this research could, furthermore also be beneficial for Higher Institutes, public libraries and for the forthcoming national library and repositories of Eritrea.

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Appendix A – Interview schedule: Managers of ERDC

Purpose of the interview: Extracting information regarding the policies, resources and infrastructure necessary for the sustainable digitisation of valuable collections owned by Eritrean Research Documentation Centre (ERDC).

1. **Text of an e-mail to be sent to the interviewees (Managers of ERDC) prior to the actual telephone interview**

I am Kiflom Michael, an employee of the ERDC currently studying M.IT at the University of Pretoria. One of the requirements of the Masters Degree programme of M.IT student is to produce a mini-dissertation in partial fulfilment of the degree. The focus of my dissertation is on producing guidelines for sustainable digitisation of the valuable collections at the ERDC. As you are responsible for digitisation decisions at our institution you have been identified as a candidate who would be able to support and inform me regarding such guidelines.

Based on that I would like to have your opinion regarding the following:

- ❑ Collections issues
- ❑ Selection criteria for digitisation
- ❑ Human, technological and infrastructural issues of digitization
- ❑ Challenges in digitisation
- ❑ Digitisation and sustainability issues

I intend to use the information collected from these interviewees to develop guidelines that would support a sustainable digitisation program for the ERDC. In addition, I also hope that the guidelines could be of use to other institutions such as the Institute of Higher Education and Colleges that are planning to digitise their collections.

The telephone interview will take about 30 minutes. Will you be willing to participate? If so: could you please indicate a suitable date and time on any of the days between 30 July 2015 and 08 August-2015 so that I could make contact with you? Please also indicate the telephone number that you would prefer me to use.

2. Interview

2.1 Introduction

Thank you for your valuable time and willingness to discuss issues related to the sustainable digitisation program that is currently underway in our institution. As I specified in my e-mail, I would like to discuss issues related to the selection, digitisation and sustainability of programs that are practiced in the ERDC. In addition, I will be more than happy to provide you with an opportunity to add further detail to the conversation transcript if you feel that I should consider the detail after this conversation.

I would like to record this conversation to assist me with coding the information (the transcription). The information assembled through this interview will be used for study purposes only. All responses will be documented but all names will be held confidential and information reported will be anonymised. Are you comfortable with the use of a recorder?

2.2 Questions

SECTION A: ERDC digitization policy and selection criteria

1. What aspects would you expect to see included in the ERDC digitization policy?
2. What selection criteria are currently being used to identify items to digitise from our valuable collections?
3. Who is responsible for the selection process?
4. What changes would you like to have made to the current selection criteria so that these would be more appropriate for the ERDC?

SECTION B: Resources to enable the ERDC digitization program

1. In your opinion - what are the critical challenges of digitization in the ERDC?
2. Could you recommend solutions for these challenges?
3. In your opinion – are our digitization staff members willing and able to digitise our important collections? Please explain your answer.
4. What budget (funding) has been allocated to the digitization initiative?

5. How would you like to see the funding utilized in future?
6. How were decisions made regarding the infrastructure implemented and equipment currently used for digitisation?

SECTION C: Access to the digitised collection

1. Please explain the process for users to gain access to the digitized collections?
2. In your opinion, what are the major constraints that hinder access to the digitised collections?
3. How could these constraints be addressed?

Closing Remarks

I appreciate your time and the useful insights shared during the interview.

A copy of the conversation transcript will be sent to you. Would it be acceptable for me to contact you for further questions relating to the subject if some of the content needs further clarification?

I am more than willing to show you the end results of my analysis if you would like to receive a copy.

I look forward to making use of the information you shared in the interview in the design of the guidelines for digitization of the valuable collections owned by the ERDC and other institution which are planning to digitize their collections.

Appendix B – Interview schedule: Digitization operational staff of ERDC

Purpose of the interview: Extracting information regarding the processes to follow, the skill levels and the technologies required to ensure the sustainable digitisation of valuable collections owned by Eritrean Research Documentation Centre (ERDC).

1. **Text of an e-mail to be sent to the interviewees (digitization operational staff of ERDC)**

I am Kiflom Michael, an employee of ERDC currently studying M.IT at the University of Pretoria. One of the requirements of the Masters Degree programme of M.IT student is to produce a mini-dissertation in partial fulfilment of the degree. The focus of my dissertation is on producing guidelines for sustainable digitisation of the valuable collections at the ERDC. As you are responsible for digitisation operations at our institution you have been identified as a candidate who would be able to support and inform me regarding the functions and guidelines.

Based on that I would like to have your opinion regarding the following:

- ❑ Collections issues
- ❑ Selection criteria for digitisation
- ❑ Challenges in digitisation
- ❑ Digitisation processes and constraints

I intend to use the information collected from these interviews to develop guidelines that would support a sustainable digitisation program for the ERDC. In addition, I also hope that the guidelines could be of use to other institutions such as the Institute of Higher Education and Colleges that are planning to digitise their collections.

The telephone interview will take about half an hour. Are you willing to participate at this time? If so: could you please indicate a suitable date and time on any of the days between 30 July 2015 and 08 August-2015?

2. Interview

2.1 Introduction

Thank you for your valuable time and willingness to discuss issues related to a sustainable digitisation program at the ERDC. As I specified in my e-mail I would like to discuss issues related to the selection, digitisation and sustainability of the digitisation programs that have been started at the ERDC. In addition, I will be more than happy to provide you with an opportunity to add to the conversation that you feel that I should consider.

I would like to record this conversation to assist me with coding the information (the transcription). The information assembled through this interview will be used for study purposes only. All responses will be documented but all names will be held confidential and information reported will be anonymised. Are you comfortable with the use of a recorder?

2.2 Questions

SECTION A: ERDC processes to follow when selecting items to digitise

1. Please tell me how you go about selecting the items to digitise from our valuable collections?
2. Who is responsible for selecting the items to be digitised?
3. Which criteria are used when selecting items for digitisation?
4. In your opinion what are the critical challenges that you face when selecting items to digitise?
5. Please explain the workflow of digitization (or the stages in the workflow) that the ERDC follows?
6. Can you briefly state how you make the digitized collections available and accessible to patrons?

SECTION B: Skill levels and the ERDC digitization program

1. Can you explain to me what standards you adhere to when digitizing the texts and images?
2. What skill challenges do you encounter when digitizing materials?

3. What do you think are the main challenges that hinder you in digitization?

SECTION C: Technologies that support the sustainability of the ERDC digitization program

1. What critical technological challenges do you encounter while digitizing?
2. If encountered, how do you try and resolve the challenges?
3. In your opinion, what technological precaution needs to be put in place at our institution to ensure the continuity and standard quality of the program?

Closing Remarks

I appreciate your time and the useful insights shared during the interview.

A copy of the conversation transcript will be sent to you. Would it be acceptable for me to contact you for further questions relating to the subject if some of the content needs further clarification?

I am more than willing to show you the end results of my analysis if you would like to receive a copy.

I look forward to making use of the information you shared in the interview in the design of the guidelines for digitization of the valuable collections owned by the ERDC and other institution which are planning to digitize their collections.