AN INSTITUTIONAL REPOSITORY FOR UGANDA MANAGEMENT INSTITUTE 
LIBRARY

BY

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SUPERVISOR

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A project report submitted to the East African School of Library and Information Science in partial fulfillments of the requirements for the attainment of a bachelor’s degree in library and information science of the College of Computing and Information Sciences at Makerere University

OCTOBER

2017
DECLARATION

I, Sengendo Eddie, hereby declare that this report is my original work and has never been previously presented for the attainment of a degree, diploma or any other academic reward to Makerere University or any other institution of higher education.

Signature: ..................................................  Date: ..................................................

5th Oct 2017
APPROVAL

This is to satisfy that the study was carried out under my supervision and was submitted with my approval as partial fulfilment for the award of a bachelor’s degree in library and information science of Makerere University.

Signature........................................Date................

EZEREA KULISOOMA
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ABBREVIATIONS

CDSware - CERN Document Server Software

CPU- Central Processing Unity

CSS- Cascading Style Sheet

DAM - Digital Asset Management

DSpace- Dura Space

ETD-db - Electronic Theses and Dissertations database

ETDs- Electronic Thesis and Dissertation system

HTML- Hyper Text Markup Language

ICT- Information and Communication Technologies

IR- Institutional Repository

LOCKSS - Lots of Copies Keep Stuff Safe

OAI-PMH- Open Archive Initiative for Metadata Harvesting

OA-Open Access

OPENDOAR- Open Directory of Open Access Repositories

PDF- portable Document Format

SRS- Simple Random Sampling

UMI- Uganda Management Institute

UML- Unified Modelling Language

W3C- World Wide Web Consortium

WSDL- Web Services Description Language

XML- Extensible Markup Language
ABSTRACT
Institutional repositories are essential research infrastructures for scholarly and academic institutions. A properly dimensioned and well established institutional repository has the potential to increase research impact and enhance the visibility of an institution through its scholarly outputs.

The project aimed at designing and developing an institutional repository for Uganda Management Institute using DSpace software. This was achieved by the objectives of the study which were to examine the current system of storing and preserving audiovisual materials, identify the system requirements, design an online repository, implement, test and validate an online repository at UMI. It began with an extensive search for information concerning stakeholders’ attitudes towards open access publishing and institutional repositories. It was apparent from this review that no previous research had focused on the needs and building of an IR contribution in this area.

The study was therefore carried out in two settings. The first setting comprised face-to-face interviews with library users and staffs at UMI. Responses were received. The second was document review involving examining library reports. The data collection tool explored the participants’ experiences and opinions of preservation, access and the proposed UMI repository. Respondents were overwhelmingly in favor of permitting the deposit of theses and dissertations, although under specified conditions. The interviews with library patrons established that, as readers, they wanted to find many more types of material in the repository than, as authors, they were willing to deposit. However, complete dissertations, journals and conference papers were acceptable to both groups. The ability to disseminate their work and receive feedback and commentary were the most important motivators to students depositing work, closely followed by the principle of open access. The greatest deterrents were the risk of being unable to publish elsewhere later, the ownership of copyright, and plagiarism.

Findings obtained from system validation tests show that the system is a viable solution to the major challenges encountered in the access and preservation of scholarly intellectual output at UMI. Based on the findings of the literature review and the study, appropriate recommendations were made for the UMI repository.
CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1. Introduction
This chapter comprise of the background of the study, the problem statement, the aim of the study, objectives of the study, scope of the study and significance of the study as well as definitions of terms.

1.2. Background of the study
Advances in information and communication technology are drastically changing the way research and academic institutions access and preserve information. Due to the shift in strategies traditionally performed by libraries, items storage has changed drastically and are now available online via a digital gate way provided by libraries and other information providers like electronic publishers or individuals. The internet added a new dimension of information technology like online databases that fosters knowledge preservation and sharing platforms in the long run giving rise to rich concepts like Institutional repository, electronic theses and dissertation, electronic learning, archiving indigenous culture and heritage, knowledge management among others (Fralinger and Bull, 2013; Bonilla-Calero, 2013).

Institutional repository (IR) is a concept referring to the collection, management, dissemination and preservation of scholarly works created in digital format by faculties and students from different colleges and universities (Bankier and Gleason, 2014; Vishala and Bhandi, 2007). The term was born out of competition for who was to take responsibility for disseminating an institution’s output (Nabiwemba, 2015). Individual institutions felt that their competitor was e-print archive movement controlled by several well funded or subscription based groups, associations and institutions serving a variety of disciplines (Basefsky, 2009). The eprint movement provided for an open access compliant with the Open Archives Initiative Protocol for Metadata Harvesting (Vishala and Bhandi, 2007). The movement denied its member institutions rights to their own intellectual output which made them find means of controlling their items themselves. This was achieved through the establishment of individual IRs such that institutions would enjoy the benefits from their scholarly output.
Many institutions of higher education in Africa and the rest of the world generate scholarly outputs. Jain (2010) suggests that online repositories should be adopted by higher institutions of learning and research organisations that generate or coordinate research outputs. These include journal articles, conference papers, reports, theses, teaching material, research notes and research data which are faced with mismanagement challenges (Namaganda, 2015). Ngulube (2007) asserts that scholars use research findings to generate further studies, models and archetypes by reviewing such works which enables them to find gaps that need to be addressed. Thus, findings accruing from research should be made available for others to build upon and for the society to benefit.

Efforts have been made in developing IRs as one of the campaigns by the established consortiums to meet the demands of scholarly outputs. These are formed mostly by libraries for the indigenous institutional output in the world allover including a number of African countries like South Africa, Nigeria, Uganda, Botswana, Tanzania, and Kenya among others.

According to katusime and Nannozi (2012) the concept of institutional repository was still new in Uganda by then. Achoka (2014) reported a positive but slow response towards IR development in the country. Therefore, the consortium of Uganda university libraries (CUUL) advocates for the practice to be greatly adopted in the country (Namaganda, 2015).

The directory of open access repositories (OpenDoar) show statistics on the number and distribution of repositories in Africa (statistics OpenDoar, 2017). The list shows that Kenya has the largest number of repositories in east Africa with over 25 repositories. Followed by Tanzania with 10 repositories and Uganda has 2 IRs with OpenDoar including Makerere University institutional repository (MAK IR) at http://makir.mak.ac.ug/ and Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) Institutional repository at http://repository.ruforum.org/ (University of Nottingham, list last updated, 26-Apr-2017). The consortiums have yielded a number of IRs. For instance, Namaganda (2015) pointed out two registered members of the consortium of Uganda University libraries (CUUL) with established IRs in addition to Makerere University, which are Uganda Martyrs University and Aga Khan University. Institutional repositories serve several functions other than enhancing accessibility like storage, preservation, metadata generation (Jain, etal., n.d; Bankier and Gleason, 2014), interoperability functions and self-archiving (mechanism for material submission) (Ibinaiye,
Esew, Atukwase, Carte and Lamptey, [2015], Vishala and Bhandi, 2007; Cullen and Chawner, 2010) and capabilities for import, access, organization, distribution, export and preservation (Alfa Network Babel Library, 2007).

1.3. Statement problem

Academic and research institutions generate a lot of grey literature that never gets published but crucial for scholarly communication (Connell and Cetwinski, 2010). Grey literature includes but not limited to reports (pre-prints, preliminary progress and advanced reports, technical reports, statistical reports, memoranda, state of the art reports, meeting minutes and market research reports), theses and dissertations, conference proceedings, technical specifications and standards, bibliographies, technical and commercial documentation (Herb and Muller, 2008; Shoeb, 2010; Okede and Owate, 2015; Sewant, 2012).

The rise of digital media such as e-books has drawn more attention as a means of boosting information services at libraries, new issues have arisen involved in rule setting for use and long term preservation of these media (Okahashi, 2011). There is much thinking required to preserve the analogue audiovisual collections which still play quite a large role in library collections (Mnjama, 2010).

Uganda Management Institute Library (UMI) collects a wide variety of audiovisual materials (compact discs) in tangible form as backup for their graduate student’s dissertations and the collection continues to grow. Providing backup copies, repairing and cleaning the damaged optical media and other efforts to physically preserve the analogue materials for the long term has been mismanaged. Although audiovisual materials constitute a vital information resource at UMI, they are often not adequately managed after they are created (B. Lwanga, personal communication, January 26th, 2017). They are faced with severe deterioration due to factors like scratches caused by improper storage equipment’s like boxes, poor handling and maintenance, dust, inappropriate environmental conditions, technology obsolescence and media degradation which have all threaten preservation and access of information stored on optical devices in long run at UMI.

Otando (2011), suggests that research output needs to be captured, preserved and disseminated in order to address development issues. Therefore, digital conversion and migration are becoming an integral part of protecting and preserving audiovisual collections from deterioration and
obsolescence (Okahashi, 2011). And this can simply be supported by the establishment of an IR. Currently, there is a need to adopt an IR at UMI with the intent of addressing the problems aforementioned. This will enable information workers at UMI to appreciate their roles as experts in collecting, disseminating and preserving of information resources.

1.4. Aim of the study
The aim of the study is to create an institutional repository for Uganda Management Institute.

1.5. Objectives of the study
1. To examine the current system of storing and preserving content contained on audiovisual materials in UMI library.
2. To identify system requirement specifications for the proposed institutional repository at UMI.
3. To design an institutional repository for Uganda Management Institute.
4. To implement, test and validate an institutional repository for Uganda Management Institute.

1.6. Scope of the study
This was confined to identifying the requirements for the design and creation of an IR for UMI purposely to capture local content generated by the institute community.

1.7. Significance of the study
This refers to the relevance of the project in terms of academic contributions and practical use that might be made of the findings.

To the institution and staff
Institutions are searching for the most cost-effective way to maintain their digital scholarly works for the future scholars (Bankier and Gleason, 2014). And this may be achieved through the establishment of online storage facilities. Therefore, an institutional repository will provide a platform for the storage, preservation access to dissertations submitted by graduate students of Uganda Management Institute. Preservation strategies like migration, emulation and replication of various document formats will ensure integrity of information. Therefore, this will enable
administrators to access and migrate full text file formats such as PDFs and MS word documents in to a new format if need be without any alterations in the document.

The development of an IR that will increase the visibility of UMI’s intellectual output across the globe over a network. This implies that research outputs will be accessed by users via the web from anywhere (Herb and Muller, 2008). It will not necessarily require library users, researchers and scholars to physically visit the library to acquire such materials since they will be made available on the network.

An IR will provide a platform for self-archiving (authors uploading their scholarly materials by themselves), online open access, metadata creation, retrieval (Yu, 2008; Cullen and Chawner, 2010), dissemination, update (add or delete), intellectual property management and access rights to UMI scholarly online resources. This will not only save time of the scholars but will also reduce on congestion caused by users of the library in the limited space available since materials will be accessed over a network.

**To library users.**

An IR will enhance access to information provided on line through searching and browsing on a remote network. This will increase resource retrieval, sharing and utilization materials by users without physically visiting the library since resources will be readily available remotely and simultaneously.

The project will act as a basis for literature review for future researchers. Its content will enable them to find gaps that need to be addressed and it is therefore upon this study that others build upon so as to come with new and relevant studies about the subject matter in UMI society.

**1.8 Definition of key terms**

Institutional repositories are “digital collections that preserve and provide access to the intellectual output of an institution” (Krevit & Crays, 2007).

Academic libraries are defined as libraries attached to any degree awarding institution of higher learning that supports school’s curriculum and research by students and institute’s faculty (American library association, 2010).
CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction
This section consists of a critical review of research work from journals, internet sources and other projects already done which is related to the subject area as well as an analysis of existing literature on the subject with the objective of revealing contributions and weaknesses. It includes work from numerous scholarly databases like sage publications, elsevier, emerald insight, google scholar, eric and ebscohost for a period ranging from 2007-2017 hence restricting the study to work that do not exceed 10 years.

2.1 The concept of institutional repository
An institutional repository (IR) is described as a set of services offered by an institution in order to manage, disseminate, and facilitate access to the electronic documents created by that institution (Bonilla-Calero, 2013). IRs are created and maintained to provide universal access to information in electronic format so as to facilitate research and scholarship (Bhat, 2010; Ali, Jan and Amin, 2012). Ali, Jan and Amin (2012) stretched that IRs are digital archives of research materials deposited by the authors (self-archiving) of a particular institution. The self-archiving aspect provides mandate and policies which help to increase the number of files in institutional repositories (Ezema, 2011; Ahmed and Al-Baridi, 2012; Jain, 2011; Vishala and Bhandi, 2007, Cullen and Chawner, 2010).

The present era is the epoch of digitization (Ali, Jan and Amin, 2012) and IT has fundamentally changed the way information is created, stored and shared (Zheging, Huiwei and Weijing, 2010) in all organisations, including archives, libraries and documentation centers in transition from paper to electronic format (Jan and Amin, 2012). In parallel with this, the movement for open access (OA) to scientific publications each day attracts more followers as institutions and members of the scientific community increasingly adopt the approach of the IFLA position on OA. Therefore, preservation of digital items is competently crucial for the future research throughout the world.

As virtual collection consisting of single or multiple types of intellectual products created in digital form, Bishala and Bhandi (2007) and Ezema (2011) suggest four essential characteristics
that an institutional repository must have, that is being institutionally defined, obtaining scholarly content, cumulative and perpetual interoperability and open access. These must be met so as to fulfill the two main objectives for having an institutional repository which are to provide open access to institutional research output by self-archiving it (Ahmed and Al-Baridi, 2012; Cullen and Chawner, 2010) and to store and preserve other institutional digital assets, including unpublished or otherwise easily lost (grey) literature such as theses or technical reports Ezema (2011).

2.1.1 Growth of Institutional repository in the global perspective

The global repository system began in 1991 in United States of America at Los Alamos national laboratory (Cullen and Chawner, 2010; Jain, 2011). Van Westrienen and Lynch showed that IRs are a true global phenomenon at academic institutions and that they are becoming well established as university infrastructure components (Fralinger and Bull, 2013). It is today accepted by many academic institutions as a support for collecting, distribution, access and preservation of their intellectual works (Cullen and Chawner, 2010; Iyishu, Nkanu and Ogar, 2013). A study by Jain (2011) indicates that IRs were created to facilitate the filing of preprint in physics and mathematics which were later extended to computer science and biology initially.

The most comprehensive compilation of worldwide institutional repositories is the open Directory of Open Access Repositories, OpenDoar (2017). IRs have continued to deploy in both large research institutions and small liberal arts schools all over the world. Less developed countries are still lagging behind so a greater emphasis on the benefits of an IR over the obstacles needs to be given. Therefore, stronger advocacy roles are required by academic libraries in these countries (Jain, 2011). However, institutions with well-established IRs should assume a mentoring role to guide the developing IRs.

Taking into account only the number of repositories listed in OpenDoar, it is clear that IRs around the world are growing in number (Fralinger and Bull, 2013) most of which have not been registered with the directory of open access repositories at http://www.opendoar.org/. The worldwide growth and development of institutional repositories in different regions of the world has been phenomenal in the past years (Jain, Bentley and Oladiran, n.d). By 2011, the total number of repositories was 1683 (Jain, 2011) and to date the number has increased to 3347 (OpenDoer, 2017) with an increment of 1664 IRs. The establishment of IRs is overwhelmingly
carried out whole the world over (Jain, 2011). OpenDoer website (2017) statistics show that Europe has 1517 repositories (45.3 per cent) of the total worldwide. North America has 607 (18.1 per cent). Asia has 674 (20.1 per cent). South America has 288 (8.6 per cent). Australasia has 69 (2.1 per cent) and Africa has over 150 (4.5 per cent) Caribbean and Central America have only 19 contributing 0.6 per cent each. Statistics from OpenDoer show that Europe and Asia have the highest concentration of IRs and the development of IRs in Africa is still low compared to their western counterparts.

Since African repositories have an extra regional imperative, namely to get African research on the international scene, arguably IRs should be an even more important benchmark in the African context (Mgonzo and Yonah, 2014). Currently, South Africa is the leading country with well-established repositories in Africa with the others in Egypt, Kenya, Tanzania, Namibia, Uganda, Nigeria and Zimbabwe (OpenDoar, 2017). The University of Pretoria has the most well-established repository based on the number of items hosted by the platform (over 5774) for the ETD collection by 2015 (http://www.opendoar.org/) running on the ETD-db software. The other repositories have less than 2000, mostly below 1500. This may be an indication that due to a lack of resources Africa, there has been slow in IR initiatives and implementation (Mgonzo and Yonah, 2014 and Ezema 2011).

The growth of IRs has been concentrated largely in institutions in the developed world. In Uganda, number of repository platforms have been developed. Some elite educational and research institutes such as Regional Universities Forum for Capacity Building in Agriculture (RUFORUM Institutional Repository) available on http://www.ruforum.org/ (OpenDoar, 2017) and other established institutional repositories like Makerere university IR, Uganda martyrs university IR and Uganda Christian University IR. However, the consortium of Uganda University Libraries urges its member institutions at University level to build Institutional Digital Repository under its policy document (Namaganda, 2015).

Almost aforementioned are experimental in nature and are not based on research data as far as policy issues, institute specific requirements, workflow pattern, metadata and other related standards for different kinds of digital documents, multilingual and multiscript document processing, search and retrieval requirements and user interfaces at various levels are concerned (Deng, 2011).
2.1.2 Review of related institutional repositories

An IR refers to a digital archive where a university community’s intellectual work is made accessible and preserved for posterity (kamila, 2009). According to Bonilla-Calero (2013), a university based IR is a set of services that the university offers to members of the community for the management and dissemination of digital content created by the institution and its community members. The study adds on that the concept of IR suggests “the tantalizing possibility of greater library influence over the whole cycle of scholarly communication on campus from research through publication, collection and preservation”. However, the concept is becoming a fast-growing area of academic knowledge landscape although the growth of IR is still at an infant stage (Ahmed and Al-Baridi, 2012). University libraries are performing a leading role in shaping online repositories all around the globe. This has been through the creation of consortiums for example CUUL. Universities like Makerere university (OpenDoer, 2017), Uganda Martyrs University and Agakhan (Namaganda, 2015) currently have established IRs.

Makerere University IR

According to Morris (2011), Makerere University library was the first library to install a well-established institutional repository in Uganda available online at http://makir.mak.ac.ug/ operating on DSpace software platform. It was launched as a science repository but later changed to cover other disciplines. Makerere University IR has holds 2000 full text items including reports, articles, posters and other scholarly materials.

University of Zimbabwe (UZ)

According to Morris (2011), The institutional repository (http://ir.uz.ac.zw/jspui/) was established in 2005 using DSpace software. It contains past exam papers, conference papers, staff publications, DATAD: abstracts of theses and dissertations, EDT–db: full text of electronic theses, book chapters, working papers, research reports and seminar papers. The UZ is the mother of all universities with a well-documented research culture which attracts funding from donor organizations. It has a publishing house with a decent output. The UZ library personnel were the first to receive institutional repository training which they are now cascading to other libraries. It has a bandwidth of 27mb which is the envy of other universities. It is believed that its
long history and location in the capital city makes it a favorite destination for the best librarians (Morris, 2011). The above factors have created a conducive environment for the implementation of a successful institutional repository at the UZ.

**The South African law reports repository**

The South African law reports is a premier repository for South African jurisprudence (Bortfeld and Mathias, 2008). The repository has had extensive networks of reports since published in 1947. There is a report for almost every court from which judgments are received, ensuring that all reportable judgments are covered.

**2.1.4 Modules / Core functions of an institutional repository**

The following are major capabilities that a functional IR must support to meet its institutional goals.

**Open access** (OA). This refers to the free availability of contents to all (Shoeb, 2010). Many OA repositories found in “OpenDOAR” are digital by nature, online, free of charge, and free of most copyright and licensing restrictions (Bonilla-Calero, 2013). Libraries are finding it increasingly difficult to fund and provide access to this ever-expanding array of electronic resources (Krevit & Crays, 2007). The concept of Open Access offers a balance to this problem. Using Open Access journals and databases, libraries can provide resources and resource discovery at less cost, while researchers can publish and communicate their findings quickly and economically, keeping the processes of peer review and quality control intact. Discovery by a larger population of users is enhanced as well. Access to information and electronic resources of different mediums become more easily due to the advent of the internet and other digital and communication technologies which removes the many barriers that were traditionally related to the access of information (Shoeb, 2010). Better access enables the academicians and researchers to study their context more widely, reduces the amount of duplicative research, and helps researchers to produce better quality research (Shoeb, 2010). Authors or their designated intermediates deposit scholarly publications for anyone to read in the open access (OA) digital repositories which are online web sites. Therefore, an IR is the best way to provide OA service to research output for better usability and visibility (Bonilla-Calero, 2013).
Electronic journals and databases like emerald, sage elservier and jstor have developed value-added aspects that make them very attractive and useful for the researcher (Krevit & Crays, 2007). The study adds on that registration or subscription is not mandatory to reading papers or accessing resources within the IRs, as not all repositories are OA. Some secure access to specific items to local networks, locally registered users or a specific community.

**Intellectual property right management.** According to Okede and Owate (2015) this refers to intellectual property rights as to freedom rights to ownership of Intellectual works are information emanating from research and used for national development. It is important to copyright original content (Barwick, 2007; Koutsomitropoulos, et al, ibid). The economic exploitation of the repositories assets requires the management and encoding of intellectual property right (IPR) information into the content item. Water marking is one of the ways that show the copyright owner of the item (Koutsomitropoulos, et al, ibid) but labelling documents with owner’s logo is more appropriate as it can be defaulted to all items.

**Metadata generation.** Metadata is data that describes content of an item. It has to be used throughout the lifecycle of the digital item through capturing details of items contained in the IR (Afshari, and Jones, 2007; Jayakanth, Minj, Silva, and Jagirdar, 2008; Dunsire, 2008; Barwick, 2007). This is mainly to describe the digital content, support for its management and facilitate accessibility in the long run (Park and Richard, 2011). It is important to follow a widely adopted standard like Dublin core which is used general (Barwick, 2007; Dunsire, 2008; Kim and Kim, 2008; Kelly, 2007), MPEG-7 for multimedia content (Guo, 2013) and DIG-35 for images. In some instances, metadata is also used to support a high level of abstraction (collection level such as Dublin core collection level description) other than describing individual repository items (Holse, Cheverie and Dygerts, 2007, p.161; Kim and Kim, 2008).

**Security and user certification.** This clearly identifies that the designated community only is to be allowed to access the repository content items (Koutsomitropoulos, et al, ibid). This is achieved through establishment of a set of access policies for each consumer or use community (Koutsomitropoulos, et al, ibid) to support or provide for their authentication and this can be achieved through logins/passwords to the repository services.

**Interoperability capabilities.** Interoperability refers to the ability of two or more systems to share, communicate and co-operate (Singh, 2015). The IEEE Computer Society defines
interoperability as “the ability of two or more systems or components to exchange information and to use the information that has been exchanged.” However, this are obtained through adopting a well-known standard like the platform independent language XML and XML schema during the system development (Carlson, Ramsey and Kotterman, 2010; Afshari and Jones, 2007; Dunsire, 2008). An Open Archives Initiative-Protocol for Metadata Harvesting (OAI-PMH) is highly recommended so as to accommodate mass metadata import and export to and from the repository (Bankier and Gleason, 2014; Dunsire, 2008; Afshari and Jones, 2007; Jayakanth, Minj, Silva, and Jagirdar, 2008; Kim and Kim, 2008). According to JISC repositories.net (2008), the OAI-PMH refers to a mechanism used to achieve this interoperability between digital repositories. Besides, the Z39.50 protocol is also important especially for transparent and remote search in mass number of items (Koutsomitropoulos, et al, ibid). according to Koganuramath, Mallikarjun and Kademani (n.d), the Z39.50 refers to a network application standard that enables different computer systems that run on different hardware and use different software to interoperate and worktogether seamlessly (communicate for the purpose of information retrieval.). However, access and interoperability of an online database are increased or enhanced by exposing the system services as web based (Mondoux and Shiri, 2009; Koutsomitropoulos, Tsakou, Tsolis and Papatheodorou, 2002). This implies that services are described by the Web services description language (WSDL) on the World Wide Web consortium (W3C).

**Knowledge representation and management.** This constitute of the way items are organizes and made available through the repository. Content is not only restricted in one thematic domain but can also span over several domains or a combination (Koutsomitropoulos, Tsakou, Tsolis and Papatheodorou, 2002). However, it is convenient to describe the content in a semantically hierarchical and structural way. The study by Mondoux and Shiri (2009) related to the use of knowledge organization system on the web and asserts that most IRs do not use a formal subject heading to describe their items. Institutions do not include the structure of subject headings in their platforms and they rarely choose to use it to its full potential. Even though some IRs do use it uniformly for their items, some like the University of Calgary IR do not use it uniformly for their items (Mondoux and Shiri, 2009). Others like University of Manitoba, Queens’ University, the University of Guelph and University of Toronto provide subjects search function with an
alphabetical list of LCSH subject headings assigned to the items in the repository (Mondoux and Shiri, ibid). There is also no clear indication of how many items have to been or have to be assigned a specific subject term which could benefit the user (Mondoux and Shiri, 2009).

**Conventional preservation.** This refers to a measure achieving sustainability of library materials as long as possible in their original format (Iyishu, Nkanu and Ogar, 2013). The development of an IR provides an online platform with capabilities for an electronic theses and dissertations (ETDs) program to ensure the electronic preservation of dissertations (Iyishu, Nkanu and Ogar, ibid). However, the development of a repository enhances storage and retrieval of materials for future usage over a network (Bankier and Gleason, 2014).

Bankier and Gleason (2014) suggests that the LOCKSS system that keeps copies of scholarship across a network of institutions to preserve and disseminate content if the original publisher or repository ceases to exist can be adopted as a reliable method of preserving repository scholarship. The system supports techniques like:

a). **Emulation preservation technique**

This is the preservation strategy that requires the use of a single computer device or software program to imitate the behaviors of another program to yield similar results when using digital objects (Brown, Katuu, Sebina and Seles, 2009; Becker, Strodl, Neumayer, Rauber, Nicchiarelli and Kaiser, 2007). Softwares and hardwares used in the emulation practice are called emulators used to recreate the functionality of obsolete technical support on modern computer platforms (Brown, et al). Brown, et al asserts that the loss of data during emulation is distinctly possible because bits are replicated and not exactly as they were initially although however emulation allows access to the original record as though it were still housed in the original computer environment. The strategy provides integrity of the record that is better preserved as the original data without being altered and allows the original functionality, appearance and feel of the record to be recreated.

b). **Migration preservation technique.**

Brown, et.al (2009) defines migration as a process of translating data or digital objects from one computer format to another format in order to ensure users can access the data or digital objects using new or changed computing technologies.
With this preservation strategy, records are transferred from one generation of hardware or software to the next so that the intellectual content of the electronic record is preserved. Migration is a process that continuously need to be done as technologies change as a remedy to technological obsolesce. It is less adopted because it is costly to change on the pace at which technology change (Bankier and Gleason, 2014). Failure to respond to change may result in to loss of record’s original style and integrity in organisations and it may also result in to loss of information and if used must be carefully documented to avoid mistakes.

2.2 Management and preservation of audiovisual materials in libraries

Electronic materials are vital and delicate and the way they are handled can affect the life span of the records contained in them (Iyishu, Nkanu and Ogar, 2013). Electronic media must be preserved and conserved for future use. The concept preservation, in this report is used to refer to all necessary strategies, measures and steps invested into prolonging the lives of library information resources (Iyishu, Nkanu and Ogar, 2013; Okahashi, 2011). Preservation is used to denote all those activities and measures intended at conserving library materials for posterity. Iyishu, Nkanu and Ogar (2013) explained that preservation is an indirect method of treatment in which the environment around an item is changed. This includes stabilizing, maintaining and monitoring temperature, humidity, light exposure, air pollution, dirt, dust and mold. Preservation also includes surveying the proper storage and handling techniques, security, including theft, vandalism, disaster prevention, education, training and outreach programs for staff, patrons, clients, and the public, while conservation is a direct method of treatment in which an item is physically or chemically changed (Mnjama, 2010; Iyishu, Nkanu and Ogar, 2013; Okahashi, 2011). This includes cleaning, repairing, rebinding and reformatting. All conservation treatments entail the least intrusive methods possible and use of acid-neutral materials. National Archives holds private, as well as public photographic collections and videos and also serves as a depository for selected radio and television programmes (Mnjama et al., 2009).

2.2.1 Challenges facing the management and preservation of audiovisual materials

Inadequate collection acquisition policies. The collection and preservation of audiovisual materials must be supported by the law, clearly defined policies and procedures, well equipped building and storage facilities, a well trained team of audiovisual specialists and well educated and informed users on the value and importance of audio-visual materials (Mnjana, 2010).
**Inadequate storage facilities.** A major challenge facing the collection of audiovisual materials in the country pertains to storage (Mnjana, 2010; Abankwah, 2007). In virtually all the repositories visited by the author, it was established that audiovisual materials are kept under the same environmental conditions as traditional archives (Abankwah, 2007).

**Access to audiovisual materials.** A survey of retrieval tools at National archives and at the radio audiovisual materials indicates that many of these materials are partially processed or not processed at all (Mnjana, 2010; Werkers and Valcke, 2012). This is particularly true for photographs which tend to occupy large areas. In the absence of detailed descriptive catalogues, indexes and registers, access to these to these materials is hampered (Mnjana, 2010). Moreover, as many of these materials are machine dependent, the absence of playback equipment may hinder access to the information contained in these records.

**Lack of skilled man power in audiovisual materials** The nation also faces the challenge of lack of trained personnel in audiovisual archiving (Mnjana, 2010). While universities all around the world have well established programmes for the training of librarians, archivists and other information providers, the same can not be said of audio-visual archivists. The training of such professionals requires special facilities which are currently lacking in the country (Mnjana, 2010). Currently, many of the institutions holding audiovisual collections are headed by librarians seconded from the National library services (Mnjana, 2010).

**Lack of a national register on audiovisual materials.** One of the greatest challenges facing the collection and preservation of audiovisual materials is lack of sufficient information on what materials exist locally (Iyishu, Nkanu and Ogar, 2013). To date, no surveys have been carried out to establish the nature, volume and content of audiovisual materials and the conditions under which they are held. Neither is there a national register indicating the institutions currently holding audiovisual collections. Mnjama (2010) claimed that the need to compile such information in the form of a register can not be overstated. The information will not only assist in the formulation of collection policies, but will also be useful in the formulation of preservation strategies and establishing priorities on materials to be restored.

**Inadequate Funding.** Funding of archives and records management programmes has been very good and the government must be commended for its continued support to the national archives (Mnjama, 2010). The government has also been very supportive in the acquisition of audiovisual materials and equipment (Mnjana). However, financial support for training of audiovisual
archivists and the acquisition of specialist storage equipment for the storage of audiovisual materials have been limited (Werkers and Valcke, 2012). Many of the audiovisual centres visited lack a line budget for audiovisual resources.

**Technological Challenges.** Many audiovisual materials with the exception of photographs and maps are machine dependent (Mnjana, 2010). This presents challenges when users are not familiar with the use of the equipment. Apart from familiarity with technology, changes in recording and playback equipment very often results in inability to access information created in some models (Iyishu, Nkanu and Ogar, 2013). The need to constantly migrate information from one storage medium to another is major challenge to developing countries such as Uganda where resources are limited for the acquisition of each new version or model of equipment (Mnjana, 2010). In order to avoid audiovisual centres being converted into museums of outdated audiovisual equipment, it is suggested that each audiovisual centre restricts the brands of equipment it purchases (Iyishu, Nkanu and Ogar, 2013; Mnjana, 2010; Okahashi, 2011; Werkers and Valcke, 2012). The challenge posed by changing technologies and obsolete equipment is not unique to particular countries (Mnjana, 2010).

**Copyright Law and Infringements.** Copyright is a major concern for most audiovisual materials as they can easily be copied or the information migrated into newer formats and mediums (Mnjana, 2010; Okede and Owate, 2015). Moreover, more than one copyright may exist side by side for recordings (Iyishu, Nkanu and Ogar, 2013). Librarians and archivists managing audiovisual materials need to familiarise themselves with copyright requirements.

**2.3 System requirement specification for an institutional repository**

A requirement is a medium through which the system design is realized and vetted in practice. It is a feature that must be included in the new system (Miller, Mcguire and Feigh, 2017). Furthermore, McGuire and Feigh (2017) pointed out that only once features are established, can the system requirements be referenced and tested to verify and validate the representative design. System specification as analysis of data describing the system to determine how well it is performing, what requirements must be met and strategies for fulfilling them (Hughs, n.d). This is to define the functional and non-functional requirements which are base line for the design of the system. Requirements do not foster design solutions, rather they identify what the system must entail (Miller, McGuire and Feigh, 2017). The design hence provides sufficient detail that
the implementation team can carry on with the coding and testing without further information from the analyst (Hughes, n.d).

2.3.1 Functional requirements for an institutional repository
These are feature that new system must perform (Hull, Jackson and Dick, 2011). Basing on the definitions of an institutional repository and considering the current studies in the field of digital libraries and online databases, different scholars like Holse, Cheverie and Dygerts, (2007, p.161), Barwick (2007); Kim and Kim (2008); Mondoux and Shiri, (2009); Bankier and Gleason, ibid; point out that there are majorly six main functional requirements as long term storage and preservation, access, security support, intellectual property right management, interoperability capability metadata creation and knowledge management. These are the most important aspect for an institution repository to ensure efficient and effective use of an institution’s intellectual output (Bankier and Gleason, ibid; Jayakanth, Minj, Silva, and Jagirdar, 2008; Barwick, 2007). Content is characterized by abilities to permanent access provided through permanent uniform resource locators (URLs) and the repository supports and or maintain multiple versions of content since digital objects may be uniquely persistently modified and updated from time to time.

2.3.2 Non-functional requirements for an institutional repository
These describe the characteristics that a system should possess for its functionality of operations (Hull, Jackson and Dick, 2011). Such features may include control and security especially in the area in which the system must operate and security levels to be provided (Schmeling, B, et.al, 2012), efficiency and integrity shows the ability of the system to produce output with minimum wastage of the users’ time (Hull, Jackson and Dick, 2011; Schmeling, B, et.al, 2012), service delivery requirements to represent the needs of the end users of the system to be reliable, flexible and expandable (Hull, Jackson and Dick, ibid) and economic requirements are to do with the ability of the system to reduce costs or increase the profitability of the institution (Hull, Jackson and Dick, ibid). A system provides appropriate performance to be exhibited for its performance for example acceptable response time, information that is pertinent to the users in terms of content, timeliness, accuracies, and format including the necessary outputs and input to be stored as well as how current must the data be (Hull, Jackson and Dick, 2011; Schmeling, Charfi, Heinzl and Mezini, 2012; Jackson, 2011).
2.3.3 Software requirements for an institutional repository

Several studies (Kamila, 2009; Brown, Katuu, Sebina and Seles, 2009; Bishala and Bhandi, 2007; Bankier and Gleason, 2014; Magnus and Joki, 2007; Shoeb, 2010), discuss the various types of IR development softwares available such as DSpace (Dura Space), GSDL (Green Stone Digital Library), Eprint Archive, Fedora (an open source digital repository management (Fedora Itore), AGES Software, CDSware (the CERN Document Server Software), Dienst, First Search, ETD-db (Electronic Theses and Dissertations database) (Bevan, 2007), Digitool (Liu and Zhou, 2011) and LOCKSS (Lots of Copies Keep Stuff Safe). However, DSpace and Greenstone softwares are the mostly widely used repository building softwares because they can be customized easily and accept for storage a variety of data types such as videos, text, multimedia. Images and statistics (Bevan, 2007).

2.3.3.1 DSpace (Dura Space)

DSpace is an open source repository development software typically used for creating or publishing digital content (Mgonzo and Yonah, 2014; Barwick, 2007). The software was developed by MIT and HP labs, and made open source in 2002 (Bishala and Bhandi, 2007; Mgonzo and Yonah, 2014; Shoeb, 2010). DSpace is built in Java and server-side java technologies, including Java servlets, JSP, taglets, filters, Java bean activation framework, and Java mail. DSpace uses the PostgreSQL database as its default backend database to store user and system information and metadata records. It can also be customized to use other databases such as Oracle (DSpace System Documentation: Functional Overview, 2008). DSpace Manakin introduces a modular interface layer that organizes the contents of the particular IR to match the hierarchical structure of an academic institution with a consistent set of functionalities (Philips et al., 2007; Deng, 2011).

2.3.3.2 Eprints

Eprint is a free open source software providing for an open access (OA) institutional repositories (IRs) that are compliant with the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). Eprints was created in 2000 as a direct outcome of the 1999 “Santa Fe” meeting that launched what eventually became the OAI-PMH (Vishala and Bhandi, 2007). The Eprints software was enthusiastically received and became the first most widely used free open access IR
software, and has since inspired many emulations (Vishala and Bhandi, 2007) as a preservation strategy (Iyishu, Nkanu and Ogar, ibid).

2.3.3.3 GSDL (Green Stone Digital Library)

Greenstone is a suite of software which has the ability to serve digital library collections and build new collections (Kamila, 2009). Greenstone is produced by the New Zealand Digital Library Project at the University of Waikato, and distributed in cooperation with UNESCO and the Human Info NGO. It is an open source software, available from http://greenstone.org under the terms of the GNU General Public License. It provides a new way of organizing information and publishing it on the Internet or on CD-ROM. As GSDL installation is very easy and stores all types of data like PhD theses, faculty publications, lecture notes, student’s dissertations, learning objects, PG level & NET/ SET question papers, links to open knowledge objects, project reports, gray literature, unpublished theses, necessary photographs etc. successfully and enables the upload from every terminal with fantastic user interface.

2.3.3.4 Fedora (Flexible Extensible Digital Object Repository Architecture)

Fedora is developed by Cornell University Information Science in partnership with the University of Virginia Library (Vishala and Bhandi, 2007). This open source software is a Digital Asset Management (DAM) architecture, upon which many types of digital library systems might be built (Vishala and Bhandi, 2007). For an institution seeking a powerful well architected repository suitable for very large (over 1,00,000) plus collections, and that have the technical expertise to support it, Fedora is a possible solution.

2.3.4 Hardware requirements for an institutional repository

Hardware components are physical parts of an information system as distinguished from software components that executes or runs on the hardware. Feng and Liu (2013) and Shoeb (2010) assert that system hardware encompasses the client and server configurations where the client requirements for hardware are relatively low compared to the server requirements like the random-access memory, backup systems, central processing unit, operating and the network interface card. Therefore, it is important to use a computer with “64M primary memory and 4GB hard disk as clients for example central processing unit (CPU) and Pentium” (Feng and Liu, 2013; Shoeb, 2010). For an institutional repository to operate with efficiency and effectiveness, there must be a
combination of both hardware and software. However, hardware may include scanner, computers, higher processors, heavy disk space and mass memory.

2.4 Benefits of institutional repositories

Studies by (Jain et.al, n.d; Bentley and Oladiran, n.d; Bishala and Bhandi, 2007; Cullen and Chawner, 2010, p.142; Jain, 2011, pp.128-129 and Alfa network babel library, 2007) suggests that the benefits are grouped into numerous categories that is institutional and individual all as discussed below.

2.4.1 Institutional benefits

These include contributions of institution repositories to their host institutions and they are as discussed below.

Provision of feedback and commentary from users. Authors are able to receive and respond to commentary (Kim and Kim, 2008; Dorner and Revell, 2012). The study by Dorner and Revell (2012) further explains that clients mostly provide feedback about access to theses on the IR, client satisfaction reflected by the clients’ ability to access research in their subject areas from within their universities. Similarly, clients’ dissatisfaction emerges from the IR interface as a result of staff members who do not see an IR as a good idea (Dorner and Revell, 2012).

Increasing visibility and prestige (Jayakanth, Minj, Silva and Jagirdar, 2008) and as well as providing institutional works more exposure (Cullen and Chawner, 2010). A high-profile IR may be used to support marketing activities to attract high quality staff, students and funding to a particular institution hence increasing productivity and competence (Jain et.al, n.d). Therefore, an IR benefits to researchers and their institutions in terms of prestige, prizes and grant revenue.

Centralization and storage of all types of institutional output including unpublished literature to enhance management and access to a wide range of materials. Besides, many authors lack resources like funds so as to have their works published therefore the repository serve as a comprehensive publications database of the institute. Therefore, an IR facilitates better management of research knowledge generated by the Institute through achiving different researcher's works in one central place (Jayakanth, Minj, Silva and Jagirdar, 2008).

2.4.2 Individual benefits

These include contributions of institution repositories to their individual user community and they include the following.
Expansion of the range of knowledge that can be shared. Hulse, Cheverie and Dygert (2007) points out that all collaborative repositories offer their users with a wide range of items cross searched simultaneously which enables resource sharing across a network.

Maintains a researcher’s profile accompanied by added value services such as personalised publication lists and citation analyses (Bishala and Bhandi, 2007; Kamila, 2009 and Cullen and Chawner, 2010). This provides the researcher with an opportunity to enhance demand for his or her work all over. Kamila (2009) says that articles freely available on the Internet are cited more often than their paper counterparts.

Enabling of Intellectual property right to be exploited more effectively at institutional level (Bishala and Bhandi, 2007 and Jain, 2011). Kamila (2009) adds on that scholarly materials produced by universities are available in one place, reflecting the intellectual achievements of the institution, and serving as a valuable marketing tool.

Long term preservation assurance and well-organized content. For continued access, digital files need to be refreshed and migrated (Iyishu, Nkanu and Ogar, 2013; Kamila, 2009). Depositing file into an institutional repository means that the burden of ensuring the file can be opened is placed on the curator of the institutional repository and not on the author (Kamila, 2009; Jain, 2011). However, documents reflecting the institutional history of the university, both scholarly and non-scholarly, are preserved for future use, much like a traditional archive preserves paper material.

2.5 Challenges that hinder the building of institutional repositories

Various studies from different scholars like (Jain, 2011; Alfa network babel library, 2007; Bankier and Gleason, 2014; Vishala and Bhandi, 2007; Ezema, 2011) have pointed out obstacles and potential barriers to the establishment of functional IRs include the following below.

Higher cost involved. The initial financial cost for IR open source software opted for by most institutions may not be high since most softwares required like greenstone, DSpace and eprint (Jain, 2011) are provided as open source softwares. But the ongoing maintenance costs incurred from initial stages may prohibit IR developments (Xia, 2009).

Difficulties in generating content. This is because often academics are unwilling or lazy to deposit their research work. It was due to growing frustration with researcher’s passivity that ePrints had to advocate for the introduction of self-archiving mandates (Xia, 2009). Experiences
suggest that an IR only function to its optimal capacity when a mandate is in place to populate it. Most faculties do not respond to the invitation to add stuff to the IR (Bankier and Perciali, 2008; Harnad, 2009). Usually it is due to lack of institutional policies and mandatory requirements, in addition to the lack of motivation and low priority for faculty members and researchers (Chan, 2009) that cause the low deposit rates. Gardner (2008) points out that major research universities may be ahead of the curve although for many other IRs remain empty.

Problems in gaining sustainable support and commitment. Studies by (Jain, 2011; Xia, 2009 and Harnad, 2009) claims that it is difficult to sustain continuous support and commitment from the management and academic staff in most cases. Jain (2011) explains that stewardship is easy and inexpensive to claim, expensive, difficult to honor and prove to be all too easy to later abdicate.

Copyright management issues. Researchers and scholars infringe on publisher’s copyright and lack adequate awareness about their own intellectual property rights (Bankier and Perciali, 2008). Therefore, publishers look at IRs as potential obstacles and threats to their business. Since scholarly publication through an IR is a paradigm shift from traditional publishing hence management of intellectual property issues must also evolve.

Working culture and policy issues. Contributing content through user-generated or self-archiving sites can be looked at as time consuming by hard pressed academicians. It may take time, constant encouragement and mandated policies for routine self-archiving to become part of normal academic behavior (Cullen and Chawner, 2010).

Lack of incentives. With Inefficiency of the financial incentive, academics easily become demotivated to provide even bibliographic details of their academic work especially when they see incentives are available at other institutions. Bankier and Perciali (2008) and Davis and Connolly (2007) argues that the university’s core mission is to advance research and scholarship and secondarily to archive content and to make it accessible publicly. Faculty behavior and incentives are aligned with the core mission rather than the secondary one. There incentives should be provided so as to overcome the menace (Bankier and Perciali, 2008; Davis and Connolly, 2007).

Lack of respectability. Literature also notes that by publishing in IRs, it is sometimes difficult to achieve the type of recognition that the material merits (Davis and Connolly, 2007; Royster, 2008). This, however, requires reassurance and clarification regarding the term publishing. In an
E-print repository, for example, the intention is clearly to make research findings available as a supplement to a journal article appearing in a peer reviewed quality publication (Vishala and Bhandi, 2007).

**Time consuming and labour intensive.** Organizational development of IRs takes a long duration, a lot of man power planning and requires long term sustained efforts (Jain, 2011). This therefore, limits the success of an independent IR (Robinson, 2009; Jain, 2011 and Chan, 2009).

**IR benefits are not marketed and appreciated.** This is because all academic institutions and academic staff all over the world (Chan, 2009).

**Technical challenge.** These involved in the establishment of an IR are associated with trends in the information and technology infrastructure (Bankier and Perciali, 2008; Jain, 2011; Vishala and Bhandi, 2007 and Royster, 2008). Issues may range from adapting open source systems and compatibility of software to formatting documents in an appropriate long-term format as well as provision of adequate training to authors and other stakeholders (Royster, 2008).
CHAPTER THREE

METHODOLOGY

3.0 Introduction
This section comprises of the project design, area of study, project approach, sampling strategies, data collection methods and techniques, data quality control, data analysis and presentation, system architectural design, data model diagram, system implementation, testing and validation, ethical issues and limitations of the proposed system.

3.1 Project design
This is a plan that guides a study and comprises “the intersection of philosophy, strategies of inquiry like methodology, approach, ethical considerations and research methods and specific methods” (Creswell, 2009, p.5; Ngulube, 2015). It articulates what data is required, what methods were used to collect and analyze this data and how all of these answer your research question (van Wyk & Stellenbosch University, 2016) and fulfill the objectives of the study.
Bryman & Bell (2007) stressed that the design should provide the overall structure and orientation of an investigation as well as a framework within which data can be collected and analysed.
For this particular project therefore, a case study design was adopted. According to Yin (2014), a case study design refers to a plan that involves an up-close, indepth and detailed examination of the phenomenon. It provided the researcher with a clear snapshot of case under study since it involved the direct observation aspect, implementation and testing. The case study design encompasses in depth investigation of the case under study (Gravetter and Forzano, 2009; Babbie, 2007; Berg and Lune, 2012). The design therefore, describes a unit in detail, in context and holistically (Otando, 2011) by confining to IR creation for UMI.

3.2 Area of study
The study was carried out at Uganda Management Institute library located on plots 44/52 on Kampala-Jinja road about one and a half miles from the city center.

3.3 Project approach
The study used a qualitative project approach. This refers to an approach that mostly involves non-numeric data, such as interviews and observations but is coded using techniques like content
analysis (Bhattacherjee, 2012). According to Creswell (2009) qualitative approaches applies to situations where data collection, analysis, interpretation, and report writing differ from the traditional quantitative approaches. The data collected under this approach was then generalized to a larger group. It was chosen because it provides insights into the setting of a problem, generating ideas and/or hypotheses (MacDonald & Headlam, n.d). The approach attempts to gain an understanding of the underlying reasons and motivations for actions and establish how people interpret their experiences and the world around them (MacDonald and Headlam, ibid). This approach therefore, provided data to the study that was recorded, analysed so as to attempt a deeper meaning and significance of the study.

3.4 Sampling strategy

Bordens and Abbot (2008, p.158) defines a sample as a “small subgroup chosen from the larger population”. The study employed a purposive sampling strategy in which individuals that are knowledgeable about the problem were selected to take part in the study. According to Teddle and Yu (2007, p.80) purposive sampling refers to “a nonprobability or purposeful or qualitative sampling”. Studies by (Palys, 2008; Bucic, Robinson and Ramburuth, 2010; Yin, 2014; Palinkas, Horwitz, Green, Wisdom, Duan and Hoagwood, 2013) pointed out that the strategy emphasize generalization in which knowledge gained is a representative of the general population from which a sample was drawn. The purpose of purposive sampling is to get cases that could provide rich and in-depth information that would answer the research questions posed (Sarantakos, 2013). According to Plano Clark and Creswell (2008), when a researcher has specific interests in a particular subject and feels that a particular population answers the questions well then purposive sampling is used. Therefore, in this study “knowledge and expertise” were considered instrumental in the study for the sample (Sarantakos, 2013, p.178).

The researcher used a simple random sampling (SRS) method to come up with a sample for the study. Creswell (2009) describe SRS as a method in which every individual is given equal chance of being involved ensuring that the sample is a representative of the total population. The method entails determining the number of individuals to be interviewed through random selection (Gentles, Charles, Ploeg and McKibbon, 2015). The researcher used SRS by arbitrary selecting individuals giving equal chance to members for inclusion in the study. Individuals were selected basing on personal whim rather than any reason and therefore this enabled the
researcher to obtain the sample size. According to Hague (2008), a sample size is the number of respondents, units or objects selected to represent the population based on some rules or plan. Therefore, based on the strategy and method above, the sample size was obtained. The researcher ensured that the study comprise top library management (4 librarians), lower management (9 library assistants), ICT managers in the library (2) and 5 library patrons hence giving a sample size of 20 respondents for the study.

3.5 Data collection methods and techniques
Data collection methods refer to various ways employed by researchers to find facts in the field regarding a particular study. The techniques are modes or ways or tools employed while gathering data from respondents in the field. They give a description of the methods of interviews and document review and their associated tools like the interview guide (Katebire, 2007).

3.5.1 Interviews
An interview is a conversation whose purpose is to gather description of the interviewee in connection with the research questions set (Berg, 2007). It is conducted with a sole aim of obtaining information (Katebire, 2007). The study adopted a person interview were the researcher had a face to face dialogue with specific respondents. This led to gathering of first-hand information.

The interview guide composed of open ended questions that meet to probe so as to get in-depth answers. Interview was used because it is a technique that allows one to dig deeper into the phenomenon being investigated (Kothari, 2009). Interviews are known to clarify meanings and purposes of questions that are not so clear or are hard to answer (Berg, 2007). Denzin and Lincoln (2008) and Berg (2007) assert that interviews bring out qualities, meanings that cannot be illuminated by questionnaires. The essence of an interview is to bring out the perceptions and feelings of interviewees (Berg and Lune, 2012; Neuman, 2011). This was ameliorated by the researcher because it strictly followed the interview guide that was be designed. The interviewer clarified questions that appeared to be hard for respondents in order to get good responses. The nature of interviews is such that interviewer prompts the interviewee to even say what they would have normally covered up (Dornyei, 2007). It is very important when sticky information is being sought. Unlike questionnaires where it might be impossible to make clarification,
interviews allow a researcher to make clarification and therefore be able get more trustworthy information. The fact that interview can be recorded, this gives the researcher a chance to capture the exact words when transcribing interviews (Berg, 2007) and also considered economical (Neuman, 2007). The study aimed at interviewing 20 respondents as per the sample size. Only 17 were interviewed through a direct face to face sets of dialogues. However, 2 (10%) library assistants were on leave out of the 15 members from the library team and 4 (20%) library users giving a response rate of 85%. During interviewing, 1 library staff and 2 ICT managers were asked to sketch how the system home dialogue interface would look like or be designed. They prepared the interface design on paper as shown in section 4.2.5 through the participatory mapping technique.

3.5.2 Document reviews

The use of institutional documents as part of qualitative information gathering was important because they gave insight into the thinking within UMI. These included the library handbook, library reports and documents on the origins of UMI which are in the UMI archive. Creswell (2009) suggests that this is an unobtrusive source of information, represents data that participants have given attention to compiling. Yin (2014) points out that the most important use of documents is to corroborate and augment evidence from other sources. Library database usage survey was also a part of the process of getting insight into information retrieval habits of the UMI community.

3.6 Data quality control

According to Walliman (2011), data quality control is essential to ensure the integrity of results obtained from any quality improved project. Feasible methods are available to ensure that stake holder’s decisions are based on accurate data. Such methods include randomization, triangulation, piloting and pretesting. The quality of findings the researcher reports greatly depends on the accuracy, reliability and validity of the instruments. In an attempt to ensure quality findings, various methods were employed such as log book maintenance, randomization (It involves selecting subjects or participants in order to select a sample of the population hence in circumstances where there are different conditions, then the subjects are randomly assigned to the different conditions) and maximum supervision of the study which ensured that all extraneous variables to the study were under control. and pre-test which fostered the re use of
similar methods and instruments to obtain the same data among others. The collected data were checked for quality by comparing data obtained in the different fact-finding tools for reliability and validity before final presentation in order to ensure data quality and internal validity of the study.

3.7 Data analysis and data presentation

Data analysis can be powered either by the positivism or constructivism paradigms (Ngulube, 2015, p.2). Positivism is a philosophical theory in which data are based on natural phenomena, their properties and how they relate whereas constructivism describes theories of how knowledge is obtained (Ngulube, 2015). Positivism was adopted since it allows information derived from sensory experience, interpreted through reason and logic which forms the exclusive source of knowledge. Therefore, since qualitative data was collected, it was analysed, interpreted and presented in a manner that best suits the study. Sarantakos (2013) pointed out that qualitative data analysis requires subjective interpretation and reflexive view of reality based on respondents’ perceptions. However, qualitative data analysis answers the “what” and “how” research questions (Chireshe, 2014). DeCoster and Lichtenstein (2007) asserts that qualitative research is very important because the respondent is directly given chance to state their perceptions concerning the area under study. However, the study by DeCoster and Lichtenstein (2007) also suggests that for qualitative analysis to be done thoroughly well the researcher needs to have a good understanding of the participant and must also have the ability to collect and interpret data relevant to the study. Therefore, this was done through describing the respondents’ experiences by gaining insight, explore depth and richness about the phenomenon based on inductive reasoning, basic knowledge, individual interpretation, uniqueness and a systematic subjective and holistic approach.

Qualitative data were sorted based on respondents’ positions and experience, evaluated and tabulated using the content analysis to obtain reliable and relevant data. This allowed large quantities of data to be analysed in order to make generalizations. Therefore, data were presented in form of graphs, tables and pie-charts. The data were then examined to determine how well the system performs and if it meets the user demands hence stating requirements which form the basis for system design.


3.8. System design
This is the process of creating a design for the database that supports the enterprise of the operations and objectives (Mitev, 2009).

3.8.1 Systems architectural design
This is a solution or translation of requirements into ways of meeting them. It basically involves the logical design and the physical design (Ramrattan and Patel, 2010; Ting, Tsang and Tse, 2013). The IR architecture design shows the major layers of the DSpace repository as below.

![Figure 1](image-url) Showing the repository architecture layers of operation (adopted from Koutsomitropoulos, et al, ibid).

DSpace repository architecture follows a set of layer modal which involves the insertion layer, repository management (storage layer) and the consumption (presentation) layer (Gao and krogstic, 2010; Koutsomitropoulos, et al, ibid).

The storage layer comprises of the relational datadase for storing metadata and a bitstream storage modal for storing content (Mgonzo and Yonah, 2014). The repository management layer has modules that perform the business tasks of the system.

The presentation layer that provides for the consumption and access policies through the web user interface on the DSpace platform (Bankier and Gleason, 2014 and Koutsomitropoulos, et al. ibid). In the insertion layer, entities or material items to be preserved are provided in an
electronic format which ensures that the item is error free, accessible and acceptable by the repository (Koutsomitropoulos, et al. ibid; Mgonzo and Yonah, ibid).

However, specifying of logical design elements detailed the design specification of an IR that describes the features of a system such as output, input, files and databases and procedures. For this particular study, DFDs were used in designing an IR because they are common tools like data stores, data flow, processes and entities for structuring information (Valacich, George and Hoffer, 2012). Data flow diagrams are one of the main methods for analyzing data oriented systems because they emphasize the logic underlying the system (Mgonzo and Yonah 2014). They were used to show how data flows in the system and how such information is processed. It also showed the various stakeholders/entities involved in the processes and what they do and also helped the researcher to understand the boundary between the existing system and the postulated system. They generally illustrate how data is processed by a system in terms of inputs and outputs and are used to create an overview of the system as well as visualization of data processing (Mgonzo and Yonah 2014).

According to Mgonzo and Yonah (2014) processes represent either a whole system, a sub-system, or work being done, external entities represent people or organizations outside the entire system or sub-system, and usually show the initial source and final recipient of data and information, data stores represent data stores such as computer files or database transaction files, set of tables or manual files or records and data flows shows data movement through the system.

**3.8.2 Data model diagram**

A data model diagram refers to a structured description of a set of data and its relationships which represent the activities of an organization (Fowler, 2015). However, the way data is organized in DSpace is intended to reflect the structure of the organization using the DSpace system. Each repository site is divided into communities which can be further divided into sub-communities reflecting the typical university structure of college, department, research center, or laboratory as shown in the figure below.
Communities contain collections which are groupings of related content. A collection may appear in more than one community. Each collection is composed of items which are the basic archival elements of the archive. Each item is owned items by one collection. Additionally, an item may appear in additional collections however every item has one and only one owning collection. Items are further subdivided into named bundles of bit streams for storage. Bit streams that are somehow closely related, for example HTML files and images that compose a single HTML document, are organized into bundles (DSpace manual, 2017).

### 3.9 Implementation of an institutional repository

According to Mgonzo and Yonah (2014) system implementation is referred to as a process of assuring that the designed system is built and made operational. Real implementation of a system can precede a functional system prototype model which is tested to ensure that the proposed system meets the system requirements and objectives (Mitev, 2009; Ting, Tsang and Tse, 2013; Gal and Berente, 2008).
The IR implementation was done using a combination of softwares to provide a broad data ware house platform with inbuilt extract, transform and loading (ETL) tools. Such softwares are open source softwares that can easily be customized (Mgonzo and Yonah, 2014; Capaldo and Rippa, 2009). The researcher installed DSpace software integrated with prerequisite software like apache maven, PostgreSQL, java and apache tomcat to build an institutional repository for UMI. Therefore, during the implementation, the user organisation was key (major) agent in changing and modifying the proposed system. Global statistics on OpenDoar show that DSpace is the most commonly used open source software for institutional and open access online databases (Mgonzo and Yonah, 2014). High use of the software has been seen in college libraries, universities and research institutions as a mechanism of providing access to their scholarly publications and intellectual outputs (Mgonzo and Yonah, 2014). Usage statistics show that out of the 3345 repositories worldwide 1471 (44.1%) are using DSpace software (OpenDoar, 2017). DSpace software in the building of the repository, the choice can also be based on the suitability of the stable repository system (Lewis, Heales, Rice, Rome and McNair, 2012). Besides, DSpace has the largest community of users and developers worldwide, free open source software, completely customizable to fit the needs of its user community. It is used by educational, government, private and commercial institutions and can be installed out of the box and can manage and preserve all types of digital content (http://www.dspace.org/why-use). Mgonzo and Yonah (2014) and Bankier and Gleason (2014) argues that DSpace supports metadata generation by default and is oriented towards open standards and protocols therefore fully supports the Open Archive Initiative for metadata harvesting (OAI-PMH) (Yu, 2008).

DSpace organises content at a high level into communities and at institutional level, community would be laboratories, departments, courses, schools or research centers (Mgonzo and Yonah, 2014). Such communities in turn have collections that contain logically related items, content groups and metadata which users access as scholarly outputs (Vishala and Bhandi, 2007). Institutional repositories (IRs) evolved into library’s platforms to publish and showcase items including theses and dissertations, journals, books, technical reports, conference proceedings, research articles and minutes of meetings with datasets described by the reports (Vishala and Bhandi, 2007).
3.10 System testing and validation
Testing is the process of executing a program with the explicit intention of finding errors that may make the system fail whereas Validation refers to the process of using software in a live environment in order to find errors (Jan, Ullah, Shah, Johar, Shah and Khan, 2016). Testing and validation are intended to find errors in the new system and they are performed by executing a program in a simultaneous environment (Ting, Tsang and Tse, 2013). Software or hardware testing are test strategies done on a complete, integrated system to evaluate its compliance with its specified requirements (Sewart, Bari and Chawan, 2012; Saygin, Sarangapani and Grasman, 2007). System testing was carried out by uploading various files in the prototype for reliability therefore all environmental factors were considered and tested. Testing helped to assess the availability performance of the system therefore it is important that effective and reliable testing be conducted so as to expose potential problems in the new process.

Post interviews were carried out to rate the applicability, understandability, suitability, usability and interactivity of the repository. A few users received basic training on the developed IR which enabled them contribute effectively to the testing and validation exercise.

User validation of the repository was carried out to ensure that the developed IR delivers the results as expected. The users were asked for feedback on problems and omissions in the designed online repository.

3.11 Ethical considerations
Given that research was carried out in a social setting, it was crucial that ethical considerations are honored. Driscoll and Brizee (2012) suggests that when conducting research in an academic setting, it is important to be aware of the ethics behind one’s research activities. According to Connelly (2014) research ethical considerations may include participant consent, open and honest reporting and confidentiality of information provided and engagement of qualified research assistants.

**Provision of informed consent.** The researcher ensured agreement was reached with respondents. This implied that personal information (information about an identifiable, natural person) may only be collected and processed with the specific informed consent of the individual(s) involved. Only information that is relevant and necessary (not excessive) was be collected. The participation of individuals was based on their freely given, specific and informed
consent. The researcher respected their right to refuse to participate in research and to change their decision or withdraw their informed consent given earlier, at any stage of the research without giving any reason and without any penalty.

**Privacy, anonymity and confidentiality.** The researcher treated any information contained or obtained from the respondents as exclusive to the study and did not disclose the respondents’ identity by not indicating their names and positions regarding their individual contribution. The researcher tried to be unbiased and expressed opinions in the findings as they are given since the information collected was strictly for academic purposes. Privacy included autonomy over personal information, anonymity and confidentiality, especially in cases at dealt with stigmatizing, sensitive or potentially damaging issues or information. When deciding on what information was to be regarded as private and confidential, the perspective of the participant(s) on the matter was respected. All personal information and records provided by participants should remain confidential. When conducting interviews, it was made clear that confidentiality and anonymity will be safeguarded. Whenever it is methodologically feasible, participants were allowed to respond anonymously or under a pseudonym to protect their privacy. All personal information obtained directly or indirectly on or about the participants like names obtained by researchers from institution as well as information obtained in the course of research that revealed the identity of participants remained confidential and anonymous.

### 3.12 Limitation of the study

a) Software installation limited the study in a way that they take long to install in addition to the complex nature of its installation. DSpace software installation takes nearly a day as per its installer’s manual on a fully connected computer network. This limited the project especially in terms of time in which it was programmed for which led to adjustments in the time scope.

b) Software customization limited the study in such a way that the researcher had little knowledge about customizing open source software therefore it took the reporter quite some time to learn the programming languages that were used in the development of the software.

c) Time constraints limited the number of research student interviews that could take place, and indirectly, the type of analysis which could then be performed. Ideally, many more
students would have been interviewed. A larger representative sample would have enabled further qualitative analysis (including valid tests for significance) and a more useful comparison of the UMI departments. At the detailed level, the interview schedule worked well and appeared to be enjoyed by many of the respondents. This was fortunate, because it frequently exceeded the planned interview time. If the study were repeated, it might be more useful to reduce the interview like change these into closed questions.

d) Evaluation of conflicting ideas from different respondents. The researcher therefore compared the ideas from various respondents to find data that best suit the study.

e) Deliberate denial to respond to some questions during data collection by respondents. The researcher generalized from the data provided by respondents who would managed to deliver the required responses.
CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS OF FINDINGS

4.0 Introduction
This chapter comprises of the examination of the existing system, requirement specification and analysis and content to be housed in the proposed institutional repository.

4.1 Response rate and participant composition
Respondents from library staff team constituted 75% (15) while 25% (5) were from library users at UMI as illustrated in the figure below.

![Pie chart showing percentage composition of respondents in the project study](image)

Figure 3 Showing percentage composition of respondents in the study.

The study aimed at interviewing 20 respondents as per the sample size. Only 19 were interviewed as 1 (5%) library assistants were on leave out of 15 members from the library team and 5 (25%) library users giving a response rate of 95%. Respondents from among the library team were asked whether IR had been included in their library collection development policy, 12 (80%) responded (Yes), while only 3 (20%) responded (No) claiming not to have seen a policy regarding IR establishment in the library policy and this is illustrated in the diagram below.
This was an indication that, the majority were definitely aware and represent a significant interest in the establishment of an IR in future prior to the library policy at Uganda Management Institutions.

**4.1.1 Existing system**

Uganda Management Institute does not have an established system in place to provide for storage, access and preservation of its digital information. Optical devices are used as storage media for such relevant data contained on such devices. However, these are stored in Compact disk packs and others are boxed hence stored in the various corners of the library whereas those that are current are kept in the cabinet without any organization with in them. They rub onto each other causing scratches that lead to deterioration hence making information inaccessible.

**4.1.2 Challenges faced in the management of audiovisual materials**

**Inadequate storage facilities.** Uganda Management Institute has limited space in the library. Therefore, there is no provision for the safe custody of digital media items. Mnjana (2010) agrees with this considering it as a major challenge pertaining the storage of audiovisual materials in the country.

**Inadequate Funding.** Funding of Uganda Management Institute library programmes has been relatively low to cater for the management of audiovisual materials. UMI lacks a line budget for audiovisual resources. Werkers and Valcke (2012) pointed out an increase in financial support
for training of audiovisual archivists and the acquisition of specialist storage equipment for the storage of audiovisual materials would enable libraries to organize special training to their staff members so as to equip them with the necessary skills required for the proper management of audiovisual materials.

**Technological challenges.** Uganda Management Institute hold many audiovisual materials like floppy discs, DVDs, CDs and video tapes containing vital information in its collection. This presents challenges when users are not familiar with the use of the equipment. Besides, Mnjana (2010) points out that digital media are machine dependent and they are faced with changes in technology obsolescence which results into inability to access information contained on digital items.

**Lack of skilled man power in audiovisual materials.** Uganda Management Institute also faces the challenge of lack of trained personnel in audiovisual archiving. Although library staffs are trained librarians and archivists for information items, they are not professionals in audiovisual archiving which requires special skills and training. Mnjana (2010) agrees with this by emphasizing that training of such professionals requires special facilities which are currently lacking in the developing countries.

**Lack of a clear policy on audiovisual materials.** Uganda Management Institute library has no policy regarding digital media collections. This could be the reason for the mismanagement of audiovisuals in the library since they are not catered fore for their preservation and storage in the library. Library staffs stack such items in cabinets when still active but once proceeded to the semi active and inactive stages, care is driven off hence deterioration leading to loss of the valuable information contained onto these media.

**4.1.3 Open Access Policy (OA) and IR development**

Currently, the institution has no IR in place although the policy regarding Open Access exists. However, it is encouraging that sensitisation seminars have been organized in UMI with funding from the University of Pretoria, South Africa in regard to OA/IRs. Uganda Management Institute library has a policy regarding open access to its intellectual output but it has not been affected due to delayed establishment of an IR. Currently, UMI library users visit the library physically so as to access materials generated by the different communities with in the institution. Optical devices are boxed and kept in various corners of the library and in cabinets.
4.1.4 Challenges that hindered the establishment of an IR at Uganda Management Institute.

Uganda Management Institute just like any other higher education institutions in Uganda is still struggling with challenges associated with mismanagement of audiovisual materials in the library. In response to reasons for the delayed establishment of an IR yet there’s a policy regarding open access, several factors where advanced as discussed below;

**Inadequate funding to the library** (Inadequate library budget). The library does not have enough resources to support its technical activities and research programs. UMI library is underfunded hence hindering the establishment of an IR. The problem was attributed to little appreciation of the role of the library by the administration and other political leaders.

**Inadequate skills and Lack of guidance.** Uganda Management Institute has a well-established resource center for its user community. This provides an ICT infrastructure for the users although they do not make use of the facility due to limited ICT skills. Besides Institutional repositories use modern technology yet patrons and staff possess incompetent IT skills. Some scholars like Musoke (2008) and Rehman (2008) attributed the problem of library staff’s inadequate skills to library schools that pass out graduates who are inadequately skilled.

**Intellectual property and copyright issues** regarding Uganda Management Institute research output. Fear and the need to protect copyright over the institutional scholarly work has been a great hinderance towards the establishment of an IR. Besides an IR provides for a free and open access to scholarly materials over a network which means that the system provides access to remote users.

**Lack of awareness by institutional management board** (Inadequate management support). Although the policy regarding open access repository exists, there was lack of advocacy to sensitize administrators, financers and policy makers at UMI about the need of an IR. Respondents attributed the blame on the library board for not doing enough toward the advocacy campaign and concluded that an IR initiative in the institution as a role of the library.

However, solution to the challenges associated with the existing system an UMI were advocating for the development of an online storage facility that would support for a safe storage custody, enhance preservation and accessibility of UMI’s scholarly materials.
4.2 System requirement specifications and analysis

This encompassed identifying and analyzing the necessary requirement that the new proposed system must possess. It included planning which features the system must adopt so as to meet the needs its intended user community. These requirements are divided into four major aspects like the functional, non-functional, hardware and software requirements.

4.2.1 Functional requirements for an IR

The developed IR to be functional, it must support the following modules for its effective and efficient operations and such policies fosters the implementing team to design a system that supports the needs of its user community.

Submission platform. Uganda Management Institute research community is required to submit their research reports accompanied by an audiovisual material like compact disks to back up their hard copy works (theses and dissertation). With the creation of an IR, it is evident that softcopies will be submitted through the system to replace the highly fragile compact discs. Participants advocated for the need for self-archiving of materials by authors and items metadata may be captured during the submission process. Cullen and Chawner (2010) supports the idea in a study that suggested for the practice of self-archiving to become part of normal academic behavior. The practice is attempted to reduce the burden from the library staffs in form of work overload especially during the processing stage of the materials before making them available for use.

What to archive. Uganda Management Institute has to determine the kind of items to be archived in the system. In this case, it enables the system designers to develop a well-established design for the analysts and the implementation team to produce a system that meets its user’s requirements. Choice over content to be housed and who is responsible for the activity leads to easy management of items housed in the system which is in line with the study by Mondoux and Shiri (2009) which considers IRs as content management platforms on the web.

Content storage and format support. Uganda Management Institute holds both portable document files (PDFs) and word-processed files onto the audiovisual materials for their graduate students’ dissertation back up. This is in line with the study by Vishala and Bhandi (2007) which points out that IRs provide for the storage of various items in multiple formats.
Metadata creation. Uganda management institute captures data describing the various items in different databases. It is in these databases that item details like the subject, title, author, year, call numbers are managed and accessed for future usage. Park and Richard (2011) agrees with the idea by admitting that it is important that item details are captured as provision by the system. Furthermore, the study by Koutsomitropoulos, et al, ibid also suggests that metadata generation can be essential especially in the long run especially with data retrieval and interoperability.

Open access support. Scholarly materials at UMI are in a closed access facility which greatly limit their usage and access. Although the policy regarding open access exists in the library policy, intellectual output especially scholarly works are still accessible to a few. However, the development of an IR at UMI can facilitate an open and free access services since item will be provided freely over a network without necessarily physically visiting the library. This enhances visibility and usability of research outputs (Bonilla-Calero, 2013). In support of open access, Krevit & Crays (2007) pointed out that in an attempt increase open access to institutional work, the institutions add value to their collections so as to make it more attractive to researchers before having it available online. This ensures quality of materials in an attempt for the institutional digital content to compete favorably onto the digital world.

Authorization. This entails who should do what to the system. Uganda management institute has various groups of people like the students, researchers, lectures, library staffs and administrators that may use the system. This is based on associating actions with objects and the lists of e-people who can perform them. The associations are referred to as resource policies and the lists of epeople are called groups. This helps to specify responsibilities among the different entities of the system. DSpace manual (2017) in support of authorization provides two built-in groups that is administrators (who can do anything in a site) and anonymous (which is a list that contains all users).

Preservation function. Audiovisual materials provided as backups for UMI master’s student’s theses hardcopies are boxed and stored in CD ranks. The boxes used are not recommended for the storage of audiovisual items since they acidic which increases deterioration. Besides, they are stacked into corners of the library where they are prone to deterioration factors like dust, cracking hence causing loss of information contained on to these materials. The development of an IR will increase the longevity of digital items through the adoption of the various preservation
strategies like migration, replication and emulation as pointed out by Iyishu, Nkanu and Ogar (2013). An IR provides support for all the aforementioned strategies as materials can easily be downloaded and copied onto another medium of any one’s choice (Bankier and Gleason, 2014). This is in conjunction with scholars like (Iyishu, Nkanu and Ogar, 2013; brown, et al; Mgonzo and yonah, 2014 and Vishala and Bhandi, 2007) who all agree with the idea that an IR provides support for long term preservation of materials.

Interoperability support. Resource sharing at UMI is done manually where paper based items are distributed to the various users of the library. This evident in the provision of selective dissemination of information. However, interoperability entails the ability to share items among various computers regardless of their localities. Studies by Mondoux and Shiri (2009) and Koutsomitropoulos, et al (ibid) agrees with the idea of resource sharing by arguing that interoperability capabilities enhance exposure of the institutions research outputs through an IR services as on web based.

Intellectual property support. Uganda Management Institute generates a lot of grey literature especially from its research community. The authors of this literature together with the institute at large claim ownership and right over scholarly outputs. Respondents claimed that there should at least be a way the proposed system can protect their works against all kinds of infringements. This is because of the fear that having such intellectual works provided freely accessible online might seem to breach the copyright over their works. However, it is important to protect ownership of original content (Barwick, 2007). This is in line with the idea labelling items with owner’s logo as appropriate for all repository documents as suggested by Koutsomitropoulos, et al (ibid) with an intent of protecting the intellectual property of an individual institution.

A good interface designs. As a requirement to appease, satisfy and attract the users to use the system, Uganda Management institute community urge for an attractive and user-friendly interface. Studies like (Deng, 2011; Philips et al., 2007 and Bankier and Gleason, 2014) agrees with the idea when they suggested that an unattractive interface prohibits users from visiting the system which decreases the usability of resources provided online. However, based on such dimensions 3 respondents were asked to sketch or illustrate how they would expect the interface to look like during the interviews. This act of collecting data is referred to as participatory mapping. The results were as shown in section below.
Figure 5 Showing the different proposed graphical user interface designs features for an IR (Source: Field data, 2017)

The figure above shows the user interface design sketches illustrating features like login and search support, lists of collection and communities that would be included in the proposed IR which were produced during the technique of participatory mapping. It was upon these sketched data that some features were extracted to produce the system user interface as shown in section 5.2.2 below.

4.2.2 Non-functional requirements for an IR

These present features or characteristics the new proposed system must support. Hull, Jackson and Dick (2011) points out the need for features that the system must possess among which are discussed in the table below.

<table>
<thead>
<tr>
<th>SYSTEM REQUIREMENT</th>
<th>REQUIREMENT ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency and effectiveness</td>
<td>These accounts for the system’s ability to produce outputs with minimal waste.</td>
</tr>
<tr>
<td></td>
<td>They involve how duplicate steps in the process can be eliminated.</td>
</tr>
<tr>
<td></td>
<td>It exhibits the system in terms of acceptable response time.</td>
</tr>
<tr>
<td>Service</td>
<td>Service requirements represent needs in order for the system to be reliable, flexible and</td>
</tr>
</tbody>
</table>
expandable for instance, determining the use of the system and its location, documentation required and training materials that should be provided to accompany the new system.

**Information**

Information that is pertinent to the users in terms of content, timeliness, accuracy & format for instance, what are the necessary inputs and outputs? What data is required to be stored? How current must the data be?

**Control & Security**

Represent the environment in which the system must operate as well as the security levels to be provided for instance, must access to the system be controlled?

**Cost effective**

This calls for the new system to have the ability of the system to reduce costs or increase profits. This can be obtained inform of working in line with the budgetary limits as well as the timetable for IR development.

<table>
<thead>
<tr>
<th>TOOLS</th>
<th>REQUIREMENT JUSTIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSpace 6.X</td>
<td>Supports all the core modules and characteristics of an institutional repository.</td>
</tr>
<tr>
<td></td>
<td>It is customizable.</td>
</tr>
</tbody>
</table>

**Table 1** Showing non-functional requirements for an institutional repository

(Source: Field data, 2017)

**4.2.3 Software requirements for an IR development.**

It is appropriate for the institution to use DSpace software. This is because the software is open source and supports a distributed approach to an institutional digital repository (Pienaar and Van Deventer, 2008).
Java8

Open JDK download and installation instructions can easily freely be downloaded from http://openjdk.java.net/install/ and operating systems provide an easy path to install OpenJDK.

UNIX-like OS or Microsoft Windows

Many distributions of Linux/Unix come with some of the dependencies below pre-installed or easily installed via updates.

Microsoft Windows: After verifying all prerequisites, it shows the section for windows installation and windows tailored instructions. This was of an added advantage towards the system installation because UMI library computers run on windows operating system.

Apache Maven 3.0.5

Maven is necessary in the first stage of the build process to assemble the installation package of DSpace software. It gives flexibility to customize DSpace using the existing maven projects found in the dspace directory.

Apache Ant 1.8

Apache Ant is the second stage of the build process (deploying/installing the application) after maven is used to construct the installer.

PostgreSQL 9.4

It’s a powerful, open source object relational database system. It is used for the creation and storing of the database for the repository.

Apache Tomcat 7

It is an open source software implementation. It supports the Java Servlets which helps to create a Web server.

| Table 2 Showing software requirements for the building of an information repository |
| (Source: Primary data, 2017) |

4.2.4 Hardware requirements for an IR

These enable the identification of various tangible equipment’s onto which the appropriate softwares are installed for the purpose and they are discussed in the table below.
<table>
<thead>
<tr>
<th>TOOLS</th>
<th>MINIMUM REQUIREMENT</th>
<th>JUSTIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Pentium iv</td>
<td>It enables more processing power.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It is fast, reliable and stable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and can run on various computers for longtime.</td>
</tr>
<tr>
<td>Scanner</td>
<td>HP SJ 559</td>
<td>More printed books can be digitized in less time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>possible, resolution 600x600, speed, 8ppm, ADF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>capacity, flat bed size A4.</td>
</tr>
<tr>
<td>Memory</td>
<td>2GB RAM</td>
<td>Provides enough temporary space for the uploaded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>files.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>It provides fast reading and writing capabilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and in turn support in processing.</td>
</tr>
<tr>
<td>Disc space</td>
<td>40gb</td>
<td>The more the hard disk space the more data the</td>
</tr>
<tr>
<td></td>
<td></td>
<td>system can process.</td>
</tr>
<tr>
<td>band width</td>
<td>10mbps</td>
<td>It enables high speed access and design.</td>
</tr>
</tbody>
</table>

Table 3 Showing hardware requirements for the development of an IR
(Source: primary data, 2017)

4.3 Contents / collections submission in an institutional repository.
A high concentration of about 95% of the sample size advocated for the custody of theses and dissertation compared to other collections as illustrated in the figure below.
Data collected were discrete in nature and were converted to continuous data in relation to the type of materials that the proposed IR should accommodate. Respondents that suggested for theses and dissertations were 6.5 making a percentage of over 32.5% of the sample size of 20 participates and journal articles were 2.9 (14.5%), technical reports were 4 (20%), conference papers were 3.5 (17.5%), working papers was 1 (5%) and others were 2.5 (10.5%) as illustrated in the figure above.

**Figure 6** showing content submitted in IR (Source: Field data, 2017)
CHAPTER FIVE
SYSTEM DESIGN AND IMPLEMENTATION

5.0 Introduction.
This section comprises of system design involving the different levels of data flow diagrams, system implementation, testing and validation.

5.1 Repository system design.
This design specified in detail how the institutional repository was created. For the case of DSpace IR, dataflow diagrams (DFD) were used in the design part.

5.1.1 DFD level 0
This level represented the context model diagram at a higher level (Level 0) of the data flow diagram. It only contained one process node that generalized the function of the entire system in relationship to external entities. The diagram did not contain any data store as shown in level 0 diagram below.

![Data Flow Diagram at level 0](image_url)

**Figure 7** Showing Data Flow Diagram at level 0

In the built DSpace repository system, three possible users were identified and these act as information sources or final recipients of information. They interact with the system with various roles namely, librarian (a person assigned system administration roles to control and monitor users and content submitted into the repository), authors (include faculty, students, and researchers who interact with the system when they submit their scholarly materials into the repository) and the viewers (all persons who visit the repository for reading the contents).
5.1.2 DFD level 1
The outcome of expanding the level 0 diagram is level 1 diagram as shown in Figure 8. The diagram broke down the context diagram and led to four main processes of the system. These were item submission, manage submissions, submission acknowledgement and view content process shown in level 1 DFD diagram below.

![DFD Diagram Level 1](image)

**Figure 8** Showing DFD at level 1

At this level, 4 major processes were involved in an attempt to expand the processes involved at level 0. At this level the author submits the item into the system and receives a confirmation of the activity. The librarian manages the submitted item by checking for its suitability and archives to make accessible by the viewers. The viewer searches and browses through submitted items via a remote network.

5.1.3 DFD level 2
The outcome of breaking down the level 1 diagram is level 2 diagram as shown in Figure 9. The diagram expanded on the level 1 diagram to show sub-processes of the main processes of the system like log in, create profile, submit item and acknowledge submission sub processes for the author functionalities; accept item and commit archival for the librarian functionalities and view content for the viewer functionalities.
Figure 9 Showing DFD at level 2

At this level, all the technical processes were illustrated and it showed the interaction between the various entities and the system so as to execute work. In this case, the author logins, creates a profile and submits an item into the repository and receives back a confirmation of the activity. The librarian accepts the item and archives it into the repository. The DSpace repository stores all data provided by the entities and executes the activities as per their commands. The viewer searches and browses in the system via a remote network to obtain items from the repository.

5.1.4 Use case diagram for an institutional repository

This identifies all the process or activities and actors (entities) of the system as shown in the diagram below. It highlights all the functionalities of the system in relation to user requirements.
Figure 10 Showing a use case diagram for an institutional repository

This summarised all what was addressed in the data flow diagrams above illustrating how external entities associate with the system. Therefore, from the use case diagram an author logs it to the system, creates a profile and submits an item in the process of self-archiving. The librarian manages users who provide details to the system and manages content submitted. The viewer searcher and or browses through items provided online with the graphical use interface of the system.
5.2 UMI institutional repository implementation

In practice, system implementation assuring that the designed system is built and made operational. In our case, it is a software development or assembling step that implements previously created system design. By default, DSpace integrates other prerequisite softwares. To build up the UMI repository system, prerequisite softwares presented in section 4.2.3 were used.

5.2.1. UMI institutional repository structure

The proposed institutional repository was implemented with two communities as show in the figure below.

![Hierarchical Structure of an IR](adapted-from-DSpace-manual-2017)

**Figure 11** Showing the hierarchical structure of an IR (adapted from DSpace manual, 2017)

In general, the hierarchy is in two folds. In one case, it may be as community /sub-community /collections /Items and in another it another case where there no sub communities in the hierarchy, collections may be put immediately under specific communities with no sub communities in the repository. However, for this particular study the first fold of the hierarchy structure was adopted and was as summarized in the table below.

<table>
<thead>
<tr>
<th>Communities/depts.</th>
<th>Sub-communities</th>
<th>Collections</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative reports</td>
<td>None</td>
<td>Item type</td>
<td>Items</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>Item type</td>
<td>Items</td>
</tr>
</tbody>
</table>
Table 4 The table summarizes the structure of UMI repository.

<table>
<thead>
<tr>
<th>Item type</th>
<th>Item type</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>Theses &amp; dissertations</td>
<td>Courses</td>
</tr>
<tr>
<td>Scholarly articles</td>
<td>Item type</td>
<td>Items</td>
</tr>
<tr>
<td>Journal papers</td>
<td>Item type</td>
<td>Items</td>
</tr>
<tr>
<td>Portal</td>
<td>Item type</td>
<td>Items</td>
</tr>
</tbody>
</table>

5.2.2 User interfaces for UMI institutional repository

![UMI repository user home interface](image)

**Figure 12** Showing UMI repository user home interface.

5.2.3 Collections in a sub community of research community in UMI IR

The structure under the research community in the repository is reflected in figure 13, 14 and 15 which shows the collections in a particular sub community (theses and dissertations) under a community research.
Figure 13 Showing a sub community and collections under it in the repository.

Figure 14 Showing collections under a sub community in the repository.
Figure 15 Showing collections under a sub community in the repository.

5.2.4 Items in a collection

Figure 16 Showings items in the monitoring and evaluation (M&E) collection in the repository.
5.2.5 Sample submitted items

Figure 17 Showing a sample of an item submitted and searched from the repository through the path identified with an arrow.

5.2.6 Item metadata record in UMI IR

Figure 18 Showing an item record captured by the system using the Dublin core support.
5.2.7 Content Submission Workflow

The submission workflow describes the process through which an item is created, reviewed for quality control, uploaded into the system, and finally archived as shown in the diagram below.

**Figure 19** Shows the item workflow before submission to the repository.

In the initial stage, work is done manually between the student and supervisor because the system cannot handle quality control functionalities. The repository architectural design in section 3.8 above illustrates the content submission workflow for UMI. Later authors are then required to follow the online steps to submit the item into the institution repository which then archives the item through the steps shown below.
Figure 20 Showing the item submission process for a registered author which is identified with an arrow above.

5.2.8 User registration interface for UMI IR

Figure 21 Showing the new system user registration pane.
5.2.9 User management interface for the librarian in UMI IR

![User management interface](image)

**Figure 22** Showing the user management pane for the librarian.

5.2.10 Librarian material management interface for UMI IR

![Material management interface](image)

**Figure 23** Showing the librarian submitted material management interface
### Metadata Schema: "dc"

This is the metadata scheme for HTTP://db憧憬.org/documents/xml/1terms.x. You may add new or update existing metadata fields to this schema. Fields may also be selected for deletion or moved to another schema.

**Add new metadata field**

**Field Name:**
- dc: 

**Scope Note:**
Additional notes about this metadata field.

**Add new metadata field**

#### Schema metadata fields

<table>
<thead>
<tr>
<th>ID</th>
<th>Field</th>
<th>Scope Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>dc.contributor.advisor</td>
<td>Use primarily for thesis advisor.</td>
</tr>
<tr>
<td>1</td>
<td>dc.contributor.author</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>dc.contributor.editor</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>dc.contributor.editor</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>dc.contributor</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>dc.coverage.spatial</td>
<td>Spatial characteristics of content.</td>
</tr>
<tr>
<td>6</td>
<td>dc.creator</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>dc.creator</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>dc.creator</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>dc.creator</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>dc.creator</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>dc.creator</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>dc.creator</td>
<td></td>
</tr>
</tbody>
</table>

### Bitstream format registry

This list of bitstream formats provides information about known formats and their support level. You can add or modify the bitstream formats with this tool. Formats marked as ‘internal’ are hidden from the user, and are used for administrative purposes.

**Add a new bitstream format**

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>MIME Type</th>
<th>Support Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Unknown</td>
<td>application/vnd-stream</td>
<td>Unknown</td>
</tr>
<tr>
<td>1</td>
<td>License</td>
<td>text/html</td>
<td>Known</td>
</tr>
<tr>
<td>2</td>
<td>CC License</td>
<td>text/html</td>
<td>Known</td>
</tr>
<tr>
<td>3</td>
<td>Adobe PDF</td>
<td>application/pdf</td>
<td>Known</td>
</tr>
<tr>
<td>4</td>
<td>XML</td>
<td>text/xml</td>
<td>Known</td>
</tr>
<tr>
<td>5</td>
<td>Text</td>
<td>text/plain</td>
<td>Known</td>
</tr>
<tr>
<td>6</td>
<td>HTML</td>
<td>text/html</td>
<td>Known</td>
</tr>
<tr>
<td>7</td>
<td>CSS</td>
<td>text/css</td>
<td>Known</td>
</tr>
<tr>
<td>8</td>
<td>Microsoft Word</td>
<td>application/vnd.ms-word</td>
<td>Known</td>
</tr>
<tr>
<td>9</td>
<td>Microsoft Word XML</td>
<td>application/vnd.oasis.opendocument.text</td>
<td>Known</td>
</tr>
<tr>
<td>10</td>
<td>Microsoft PowerPoint</td>
<td>application/vnd.ms-powerpoint</td>
<td>Known</td>
</tr>
<tr>
<td>11</td>
<td>Microsoft PowerPoint XML</td>
<td>application/vnd.oasis.opendocument.presentation</td>
<td>Known</td>
</tr>
<tr>
<td>12</td>
<td>Microsoft Excel</td>
<td>application/vnd.ms-excel</td>
<td>Known</td>
</tr>
<tr>
<td>13</td>
<td>Microsoft Excel XML</td>
<td>application/vnd.oasis.opendocument.spreadsheet</td>
<td>Known</td>
</tr>
</tbody>
</table>
5.3 System testing and validation.
The system was done by both the developer and the UMI library team and some errors were identified corrected. These errors included the system failure to launch apache Solr which required repeating the same task performed initially so as to have the system validated. This is a popular default problem was not able to capture the range of strings input which was causing the system to crash. This was corrected by using range validators to limit the length of the string. Testing and validation was iteratively performed by trying out the different system functions to determine its behavior. Users were deleted in the system and many items that were uploaded during testing were deleted. Users provided feedback to the system administrator through the system. However, all these are illustrated in the diagrams below.
CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.0 Introduction.
This section addresses the conclusion to the study, summary and recommendation of the study of an IR for UMI.

6.1 Summary
This highlights both the summary to the study and the summary of findings as below.

6.1.1 Summary of study
The development of an institutional repository system which will be used as a platform to curb the problem associated with the mismanagement of scholarly research outputs at Uganda Management Institute as a case study. The development of an IR is based on the need for such a system as a solution for the challenges faced by faculty and students in the collection, preservation and dissemination of audiovisual materials.

The overall aim of this project was to ‘to design and build an institutional repository for Uganda Management Institute’. The objectives were to examine the existing system, to identify system requirement specifications for the IR at UMI, to design an institutional repository, to implement, test and validate an institutional repository at UMI.

All the objectives were achieved. The views of both library users and library staffs have been sought, described, analysed and discussed at length. Only the issue of inter-disciplinary differences remains inconclusive. Either the small sample of respondents interviewed as representative of the total student population and there are few significant differences between the faculties or the sample is not representative and further work is required.

Besides the system was implemented using open source DSpace repository software. There are several advantages behind open and free source software. One is overcoming the financial constraints most organizations face in implementing similar systems. The other major advantage is the continued support and improvement that open source software benefits from the global community of software developers. Therefore, the repository is suitable. The system is also capable to benefit the institution in many other ways. For example, it can be used as a tool to
monitor and assess the number and quality of research outputs of the institution. By doing so, the value of money invested in research and educational activities can be evaluated based on this fact. The system also can be a platform for new knowledge discovery which can create innovations that solve other similar challenging problems.

Above all, it is important that IR management work collaboratively the UMI community, including researchers, students, academic staff, IT services and senior management, to ensure the IR is accepted and valued.

6.1.2 Summary of findings

The preservation of audiovisual media containing research findings in Uganda Management Institute library is one of the greatly under looked aspects. This is due to the many challenges like inadequate storage facilities, lack of skilled man power in audiovisual materials, inadequate funding, technological challenges, accruing to the mismanagement of these materials due to lack of a well-established system to protect such items.

Requirement engineering yielded results from the various interviews conducted with participants as well as reviewing documents in the library. Functional policies like support for open access, content, submission capabilities, metadata, selection (replacement/withdraw), intellectual property, preservation and usage while non-functional requirements like efficiency, service, cost effectiveness and security were established for the new system. Softwares like DSpace, PostgreSQL and hardware requirements appropriate for the system were established.

Challenges for the delayed building of an IR yet the policy regarding open access was clearly stated as per the library policy. These included the Inadequate library budget, inadequate skills and lack of guidance, intellectual property and copyright issues and inadequate management support).

In this report therefore, the author believed that UMI has all it takes to develop open access IR. What was required was to realize that there was proper creation of awareness, adequate funding of institute library, regular power supply, development of ICT infrastructure, effective advocacy and submission of electronic theses and dissertation. However, the creation of an IR was mandatory to limit the use of compact discs as backups for hard copy theses and dissertations through the various preservation methods like migration, refreshing and replication providing
safe storage to the institutes’ intellectual outputs as well as enhancing accessibility to such information in the long run.

6.2 Conclusions

The study intended to finding a way to launch the institutions’ scholarly outputs contained on digital media in one centralized facility to enhance access and preservation. The building of IR in UMI using DSpace software perhaps to a large extent will improve the preservation and scholarly communication of intellectual outputs of the institution to the global arena. Visibility entails the publication in high impact journals but with access toll. Most papers in such journals have limited readership especially in developing countries. However, the creation of an IR would require the development of a new technological culture, which is capital intensive. The system will curb the problem of the intensely deteriorating digital media which leads to loss of the valuable information contained on such items.

6.3 Recommendations

This particular study intended at the creation of an institutional repository for Uganda Management Institute and researcher recommends the following studies to the library and recommended future works as below.

6.3.1 To the library

It is hence recommended that the system be evaluated in the future, say in 2-5 years to assess its success in terms of content recruitment and in terms of the promised functionalities such as preservation, management, resource sharing, and alternative publishing platform.

The following file formats are favored by researchers, and an upgrade (migration) path for these should be provided for example PDF, HTML, word processed documents, images, presentations and spreadsheets. For these generic file formats especially word-processed documents, there should be a recommended IR standard like Microsoft Word.

The repository should be checked periodically using the checksum checker support whose purpose is to verify that the content has not become corrupted or been tampered with. The tool is extensible to new reporting and checking priority approaches.

IR administrators should encourage the deposit of all types of material. If this is not feasible, as a minimum the following types of material should be permitted in the repository theses, post
prints, conference papers, book chapters. These are among the most acceptable formats for both authors and readers.

If there are likely to be rights problems with the long-term storage of files created using proprietary software, then a straightforward procedure should be available for converting these document types to copyright free formats. Authors should be able to perform any conversion procedures themselves.

Library staffs should be equipped with adequate ICT skills so as to meet the requirements of an IR operator since the system uses modern technology. Besides DSpace software also keeps on advancing in versions and therefore a more recent version may be the best choice. This means that there must be a technician or specialist among the library staff who can upgrade the system to a new version.

The library should to play roles like promotion/advocacy of an IR concept, formulation of IR policies, sensitization workshops, formation of functional committee on IR, software training for members, provide leadership role in setting up of IR, providing discussion forum and funding.

Advocacy involves building an informed awareness therefore a communication plan for the advocacy campaign is a necessity. Avenues the round table can be used by UMI library to advocate for an IR building. This can also be achieved by through providing promotional brochures and presentations to departments.

It is recommended that Dspace can only be installed and operated on most modern PC, laptop or server hardware.

**6.3.2 Areas of further studies**

The study recommends that more further studies should be carried out in future like;

Building institutional repositories in CUUL member institutions in Uganda: Current status and emerging challenges.

The impact of an institutional repository on research development at Uganda Management Institute.
REFERENCES


Alfa network babel library (2007). Guidelines for the creation of institutional repositories at universities and higher educational organisations. Valparaiso, Columbus: Europe aid cooperation.


Deng, S. (2011). Building new interfaces for shocker open access repository. *Kansas Library Association College and University Libraries Section Proceedings, 1*(1). http://dx.doi.org/10.4148/culs.v1i0.1356


Personal communication (interview)


APPENDICES

Appendix A: Interview Guide for staff

The interview guide has been prepared for data collection regarding or concerning the development of an institutional repository at UMI. I therefore kindly request to please join efforts with me in conducting my study by responding to this interview. Information provided is purely for academic purposes and therefore will be treated as confidential and accorded the respect it deserves. Your positive response is highly appreciated.

What is your designation? -----------------------------------------------

Existing system

1. Does UMI have a system for digital media long term preservation and accessibility to information materials?
2. How does UMI library store its digital media materials?

Challenges with management of digital media

1. How are audiovisual materials preserved in the library?
2. What factors account for the mismanagement of digital media at UMI?

IR development

1. Does the institution have a policy concerning open access?
2. What has delayed the establishment of an online repository in UMI?
3. Is there a need for the development of an online central repository?
4. What factors have hindered the development of an IR at UMI?

Core Functions

Materials Submission

a) What is your preference for material submission?
b) Who should have a right to submit items in the system?
c) Who should judge whether items are archival or not?
d) How will one know if something belongs in a collection (subdivision)?
e) What file formats should the new system support?
f) What formats are collected?
g) What types of materials should be housed in the new system?
h) Who authors the materials?

i) Is there a collection policy?

j) Is archival material included?

**Metadata application**

a) What types of metadata will you collect?

b) Who will be responsible for metadata generation supplied?

c) Will it be library supplied?

**Access Control**

a) How will you manage digital rights?

b) Will you authenticate?

c) Should the new system support logins?

d) Will one need/have to be on campus to access or submit?

e) How should the new system search for information (author, title or year)?

**Discovery Support**

a) Where can you search for items?

b) How will one access the IR on campus (linking)?

**Distribution**

a) Will there be limits on viewing full-text (on-campus; by the author)?

b) Will one need plug-ins?

**Preservation**

a) Do you have a preservation plan?

b) Do you back up your data?

c) How do you preserve audiovisual materials?

d) How often will the IR be updated?

e) How often will you convert file formats (i.e. Word to PDF or HTML) in the system?

f) How often will you update formats?

**Interface design**

How would you like the graphical user interface to look like? (Provide a respondent with a participatory mapping sheet).
Appendix B: Interview Guide for library users.
The interview guide has been prepared for data collection regarding or concerning the development of an institutional repository at UMI. I therefore kindly request to please join efforts with me in conducting my study by responding to this interview. Hope that the findings drawn from here will be great value to the organization. Information provided is purely for academic purposes and therefore will be treated as confidential and accorded the respect it deserves.

Your positive response is highly appreciated.

1. How often do you use the library?
2. What services does UMI library offer to its users?
3. What type of information materials does the library accommodate?
4. How often do you use audiovisual items from the library?
5. What type of digital media do you normally ask for when you visit the library?
6. How do you find the service?
7. Are you satisfied with the services provided regarding access to materials?
8. What challenges do you face in accessing materials in the library?
9. How much time does it take one to acquire an information material that he or she wants?
10. Is there a need for an online storage facility?
11. If “yes”, What information materials would you select to be housed in the UMI online storage facility?
12. What are your expectations for the proposed system?