ASSESSING INSTITUTIONAL REPOSITORIES' CAPACITIES IN SUPPORTING TEACHING, LEARNING AND RESEARCH IN FOUR SELECTED UNIVERSITIES IN KENYA

BY

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DECLARATION

DECLARATION BY THE CANDIDATE:

I declare that this thesis is my original work and has not been presented for a degree award in any other University. No part of this thesis may be reproduced in any form without prior written permission of the author and/or Moi University.

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DEDICATION

I dedicate this work to my family; especially my husband, Abraham, children, Jayden, and Jaylen, my parents, sisters and brothers for their great support and encouragement to do all my best even when the going was very tough. Thank you all and God bless you.

ABSTRACT

Institutional repositories (IRs) are digital archives for collecting, managing, providing access to, disseminating, and preserving digital materials produced at an institution. Many benefits are gained from implementation of the IRs. Kenyan universities have adopted institutional repositories (IRs) to support teaching, learning and research activities. However, the adoption of IRs in Kenyan universities seems not to have been successful in supporting these primary functions of universities. The aim of this study was to assess institutional repositories' capacities in supporting teaching, learning and research activities in four selected universities in Kenya with a view to proposing an appropriate model to improve teaching, learning and research. The specific objectives of the study were to: establish the effectiveness of content and content recruitment in IRs; assess content utilization of IRs; establish the contribution of librarians and research directors on use of IRs; determine the effectiveness of IRs in supporting teaching, learning and research activities and to propose an appropriate model to improve teaching, learning and research. The study was informed by technology acceptance model and the diffusion of innovation theory. This study adopted a pragmatic paradigm associated with mixed method approach and a multiple-case (embedded) research design. The target population for the study comprised of 93000 students, 2463 academic staff. A combination of stratified random and purposive sampling techniques were employed to obtain 370 students, 322 academic staff and 12 key informants from the four selected universities. Data was collected using questionnaires and interview schedules. Quantitative data was analyzed using descriptive statistics and presented using frequency distribution tables and bar charts while qualitative data was analyzed thematically based on the objectives and research questions and presented in form of narrative. Content in IRs was found to be inadequate, sometimes out-dated, of poor quality, and infrequently uploaded. Half of the respondents (n=298, 50%) discovered content in IRs by directly visiting them but a significant proportion (n=225, 38%) discovered IR content inadvertently, when using search engines. Respondents preferred to use traditional journals (38%) and subject repositories (26%), rather than IRs (25%) for teaching, learning and research materials. The study found that university librarians, system librarians and research directors were involved in all the stages of IR implementation. They work together to design and develop the system, identify user needs, work with faculty to recruit content, verify the type of content, validate and approve contents. The study concluded that IRs as currently constituted are not effective in supporting teaching, learning and research because about 50% of the academic staff did not use them, the content though broad was not deep, and members of academic community preferred research journals and subject repositories for their sources of teaching and research materials. The study recommended among others, that IRs should be promoted and marketed; adequate funding; IR policies reviewed and implemented regularly; content should be optimized for greater search engine visibility; described and uploaded, and the proposed IR model should be adopted to improve teaching, learning and research activities.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS/ACRONYMS

AAU	African Association Universities
ACRL	Association of College and Research Libraries
AMOS	Analysis of Moment Structures
API	Application Program Interface
BOAI	Budapest Open Access Initiative
CERN	European Organisation for Nuclear Research
CSIR	Indian Council of Scientific and Industrial Research
CUE	Commission for University Education
DEST	Department of Education, Science and Training
DOI	Diffusion of Innovation
ERP	Enterprise Resource Planning
FEDORA	Flexible Extensible Digital Object & Repository
GS	Google Scholar
ICT	Information Communication Technology
IREC	Institutional Research and Ethics Committee
IRs	Institutional Repositories
KRIS	Kiwi Research Information Service
LGPL	Lesser General Public License
MIT	Massachusetts Institute of Technology
MMR	Mixed Method Research
MU	Moi University

NACOSTI	National Commission for Science, Technology and Innovation
OA	Open Access
OAI	Open Archive Initiative
OpenDOAR	Directory of Open Access Repositories
OSS	Open-Source Software
SCNs	Scholarly Collaboration Networks
SCOAP	Sponsoring Consortium for Open Access Publishing
SCT	Social Cognitive Theory
SEMPATH	Structural Equation Modelling – Path Analysis
SPARC	Scholarly Publishing and Academic Research Coalition
SPSS	Statistical Package of Social Sciences
SSRN	Social Sciences Research Network
SU	Strathmore University
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
TTF	Task Technology Fit
UNESCO	United Nations Educational, Scientific & Cultural Organisation
UON	University of Nairobi
USIU-A	United States International University – Africa
UTAUT	Unified Theory on Acceptance and Use of Technology

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CHAPTER ONE

INTRODUCTION AND BACKGROUND INFORMATION

1.1 Introduction

This chapter introduces and provides the background to the study. It presents the statement of the problem, general and specific objectives, research questions, and assumptions of the study. The significance of the study, study scope and its limitations, operational definitions of terms and concepts used in the study are also presented.

Access to scholarly information is one of the biggest hurdles that hinder research and teaching in universities, especially those in developing countries. The high cost of scholarly literature, such as books and journals, the significant growth in the overall volume of research, and the long latency in the traditional print publications paradigm have inhibited research and teaching in universities (Saini, 2018; Ukwoma and Dike, 2017). Institutional Repositories (IRs), products of the changing digital landscape of the 21st century, are emerging as vehicles for potentially supporting the academic community in institutions. According to Jain, Bentley and Oladiran, (2016) an IR is a digital research archive consisting of accessible collections of scholarly works that represent the intellectual capital of an institution. It is a means for institutions to manage the digital scholarship their communities produce, maximise access to research outputs both before and after publication and also to increase the visibility and academic prestige of both the institution and authors.

The global focus on generating knowledge and innovation to drive economic and social progress has created challenges for universities and other equivalent institutions. Frieda

& Yule (2019) notes that the technological advances in recent years have made it possible to think and package significant knowledge of the human population in a digital form for reference and utilization

An IR consists of the following criteria: A Web-based database (repository) of scholarly material (the material are purely scholarly); and institutionally defined (as opposed to a subject-based repository, it contains institution-wide material). Others are cumulative and perpetual (a collection of permanent and increasing material); open and interoperable (compliant with Open Archive Initiative compliant software); and collects, stores and disseminates scholarly material as part of the process of scholarly communication (Ware, 2004).

Institutional repositories have become a global phenomenon. They are now established on all continents, with the largest repositories being found in Europe, North and South America, Japan, India and Australia. Interest in establishing and promoting repositories is likely to show continued growth, particularly as academic staff increase their online presence and adapt their work patterns to the new Web 2.0 tools such as blogs, RSS, wikis, and virtual communities (Cullen and Chawner, 2013).

There are two schools of thought contrasting philosophical viewpoints about the objectives of IRs: one that considers IRs as competition and possible replacement for traditional publishing (Harnard, 1995; Crow, 2002); the other that views IRs as a supplement to traditional publishing (Lynch, 2003). Harnad (1995) argued that academics should publish their work in IRs to circumvent the economic barriers put up by publishers that limit scholarly access to research. Crow (2002) argues that IRs should take over all

the traditional functions of traditional publishing, namely, registration, certification, dissemination, and archiving, and hence, placing the function of scholarly publishing rightfully into the hands of the Academy. Lynch (2003) on the other hand, views IRs' roles as supplementary, arguing against them taking on the function of certification during the course of scholarly publishing, warning that, "the institutional repository isn't a journal, or a collection of journals, and should not be managed like one" Lynch (2003). Studies by McDowell (2007) and Bailey *et al*. (2006) suggest that the model that has become dominant over time is that of Lynch (2003) with IRs containing mostly grey literature rather than journal articles.

The primary functions of universities are teaching, learning and research (Gilman, 2016; Richardson and Wolski, 2012). Universities are currently undergoing various challenges identified as a decrease in quality of learning and teaching, quality of research, decreased funding, accreditation of universities and programmes (Sarker, Davis and Tiropanis, 2010). A useful disaggregation of challenges that face universities in developing countries was given by the World Bank (2017 and 1994), which categorised them into four areas: (a) severe resource constraints, (b) internal efficiencies, (c) external efficiencies, and (d) social equity. A dramatic increase in demand and enrolments in developing countries over the past 40 years, has strained infrastructure and resources beyond what they were meant to accommodate. Teaching methods primarily depend upon lecturing and writing notes on the chalkboard, which students copy into their notebooks. Most students cannot afford to buy textbooks and only a small number of books are available in libraries for use by students.

Internal inefficiencies result from rapid enrolment, which has led to the proliferation of uneconomically small institutions and significant duplications of their programs. This has led to limited faculty, low student to staff ratios, and high dropout rates (World Bank, 2017 and 1994). External efficiency arises from two sources: graduate unemployment and declining research output. One pertinent dimension of unemployment is the production of graduates whose skills do not match those of industry and the lack of established links between industry and universities. Problems in research in developing countries are traceable to shortages in physical infrastructure, laboratory equipment, computers and software, learning resources such as textbooks and journals, "brain drain", and lack of qualified staff. Equity more often creates a tension with equality with regard to access policies (World Bank, 2017 and 1994).

1.2 Background Information

1.2.1 Development of Institutional Repositories

IRs are recent phenomena, emerging in 2000s. A major movement to the establishment of IRs was the escalating cost of journals, with statistics showing that their costs rose by an incredible 73% between 1986 and 2004 while the consumer price index increased by about 73% over the same period, roughly in tandem with library budgets. Consequently, most libraries struggled to balance between the need for journal access and procurement of other essential services, such as books, in the face of diminishing budgets (Saini, 2018). IRs evolved on the back of two events: the emergence of the Open Access (OA) movement and the wide availability of the internet that could allow for the dissemination of scholarly literature (Luther, 2018; Wu, 2015). The provenance of the OA movement is usually ascribed to seminal articles by William Gardner and Stevan Harnad in 1990

(Gardner, 1990; Bangani, 2018). Harnad (1990: 3) in his article, "Scholarly Skywriting and the prepublications continuum of scientific enquiry", wrote:

> *"The whole process of scholarly communication is currently undergoing a revolution comparable to the one occasioned by the invention of printing".*

In 1991, physicist Paul Ginsparg founded the first open access subject-specific archive called arXiv.org at the Los Alamos National Laboratory in New Mexico, but now housed in Cornell University in Ithaca, New York, since 2001.The archive specialises in theoretical physics and computer science (Hailing, 2011).In 1995, Harnad wrote a provocative article titled the "Subversive Proposal", whose thrust was to urge scholars to make their writings freely available online to allow for the unhindered movement of knowledge to everyone. Harnad (1995: 9) stated:

> *For centuries, it was only out of reluctant necessity that authors of esoteric publications entered into the Faustian bargain of allowing a price-tag to be-erected as a barrier between their work and its (tiny) intended readership, for that was the only way they could make their work public at all during the age when paper publication ... was their only option.*

Following this first call for an IR, subsequent discussions among scholars centred on the technical requirements of the systems, centralised versus decentralised storage and the issues of copyright. Lederberg argued for the establishment for institutional rather than subject archives (Jones, 2006). He stated thus (Okerson & O'Donnel, 1995: 116),

> *"...instead let each institution set up its own ftp-able archives for all of its scholars. That way, each place can also set up its own ground rules."*

IRs really took off in 2002 with the public release of the open-source institutional repository software DSpace along with the publication of the Scholarly Publishing and Academic Resources Coalition (SPARC) paper, The Case for Institutional Repositories

(Lynch, 2016; Bangani, 2018). IRs spread amongst academic institutions because of the ready availability and relatively easy implementation of various open-source software platforms. In addition, various universities required their graduate students to deposit thesis and dissertation output in IRs

The establishment of the arXiv.org was a watershed moment in the open access movement, opening up scholarly publications to a wider audience. This momentum was given further impetus with the setting up of e-biomed proposal, a biomedical digital archive of post-prints and pre-prints by the National Institutes of Health in USA in 1999. Its objective was to publish articles and make them available freely without any subscription fees or other restrictions (Sánchez-Torrago, 2007). According to the Bethesda Statement (2003), open access is a mode of publication that allows for unrestricted derivative use, for instance, copying, printing or translating. Suber (2007) similarly defined open access as the online, digital literature that can be used freely and is free of most copyright restrictions. Given that IRs are open, materials deposited in them are usually also open access.

In 2000, various scientists started the Public Library of Science (PLoS) to make journals available through open initiative (Bonilla-Calero, 2014). In 2001, the Open Society Institute hosted a meeting, which led to the Budapest Open Access Initiative (BOAI). This was followed in 2003 by Berlin Declaration on Open Access ("Open Access to knowledge in the sciences and humanities") and the Bethesda statement on scientific research and its objectives (Hailing, 2011).

Institutions in America have developed and implemented IRs. One of the first institutional policies in USA requiring self-archiving (mandate) was that of the National Institutes of Health (NIH). In May 2005, there was a call to all researchers to submit electronic versions of the final manuscripts after acceptance for publication in PubMed central (Xia, 2007).

Similarly, in Europe, there was an initial agreement between the British Research Councils to include the publications of their projects in IRs. More recently, the Finch Report in the UK recommended that funding agencies provide money to pay gold open access journals processing fees to successful applicants and science papers should be made freely available within six months of publication if the UK government funded them (Van Noorden, 2012).Other initiatives in the OA movement since 2012 include; Sponsoring Consortium for Open Access Publishing (SCOAP), which allowed open access to articles, published in particle physics and Nature Publishing Group, which announced a new open access journal, Scientific Data in April 2013 (Scheer, 2013).

According to Cullen and Chawner (2009) New Zealand is one of the countries that have implemented IRs and tertiary libraries are involved in wide variety of institutional repository projects most of which began as part of four consortia in the country through which, national funding grants, expertise, and software infrastructure were shared. These are all linked to the umbrella metadata resource discovery system hosted by the National Library of New Zealand, Kiwi Research Information Service (KRIS). In general, New Zealand tertiary institutions have embraced the concept of institutional repositories with enthusiasm and felt the need to show some benefits from the venture. In multi-part study

of IRs in New Zealand, Cullen and Chawner (2009) identified factors that influence New Zealand academics‟ decisions to contribute to and use IRs. The study reported that, while New Zealand academic library managers were very positive about the value of IRs, academics failed to recognize the potential benefits of IRs and were reluctant to contribute to output.

In Asia, India leads with 16 functional IRs developed by academic institutions of national and international importance such as Indian Institute of Science and Indian Institute of Management. In addition to IRs, subject-specific repositories also exist, which store and provide access to subject-specific collections of documents (Sawant, 2012). In Japan, the Ministry of Education, Culture, Sports, Science and Technology has encouraged Japanese university libraries to develop institutional repositories to promote sharing of knowledge throughout Japan and internationally. In Pakistan, librarians were not prepared to embrace changes forced by new technologies because of little knowledge of benefits it would bring forth thus the country lags behind in the use of technological inventions (Cullen & Chawner, 2009).

Different studies in Africa show that IRs are being integrated and used in institutions of higher learning, where they display research outputs such as theses and dissertations. Mutula (2012) highlighted the increasing importance of information and communication technology (ICT) in the digitization and preservation of content, and establishment of IRs in Africa. The IRs capture and preserve the university's intellectual output, for instance, PhD theses, preprints, post prints, working papers, technical reports, public archives, and graphic material. He noted that the Association of African Universities (AAU) was

helping in the digitisation process. Despite all the efforts to create digitization programs, roadblocks such as copyright issues, funding, institutional support, technical drawbacks and conservation of originals have always hampered meaningful progress in building digital libraries and institutional repositories (Mutula, 2012).

1.2.2 Institutional Repositories Support for Teaching, Learning and Research in Universities

Institutional repositories can help universities address some of the most significant challenges in teaching, learning and research (Sarker *et al*, 2010; Tiropanis *et al*, 2009; Tsunode et al (2016). For instance, Saini (2018) argues that IRs are considered a compelling response to dual strategic issues facing academic institutions: an opportunity to reform the system of scholarly communication by expanding access to research and reasserting control over scholarship by the Academy; and could potentially serve as clear indicators of a university's quality.

According to Sarker *et al* (2010), IR could be crucial for universities in helping to manage and capture intellectual assets as a part of their information strategy, provide linking to other repositories and also supply machine process able data to support the institutions. By providing freely accessible information such as course information, teaching and learning materials, research output, training and resource information, IR can help address some of the challenges in teaching, learning and research. Academics can use IR to access articles and other information resources for learning and research and archive published works to increase their visibility and collaboration with other academics (Ukwoma and Dike, 2017).

The development of institutional repositories in Africa is seen as a way of making institutional research outputs available to a community with less-than-optimal access to resources (Musoke, 2008). IRs can help capture the whole intellectual capital of an institution (Rieh *et al*. 2007) and lead to long term preservation of the institution's digital assets (Crow, 2002). South Africa and Botswana are among the leading countries in Africa in adopting and using IRs. Mutula (2012) found out that, successful implementation of library automation and IRs in Botswana can be attributed to extensive involvement of staff at all levels in the automation process, capacity building, understanding of benefits that automation could create and assuring staff of job securities. With respect to Nigeria, Okoye and Ejikeme (2011) noted that librarians in Nigerian universities have positive attitude towards the use and implementation of ICT because they have skills, knowledge and understand advantages of ICT.

Studies conducted in Kenya indicate that, development and implementation of IRs has been gaining momentum in institutions of higher learning (Mutula, 2012). For instance, Chilimo (2016) and Chilimo (2015) reported that the number of IRs in Kenya listed in OpenDOAR rose from two in 2009 to 22 in 2016 while many more universities were in the process of developing them. While some of them are already on the World Wide Web (or Web) but not yet listed in OpenDOAR, others still operate on their institutions' local area network (LAN). Karanja (2017) documented the scarcity of research outputs that are made available in university IRs in Kenya. The researcher contented that the outputs are dominated by abstracts rather than full texts. The IRs have also failed to incorporate a full range of services that could support academic and research work. Ogenga (2015) looked at adoption of IR in dissemination of scholarly information at

United States International University – Africa while Talam (2014) investigated the integration and use of IRs in UoN. However, there is scarcity of studies in Kenya that have empirically investigated how IRs in universities have helped them address challenges in teaching, learning, and research.

1.3 Institutional Repositories Selected Universities in Kenya

Statistics from OpenDOAR (2020) places Kenya as the second-largest contributor of IRs in Africa, after South Africa with 44 repositories by August 2020. This implies that relative to other East African countries, Kenya has made some significant progress in the implementation of IRs. Institutions in the country that have established IRs, include University of Nairobi (UoN), Strathmore University (SU), Kenyatta University (KU),Moi University (MU), Pwani University (PU), Jomo Kenyatta University of Agriculture and Technology (JKUAT), Kenya Human Rights Commission (KHRC), Lake Victoria Basin Commission (LVBC), and Dedan Kimathi University (DKU) (OpenDOAR, 2014).Nevertheless, studies indicate that IRs in Kenya are still in their infancy, relatively few and generally underdeveloped (Karanja, 2017; Chilimo, 2015; Mutula, 2012).

To therefore gain an insight on the status of IRs in Kenya, four universities were sampled systematically from the 39 chartered (22 publics and 17 private) universities where the researcher chose every fourth university from a list of universities that were ranked in 2017 webometrics. This was adopted to avoid biasness and hence, this study focused on four selected universities two private (United States International University and Strathmore university) and two public (Moi University and University of Nairobi).

1.3.1 The University of Nairobi (UoN)

University of Nairobi was established in 1970 as the first national university in Kenya (Annual Report, 2013/2014). It has grown tremendously since then and has established various colleges and campuses within Kenya with over 300 training programs at PhD, Master's, Bachelor's, and Diploma and Certificate levels. The university student population has grown with 54,000 students at present; 40,000 in undergraduate and 14,000 in postgraduate level. The university has launched several policy frameworks, which include the research policy, plagiarism policy, open access policy and the intellectual property policy. The university has also introduced module 2 and module 3 degrees to cope with the demand of universities in Kenya. Owing to this structure, the university has rapidly evolved into world class institution, and was ranked number 1 in Kenya and 13th among the top 1000 universities in Africa (Webometrics, 2017).

The university is committed to open and free access to information and takes responsibility for dissemination for research outputs owing to the fact that it has the largest annual research kitty of Ksh.3 billion. This commitment is rooted in the universities mission, is undergirded by the core values of innovativeness, professionalism, and cooperate social responsibility. The university through the library has established the digital repository that provides long-term preservation and showcases scholarly outputs in relation to teaching, learning, research, community service and consultancy. The library promotes access to information, provides information literacy training, collects, and maintains relevant and balanced stock of information resources. The library system comprises of the main library and 13 college and branch libraries spread across various campuses of the university. Access to electronic resources is

enhanced through expansion of computer laboratories and other access points throughout the university. In addition, the university through the library has continuously shown mutual support to the open access concept by holding successful open day/open access week every year since 2011. The aim of the open day is to create awareness on library resources and promote access to free global information resources including the institutional repository (UoN Library portal, 2014).

1.3.2 Moi University (MU)

Moi University was established in 1984 by an Act of Parliament (Moi University Act, 1984) as the second public university in Kenya. The University was ranked 4th amongst Universities in Kenya and 51 and 2156 position in Africa and the whole world respectively (Webometrics, 2017). The University is located in Kesses, 35 kilometres from Eldoret Town, and 310 kilometres Northwest of Nairobi, the capital city of Kenya. Moi University has expanded tremendously over the past decade and this can be attributed to the commitment of the entire Moi University fraternity, government investment, strategic partnerships, and the visionary leadership of the University Council and Management. These achievements are a testament to the resilience and fortitude of every faculty and staff member who enabled change at a pace and on a scale never experienced before in the country. Moi University has physical facilities for instruction in the 15 schools albeit, constrained physical facilities against student numbers. These include classrooms, laboratories, lecture halls, residential hostels, re-creational facilities, administrative space among others.

The university has fully embraced ICT particularly in Financial, Library Information Management Systems and Students Accommodation. There is continued progress towards achieving a fully integrated University Information Management System. The university has undertaken major works in ICT infrastructure, which have improved internet and intranet connectivity with high speed in all campuses. The University implemented a new ERP system, enabling it to integrate and automate its systems in order to improve service delivery.

Moi university open access institutional repository is a digital service that collects, preserves and distributes digital materials to the academic communities. it serves as the home of intellectual output of Moi University. Digitals materials available are dissertations, faculty publications, open access publications and open educational resources and many more.

1.3.3 Strathmore University

One of the top ranked private universities in Kenya, Strathmore University (SU) was established in 2002 by Universities Act (CAP 210B). It offers both undergraduate and postgraduate programmes. For several years' web metrics has listed SU among the top 200 universities in Africa. It became the first amongst all the private universities in Kenya, 8th amongst all the universities in Kenya and 168th and 4183 position in Africa and the whole world respectively (Webometrics, 2017). This ranking was based on research outputs, visibility of the university nationally and internationally, volume of scholarly materials that was created and published, size and the impact of the web presence. Strathmore University library was the first University in Kenya to implement

an institutional repository called SU+, using open-source software called Dspace. SU+ has been listed in the "open- DOAR" service. Development of an open access institutional repository at SU library was initially faced with many challenges. There was a lot of resistance from the faculty level and as (Burris, 2009) noted that success of an IR will largely depend on the participation of the faculty. An IR without content is like a library with empty shelves.

1.3.4 United States International University – Africa (USIU-A)

Unites States International University-Africa is the private, independent, non-profit university accredited by the Commission for University Education (CUE) in 1999. It was ranked 2nd amongst all the private universities in Kenya, 12th position in Kenya, 254 and 5723 position in Africa and the whole world respectively (Webometrics, 2017).The University's vision is to be the premier institution of academic excellence with global perspective, whose mission is to promote the discovery and application of knowledge, the acquisition of skills and the development of intellect and character in a manner which prepares students to contribute effectively and ethically as citizens of a changing and increasing technological world. The mission is achieved through selected high quality undergraduate and graduate academic programs which result in high order thinking, literacy, global understanding and multicultural perspective, preparedness for career, leadership and ethics, community service and development. The University has three schools that offer various undergraduate and graduate degree programs including Chandaria School of Business, School of Humanities & Social Sciences, School of Science and Technology. The University library and information centre is an ultramodern facility which provides information resources necessary to support teaching, learning and

research, making it the intellectual hub of the University, the library accommodates over 300,000 volumes of books and presents a vision for the 21st century through the integration of books and information technology as well as inviting space that encourages collaboration learning.

The USIU-Africa Digital Repository is an open access digital collection and archive containing the research output of USIU -Africa faculty, staff graduate and postgraduate students. Included are digital theses, journal articles, conference papers, reports and more.

The repository showcases the research outputs and increases their exposure and impact by making them visible and freely available through services such as Google Scholar and CORE

1.5 Statement of the Problem

Rapid expansion in Kenyan universities has strained infrastructure and resources, leading to a decrease in quality of learning, teaching, and research. Teaching and research have also been hindered by limited faculty; low student to staff ratios; declining research output owing to shortages in physical infrastructure, laboratory equipment, computers and software, learning resources such as textbooks and journals, “brain drain”, and lack of qualified staff (World Bank, 2017; Sarker *et al*., 2010).

Institutional repositories can potentially solve some of the most significant challenges of Kenyan universities, and hence support teaching, learning and research activities. For instance, by providing the much-sought scholarly information to students and staff. By storing research articles, lecture notes and other articles, archiving, the intellectual output of a university, and preserving the works for posterity. Lastly, by displaying the digital

scholarship of a university community, IRs can raise the profile, visibility and academic prestige of the institution and authors, which can help attract funding. This can be invested in projects that promote teaching, learning and research

Nevertheless, IRs in Kenyan universities seems not to be effective in supporting teaching, learning and research in universities because of challenges in content recruitment, type of content in them, software used, and content discovery and use. The predominance of grey and non-published literature in IRs over published and peer-reviewed material have diluted the ability of repositories in supporting teaching, learning and research (Chilimo, 2016; Chilimo, 2015). Studies continue to illuminate low usage of IRs and preference for the traditional journal publishing in Kenyan universities (Shukla and Ahmad, 2018). Discovery of content in IRs tend to be accidental when using search engines, such as, Google, rather than a purposeful visit of IR's websites (Njagi & Namande, 2018).

Despite their potential roles, empirical studies that have been done on IRs in Kenya did not go far enough to provide data on IRs' actual impact on teaching, learning and research in Kenyan universities (Njagi & Namande, 2018; Karanja, 2017; Ratanya, 2017; Chilimo, 2016; Chilimo, 2015; Ogenga, 2015; Talam, 2014). For instance, Ogenga (2015) looked at adoption of IR in dissemination of scholarly information at United States International University – Africa while Talam (2014) investigated the integration and use of IRs in UoN. Ratanya (2017) examined the access and use of IR among academic staff at Egerton University. These studies did not provide any evidence on IRs' support for teaching, learning and research in the respective universities.

By focusing on the effectiveness of the IR, that is content recruitment, type of content, software used, content utilization and the people involved (librarians, research directors, students and academic staff), this study hoped to develop a better structural model that could improve IRs capacities in supporting teaching, learning and research activities. This study aimed to provide empirical evidence of the roles IRs play in supporting teaching, learning and research activities in four selected universities in Kenya.

1.6 Aim of the Study

The aim of the study was to assess institutional repositories' (IRs) capacities in supporting teaching, learning and research activities in four selected universities in Kenya with a view to proposing an appropriate model to improve teaching, learning and research.

1.7 Research Objectives

The study sought to achieve the following objectives:

i. Establish the effectiveness of content and content recruitment in institutional repositories in selected universities in Kenya.
ii. Assess the content utilization of institutional repositories in supporting teaching, learning and research activities.
iii. Establish the contribution of university librarians, system librarians and research directors toward use of institutional repositories to support teaching, learning and research activities.
iv. Determine the effectiveness of institutional repositories in supporting teaching, learning and research activities.

v. Propose an appropriate model to improve institutional repositories capacities to support teaching, learning and research activities in selected universities in Kenya.

1.8 Research Questions

To address the stated objectives, the study was guided by the following research questions:

i. How effective are content and content recruitment in institutional repositories in selected universities in Kenya?
ii. How does content utilization of institutional repositories support teaching, learning and research activities?
iii. What is the contribution of university librarians, system librarians and research directors toward use of institutional repositories to support teaching, learning and research activities?
iv. How effective are institutional repositories in supporting teaching, learning and research activities?
v. What would be a suitable model to improve institutional repositories capacities to support teaching, learning and research in selected universities in Kenya?

1.9 Assumptions of the Study

This study was based on the following assumptions:

i. The current IR model seem not to have the capacity to support teaching, learning and research at universities due to various factors.

ii. Factors relating to content recruitment, content type in IRs, and the content utilization have hindered the ability of IRs to efficiently support teaching, learning and research at universities.

iii. It is possible to come up with an improved IR model to support teaching, learning and research if all the above factors are critically examined and addressed.

1.10 Significance of the Study

The findings from this study are expected to have practical, theoretical, and policy-related implications as outlined below:

1.10.1 Practical Significance

The study findings are expected to be important as follows:

University and faculty: The study is expected to develop a model to improve IRs' support of teaching, learning and research. This could be important to university and faculty to ensure that IRs support the core academics of universities.

Librarians: The findings from this study are expected to guide them on how they can play a better role in ensuring that IRs support teaching, learning and research in universities.

Students: The study revealed reasons for poor content discovery in IRs and extent to which repositories support learning and research. It is hoped that recommendations made will help students on knowing the importance of IRs and how they can discover content in them more easily.

Faculty staff: By showing reasons for poor content recruitment in IRs and developing an appropriate model, it is expected that staff will deposit their scholarly content in IRs more readily.

1.10.2 Theoretical Significance

It is hoped that the study will contribute to the existing body of knowledge in area of institutional repositories particularly on IRs capacities in supporting teaching, learning and research activities. There are few empirical studies that have been done in Africa and particularly in Kenya on IRs capacities in support of teaching, learning and research and therefore this study will be of significant in contributing to the scholarly research and literature in the field of IRs where empirical studies are still few.

The findings will also shade more light on the actual roles IRs play in teaching, learning and research activities as well as provide new ground for scholars and researchers to conduct further research in the area.

1.10.3 Policy-related Significance

The findings from this study are expected to inform stakeholders on policy formulation in that it will guide them on ownership, quality standards, copyright issues and IR content.

1.11 Scope of the Study

The study mainly focused on the institutional repositories capacities in supporting teaching, learning and research activities in four selected universities in Kenya. The study was carried out in main campuses of the top two public and private universities, namely, USIU-A, Strathmore, University of Nairobi (all located in Nairobi) and Moi (situated in

Eldoret) universities. Thus, the geographical scope of this study was Nairobi and Eldoret. The research was conducted between the months of December 2019 to February 2020.Therefore, the temporal scope of the study was within this period. The study targeted university librarians, system librarians and research directors, students and academic staff within the selected universities.

1.12 Limitations of the Study

When undertaking any research limitations always exist. This study was limited by the busy schedule of academic staff, students and Librarians as data was collected during official working hours hence there was regular interruptions during filling of questionnaires and interview sessions. However, the researcher prior asked for specific date and time as per the respondent's schedule to avoid unnecessary disruptions.

This study was also constrained by the limited literature on the subject of IRs capacities in supporting teaching, learning and research activities in Kenyan universities and therefore a lot of time and effort was needed to look for information from various sources.

1.13 Chapter Summary

This chapter introduced the study, looking at the background, history of IRs, problem statement and study objectives. The chapter has shed light that although IRs can help universities in teaching, learning and research activities, there is lack of empirical evidence on their actual impact on these activities in universities. Moreover, IRs in Kenya seems not to be efficient in supporting teaching, learning and research in universities because of challenges in content recruitment, type of content in them,

software used, and content utilization. The aim of the study was therefore to assess institutional repositories (IRs) capacities in supporting teaching, learning and research activities in four selected universities in Kenya. The study focused on IRs, from content recruitment to its use; and the relevant players (university librarians, system librarians, research directors, students and academic staff). This may be crucial in yielding an appropriate model for IR that can better support teaching, learning and research in universities. Such a model will be important to students, faculty staff and universities, as it will improve the level of teaching, learning, and research in the institutions.

1.14 Definition of Terms and Concepts

Academic staff: In the context of this study, these are lecturers who are involved in teaching and research in higher learning institutions. For instance, assistant lecturers, senior lecturers, professors and associate professors.

Capacity: In the context of this study, this is the effectiveness or capability of an institutional repository to supporting teaching, learning and research

Content Recruitment: It is the process of getting institutional repositories filled with research output and other institutional materials.

Content: These are materials deposited in an institutional repository such as journal articles, theses and dissertations.

Dspace/ Dura space: It is free and flexible open-source software, which aims to collect manage and disseminate the intellectual output of a research institution. It accepts all forms of digital materials including text, image, video and audio files

Eprints: It is a free software package for building open access repositories

Innovation: It is an idea, concept or practice that people perceive as new

Institutional Repositories: digital archives that provide the means to collect, manage, provide access to, disseminate and preserve digital materials produced at an institution.

Learning: It is the act of getting experience, knowledge skills and values by understanding what to do and how to do any task.

Open Access (OA): Unrestricted online access to research articles published in scholarly journals or institutional repositories.

Scholarly Communication: It is a process of storing faculty research and making it accessible for use vie the internet.

Schools: These are the main sections in the institutions of higher learning eg School of Information Science

Search engine: Computer software used to search data (as text or a database) for specified information; also a site on the World Wide Web that uses such software to locate key words in other sites (e.g. Google, Yahoo).

Self-Archiving: The academic staffs' act of depositing and making their non- peer reviewed documents (E-prints) free and publicly accessible to everyone via the internet.

Teaching: Set of events outside the learners, which are designed to facilitate learning.

Website: A collection of web pages, images, videos and other assets hosted on one or more web servers to be accessible over the internet. Websites are an effective way of distributing information such as advertisements, technical information, comments and ideas. They can be accessed through their full address or web page and may give links to other web sites.

WWW: An acronym for World Wide Web also referred to as “the web” is an extensive technology with a vast network of connected computers. It is a particular component of the internet that allows digital materials to be created, stored, accessed and interacted with over the internet.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

According to Denney and Tewksbury (2012) literature review is a comprehensive re-examination of previous research with the sole objective of finding what is known and what is yet to be known about a topic, consequently justifying the need for a new inquiry. A cogent literature review comprehensively and systematically re-examines quality literature. This will be pertinent in justifying of the selection of the research topic, determine the selection of research methodology, and demonstrate a gap in the corpus of knowledge that the proposed research intends to address (Levy & Ellis, 2006; Webster & Watson, 2002). All meaningful and important researches are by necessity cumulative; they borrow from previous research, learning and improving on them. The literature review delineates the scope of the study, defines the confines of a study and places it in broad scholarly and historical context (Boote & Beile, 2005).

The purpose of this chapter is to review both conceptual and empirical literature to provide understanding on the institutional repositories capacities in supporting teaching, learning and research activities in universities. This chapter is organised as follows: first, a review of theories relevant to the study and their justifications is presented, followed by a discussion of the concepts of teaching, learning, research and institutional repositories. This is followed by the conceptualization and a review of empirical literature on the study's major themes: content and content recruitment in IRs; content utilization of IRs in supporting teaching, learning and research; contributions of librarians and research officers toward use of IRs; potential roles and evidence for the

effectiveness of IRs support of teaching, learning and research activities; and factors that hinder IRs' ability to support teaching, learning and research. The last theme could help in the developing an IR model that could improve IRs' effectiveness in supporting teaching, learning and research. The chapter concludes with a summary that shows the gap in knowledge that the study intended to bridge.

2.2 Theoretical Framework

A review of definitions of the word theory invariably contains elements such as 'making predictions' and 'explaining'. Liehr and Smith (1999: 86) give a typical definition of theory as:

> *A set of interrelated concepts, which structure a systematic view of phenomena for the purpose of explaining or predicting. A theory is like a blueprint, a guide for modelling a structure. A blueprint depicts the elements of a structure and the relation of each element to the other, just as a theory depicts the concepts, which compose it and the relation of concepts with each other.*

A theoretical framework can be conceived as a structure or blueprint that identifies and describes the major elements, variables, or constraints that organize a research (Jacard and Jacob, 2010). According to Ravitch and Matthew (2017) a theoretical framework is a useful scaffolding that could be used to understand hypotheses or provide explanations of the relationships amongst elements that are antecedents of particular outcomes detailed in a study.

A theory can enable a study to plan, collect and analyse data, explain findings from the study and is therefore, considered as a crucial element in the research process. Neuman (2006: 77) admonished those who proceed without theories, observing that "researchers

who proceed without a theory or model, rarely conduct top-quality research and frequently find themselves in quandary'' in reporting their research findings. Generally, a theory is a product of repeated and systematic empirical testing and validation while a model is less rigorous, being a bridge between empirical data and theory (Burch, 2003).

2.2.1 An Overview of Theories and Models Related to the Study

IRs are relatively novel technologies. Thus, technology adoption theories and models were expected to explain the spread, adoption, use and acceptance of IRs in higher education institutions, which was in tandem with this study's objective of their capacity in supporting teaching, learning and research activities. According to Marangunic and Granic (2015), theories and models have been developed to explain why users accept or reject a technology. The influence of a technology on humans is explained by a number of social and psychological factors and characteristics.

This study first reviewed all the technology acceptance models before choosing the most relevant ones, which could help enrich the theoretical underpinnings of the study. These theories include Theory of Reasoned Action (Fishbein & Ajzen, 1975), Theory of Planned Behaviour (Ajzen, 1991), Theory of Task-technology fit (Goodhue & Thompson, 1995), and Decomposed Theory of Planned Behaviour (Taylor & Todd, 1995).Others were Social cognitive theory (Bandura, 1986), Technology Acceptance Model (TAM) (Davis, Bogozzi & Warshaw, 1989), TAM 2 (Venkatesh & Davis, 2000), Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis & Davis, 2003), TAM 3 (Venkatesh & Bala, 2008), and Diffusion of Innovations (Rogers, 2003).

2.2.1.1 Theory of Reasoned Action

The Theory of Reasoned Action (TRA) originated from social psychology and was proposed by Fishbein and Ajzen (1975). The key elements of the theory are behaviours of individuals, behavioural intentions, attitudes, norms and beliefs. The theory predicts that how an individual behaves is determined by their intention. The intention, in turn, is influenced by either the individual's attitudes (one's assessment of the behaviour) or their subjective norms (one's perception of what others think it is important to do) towards the behaviour. A person's beliefs shape their attitude whereas their motivations to comply with norms determine their subjective norms.

The theory postulates that human behaviour should be volitional, systematic and rational. In a meta-analysis on the application of the theory, Sheppard, Hartwick, and Warshaw (1988) showed it could produce reasonable predictions of choices made an individual in the face of several alternatives. The major criticism of the theory is that there is no room for habit to explain behaviour, which solely is ascribed to cognitive deliberation (Taherdoost, 2018). Consequently, this study did not use this theory since the use of IRs for learning and research may not always be a conscious decision.

2.2.1.2 Theory of Planned Behaviour (TPB)

The model was proposed by Ajzen (1985) to improve the predictive power of the Theory of Reasoned Action (TRA). In this model, a new variable, perceived behavioural control (PBC) was added to the TRA. Thus, behavioural intention is determined by three factors, attitudes, subjective norms (from TRA) and PBC.PBC is defined as a person's perception of the ease or difficulty of carrying out a specific behaviour (Ajzen, 1991). The degree of

control an individual has over a behaviour and the amount of effort required to engage in a behaviour will strongly influence whether one engages in that behaviour. Thus, if an individual's attitude and subjective norms towards behaviour are favourable and they perceive that they have a greater behavioural control, then, the stronger will be the individual's intention to perform the behaviour.

The model can explain individuals' behaviours based on logical, reasoned decisions arrived at by evaluating information available to them. TPB has been the basis for several studies of Internet purchasing behavior (George, 2004). However, it has been criticised for lack of an explicit definition of PBC and insufficiency of variables, with some suggesting that adding beliefs, moral and religious norms could improve its predictive power (Godkin & Koh, 1996). Consequently, this model was not used in the study.

2.2.1.3 Social Cognitive Theory

Social cognitive theory posits that people learn through observing other's behaviours, attitudes, and outcomes of those behaviours (Bandura, 1986). This theory was developed from the social learning theory, proposed by Miller and Dollard in 1941 (cited in Bandura, 1989), which postulated that individuals learn particular behaviours through clear observations. Albert Bandura, a Canadian Psychologist, subsequently refined and expanded this proposition beginning from 1962.

According to Bandura (1986: 112) change in an individual's behaviour involves, "triadic reciprocal determinism", in which, "behaviour, cognition and other personal factors, and environmental influences all operate as interacting determinants that influence each other bidirectional". Thus, a person's thoughts, expectations, beliefs and other personal factors

affect how he or she behaves and vice versa. On the other hand, human cognition and other personal factors are developed and modified by social influences and vice versa. Lastly, behaviour alters the environment and is in turn also altered by it (Bandura, 1989).

The salient principles of the social cognitive theory are as follows. People learn by observing others, a process known as vicarious learning, not only through their own direct experiences. Secondly, although learning can modify behaviour, people do not always apply what they have learned. Instead, individual choice is based on perceived or actual consequences of behaviour. Thirdly, people are more likely to follow the behaviours modelled by someone with whom they can identify. Lastly, the degree of self-efficacy, the fundamental belief in one's ability to achieve a goal, which a learner possesses directly affects his or her ability to learn. Those with more belief are likely to achieve more (Bandura, 1989).

Social cognitive theory has been widely applied in studies examining attitude or behaviour changes triggered by mass media. The theory suggests that heavily repeated images presented in mass media can be potentially processed and encoded by viewers (Bandura, 1989). Nevertheless, the theory has been criticized for not being a unified theory, for its failure to unite observational learning and self-efficacy. Secondly, not all social learning can be directly observed, hence it is difficult to rate the effect of social cognition on learning (Gawronski & Bodenhausen, 2015).

2.2.1.4 Decomposed Theory of Planned Behaviour

Decomposed Theory of Planned Behaviour was introduced by Taylor and Todd (1995) and is a modification of the Theory of Planned Behaviour (TPB). Like the TPB, it

maintains three variables (attitudes, subjective norms and perceived behaviour control) to explain an individual's behavioural intention. However, each of these variables is further split (decomposed) into several sub variables in order to increase the model's explanatory power. Attitudes are decomposed into trust, perceived usefulness, perceived enjoyment and perceived ease of use. Subjective norms are split into influence exerted by friends, colleagues, and family whereas perceived behaviour control is decomposed into self-efficacy.

Taylor and Todd (1995) showed that the decomposed theory of planned behaviour has more predictive power than the theory of planned behaviour. The advantages of a decomposed theory include an ability to model a multidimensional view of belief and greater flexibility in choosing a stable set of beliefs to be applied in various settings. The theory has been mainly used for products already in the market place, and is unduly subjective (Lai, 2017), and would not therefore explain the spread and adoption of IRs.

2.2.1.5 Theory of Task-Technology Fit (TTF)

The theory of task-technology fit postulates that technology is more likely to be used and have a positive effect on a person's performance if the technology match or fit the tasks the user must perform (Goodhue & Thompson, 1995). Goodhue and Thompson (1995) developed a measure of TTF consisting of eight variables: quality, locatability, authorization, compatibility, ease of use/training, production timeliness, systems reliability, and relationship with users.

Goodhue and Thompson (1995) found the theory to be a significant predictor of user reports of improved job performance and effectiveness. The theory has been applied in a

wide range of information systems including electronic commerce systems and combined with or used as an extension of other models. However, this model presumes that a technology must first be utilised before any assessment of fit and performance may be done. This might not have applied to this study where some academic staff and students were not using IRs for teaching, learning and research. Hence, this model was not adopted for the study. This study reviewed all the technology acceptance models. Though relevant to the study, they were not used to underpin the study because their negatives outweigh their positives.

2.2.2 Theoretical Models for the Study

The purpose of the study was to assess institutional repositories capacities in supporting teaching, learning and research activities in four selected universities in Kenya with a view to proposing appropriate model to improve service provision. Studies by Gichiri, Ng'etich, Omwoha and Maina (2017), Ogenga (2015), and Talam (2014) indicate that though most universities in the country have adopted IRs, their use amongst academic and non-academic staff and students is not absolute. For example, Talam found that only 36% of the respondents had used IRs as an information resource (and these were mainly from the international community rather than students and staff at the University of Nairobi's library) while only 14% of them had ever deposited material in the repository. Since, the theories of Task-technology fit, Reasoned Action, Planned Behaviour and Decomposed Theory of Planned Behaviour have been mainly used for products already in the market place and tend to be subjective (Lai, 2017), they will not be used to guide this study.

The study required a model(s) that could perform two functions. One, that could explain why staff and students could embrace a technology and proceed to use it, secondly, a theory that explains why use of a technology (repository) could spread to staff and students not using it and the possible reasons for the absence or difficulty in the diffusion of the innovation.

The best model that could explain the first function was the Technology Acceptance model (TAM) while Diffusion of Innovations (DOI) model could explain the second. Thus, this study used a combination of both TAM and DOI as its theoretical underpinnings.

Table 2.1: Mapping Research Questions to Key Variables of the Theories/Models

	Research Questions	**Theory Model**	**Key Variables from the Theory/Model**
1	How effective are content and content recruitment in institutional repositories in selected universities in Kenya?	Technology Acceptance Model	Perceived Usefulness Perceived ease of use
		Diffusion of innovation Theory	Relative advantage Compatibility Complexity Trial ability observability
2	How does content utilization of institutional repositories support teaching, learning and research activities?	Technology Acceptance Model	Perceived Usefulness Perceived ease of use Attitude
		Diffusion of innovation Theory	Knowledge Persuasion Decision Implementation confirmation
3	What is the contribution of university librarians, system librarians and research directors toward use of institutional repositories to support teaching, learning and research activities?	Technology Acceptance Model	Perceived Usefulness of IR Perceived ease of use of IR Attitude of IR users Behavioural intention Actual Usage of IR
		Diffusion of innovation Theory	Knowledge Persuasion Decision
4	How effective are institutional repositories in supporting teaching, learning and research activities?	Technology Acceptance Model	Perceived Usefulness of IR Perceived ease of use of IR Attitude of IR users Behavioural intention Actual Usage of IR
		Diffusion of innovation Theory	Relative advantage Compatibility Complexity Trial ability observability
5	What would be a suitable model to improve institutional repositories capacities to support teaching, learning and research in selected universities in Kenya?	Technology Acceptance Model	Perceived Usefulness of IR Perceived ease of use of IR Attitude of IR users Behavioural intention Actual Usage of IR

2.2.2.1 Technology Acceptance Model (TAM)

The TAM has been one of the mainstay theoretical frameworks among information systems community, receiving considerable support in understanding the adoption of new technologies (Park, 2009; Chen, Chen, Lin &Yeh, 2007). Fred Davis first introduced TAM in 1985 for his doctorate thesis to model users' acceptance of information systems and technologies (Davis, 1985). The TAM is a modification of the theory of reasoned action, proposed by Fishbein and Ajzen (1975). Davis *et al*. (1989) used TAM to model determinants of computer usage behavior across a wider variety of computer technologies and user populations. The basic TAM model Davis *et al*. (1989) explicated is shown in Figure 2.1.

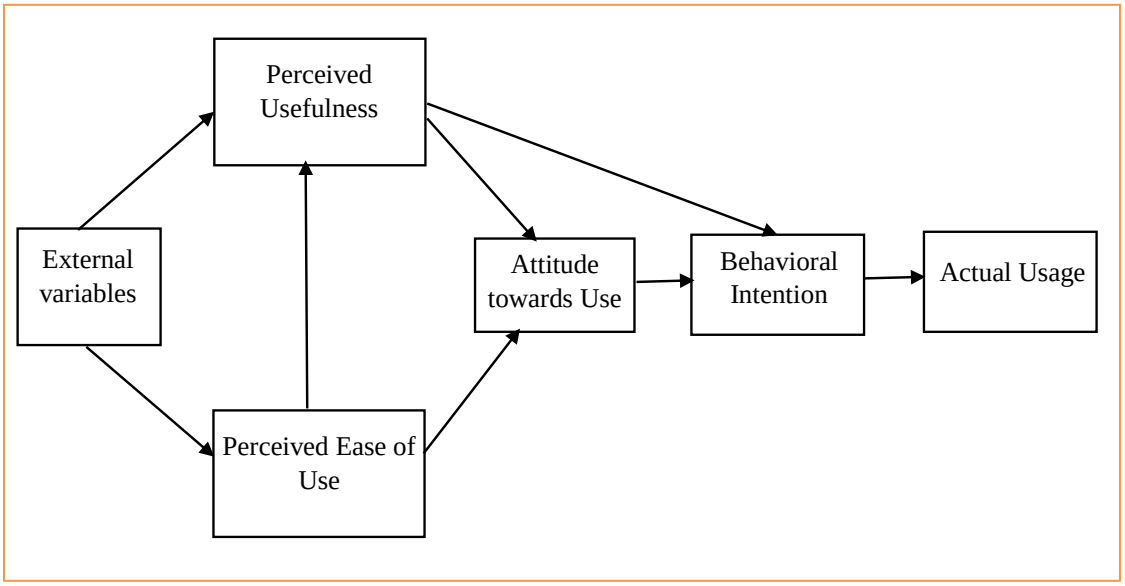

Figure 2.1: The basic Technology Acceptance Model (Adapted from Davis *et al*., 1989)

The model theorizes that users' acceptance of technology is determined by their behavioural intention (BI). BI is strongly correlated with actual usage, with Farahat (2012) stating that, "if a person intends to do a behaviour, then it is likely to be done".

Because actual usage can sometimes be difficult to measure in research, studies sometimes use BI to indicate usage (Chau & Hu, 2002). According to Davis *et al*. (1989), the attitude of a user influences their BI. Attitudes, in turn, are shaped by two variables: perceived usefulness (PU) and perceived ease of use (PEU) of the technology. The PU is defined as "an individual's perception that using an IT system will enhance job performance" whereas PEU is conceptualised as "an individual's perception that using an IT system will be free of effort" (Davis *et al*. 1989: 21). The model predicts that when the PU and PEU of a technology improves, a user's attitude towards the technology will be positive, leading them to adopt it. In the context of this study, academic staff and students have to understand the usefulness of an IR then develop positive attitude towards embracing and using this IR for teaching, learning and research. In addition, PEU can positively influence PU while PU can independently affect BI. Various external variables can affect both PU and PEU. The external variables frequently used include system design characteristics, training (Igbaria & Livari, 1995), compatibility, experience, enjoyment, self-efficacy, complexity, managerial support, social influence, and computing support (Farahat, 2012; Lee, Kozar& Larsen, 2003; Chau, 1996). Thus, the major determinant of whether users will use a system is their attitude towards it, which in turn, is influenced by the perceived usefulness and perceived ease of use of the system, which in turn are shaped by external factors.

TAM has been modified over the years. Venkatesh and Davis (1996) dropped the variable of attitude from the model after finding out that both perceived usefulness and perceived ease of use directly influenced behavior intention (Figure 2.2).

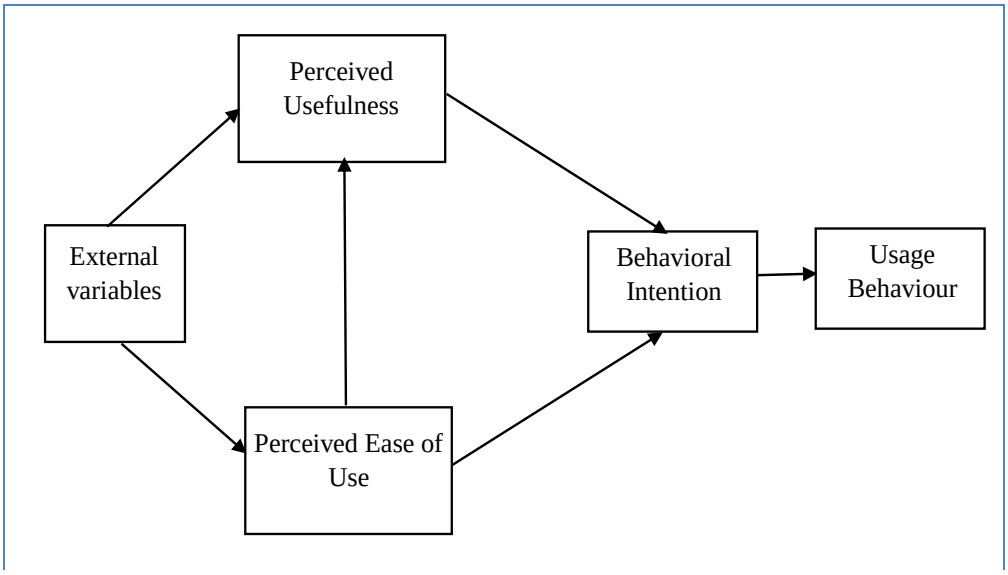

Figure 2.2: Modified Technology Acceptance Model (Adapted from Venkatesh & Davis, 1996)

In another modification referred to as TAM 2, Venkatesh and Davis (2000) added another construct to measure social influence (SI), for instance, the effect of colleagues, peers or bosses, on the adoption of technology. Venkatesh *et al*. (2003) unified eight technology acceptance and usage models to yield the Unified Theory of Acceptance and Use of Technology (UTAUT). The theories that formed UTAUT included TAM, Motivational Model, Theory of Reasoned Action, Theory of Planned Behavior (TPB), Combined-TAM and TPB, Model of PC Utilization, Diffusion Innovation Theory, and Social Cognitive Theory (Venkatesh *et al*., 2003; Venkatesh, Thong &Xu, 2016).

UTAUT retains much of the features of TAM. The theory maintains behavioural intention as a predictor of use behaviour (just like in TAM), which measures users' adoption of technology. The theory proposes that three constructs, performance expectancy, effort expectancy, and social influence, in turn, influence behavioural intention while a fourth variable, facilitating conditions, predicts technology use, together

with behavioural intention. The model also has four moderators: gender, age, experience and voluntariness of use. TAM's PU, PEU and SI are incorporated into UTAUT's performance expectancy, effort expectancy, and social influence, respectively (Venkatesh *et al*., 2003). The model has been found to have high explanatory power, accounting for about 70% and 50% of the variance in behavioral intention and actual use, respectively (Venkatesh *et al*., 2016). The study sees no reason for adopting UTAUT as many of its elements are already contained within TAM.

2.2.2.1.1 Justification of the TAM for this Study

TAM is one of the most influential and frequently cited models amongst other technology acceptance models. It's a well-researched model whose overall explanatory power and measurement validity has been tested in various empirical settings characterizes by different user groups, technology and organizational settings, which makes its use more operationally appealing (Hu *et al*., 1999). TAM is applauded for its ability to predict 40 to 50 percent of users' acceptance of technologies. According to, Lai (2017), Durodolu (2016), Holden and Karsh (2010), TAM has become the gold standard, if not a paradigm, in the theory of IT acceptance, with about 10% of all published literature in the field using the theory. Despite its relative simplicity, reviews of the most basic version of the theory show that it accounts for between 30 – 40 % of IT acceptance. According to Marangunic and Granic (2015), of all the models suggested on the effective use of technology, the Technology Acceptance Model is the best in examining issues affecting users' acceptance of modern technology.

This study applied Technology Acceptance Model (TAM) because of its ability to explain factors that determine the capacity of institutional repository to support teaching, learning and research , such as perceived usefulness of the institutional repository (benefit that the academic staff and students will derive from using content in the institutional repository for teaching, learning and research, therefore contributing to quality teaching, learning and research hence university's quality), and perceived ease of use of the institutional repository which is determined by factors like the IR infrastructure (organization of data, software) in place. If the academic staff and students who use IR perceive its infrastructure in place as good enough, then the usefulness of the institutional repository will increase. Also, there are other factors that determine the capacity of institutional repository to support teaching, learning and research. For instance, the type of content contributed by the academic staff and students, software used, content discovery and use of the institutional repository all these external factors may have an impact on institutional repository to actually support the primary functions of universities.

Different studies have used this theory for instance; Achieng (2016) investigated 200 students at the University of Nairobi to explain user perspective satisfaction and awareness of digital repository and she adopted TAM to explain user perspectives on efficiency, effectiveness, satisfaction and awareness of digital repository. The study found that e-resources were underutilised, students lacked access to computers and resources while the library portal was hardly used. Repository effectiveness, efficiency, satisfaction and awareness were found to have a significant and positive influence on the usage of the repository. Although the author did not explicitly discuss perceived

usefulness, perceived ease of use and external variables, the factors used in the study (effectiveness, efficiency, satisfaction and awareness) represent some of the elements of TAM.

Wynn, Winn and Syed-Mohamad, (2012) investigated the acceptance of a newly developed Multimedia Repository System amongst 35 lecturers from the School of Health Sciences, UniversitiSains Malaysia. The respondents attended a workshop lasting two and half hours, in which they were trained on how to use the system, and were given questionnaires about their acceptability of the system at the end of the session. The study, incorporating elements from both DOI and TAM theories, asked participants about the system's perceived ease of use, perceived usefulness, web experience, compatibility, computer experience and technical support. The study found that usefulness, compatibility and computer experience were strong predictors for intention to use the system. However, the study did not asses the capacity the repository played in teaching and research.

Saulus, Mutula and Dlamini (2018) investigated 45 staff in the faculties of Agriculture and Consumer Sciences at the University of Swaziland, Luyengo Campus about technology acceptance factors that could promote or inhibit the use of IRs in dissemination of library information. The factors examined included ease of navigating IRs, perceived usefulness, the use of IRs by peers and availability of resources to support usage, all elements of the TAM. Findings showed that perceived usefulness and ease of use influenced intensions to accept and use the repository whereas social influence did

not. Nevertheless, the research did not look at the use of IRs in supporting teaching, learning and research.

In a descriptive study, Ukwoma and Dike (2017) surveyed attitudes of 491 academics and 5 repository librarians from 5 Nigerian universities about the utilization of IRs in their institutions. The study adopted the TAM to model the respondents' attitudes towards IRs. The model used was the original TAM but with perceived usefulness, in addition, theorized to influence behavioral intention to use while system represented the external variable. The study found that participants had positive attitudes towards the use of IRs. However, the study did not explicitly study how variables from TAM, such as perceived usefulness and ease of use of IRs could affect attitudes. This study shows that academic staff and students who use IRs in teaching, learning and research are those who perceive them to be useful and easy to use. On the other hand, those who are reticent find them to be of little value and difficult to use.

Therefore, in spite of the suitability of Technology Acceptance Model in this research study, the researcher felt that a gap still existed that needed another theory that could help explain the spreading of institutional repositories (innovation) to the user communities (students and academic staff).

This was important because it was possible that some members of the user community (academic staff & students), might never have seen or used IRs for teaching, learning and research. Therefore, diffusion of innovation theory was seen as relevant to this study because it seeks to explain how innovations are taken up by user community.

2.2.2.2 Diffusion of Innovations (DOI) Theory

The theory on how innovations spread through a social system has been intensely studied since the 1960s and has been expanded upon by Everett Rogers since 1962 as a way of explaining the diffusion of a wide variety of innovations (Rogers, Singhal & Quinlan, 2009). The theory explains how over time an idea or product gains momentum and diffuses (spreads) through a specific population or social system. This theory is particularly important because it has influenced numerous other theories of adoption and diffusion (Straub, 2009). It also provides a framework that explains how an innovation comes to be accepted by different social groups upon its origin and has been applied in a wide variety of disciplines including economics, education, information science, computer science, business and sociology (Rogers & Scott, 1997). The theory of diffusion of innovation therefore seeks to explain how innovations are taken up in a population.

According to Rogers (2003: 12) an innovation is defined as "an idea, practice or object that is perceived as new by an individual or other unit of adoption". According to him, an innovation and technology are synonymous, defining the latter as "a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome" (Rogers, 2003: 13). A technology consists of two parts, hardware, "the tool that embodies the technology in the form of a material or physical object," and a software "the information base for the tool" (Rogers, 2003: 259). Diffusion of innovations refers to the process by which an innovation or a technology "is communicated through certain channels over time among the members of a social system" (Rogers, 2003: 99). The diffusion process therefore consists of four key

elements: innovation, communication channels, time and social system. In this study, the institutional repository itself is considered as an innovation because although used, other users may not have used it or heard about it.

This theory clearly explains that adoption of an innovation is not a single act but a continuous process that can be examined, facilitated and promoted, (Keese & Shepard, 2011). Knowledge of such steps in the innovation-decision process can possibly help university management introducing new innovation to intervene through promotional activities in order to encourage the adoption of such a new innovation, for instance, an institutional repository and through it the university can enhance teaching, learning and research. Innovation-decision process is also a mental process through which an individual pass through from first knowledge of an innovation to forming an attitude towards the innovation, to adopt or reject, to implementation of the new idea, and to confirmation of the decision.

2.2.2.2.1 Stages in the Innovation-Decision Process

From the definition of innovation above, the key notion in an innovation is that people should perceive it as being new. It does not matter that a technology is actually old, so long as it was felt as new would influence its spread in a social group. The newness characteristic of an innovation influences knowledge, persuasion and decision during an innovation-decision process (Rogers, 2003). A communication channel is the second element in DOI process. Rogers (2003: 5) defined communication as “a process in which participants create and share information with one another in order to reach a mutual understanding”. Diffusion is a specific type of communication involving an innovation,

two or more individuals, and a communication channel, which may be mass media or interpersonal communication. The latter is more important in changing attitudes (important in persuasion stage) and this requires some degree of difference between the individuals, that is, they should be 'heterophilous'. On the other hand, mass media are important in communication between an individual and outside sources ('cosmopolite channels') and are crucial in knowledge stage (Rogers, 2003).

Time, the third element, affects innovation-diffusion process, adopter categorization, and the rate of adoptions and should always be present in the model. Rogers (2003) defined the social system, the last element, as "a set of interrelated units engaged in joint problem solving to accomplish a common goal". Social system provides the context in which diffusions spread and affects individuals' innovativeness.

Rogers (2003: 172) also described the innovation-decision process as "an information-seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation". The innovation-decision process consists of five sequential steps (Figure 2.3): knowledge, persuasion, decision, implementation, and confirmation (Rogers, 2003).

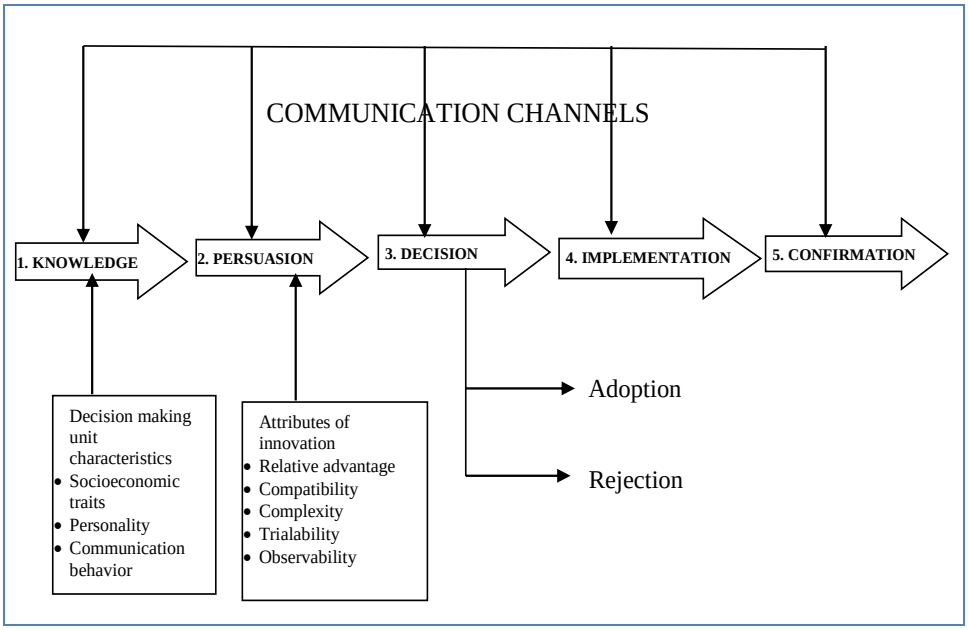

Figure 2.3: Rogers' (2003) Five Stages in the Innovation-Decision Process (Adapted from Rogers, 2003)

In the first step, an individual learns about the existence of innovation and seeks information about it. The pertinent questions asked during the knowledge step are, 'what is the innovation?', 'how does it work?', and 'why it works?' This leads to three types of knowledge: awareness-knowledge, how-to-knowledge, and principles-knowledge. The first represents knowing about the existence of an innovation. This could lead to learning more about it and eventually adopting it. The second represents the ability to use the innovation correctly and is essential for a technology to be adopted; people must know how to use it first. The last describes the functioning principles of a technology and while people may adopt it without the knowledge, it is likely to be misused and therefore, discontinued.

After obtaining knowledge, the person will either form a positive or negative attitude towards the innovation during the persuasion stage. Whereas the knowledge stage is more

cognitive, the persuasion step is more affective, with emotion playing a more prominent role. Persuasion is when the individual becomes interested in the innovations and starts seeking information about it. Social reinforcement from others and the magnitude of uncertainty largely shapes an individual's opinion about an innovation.

During the decision step, an individual either adopts or rejects the innovation. Adoption is usually faster if individuals are given an opportunity to try out the innovation first. The individual takes the concept of change; weighs the advantages and disadvantages of using the innovation and decides whether to adopt or reject it. Rogers (2003) identified two types of rejection: active and passive. In active rejection or discontinuance, a user rejects an innovation after first trying it. In passive or non-adoption rejection, the potential user does not think about using the innovation at all.

At the implementation stage, an innovation is put into practice. The newness in an innovation engenders some degree of uncertainty, which may require technical assistance from change agents (Rogers, 2003). Reinvention may also occur at this stage. Reinvention is "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation". At the confirmation stage, the individuals evaluate an innovation and decide if they will continue using it or not. Depending on the support for adoption of the innovation that may involve strategies encouraging the innovation usage and the attitude of the individual, later adoption or discontinuance happens during this stage.

According to Rogers (2003: 232), the innovation-diffusion process is an "uncertainty reduction process" and argued that five attributes will influence the rate at which

innovations are taken up: relative advantage, compatibility, complexity, trial-ability, and observability. Accordingly, he argued that whereas there were numerous researches on adopter characteristics, the same intensity had not been focused on the effects of the perceived attributes of innovations on the rate of adoption.

Relative advantage refers to "the degree to which an innovation is perceived as being better than the idea it supersedes by a particular group of users, measured in terms that matter to those users, like economic advantage, social prestige, convenience, or satisfaction (Robinson, 2009). The greater the perceived relative advantage of an innovation, the more rapid its rate of adoption is likely to be. Robinson further points out that relative advantage therefore depends on the particular perceptions and needs of that particular user group. As an innovation, institutional repositories are a relatively new idea, product or service that is increasingly being deployed in universities as a means to collect, manage, provide access to, disseminate and preserve digital materials created by the institution and its community members (Lynch, 2003). Compatibility is defined as the extent to which an innovation is "perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 2003: 15). A higher compatibility of an innovation with an individual's needs reduces uncertainty and therefore increases adoption. Therefore, an IR should be compatible to the existing values and practices as it offers a platform for increased visibility, teaching, learning and research.

The degree to which an innovation is perceived as being difficult to understand and use describes its complexity (Rogers, 2003). New ideas that are simpler to understand are adopted more rapidly than innovations or services that require the adopter to develop new

skills and understandings. Trialability, the ability to experiment with an innovation for a limited period, is positively correlated with adoption. Observability measures the extent to which the results of an innovation are visible to others (Rogers, 2003). In conclusion, innovations perceived by individuals as having greater relative advantage, compatibility, trial ability, and observability will be adopted more rapidly than those perceived as more complex.

Rogers (2003) also classified members of a social system into adopter (only those who use the innovation) categories based on the degree of innovativeness. These were innovators, early adopters, early majority, late majority and laggards and he found that they formed a normal distribution. Rogers, found that innovators (those willing to experiment with new technology) and early adopters (leaders who adopt the technology early on) constituted 2.5 and 13.5% of the social system respectively. Early majority (the many who follow early adopters in adoption) and late majority (the many who adopt the innovation after the early majority) each constituted 34% of the social system. On the other hand, laggards (sceptical members who only adopt the technology after all the others) comprised 16% (Figure 2.4).

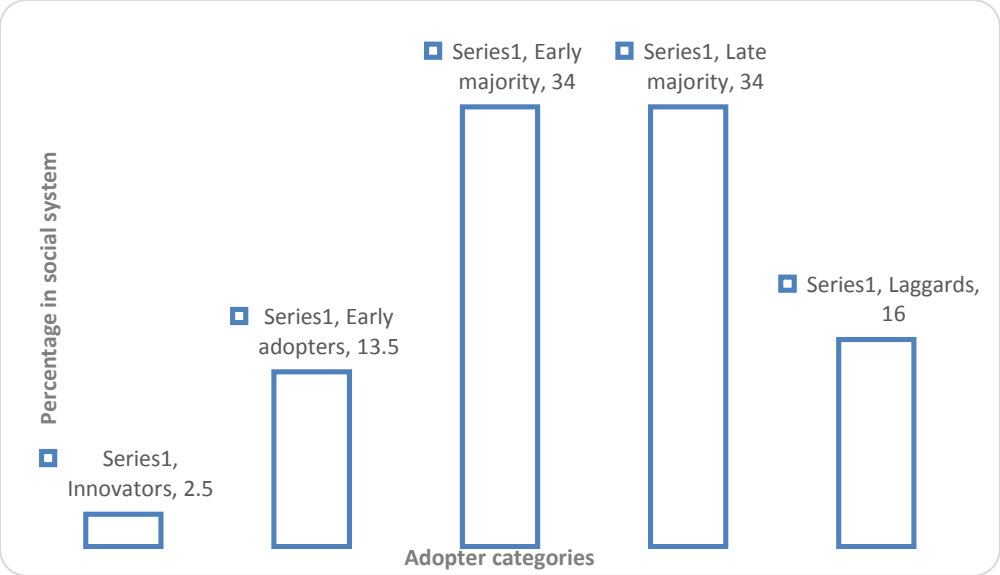

Figure 2.4: Categories of Adopters based on the time of Adoption (Adapted from Rogers, 2003)

Thus, most people in a social group are early or late majority while a few are innovators, early adopters or laggards. In the context of this study, it is important to understand which adopter categories do students and academic staff belong with respect to the use of IRs in teaching, learning and research.

2.2.2.1.2 Justification of the DOI Theory for this Study

Although IRs have been adopted by most universities, their usage is not universal amongst students and staff (Gichiri *et al*., 2017; Ogenga, 2015; Talam, 2014), necessitating a need to understand why this is the case. IRs exhibit all the four elements necessary for an innovation to diffuse: innovation, communication channels, time and social system. Although IRs are about 20 years old, the fact that some users have never heard or used them (Gichiri *et al*., 2017; Talam, 2014), means that they will be perceived as new amongst this group, that is, repositories are an innovation. This will be key in the five sequential steps of innovation-decision among staff and students: knowledge,

persuasion, decision, implementation, and confirmation. In the knowledge step, it will be important for the study to establish whether staff and students who do not use IRs are aware of their existence, know how to use them properly and how they function, as this will be an important initial step in their adoption.

In the second step of persuasion, it is useful to understand the role librarians, peers, and institutions play to persuade staff and students in the necessity of use of IR to support learning and research. During the decision stage, a user may either actively or passively reject an innovation, depending on whether they first try out an innovation or not. It is important to find out in this study whether those who reject the use of IRs are active or passive. At the implementation stage, it is important to determine whether the adoption of IRs in the universities (hardware and software) was seamless or was beset with technical problems. Lastly, during confirmation stage, this study seeks to understand whether the use of IRs in teaching, learning and research is expanding or decreasing and the degree to which this is happening. This is important since at this stage, users may choose to discontinue using the innovation while late adopters may try it.

Although numerous studies have used Rogers' theory as their theoretical framework with respect to IRs, few studies have specifically applied the theory to assess IRs capacities in supporting teaching, learning and research activities in universities. The following empirical studies have applied DOI theory in a general context of institutional repositories. Revelland Dorner (2009) investigated nine New Zealand academic subject librarians' perceptions of IRs as sources of information for their clients, using Rogers' DOI. The study investigated the five attributes of innovation that affect its use: relative

advantage, compatibility, trialability, observability, and complexity and role of librarians as change agents in promoting the use of IRs. The study found out that, librarians have both positive and negative perceptions of IRs and hence was ambivalent in promoting their use. Significant participants found IRs not compatible with current information resources, their interfaces to be complex, had low rates of trialability, and were observable.

Kiplang'at (2004) applied DOI to investigate the diffusion of Information and Communication Technologies (ICTs) in the communication of agricultural information among agricultural researchers and extension workers in Kenya Agricultural Research Institute (KARl) and the Ministry of Agriculture and Rural Development (MoARD) in Kenya. The innovations were found to have low relative advantage, little compatibility, cell phones were less complex relative to internet and email, low trialability and relatively visible. The rate of adoption was found to be sigmoid. In a related study, Minishi-Majanja (2004) mapped and audited ICTs in LIS education in sub-Saharan Africa using DOI as the conceptual and theoretical framework. The study found ICTs to have high relative advantage, acceptable compatibility, to be complex, visible while its adoption was slow at first but gradually increased. Swanepoel (2005) also used the Roger’s Diffusion of Innovation theory to investigate the extent to which institutional repositories have been accepted as a method of communicating scientific and scholarly information.

2.3 Concepts of Teaching, Learning, Research and Institutional Repositories

Teaching is a set of events, outside the learners, which are designed to facilitate learning. As Abbatt and McMahon (1993) once remarked, 'Teaching is helping other people to learn'. Teaching may be conceptualized as the provision of pre-structured knowledge or specific influences consciously designed usually in a formal institution (school, college or university) to bring about development and growth of the child (Sequeira, 2012; Niemi, 2009). According to John Dewey, a school (which may refer to a kindergarten, college or university) is a consciously designed institution whose sole purpose is to teach a child (Dewey, 2010).Thus, teaching activities in a school can lead to learning and in a narrow sense, teaching is education (Sequeira, 2012).

Learning is the core of education. Learning is the act of getting experience, knowledge, skills and values by understanding what to do and how to do any task by synthesizing the different types of information perceived by an individual (Sequeira, 2012; Prozesky, 2000; Reece and Walker, 1997). Learning is typified by three attributes: permanent change in an individual's behaviour, it manifests in an individual's behaviour or activities that may not be directly observable, and is dependent on practice and experience (Niemi, 2009; Chambers, 2001). This study therefore conceptualizes learning as a core activity of education and that teaching can facilitate (teaching is not the only one) that learning. Thus, teaching and learning can constitute education.

Research is defined as the systematic and scientific search for pertinent information on a specific topic. Research usually consists of the following steps: identifying a problem, formulating a hypothesis, collecting data or facts, analysing data, and reaching a

conclusion either in the form of solution(s) towards a concerned problem or in certain generalization for some theoretical formulation (Phillips, 2009; Ellis and Levy, 2008; Saunders *et al*., 2009; Kerlinger, 1986). Education and research are closely intertwined. Since the major objective of research is the search of knowledge, what is generally known in the parlance of research as an 'original contribution to knowledge' (Ellis and Levy, 2008), it results greatly to education (Veal, 2005) and vice versa. At the Lisbon Summit in 2000, the European Commission adopted the triangle of knowledge (education, research, and innovation), in which they enunciated that education is the tool leading to research and then, to innovation (Koutras and Bottis, 2013). Little wonder that, the primary functions of universities, the pinnacles of schooling, are teaching, learning and research (Gilman, 2016; Richardson and Wolski, 2012).

One of the earliest definitions of an institutional repository was provided by Lynch (2003), who defined it as "a set of services that a university offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members." According to Jain, Bentley and Oladiran, (2016), an IR is a digital research archive consisting of accessible collections of scholarly work that represent the intellectual capital of an institution. These definitions reflect the one given by Shreeves and Cragin (2008), which this study adopts. They defined an institutional repository as technologies that provide the means to collect, manage, provide access to, disseminate, and preserve digital materials produced at an institution. According to Ware (2004), IR is constituted by the following criteria: Web-based database (repository) of scholarly material (the material are purely scholarly); and institutionally defined (as opposed to a subject-based repository, it contains institution-

wide material). Others are cumulative and perpetual (a collection of permanent and increasing material); open and interoperable (compliant with Open Archive Initiative compliant software); and collects, stores and disseminates scholarly material as part of the process of scholarly communication.

2.4 Content and Content Recruitment in Institutional Repositories

This section presented related literature on the contents in IRs and the recruitment of such content. It reviewed also the implications of the content and its recruitment on teaching, learning and research.

2.4.1 Content in Institutional Repositories

This study operationally defines content as the material deposited in IR, such as journal articles, theses and dissertations (Crow, 2002). Four parameters, all with implications on their ability to be used in teaching, learning and research, define IR content: diversity, currency, size, and metadata (Kanto, 2005; Saracevic, 2000 & 2005; Saracevic & Covi, 2000; Fuhr, Hansen, Mabe, Micsik & Sølvberg, 2001). Whereas Saracevic(2005) emphasizes more on procedural characteristics of content management. Fuhr *et al*. (2001) and Kanto (2005) dwell more on formal features of the content. In addition, Larsen (2002) was concerned more with final product in IRs, emphasizing that the content should be sufficient, current, and of good quality.

If IRs are to legitimately support teaching, learning and research in higher institutions, the contents they carry must be both broad and deep. If a repository contains few materials, potential users will not bother checking it while depositors will resist

depositing their work as it will not be visible to the academic community (Dubinsky, 2014; Richardson and Wolski, 2012).

Nevertheless, there has been wide variation in content of IRs, with Shreeves and Cragin (2008) arguing that the type of content contained in them depended upon the goal of the repository. Each institution defines its own content and decides what to populate the repository because the policy guides them on deposition of content into IR. According to the University of Nottingham's Directory OpenDOAR (2008), IRs of top 100 universities in the world contains 12 main document types: journal articles, theses and dissertations, conference and workshop papers, books, book chapter and section, datasets, and multimedia and audio-visual materials. Others are unpublished reports and working papers, learning objects, patents, software, bibliographic references, and other special item types (Tsunoda *et al*., 2016; Kaur (2017).

Allen (2005) and McDowell (2007) reported a wide variance in scope and content of IRs, identified several small and under-utilised repositories, noted that the contents were dominated by science and technology, and found that the largest proportion of deposits consisted of PhD and other theses, followed by faculty research output, of which only 13% was peer reviewed. The inclusion of grey literature in IR has sometimes brought collision between IRs and repository managers for veering away from the objectives of the open access movement (Poynder 2006a). Grey literature includes preprints, working papers, theses and dissertations, research and technical reports, conference proceedings, departmental and research center newsletters and bulletins, papers in support of grant applications, status reports to funding agencies, committee reports and memoranda,

statistical reports, technical documentation, and surveys (Scholarly Publishing & Academic Research Coalition, SPARC, 2002). According to Adie (2014), grey literature is: created by researchers and informed by research but aren't usually viewed as first class citizens of the scholarly literature. They are not all tracked in citation indexes like Web of Science or Scopus and can be difficult to cite in academic journals.

There are two school of thoughts contrasting philosophical viewpoints about the objectives of IRs: one that considers IRs as competition and possible replacement for traditional publishing (Harnard, 1995; Crow, 2002); the other that views IRs as a supplement to traditional publishing (Lynch, 2003). Harnad (1995) argued that academics should publish their work in IRs, thereby circumventing the economic barriers put up by publishers that limit scholarly access to research. Crow (2002), similarly argued that IRs should take over all the traditional functions of traditional publishing, namely, registration, certification, dissemination, and archiving, and hence, placing the function of scholarly publishing rightfully into the hands of the Academy. Lynch (2003), on the other hand, viewed IRs' roles as supplementary; arguing against them taking on the function of certification during the course scholarly publishing. The author warns, "The institutional repository isn't a journal, or a collection of journals, and should not be managed like one" Lynch (2003). According to him, IRs should complement traditional publishing by disseminating "grey literature", such as conference presentations, bulletins and pamphlets, which are usually ignored by scholarly publishers.

This dialectical tension between the two schools of thought can influence the size, diversity and quality of content of IRs. IRs following Harnard's (1995) and Crow's,

(2002) mold would be expected to contain more diverse and bigger volumes of content, ranging from grey literature to traditional forms of publishing such as journal articles. On the other hand, IRs in the Lynch's (2003) fashion will be expected to have a narrower content, with preponderance towards non-traditional forms of literature. This tension generates a further conundrum for IRs: aim for broader content, which may become unwieldy or go for a narrower, grey literature, risk alienating those searching to replace traditional scholarly publishing.

Studies by McDowell (2007) and Bailey *et al*. (2006) suggest that the model that has become dominant over time is that of Lynch (2003), with IRs containing mostly grey literature rather than journal articles. In addition, the content is not self-archived by the authors. Some have argued that the result is patchy coverage that is neither likely to reform scholarly publishing nor meet long-term preservation goals. (McDowell, 2007). It is this study's contention that while IRs should continue featuring grey literature (such as conference presentations and bulletins), they should also attempt to reform the process of scholarly publishing, by enabling the publishing of peer reviewed articles that could be assessed by scholars.

The key distinguishing characteristic between IRs and subject repositories, from which they descended, is that their content is institutionally defined (Ware, 2004). Because each institution defines its own content and decides what to populate the IR according to its needs and aspirations, there is great variability in content (Shirky, 2005). Because of the variability of content in many IRs, some authors have called for standardization of repository content. For instance, the Commonwealth Schools of Education, Science and

Training (DEST) of Australia recommended that "identifying international standards for use with the contents of E-print repositories" (DEST, 2002: 54). Others have disagreed with the notion, arguing that IRs should be free to accept all materials, not just those that are peer reviewed. They suggest that libraries should record materials of varying levels of quality in standardized metadata and made available to users. The materials are put in categories for easy searching, such that if a user wanted only peer-reviewed materials, they can look in the relevant category. The question of who should police the filling up of the repository arises, as to whether they should be librarians or faculty staff (Chapman *et al*., 2009).

Materials deposited in IRs by academic staff have been plagued by concerns over misspelling and grammar, unclear copyright issues, prominence of style over substance, and technical problems, lowering its quality. However, it has been argued that such content is not substandard as students usually use it, and hence, it could be important in teaching, learning and research (Arlitsch & Grant, 2018).

2.4.2 Content Recruitment in Institutional Repositories

The scope and content of IRs depend upon the rate at which materials are deposited in them. Content recruitment is the process of getting IRs filled up with research output and other institutional materials. It is generally accepted that content recruitment is the core of an IR (Covey, 2011). Successful content recruitment requires collaboration between various actors. For instance, Lynch (2003:12) stated that, "An effective institutional repository of necessity represents collaboration among librarians, information technologists, archives and records managers, and university administrators and

policymakers". One of the earlier visions of IRs was that faculty and researchers at the university or their agents would deposit or self-archive their own work pre- or post-peer review. This practice, also known as green archiving, would ensure that people most knowledgeable about the work would describe it (provide its metadata) rather than mere catalogers, such as librarians and repository managers (Davis-Kahl, 2016; Chapman, Reynolds, & Shreeves, 2009). However, self-archiving has not been successful in filling up IRs with McDowell (2007) showing a median annual increase of only 366 items in IRs between 2005 and 2006. The best practice in populating IRs has been mediated green archiving where repository managers deposit faculty work and other university materials on behalf of the authors (Davis-Kahl, 2016; Chapman *et al*., 2009).

Studies show that faculty members are reluctant to contribute material to IRs. A study conducted by Omeluzor (2014) in Nigeria universities on IRs awareness and willingness of faculty staff to deposit research work revealed that many faculty staff were not willing to contribute any publication in IR because they found difficulty in depositing content in IR. Similarly, Molteno (2016) found in his study that researchers in Africa were still invisible because they felt reluctant to deposit their work in IRs for archiving. Casey (2012) surveyed directors at the Association of Research Libraries (ARL) and found that most of the faculty members at the institutions were not contributing. Similarly, Schonfeld and Houseright (2010) found that less than 30 percent of faculty in U.S. colleges and universities were contributing to IRs. Reasons for reluctance to contribute include steep learning curve for IRs, fear of copyright infringement, concerns about plagiarism, fear that low quality of some material in the IR would taint the research, and concerns over whether contributing to the IR is equated with publishing. Others included

perceived quality of self-archived materials, disciplinary culture and practices, lack of time, lack of technical skills, and concerns regarding promotion of materials (Arlitsch & Grant, 2018).All respondents in the Census of Institutional Repositories in the US reported having difficulty recruiting content from faculty and graduate students, and also found that the more mature the repository is, the more sceptical the staff in charge of the repository are of any given recruitment strategy (McDowell, 2007). National Institute Informatics (2014) reported a similar trend with regard to IRs in Japanese universities, noting that the large amount of content registration that occurs during inception of repositories tends to taper off and give way to mundane, routine content registration, inevitably leading to a decline in the number of new materials. These findings appear to challenge the foundational basis of IRs as alternative tools for the current scholarly publishing model (McDowell, 2007).

Giesecke, (2011) argued that faculty and other researchers may upload inferior materials that may not meet quality standards. Consequently, the work needs to be corrected and improved to ensure continued reputed quality of IRs. Faculty may not know how to describe the work in such a way that it optimises their chances of discovery by search engines such as Google. Providing correct key words and expressive abstract can increase the chances of users identifying and using them in teaching, learning and research.

Davis and Connolly (2007) observed that material in IRs is often made as one-time deposits or through periodic batch additions of works, rather than by continuous additions by enthusiastic faculty (Davis and Connolly2007). Salo (2008) presents a pessimistic view of IRs, noting faculty disinterest, abysmal marketing efforts, implementation

dictated by university policy rather than user needs, inadequate staff and support services. The IR, in essence, had become a “roach motel”, in which the faculties work “live and die” after submission (Salo, 2008). The faculty neither understood the purpose of the IR nor did derive the full range of benefits from it. Cullen and Chawner (2011) showed that regardless of the medium, the faculty just wanted to carry out research, share their findings, and find the research of their colleagues. They concluded that an IR should not be a place where research goes to die.

The above studies do not establish the effectiveness of content and content recruitment on teaching, learning and research activities in universities. This study addressed this gap by directly relating how content and content recruitment affects teaching, learning and research activities.

2.5 Content Utilization of Institutional Repository in Supporting Teaching Learning and Research

This section discusses literature on the way clients discover and utilize content in IRs. At the heart of utilizing IRs could be content discovery and use, and the type of software used by IRs. Thus, in addition, this section presents literature on the various software used by IRs and their relative strengths and weaknesses.

2.5.1 Content Discovery and Use of IRs

Tay (2017) observed that users do not usually visit directly the IRs’ websites, rather they discover content through search engines such as Google Scholar that link them to the page. Consequently, few actually see IR pages except for those who submit papers. The small number of visitors makes individual IRs to have a small mass and therefore unable

to enjoy network effects – the ability for a bigger platform to attract even more visitors. The lack of aggregation of IRs means that they may never develop into behemoths such as Facebook or Google or even subject repositories such as PubMed, SSRN and ResearchGate. The logic becomes circular. Since IRs have few papers, few people visit them and because of this only a few would want to deposit their work in them. This diminishes the ability of IRs to support teaching, learning and research as the quality of the papers will be low.

Similar arguments have been made by Arlitsch and Grant (2018), Van de Velde (2017), Wenzler (2017) and Coalition for Networked Information (2017). For example, Van de Velde (2017) argues that disaggregated nature of IRs affords local control but creates problems of siloed content and non-uniform application of metadata standards. Arlitsch and Grant (2018) argued that few users bother to search individual IRs, preferring to use aggregators such as Google Scholar (GS). In addition, many IR content is poorly represented in GS index, as IRs do not follow its harvesting and indexing requirements.

Jean *et al*. (2011) reported barriers in users attempting to access IR websites, including non-functioning of the website, lack of visibility of the IR, and absence of content in IRs. Others were poor organisation of materials in the IR, unappealing and inadequate IR interface such as lack of features present in modern websites, inability to rate and promote articles and difficulties in navigating content.

Jean *et al*. (2011) also reported on the nature of IR use by visitors. They found that users visited IRs to find out what type of research was on-going in their campus, since they had the ability to contact the researchers if they actually wanted as they were in the same

institution. Others visited to find out the type of formatting their campus thesis or dissertation took. IRs could also be uniquely suited for networking as, as one can theoretically link up with people in an institution undertaking similar research. Users use IRs to find out what their friends and colleagues were researching upon and for fun. IRs could also be pertinent in assessing materials not available through other channels especially unpublished works such as conference papers, research data, and manuscripts.

Shukla and Ahmad (2018) surveyed scientists and researchers at Indian Council of Scientific and Industrial Research (CSIR) on their preferences on publishing their scholarly works. They found that most scholars preferred to publish their works in peer-reviewed scholarly journals rather than in IRs because of the strong peer-review mechanism of the former that ensured good quality articles. It appears that the lack of certification for works appearing in IRs comprised the quality of some of them. IRs were preferred because of their ability for long term preservation of research materials and an abundance of grey literature of all types.

Bamigbola (2014) surveyed 80 faculty staff from eight departments in the School of Agriculture and Agricultural Technology of the Federal University of Technology, Akure, Nigeria about their level of awareness and attitudes to use of IRs. The study found that although there was a general positive attitude towards IRs, only 8% of them had both searched them for academic information and submitted their research to them whereas 33% had neither searched nor submitted their scholarly work to IRs.

Ratanya (2017) conducted a case study of access and use of Egerton University's institutional repository by academic staff. The findings of study showed that the majority

of the respondents were not aware of the existence of the repository while those who were aware faced myriad challenges in accessing and using the repository content. Similarly, Moseti (2016) studied institutional repositories of six universities in Kenya. The study found that the scholars rarely used the university's repositories to preserve their research because they were not aware of the role of the repositories in the preservation of research output.

Kim (2007) and Kim (2010) concluded that IRs collect and curate the intellectual outputs of an institution. Repositories could also be used to manage and measure teaching and research activities, provide workspaces for research-in-progress and large and collaborative projects and encourage interdisciplinary collaboration in research. In addition, repositories could encourage sharing of digital teaching materials and provide access to theses and dissertations.

In a survey of faculty attitudes towards depositing in IRs, Manjunatha and Thandavamoorthy (2011) found that although most researchers had high interest in and positive attitudes towards depositing their work in IRs, they had low awareness of the existence of the repositories. In addition, the respondents were not aware of the benefits of IRs such as global visibility of their institution and the website functionality and usability was not intuitive. The study concluded that simplicity and ease of use of IRs is required to attract more users to them.

The studies surveyed in foregoing document show difficult in discovering and using content in IRs. However, none of them makes reference to the relationship between IR content utilization and IRs' support of teaching, learning and research in universities.

2.5.2 IRs' Software and its Implications on Content Utilization

The software platform used in an IR could affect the quality of content, content discovery, and use, and hence, its ability to be used in teaching, learning and research activities (Velmurugan and Radhakrishnan, 2014; Wacha and Wisner, 2011). According to UNESCO (2014), desirable IR software should have 11 features. These are content organisation and control, content discovery, infrastructure, publication tools, reporting, multimedia, social features, interoperability, authentication, accessibility, and preservation. Each software platform should enable uploading and downloading of content, systematic organisation and access controls of the content. The software should increase content visibility and retrieval. The infrastructure covers how easily an IR can be installed, configured, customised, hosted and maintained. Publication enables editing, reviewing, and writing of metadata of the contents. Good software should provide feedback and generate statistical reports of deposits and use. The software should support many forms of content, such as images, video and text while social features allow interaction with users. Interoperability allows integration with discovery systems, researchers' profiles and mobile services.

IR software may be free/open source, freeware, commercial, or hosted. Proprietary (commercial) software is purchased from a commercial developer and who is paid to maintain and improve it. The user cannot access source codes for the software. Shareware software can be downloaded free of charge and used for a period but must be bought ultimately. Open-source software (OSS) is free, flexible, and extensible software that allows users to modify it because its source codes are available, that is, it's both free and open source. Consequently, it requires some degree of expertise to implement and

maintain. Freeware software can be downloaded, used and copied without any restriction but it cannot be modified and improved as its source codes are not available (Velmurugan, & Radhakrishnan, 2014). OSS includes DSpace, EPrints, Digital Commons, Fedora, Greenstone, Aigainon, BRICKS, Invenio, Islandora, Museolog, Omeka, Refbase, RefDB, and SobekCM. Others include Hydra, Open Library, DMP Online, Curate, Archivematica, Open Harvester Systems, IR+ (irplus) Institutional Repository, WEKO, eXtensible Text Framework, Variations, MyCoRe, Kramerius, Atrium D, and Archimede (Velmurugan & Radhakrishnan, 2014).

Massachusetts Institute of Technology (MIT) Libraries and Hewlett-Packard (HP) jointly developed DSpace, a Java-based software that runs most efficiently on a PostgreSQL database. A group of individuals that respond to help calls and requests from the user community maintains the software codes. The requirements for server, memory and storage are medium while a staff equipped with database administration and UNIX skills is required to run it (Chapman *et al*., 2009). DSpace was designed to deal with a wide variety of content such as research articles, grey literature, dissertations, theses, data sets, audio and video materials (Davis & Connolly, 2007). DSpace can also be plugged in a Scopus application program interface (API) to generate metrics in Scopus (Elsevier, 2016).

Although DSpace is widely used, there are many versions. Nearly 40% of the versions belong to 1.8 Version or earlier, which were released about 16 years ago. Among the latest release are version 6.x and all versions before 5.x became unsupported in January 2018. With release of new versions, IRs that use older software become more difficult to

upgrade and are more vulnerable to attacks by viruses and ransom ware, which reduces the trust of users (Arlitsch & Grant, 2018). In the context of this study, it was pertinent to discover if the university uses DSpace, the version (if it does), and how it affects teaching, learning and research activities.

E-Prints (not to be confused with e-prints) were created in 2000 to build repositories compliant with OAI-PMH (Velmurugan & Radhakrishnan, 2014). According to Chan (2004), E-Prints and DSpace, the two pioneering and dominant IR software's, have different philosophical objectives. Whereas E-prints was designed to host traditional forms of scholarly publishing such as journal and conference articles, DSpace was intended to host a much greater variety of material, including both traditional scholarly works and grey literature. Consequently, while Eprints was developed specifically to allow researchers to make their work open access, DSpace was originally designed to address greater preservation of and access to the intellectual output of a community (Harnad, 2008; Moore, 2011).

FEDORA (Flexible Extensible Digital Object and Repository Architecture) is a web-based repository service with well-defined APIs for storing, organising and accessing digital content. In addition, the software allows for search features, OAI-PMH, messaging, administrative clients. It has a community consisting of registered users, sponsors, service providers and developers, who improve the code.

Greenstone is software that can be used to build and distribute materials on the internet or CD-ROM. The University of Waikato's New Zealand Digital Library Project produces the software, which is distributed together with UNESCO (United Nations Educational,

Scientific and Cultural Organisation) and Human Info (a non-governmental organisation based in Belgium). Invenio, developed by CERN (European Organization for Nuclear Research) Software group, provides tools to manage materials in IRs. Islandorais built on Fedora Commons, Drupal and other applications. Developed by Robertson Library at the University of Prince Edward, it is released under the GNU general public license. Omeka is software for managing online digital collections and was developed at the Centre for History and New Media at George Mason University (Velmurugan & Radhakrishnan, 2014).

Refbase, written in PHP (Hypertext Pre-processor) and built on MySQL (Michael Widenius' [co-founder] daughter and Structured Query Language), is a web-based IR software. Licensed under the GPL (GNU General Public License), it can produce formatted bibliographies and citations in HTML (Hyper Text Mark-up Language), PDF (Portable document File) and RTF (Rich Text Format), can generate RSS (Really Simple Syndication) feeds from searches and supports search and retrieval via URL (Uniform Resource Locator) and OpenSearch web services. SobekCM is software for managing digital collections, libraries, and repositories and was developed by the University of Florida Libraries (Velmurugan & Radhakrishnan, 2014).

BRICKS, an acronym for Building Resources for Integrated Cultural Knowledge Services, were first released in December 2005 and are shared under the GNU (GNU's Not Unix) Lesser General Public License (LGPL). BRICKS have been used in various cultural institutions under the aegis of the BRICKS Cultural Heritage Network, a

community of cultural heritage, scientific and industrial organizations across Europe (Velmurugan & Radhakrishnan, 2014).

The main repository platforms can provide information on download counts. For example, EPrints report download counts using graphical displays such as graphs and pie charts. DSpace can display statistics about items and collections while Digital Commons uses e-mail to report usage to authors and IR managers and an 'Author Dashboard' to display download counts and locations and search terms harvested by Google Analytics (Konkiel & Scherer, 2013). While the download information may be displayed at the level of item, collection, community or site in DSpace, Digital Commons provides a Readership Map to show download items. However, as open-source software, repository managers can modify the source code of DSpace, EPrints and Digital Commons to produce more robust and sophisticated usage statistics.

Many IRs can supplement usage statistics reported by their repository platforms with metrics obtained from third party sources, such as Scopus, Google Analytics and altmetrics. Repository managers can use these sources to track repository use and visits, for instance, users' demographics, their social media usage, search behaviour, and referrals (Bruns & Inefuku, 2016). DSpace and EPrints can offer citation metrics so long as the hosting institution has a subscription to SciVerse Scopus API. However, it is not clear the extent that Kenyan universities keep and use such metrics. If repository managers can combine citation measures and altmetrics into their repositories, authors and readers may be able to see the impact of their scholarly works in one place, which may encourage deposition and usage of IRs.

The term altmetrics is a contraction of ‘alternative metrics and references various online metrics that track scholarly work and can complement citations and downloads, despite the name. Especially important are social media metrics, which can become visible in real time the moment an article is published in an IR as opposed to citations that take some time (Holmberg, Haustein & Beucke, 2016). Shuai, Pepe and Bollen (2012) report that tweet to articles usually peak the moment they become available online. IRs, given their ability to make scholarly work available immediately, are in a superior position to utilise these metrics to increase their prestige and attract more users and depositors, thus, enhancing their educational and research value. Social media metrics include blogs, micro blogs, online mentions, bookmarks, presentations, likes, and shares.

Salo (2008) in a scathing article on IRs titled “Innkeeper at the Roach Motel” observed that they were bound to fail because of their inappropriate software and lack of a compelling vision and support. Many researchers increasingly deposit their work in either subject repositories or preprint repositories, for instance, SSRN (Social Science Research Network), arXIv, and SCNs (Scholarly Collaboration Networks) such as Academia, Research Gate and Mendeley, rather than in IRs, partly because of software issues (Tay, 2017). In the current structure, academics who deposit their work in IRs lose direct control when they leave the institution, such that they cannot edit the work unlike when they deposit it SCNs, where they retain lifelong control. In addition, using SCNs ensures that scholars obtain usage statistics in one place rather than being disaggregated in several IRs (Tay, 2017).

Tay (2017) also notes that IRs' software is inferior in functionality and sophistication relative to SCNs. For instance, some software could not automatically show metadata to lessen the task of manually keying in bibliometric data or inform researchers that their paper could be self-archived. On the other hand, although SCNs can be intrusive, they always innovate, using the latest software and social networking tools. For example, ResearchGate can tell a researcher who read their paper, viewed their record or downloaded it, and allows the researcher to communicate with the user.

2.6 Contribution of Librarians and Research Officers toward Use of Institutional Repositories

Librarians play a crucial role in the whole process of information archiving and retrieval from IRs. Crow (2002) argued that librarians serve as managers and preservers of an institutional scholarly work. As mentioned earlier, the process of scholarly communications consists of four sequential processes: registration, certification, awareness and archiving. Crow contends that in the traditional academic journal system of scholarly communication, both librarians and publishers carry out awareness but only librarians conduct archiving. However, in the proposed disaggregated model of communication involving IRs, librarians are the sole custodians of both awareness and archiving, showing how critical they are in the potential usefulness of IRs in learning and research.

Libraries and librarians are well suited to drive implementation of IRs. First, the library is a preserver of scholarly literature (Cervone, 2004). Secondly, librarians are professionals, trained in content organisation and metadata creation. Thirdly, librarians are

knowledgeable about preservation of digital materials and self-archiving techniques (Ware, 2004). Fourthly, the library is a technology hub and a leader on information technology tendency in the university (Philip, *et al*., 2007; Bruns & Inefuku, 2016). Fifthly, research directors are to establish the links and correlations and manage the content in a coherent form to avoid scattered contents without links (Hoq & Akter, 2012:93).

Andayani (2017) in a study conducted at Syarif Hidayatullah State Islamic University, Jakarta, explored the practices of IRs development and the roles librarians and research directors could play in ensuring the successful implementation of repository projects. The study used a descriptive approach and collected data from documents, repository managers and databases. The major finding from the study was that university and system librarians were involved in all the phases of IR development. During pre-implementation, system librarians work with IT to design and develop the system, identify user needs, design metadata requirements. University librarians, on the other hand, work with faculty and research directors to recruit content, deposit old materials and ensure deposited materials have watermarks. Thus, they play a role in system development, content recruitment and content preparation. During implementation, university librarians are important during submission and publishing. During submission, they create metadata and upload files attachment. During publishing, university and system librarians verify metadata, format, and content type, validate content, approve contents and facilitate the digital creative common license. In post-implementation, university, system librarians and research directors provide repository services, promote IR among faculty and conduct IR-related training. Thus, while librarians and research directors play a strategic

role in the operations of IRs, the study did not show a link between this role with teaching, learning and research.

Kamraninia and Abrizah (2010) conducted a study in eight Malaysian universities on the roles of librarians in the deployment and content recruitment in IRs. The study showed that content recruitment in IRs was mainly done by university librarians rather than by authors or researchers. In addition, librarians were also important in providing training sessions, enhancing cooperation with departments and faculties by holding meetings and linking of the IR website from the faculties' website. The authors viewed librarians' role in IRs as that of change agents. However, the study did link the role of librarians with IRs' support of teaching, learning and research.

Casella and Morando (2012) conducted an online survey among 60 Italian repository managers with the objective of analysing their skills, education and training. The study showed that although the repository manager's position was the most important, it was highly complex, requiring cross-functional and highly specialised competencies. The most important competencies were found to be communication skills, collection, development and metadata expertise, familiarity with project management, and possession of some technical skills in relation to interoperability standards and protocols.

Joint (2006) in an opinion piece based on practitioner insights into their cataloguing practice and digital preservation issues sought to determine the amount of resources that are required to effect the process of self-deposit into IRs. The major findings revealed that metadata creation and formulation of digital preservation procedures for IRs required significant resources. Further, Joint concluded that system and university librarians are

very important in the preparation of metadata and digital preservation activities required in setting up and running IRs. The paper also argued that a successful IR is one involving librarian-mediated deposit rather than a pure self-archiving by faculty.

However, not everyone has accepted the important role libraries and librarians could play in the process of scholarly communication and research. Richard Poynder thought that librarians' role could be eliminated altogether, asserting that, "Maybe it is also time to think the unthinkable, and walk away from the library as well" (Poynder, 2006a: 3). Stevan Harnad (cited in Poynder, 2006b: 2) talked derisively of librarians as, "maddeningly pedantic and out-of-touch at times".

Salo (2008: 10) argue that librarians may be ineffective in enhancing IRs as open access tools because the "collection-development model" of a repository is completely alien to librarians, who are used to choosing from already vetted book and journal lists provided by traditional publishers. Content in IRs is non-traditional and not all of it is peer-reviewed. Consequently, librarians do not actively promote IRs and cross-repository search engines. Most librarians do not understand how or why they should promote IRs, and when asked to deposit their own content, they are as reluctant as faculty. Because of little deposition, repository managers fear not meeting lofty performance standards, are starved of resources, and refuse to promote or educate potential users.

IRs that have been successful is those that have involved cooperation and effort between the library, faculty and the institution's top administration. Librarians, alone may not be powerful enough to compel faculty to deposit or use material in IRs, unless they have the university's administration backing. For example, one of the cited success stories is the

Ohio State University's Knowledge Bank repository, in which the institution's administrators rather than librarians spearheaded the efforts in establishing the repository. Since then, the administration's support has enabled the library to create workflows and staff to handle mediated deposit (Hixson &Cracknel, 2007). The success of the Ohio State's repository suggests that that the best way of filling an IR is by librarians helping the faculty to self-deposit (in a mediated deposit model).

The role of librarians on use of IRs that can potentially support teaching, learning and research may be summarised as follows:

- Management and stewardship of IR collections: Librarians can add materials, assist faculty to self –archive, administer collected materials, supervise and manage collections (Crow, 2002; Lynch, 2003). Librarians should upgrade their knowledge synchronously with information environment and adapt themselves with their new roles as a collection administrator of digital materials. Librarians face problems in collection management because the acquisition of collections is in the hands of faculties (Allard *et al*., 2005). Authors are in charge of selecting items to add to the repository and librarians are the stewards of the collection (Genoni 2004) especially for preserving the repository (Wheatley 2004).
- Persuading authors to self-archive: Librarians can encourage faculty to self-archive by being enthusiastic, educate them on copyright issues, new technologies, and benefits of publishing in IRs, browse repositories using OAI search engines, or deposit materials on behalf of authors (McDowell, 2007. Swan and Brown (2005) found that the majority of authors were unconscious about the

benefits of publishing their works in institutional repository. Their research showed less than one third of the respondents were using OAI search engines to find out their required information through the institutional repository and only 10% of the authors were aware about SHERPA/RoMEO list of publishers' permissions policy with respect to self-archiving (Swan and Brown 2005).

- Establishing a standard metadata and catalogue system: Librarians prescribe metadata standards, prepare a cataloguing system, develop indexing materials, and review submissions for quality control (Lynch, 2003). In the past, metadata was defined as a role for librarians but now authors have authorization to submitting metadata. Librarians should establish the clear metadata standards so that authors can use it. The standards can be provided as a set of development guidelines for institutional repository creators, which can help authors to do self-archiving with the predicted contents and standard metadata.
- Understanding of software and training authors: Librarians are expected to comprehend the IR software fully so that they may use it and extend its functionalities. With this knowledge, they also train faculty on how to use the software (Bruns & Inefuku, 2016; Kim, 2007). Allard *et al*., 2005 contend that librarians should comprehend the software with the intention that they can design repositories in their libraries. They should also have the ability to create institutional repository that is useable by the software extender since authors and their contributions in institutional repository is one of the significant elements in the development of institutional repositories. With a consideration of natural extension of preparation and training of users, librarians should educate authors to

deposit their intellectual works to institutional repositories. Education would consist of assisting university community to learn the use of institutional repository software to accomplish self-archiving (Abrizah 2010).

- Training users search techniques: Librarians are expected to show users how to deposit materials in IR, how to extract materials from them, and build interfaces amenable to searching and deposition (Jenkins, Breakstone & Hixson, 2005). They should teach users on how to recruit search techniques to use the available resources, which could persuade users to become involved with institutional repositories. Reference librarians could also build search interfaces that make possible searching and accessing of the materials in institutional repositories. Other than facilitating search and increasing access to resources and information, it also helps in bringing the institutional repository contents together in a library database or library catalogue (Jenkins *et al*. 2005).
- Promotion and marketing: Since IR is a relatively new concept, librarians must provide more clarifications, marketing, promotion, and explain several concerns of users (Jenkins *et al*., 2005).

The marketing of new library resources or services is always essential to spread the word of value-added tools to enrich the academic lives of the university community. Faculty involvement is critical to ensure that the system meets the scholarly needs of dissemination and visibility of the present and future generations. Additionally, it is imperative for reference librarians to engage faculty in a change agent role by garnering IR buy-in. For instance, Massachusetts Institute of Technology (MIT)'s DSpace and California Digital Library's studies showed that faculty needed to see IR-related

information at least five and seven times, respectively, before the IR registers as a technology worthwhile to pursue (Branschofsky, 2004). Given these baseline studies and anecdotal evidence, librarians must realize that perseverance in pursuing contact with faculty within the IR context is essential to populate the archive.

The biggest challenge of the IR appears to be garnering content. Librarians have to become marketing specialists embarking on a mission of advocacy for the IR. For faculty who are used to the traditional journal peer review process, there are questions raised about the benefits of submitting materials to the IR regarding required time and effort. Reference librarians who have been assigned to promote the IR and train potential users will encounter resistance in the guise of, "There is no reward or incentive, it is not a priority, I have already published my papers where my professional peers have immediate access to my scholarship or I don't have the time". This are often the remarks received from faculty and staff. To counter these concerns, issues about copyright may be voiced at IR presentations. Faculty and students can be enticed to add scholarship into the IR by targeting graduate students working on theses and projects while preparing to graduate, and on proactive faculty that tends to gravitate to using new technologies is one promising strategy. Continued marketing leads to continued growth of the IR" (Madsen &Oleen, 2013).

Solid marketing framework should start as soon as possible, with Kocken and Wical (2013) stating that "before content recruitment can become a focal point of any marketing strategy, librarians and institutional repository managers must build awareness". The importance of marketing for IRs is commonly repeated as the solution for content

recruitment, though there exists much less literature on effective marketing for IRs. Gierveld (2006) points out that IRs are not developed in response to market demand, making the recruitment of content challenging. Common marketing activities found in the literature include the creation of informational brochures and flyers, presentations to faculty groups and using personal academic connections (Laws & Fortier 2014).

All the studies cited above show the critical role librarians play in a successful IR. However, none of the studies shows a link between the role of librarians and the ability of IRs capacities to support teaching, learning and research in universities.

2.7 Potential Roles and Empirical evidence for the Effectiveness of IRs' Support of Teaching, Learning and Research Activities

According to Sarker *et al*. (2010), Tiropanis *et al*. (2009) and Tsunoda *et al*. (2016), IRs could help higher education institutions to address some of the challenges they face in teaching, learning and research. The current system of scholarly publishing is undergoing pressure from the dramatic increase in journal prices, explosion in the volume of information, and increasing cost of storing printed material (Vrana, 2011).The problem of high journal prices is especially acute in universities in developing countries that face decreased funding and severe resource constraints (Sarker *et al*., 2010).IRs by providing scholarly literature completely free of charge can help both lecturers and students assess much needed academic material. World Bank (2017) and (1994) has noted that most students in HE institutions in developing countries cannot afford to buy textbooks and only a small number of books are available in the library for use by students. In addition, books tend to contain dated material compared to journals. Thus, if IRs could contain

materials, such as, journal articles, theses and dissertations, conference and workshop papers, books, chapter and section, datasets, and multimedia and audio-visual materials, that are free of charge, they could potentially help in teaching, learning, and research.

Saini (2018) has argued that IRs could enable the Academy to reassert control over scholarship and reform the system of scholarly communication by expanding access to research. Other researchers, such as Bangani (2018), Lynch (2016), Lynch (2003), Crow (2002), and Harnad (1995) have bemoaned the fact that publishers who are usually business people control the process of scholarly publishing rather than academics themselves. Crow (2002) argues that although the Academy provides the bulk of direct labour involved in scholarly publishing, it also bears much of the cost through subscription fees. Faculty scholars produce the original research itself; academic peer-reviewers authenticate the quality of the research; academic libraries process, distribute and archive the research whereas journal publishers themselves spend little or nothing. In addition, with the evolution of digital publishing and distribution over the internet, the cost of print production and distribution has declined and yet publishers have not reduced the price of journals commensurately. IRs could create new communication models, constructed and controlled by scholars themselves and eliminate apparently insurmountable publisher advantages in a short period (Crow, 2002).

IRs, by capturing, archiving, and disseminating the combined intellectual output of a university, helps to serve as palpable indicators of an institution's quality (Saini, 2018; Crow, 2002). This could increase a university's prestige and help attract funding in resource-constrained institutions and the best staff and students, thereby improving the

quality of teaching, learning and research. Crow (2002) argues that the current system of scholarly communication dissipates the institution's intellectual output in a myriad of journals. IRs, on the other hand, can bring together all of an institution's research outputs into a single interface, making it easier to encapsulate the university's academic productivity and prestige.

According to Sarker *et al* (2010), IR could be crucial for universities in helping to manage and capture intellectual assets as a part of their information strategy, provide linking to other repositories and also supply machine process able data to support the institutions. By providing freely accessible information such as course information, teaching and learning materials, research output, training and resource information, IR can help address some of the challenges in teaching, learning and research activities.

IRs have been described as representing a major and alternative gate of knowledge (Koutras and Bottis, 2013). By storing in digital form academic materials, such as, theses, dissertations and research articles, IRs help to disseminate materials that would otherwise have existed only in print format and secreted in basements. The materials in IRs are of scientific, technological, artistic, cultural value, which could be important for teaching, learning and research. According to Vrana (2011), the diverse content of IRs represents rich resources for teaching, learning and research, which could be pertinent in higher education in fostering students' research and education.

According to Ukwoma and Dike (2017), lecturers and students can use IRs to access articles and other information resources for research and learning. For instance, IRs can supplement and increase the knowledge that scholars have in the subject area of interest.

Academic staff and students can download freely published articles from the repositories and review the literature to identify gaps in knowledge or new findings. Individually, academics could also use IRs to archive their own published works. This will help to increase their visibility, increase their global networks, and allow for collaboration with other academics all over the world.

The process of scholarly communication consists of four elements: the identification of the real author (registration), validation of the quality of research (certification), making the research available to others (awareness) and long-run preservation of the research for future use (archiving) (Roosendaal & Geurts, 1997; Crow, 2002). IRs changes this orderly process as it only upholds awareness and archiving in the current process of scholarly communication. By omitting certification, questions could be raised about the quality of the content in IRs and whether it could in fact support teaching, learning and research in higher institutions of learning.

Despite the ample evidence on the potential roles that IRs could play in supporting teaching, learning and research, there is paucity in empirical evidence on their actual impact on teaching, learning and research in higher education institutions (Tsunoda *et al*., 2016; Gilman, 2016). For example, academics may use IR to access articles and other information resources for research and learning and archive published works to increase their visibility and collaboration with other academics (Ukwoma and Dike, 2017). However, the extent this actually occurs in universities in Kenya is unknown and so are the factors influencing the usage of IRs. According to researchers such as Vrana (2011), part of the reason could be because of the relatively young ‘age’ of IRs. However, having

started in the early 1990, IRs have now been in operation for about 20 years, which is long enough for them to be audited.

Stanton and Liew (2012), examined doctoral students' awareness and attitudes toward open access publication, IRs, and mandatory submission of their theses to the IR. The study collected qualitative and quantitative data by using a self-completion web survey of 251 students and interviews of eight doctoral students learning in various disciplines in a New Zealand University. The study found that only a small number of students used repositories and open journals in their own research, despite the existence of research services like Kiwi Research Information Service, EthOS, and Australasian Digital Theses. Nevertheless, almost every student used Google Scholar, leading the study to conclude that the students could inadvertently be accessing open access materials from IRs. This could prevent one of the objectives of IRs - displaying the intellectual output of an institution in a single portal. If students access material from an IR without knowing it, it would hardly lead to an increase in the prestige of that institution. Data from the interview deemed inadequate to answer the substantive question as to whether students used IRs in research activities.

In an exploratory study, Jean, Rieh, Yakel and Markey (2011), interviewed 20 end-users on their perceptions and experiences using IRs. The study found that users hoped to find journal articles, conference papers, theses and dissertations, raw data, lectures, presentations and newsletters in IRs. They also wanted to access course content for use in their work, access raw data for use in research projects, and identify colleagues and research students interested in collaboration. Others wanted to use IRs to find out if

particular researches were on-going at related universities, access content they could use as models of their work and for fun and general enjoyment. Although the sample size was small, the study concluded that IRs still lack visibility and transparency.

Most studies reviewed above show that IRs could potentially support teaching, learning and research in universities. However, very few studies have documented the actual impact that IRs have had on these academic activities in universities. This study set out to provide empirical evidence on the extent to which IRs support teaching, learning and research activities in selected universities in Kenya.

2.8 Model to Improve Institutional Repositories Capacities to Support Teaching, Learning and Research Activities in Selected Universities in Kenya

This study used the theories underpinning it to propose an improved model that could better support teaching, learning and research. The model incorporated findings presented in Sections 2.4, 2.5, 2.6, 2.7, and 2.7. In addition, the study also reviewed literature on the factors that hinder IRs' ability to support teaching, learning and research activities in higher education institutions. These helped to enrich the recommended model and are presented in the following section.

Kim (2010) identified four motivators and three barriers that significantly influence self-archiving. The motivators were altruism, self-archiving culture, technical skills and impact on promotion. Researchers who believe in helping others with research and in open access will deposit more. Disciplines that have a self-archiving culture and with members possessing the requisite technical skills have higher rates of self-archiving. Lastly, a belief that self-archiving is either neutral or can lead to a scholar's promotion,

funding or tenure increases deposit rates. The study found significant barriers to self-archiving to be copyright concerns, age, and time and effort. The greater the fear of infringing copyright, the lesser the deposition. Younger faculty deposit more because of familiarity with technology while the greater the effort and time spent on depositing, the lesser the archiving.

The IR model could be a barrier that inhibits its successful use in teaching, learning and research. First, the institutional nature of repositories does not align well with the social networks of scholars, which are more attuned with disciplinary repositories (which may be global) than with institutions (Arlitsch & Grant, 2018; Tay, 2017; Van de Velde, 2017; Wenzler, 2017; Coalition for Networked Information, 2017). Consequently, many faculties may choose to deposit their scholarly work in subject repositories rather than institutional ones. Secondly, while IRs are often impermanent, subject/discipline affiliations tend to be more stable, with academics continuing to research in their specific areas even when they changed institutions. For example, when a scholar leaves an institution, they tend to sever their relationship with IRs. Consequently, they are more likely to put papers in subject repositories such as SSRN where they can share with their colleagues rather than in IRs. Thirdly, the disaggregated nature of IRs, although affording local control, creates problems of small mass and siloed content, which discourages scholars from using them (Arlitsch & Grant, 2018; Tay, 2017; Van de Velde, 2017).

Fourthly, many researchers have reported on the difficulty in functionality of IRs, with uploading difficult by having to create metadata and articles difficult to find on the internet (Jean *et al*., 2011; Arlitsch & Grant, 2018). Fifthly, the lack of certification for

materials deposited in IRs has led to a predominance of grey literature in them, some of dubious quality. Because of this, some scholars prefer to publish their papers in peer-reviewed journals than in IRs (Arlitsch & Grant, 2018; McDowell, 2007; Shirky, 2005).

Chandra and Halder (2012) in an investigation of 23 Indian IRs found that humanities and social science researchers had low levels of awareness of the IR but were interested in contributing their scholarly work to the repository and had positive attitudes towards providing free access their research results. Other researchers have also noted that the lack of awareness of IRs could be a barrier to their usage (Kim, 2010; Davis & Connolly, 2007). Studies also suggest many faculties do not understand the benefits of IR (Davis & Connolly, 2007; Bankier & Smith, 2010) or are simply not interested in them (Salo, 2008). This suggests that there could be a need to conduct intensive education, promotion and campaigns about the possibilities of IRs.

A study carried out by Okumu (2015) on adoption of institutional repositories in universities in Kenya revealed that IRs are very important in tackling challenges users face in relation to access and use of digital resources. However, library staff lacks the necessary skills to manage the repository effectively, concerns about intellectual property and the cost of institutional repositories.

The foregoing shows that; IRs face important barriers that prevent their effectiveness. However, the studies did not provide a direct link between the barriers and ability of IRs to support teaching, learning and research. This study looked at challenges that IRs in Kenyan universities face and used this empirical evidence to develop a model that could better enable IRs to support teaching, learning and research activities.

2.9 Chapter Summary

The chapter reviewed the theoretical underpinnings of the study, concepts of teaching, learning, research and institutional repository. In addition, it reviewed literature on content and content recruitment, discovery and use of IR and the contribution of librarians'/research directors and empirical evidence for IRs' extent of support of teaching, learning and research. The review of the past studies that have been done in Kenya showed that faculty staffs are reluctant to deposit content in IRs. In addition, content in IRs is dominated by grey literature, arising mainly out of mandatory requirements to make deposits. However, these studies do not show how this influences teaching, learning and research, a gap this study attempted to address. Many studies also show low usage of IRs and difficulties in discovery of content therein but fail to relate this with the effectiveness of repositories to support teaching, learning and research. The literature also showed that IRs as currently constituted, seem not to have the capacity to support teaching learning and research or they could be flawed models as receivers and dispensers of intellectual content relative to subject/discipline repositories. This study, therefore, tried to fill the gap by developing a model, flowing from empirical data gathered in the study, on how IRs can best have the capacity to support teaching, learning and research in universities.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology and design adopted by the study. The philosophical stance of the study, the target population, sampling techniques, data collection instruments, reliability and validity, data analysis and ethical considerations. The methodology of the study was guided by the research objectives presented in Chapter One. The chapter concludes with a summary.

3.2 Research Approach

According to Creswell (2014) research approaches are plans and procedures of a research that encompasses broad assumptions of a study to a description of methods of collecting data, analyzing and interpreting it. On the other hand, Schwardt (2007) defined research methodology as a theory of how a research should be conducted, involving the assumptions of the study, principles and procedures. Teddle and Tashakkori (2009) conceptualized research methodology as a broad approach to scientific enquiry specifying how research questions should be asked and answered while Bogdan and Biklen (2007: 35) defined methodology as "the general logic and theoretical perspective" of a study. This study therefore adopted Chu's (2015) view that both research methodology and approach are similar, both being broad concepts concerned with the overall strategy on how best to ask and answer research questions. Thus, basing on a particular philosophical worldview, a research methodology prescribes the type of research design and research methods that should be used.

It is generally accepted that there are three research approaches or methodologies: qualitative, quantitative and mixed methods (Creswell, 2014). Quantitative and qualitative approaches are not mutually exclusive but represent different ends on a continuum. Thus, a study may be more quantitative than qualitative and vice versa.

Quantitative methodology emphasizes objective measurements of phenomena to collect numerical data, which can be analyzed using statistical procedures. Quantitative research is based on the scientific method and is therefore hypothetico-deductivist therefore aims to test, objectively, theories and thus, tends to be confirmatory (Babbie, 2010). This has been the traditional approach dominating research in the late 19th C and throughout the 20th C; such that some scholars think it is only the legitimate way to conduct research (Creswell, 2014).

Qualitative methodology is a type of research that collects non-numerical data and explores it in order to understand social issues through study on individual or groups (Creswell, 2014). Qualitative research involves an interpretive, naturalistic approach in the study of phenomena, in which the researcher attempts to study phenomena in its natural setting (Denzin & Lincoln, 2005). Hancock (2002) explicated the following characteristics of qualitative research:

- It focuses on understanding social phenomena
- It inquires about human behavior, attempts to understand how opinions and attitudes form, cultural perspectives, and feelings towards specific phenomenon.
- It uses mostly open-ended questions, which tend to begin with ‘how’ and ‘why’.
- The methodology aspires to understand phenomenon in a holistic approach

- It uses inductive logic in developing concepts and theories that attempt to understand human experience.

While quantitative approaches generally test a theory, qualitative studies use a theory to guide their research design or generate new theories from their data. Quantitative approaches often use deductive logic, starting with a theory or hypothesis and collecting numerical data to support or reject the theory. Qualitative approach on the other hand, uses inductive logic, exploring opinions of individuals to build up a theory or explanatory model. Quantitative approaches use large samples and attempt to generalize their findings whereas qualitative research is based on smaller number of specific individuals or groups to gain deeper understanding of phenomena. Consequently, whereas quantitative research generally uses large, randomly selected samples, qualitative approach usually use purposive sampling, in order to target individuals with specific information. To answer this study's research questions, both qualitative and quantitative data were collected. Thus, to use a purely quantitative or qualitative methodology was not sufficient. This study adopted a methodology that combines both the quantitative and qualitative approach.

Thus, given the nature of this study, research objectives, research questions and pragmatic stance, this study adopted a mixed method research (MMR) approach, which was found to be appropriate because it involves collecting both qualitative and quantitative data concurrently and then integrating the two types of data into a single study during analysis. The researcher embedded the smaller qualitative data within the larger quantitative data, hence provide a richer & more comprehensive response to the

research questions. The quantitative aspects in this study were larger and qualitative was smaller because it focused more on quantification of data and used large sample sizes (Creswell, 2014).

3.2.1 Mixed Methods Research (MMR) Approach

Kemper, Springfield and Teddlie (2003) define mixed methods research as an approach that includes both qualitative and quantitative data collection and analysis in a parallel manner. According to Creswell (2014), MMR is an approach that involves collecting both qualitative and quantitative data and then integrating the two types of data. Burke and Onwuegbuzie (2005) looked at MMR as an approach where quantitative and qualitative research techniques, methods, approaches, concepts and language are combined in a single study. MMR is not just about combining quantitative and qualitative data; the data should be integrated. MMR is appropriate when neither qualitative nor quantitative approaches are sufficient to apprehend the nature of the phenomenon.

MMR involves the following characteristics (Creswell, 2014; Onwuegbuzie, & Turner, 2007):

- It involves the collection of both qualitative (open-ended) and quantitative (closed-ended) data in order to answer research questions or hypotheses.
- It analyses both qualitative and quantitative data.
- To ensure integrity of the two types of data, procedures for both qualitative and quantitative data collection and analysis need to be rigorously specified and conducted, for instance, the sample should be adequate and the steps in data analysis should be well specified.

- The two forms of data are integrated during analysis by merging the data, connecting the data, or embedding it.
- The design for the MMR should be well specified, for instance, whether concurrent or sequential and the degree of emphasis on each type of data to be collected.
- MMR is also informed by philosophical worldviews or a theory.

MMR is a relatively new methodology, emerging in the late 1980s and early 1990s, from several researchers working in education, management, sociology, health sciences and evaluation (Creswell, 2014). MMR uses several logical perspectives: induction, building of theory from data; deduction, the testing of theories and hypotheses; and abduction, searching for the best explanations to understand research results (Johnson & Onwuegbuzi, 2004).

There are numerous research designs under the mixed methods research (MMR), with authors using diverse terms to describe them and with substantial overlap existing between different typologies. A useful categorisation was given by Creswell (2014), who identified four major types, namely, triangulation, explanatory sequential, exploratory sequential and embedded designs. In triangulation design, also known as, convergent parallel, both quantitative and qualitative data are collected, analysed separately and the results are merged together. The key requirement of this design is that it collects both quantitative and qualitative data using the "same or parallel variables, constructs, or concepts" (Creswell, 2014: 269). That is, for any variable collecting quantitative data, there must be an identical or similar variable collecting qualitative data. An explanatory

sequential design involves collecting quantitative data in the first phase, analysing it and using the results to plan for collecting data in a second qualitative phase. An exploratory sequential design is the opposite of this design, in which a researcher collects and analyses qualitative data in the first phase and then uses the results to plan for a second quantitative phase (Creswell, 2014).

On the other hand, embedded design involves the collection and analysis of both quantitative and qualitative data simultaneously. In this design one or more forms of data (quantitative, qualitative or both) is usually nested within a larger design (quantitative, qualitative or both), allowing the smaller dataset to supplement and support the larger one (Creswell et al., 2003). This is unlike triangulation, in which similar variables are used for quantitative and qualitative data. In embedded design, the variables could be different.

This study adopted the embedded design as the most suitable for achieving the research objectives. This is because both quantitative and qualitative data were required for generalizations and deeper understanding, respectively. The qualitative data (arising from interview schedules for librarians and open-ended questions for the rest of the respondents) was nested within the larger quantitative data framework, consisting of university students and academic staff. Since the two sets of questions were different, triangulation was inappropriate. Integration of the two datasets was done during the concurrent analysis, with results from the two sets complementing and supporting each other.

3.2.2 Justification for using Mixed Methods Research Approach

On a general level, this study used mixed methods research (MMR) approach, which combined the strengths of both qualitative and quantitative methods to produce a richer and comprehensive research. This approach also ensured that the researcher compensated for the weaknesses of using one approach with the strengths of another as suggested by Mills (2010). The purpose of this study was to assess institutional repositories capacities in supporting teaching, learning and research activities in four selected universities in Kenya with a view to proposing appropriate model to improve service provision. To answer this objective completely, this study needed data and information from academic staff, students, librarians and research directors on a variety of issues such as content and content recruitment, discovery and use. This data comprised both numerical and non-numerical data. Some data were objective while others contained opinions of participants. Consequently, MMR was required that could allow the collection of both quantitative and qualitative data.

For example, to establish the effects of content and content recruitment in IRs, and the extent to which IRs support teaching, learning and research yielded mainly quantitative data using questionnaires. However, it was pertinent to probe deeper, to establish, for instance, the failure by some academic staff and students to use IRs. This probing, on the other hand, yielded qualitative data. Further, determining the role played by librarians and research directors on the use of IRs yielded purely qualitative data. As a result, a MMR was pertinent.

To develop a model to support IR use, the study needed to synthesize objective data and opinions from study participants. Thus, a solely quantitative or a purely qualitative approach was not appropriate for this study. This study contended that the best approach that was likely to answer the research questions was an approach that combined or mixed both quantitative and qualitative methodologies. Creswell (2014) has argued that MMR is the ideal approach if a study generates both quantitative and qualitative data.

The MMR approach was most appropriate because it allowed for the following:

- Explanation of results from quantitative analysis using qualitative data.
- Comparison of different perspectives derived from quantitative and qualitative data.
- Development of a more complete understanding of IR use by combining both types of data.
- Development of an appropriate model to improve IRs' support of teaching, learning and research by using both quantitative and qualitative data.

A research approach specifies three elements: philosophical worldviews (assumptions), research design, and specific methods.

3.3 Philosophical Stance

This section presents the philosophical underpinnings of the study.

3.3.1 Research Paradigms

As noted by Creswell (2013) and Lincoln (1995), a paradigm (also called philosophical assumption or worldview) can be defined as a set of beliefs, assumptions or worldview

that guide research. A research paradigm as asserted by other researchers (Denzin and Lincoln 2005; Mertens, 2015) affects every stage of the research from deciding on the research problem to analyzing and interpreting the data. Creswell (2013), Cecez-Kecmanovic and Kennan (2013) argue that paradigms help researchers to choose the problem of study, the research questions and theories to guide the study. Thus, a paradigm might be conceptualized as a philosophical lens by which a researcher looks at the methodological aspects of the study to determine research methods, data collection and analysis. Consequently, before selecting an appropriate methodology for research, a suitable paradigm needs to be identified.

Paradigms provide beliefs about two basic questions in research: what can be known and how it can be known. This is pertinent in determining the types of research questions to be asked, the research approach taken, and the data collection and analysis strategies (Wright, O'Brien, Nimmon, Law & Mylopoulos, 2016). Since there are many different paradigms in social sciences, which differ in terms of their underlying philosophical assumptions, it was prudent to understand first the assumptions for each paradigm before deciding on the suitable paradigm for the present study. Denzin and Lincoln (2005) and Creswell (2013) identified the basic philosophical assumptions to include: ontology, which refers to the nature of reality and what can be known about it. One aspect of ontology is objectivism. This means that, things exist with a purpose independent of those social actors concerned with their existence. Another aspect is subjectivism, which holds that social occurrences are created through perceptions and consequent actions of the involved social actors. People who adopt a subjective way of thinking find it necessary to explore the details of a situation to be able to understand what is going on

(social constructionist) while epistemology refers to the nature of the relationship between the knower and what can be known, it addresses the questions; what is knowledge? How is knowledge acquired? And what do people know? and methodology, which is the technique, used to obtain knowledge. Axiology is a strand of philosophy that studies judgements about value. This includes values in the field of ethics.

Thus, ontology answers the question of "What can we know?" Ontological viewpoints may be placed on a continuum, with researchers at one end believing an objective reality exists, which is independent of our knowledge (realist or objectivist ontology) while at the other end, scholars believe that reality is subjective and individually constructed, with no universal truth to be known (constructionist ontology) (Wright *et al*., 2016; Fraser, 2014).A third ontological viewpoint, called pluralism (doctrine of multiplicity), holds that there is not one consistent means of approaching truths about the world but rather many (Fraser, 2014).Pluralism therefore accepts multiple paradigms coexisting together, with each explicating a particular domain. The realist, pluralism and constructionist ontologies are the basis of quantitative, mixed methods and qualitative approaches, respective.

This study collected objective facts such as the number of times users of IRs have downloaded or uploaded items to them, the type of items predominant in them and the extent of IRs usage in institutions. This aspect of the study was guided by the realist ontology, which holds the existence of an objective reality. On the other hand, there were different opinions by librarians, system librarians and research directors on how IRs could be improved in order to support learning and research, which required

constructionist ontology. Thus, the study combined both realist and constructionist aspects to yield pluralism ontology that guided the study.

On the other hand, epistemology answers the question of "how can we know?" Epistemological viewpoints can also be placed on a continuum, depending on the ontological disposition. On one end are those who believe that knowledge is generated through objective measurements and quantitative relationships between variables. On the other extreme, are those who believe there are some multiple realities, constructed in particular individuals or social settings, and that knowledge is best discovered by exploration of beliefs, perceptions and experiences. Basing on epistemological and ontological viewpoints, Creswell (2013), suggests three major paradigms namely positivism (sometimes called post-positivism), constructivism or pragmatism.

Positivism is rooted in the scientific method, in which universal laws and truths drive reality. Consequently, experimental and quantitative methods can be used to test and verify given postulations. On the other extreme is constructivism, which uses qualitative and synthetic methods to understand, inductively and holistically, human experience in context – specific settings. Pragmatism combines aspects of both positivism and constructivism (Creswell, 2013). This study used pragmatism that helped to generate both objective and subjective knowledge on the research problem.

3.3.2 Pragmatism Paradigm

Pragmatism is the philosophy underpinning mixed methods research approach that emphasizes on the need to focus on actions, situations and consequences rather than antecedent conditions. It recognizes that there are many ways of interpreting the world

and that in undertaking research there is no single point of view that can give an entire picture of a phenomenon since there maybe multiple entities. The philosophy emphasizes on the need to thoroughly understand the research problem and then use pluralistic approaches to solve it. According to Creswell (2014), pragmatism is characterised by the following:

- It uses several systems of philosophy and reality.
- The philosophy does not prescribe rigid methods and procedures; instead, the researcher has freedom to choose the procedures and techniques that can best solve the research problem.
- It allows for the use of several approaches, paradigms, assumptions and methods to collect and analyse data.

3.3.2.1 Justification for using pragmatic Research Paradigm

This study used a combination of both positivism and constructivism in a pragmatic paradigm. This is because to answer satisfactorily the research questions, both quantitative and qualitative data were required. The number of materials deposited in IRs and the extent of IRs' use in supporting teaching and research was objective. On the other hand, data resulting from participants' opinions about IR use was subjective. Positivist philosophy was used by the study to inform the development of research design and methods that can be able to collect objective reality. The positivist philosophy is deterministic, seeking to ascribe causes to effects (Creswell, 2014; Onwuegbuzie, & Turner, 2007). This philosophy was necessary in understanding some phenomena, for example, the rates of content deposition and use in IR, which the study showed that it was

low, and differences in the use of IRs across academic schools or participants' biographical categories.

Positivism is reductionist (Wright *et al*., 2016), breaking up problems into small parts consisting of variables that can be easily investigated. This view informed the decomposition of the overall research problem (IR's support of teaching, learning and research) into smaller parts, such as content in IRs, content recruitment, content discovery and use. This philosophy informed the development of questionnaires that allowed apprehending objective reality. Finally, this worldview informed the adoption of theories (TAM and DOI) that underpinned the study, since testing of theories is the pillar of this philosophy (Creswell & Tashakkori, 2007).

On the other hand, constructivism seeks to understand the multiple realities, constructed in particular individuals or social groups by seeking to explore their beliefs, perceptions and experiences (Creswell, 2014). These philosophical lenses were important in guiding the development of interview schedules that sought to reveal participants' opinions about IR use.

3.4 Research Design

Research design is a blueprint for research, dealing with at least four problems: which questions to study, which data are relevant, what data to collect, and how to analyze the data? (Creswell, 2014). A research design may be thought of as a structure of research or a scheme, outline or plan that is used to generate answers to research problems. It is a plan and structure of investigation so conceived as to obtain answers to the questions. It

expresses both the structure of the research problem and the plan of investigation used to obtain empirical evidence on the relations of the problem (VerLinden, 2010; Peck, 2006).

According to the nature of this study, a multiple-case embedded research design was adopted. This involved the use of multiple cases (four institutions of higher learning) and several units of analysis as explained in the following sections.

3.4.1 Case Study

Yin (2003) defines a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context, are not evident. Saunders *et al* (2012) advise that a case study is relevant if a researcher wishes to gain a rich understanding of the context of the research and the process being enacted. Although the case studies method has traditionally been associated with qualitative approach with several authors defining it as a qualitative approach (Baxter and Jack 2008; Kothari 2004). However, Saunders *et al* (2012) acknowledge that some case studies may employ quantitative approaches to collect, present, and analyze data while others may employ qualitative approaches, further still, other case studies may combine qualitative and quantitative approaches. These sentiments are shared by those of Yin (2003) who opine that, case studies can include and even be limited to quantitative evidence.

Yin (2009; 2003) identified four major forms of case study strategies as:

i. Single-case studies: where a single unit of analysis is selected where it represents a unique or critical case. One can also select a single case as a representative or typical case or one which has not been considered before

ii. Single-case embedded designs: this involves more than one unit of analysis within a single case. The sub-units have been found to add significant opportunities for extensive analysis, enhancing the insights into the single case.

iii. Multiple- case holistic designs: this is where a study contains more than a single case

iv. Multiple-case embedded designs- this involves several units of analysis within the multiple cases.

3.4.2 Multiple-Case Embedded Study Design

Therefore, the study adopted the multiple-case embedded research design which involves several units of analysis within the multiple cases. In this study, the focus was on the schools within the selected universities whereby the case involved more than one unit of analysis. By adopting a multiple case design, the researcher trusted in providing an in-depth understanding of the institutional repository (IR) capacities in supporting teaching, learning and research activities in four selected universities in Kenya with a view to proposing appropriate model for improvement of service. The embedded approach is an advanced design in which a quantitative or qualitative study is nested within a larger quantitative or qualitative study, either concurrently or sequentially (Leedy & Ormrod, 2015; Creswell, 2014). This study embedded qualitative data within the larger

quantitative data concurrently. This study chose to use the multiple-case embedded design rather than other designs because of the following reasons:

- The multiple-case embedded design enabled the study to have the 'best of both worlds' – quantitative and qualitative studies. A quantitative study utilised larger samples and thus, had higher generalizability (external validity), allowed application of theories, testing of relationships and data generated was objective and precise. The qualitative study utilised a small sample, which allowed deeper probing of participants' opinions, allowed the development of models and theories, and had high internal validity.
- The multiple-case embedded design allowed different sample sizes for the quantitative and qualitative studies, unlike for other designs, such as convergent parallel design (Creswell, 2014). This was important, as the study sampled a larger group of academic staff and students and a relatively smaller group of university librarians, system librarians and research directors.
- The design allowed quantitative and qualitative studies to answer different research questions (Creswell, 2014). This was appropriate for this study because librarians and research directors were expected to answer a different research question (in a qualitative study) while academic staff and students answered other questions (mainly quantitative study).
- This made the use of different methods such as in-depth interviews and questions possible

3.5 Target Population

A population is a group of individuals, events or objects having common observable characteristics. Kombo and Tromp (2010) envisioned a population as a well-defined group / set of people, or items that are being investigated/ studied. This study collected data from four groups of respondents involved in the potential capacity IRs could have on teaching, learning and research in universities: students, who might learn and research using IRs. ***Inclusion criteri***a: Second year and above students who were on campus at the time of data collection and consent to participate in the study met the inclusion criteria. ***Exclusion criteria***: Students absent from the campus at the time of data collection, for instance, those on long holiday and attachment. In addition, all first year's students and those students who were too sick or not willing to participate in the study were excluded. Academic staff, who might be facilitated to teach and research using IRs. ***Inclusion criteri***a: All academic staff available on campus during the time of data collection will be legible for the study. ***Exclusion criteria***: Academic staff absent from the campus or who are too sick during data collection will be excluded. University Librarian, System Librarian and Research Directors who ensure that IRs are functional, the content is well managed so as to improve university ranking and enhance research ecosystem environment in physical facilities. ***Inclusion criteri***a: Only the head of the library, system and research directors will be legible for the study. ***Exclusion criteria***: Librarians, system librarians and research officers not directors will be excluded.

Out of the 39 chartered universities (22 publics and 17 private) that were ranked in the webometrics of 2017, four universities were systematically selected, every fourth university in the list was selected to avoid biasness: University of Nairobi (UoN),

Strathmore University, USIU-A and Moi University.These universities were chosen because they have a well-established IRs and were ranked by the Webometrics Ranking of World Universities on the impact of institutional repositories (Webometrics, 2017). Consequently, the study targeted all 93 000 students and 2463 academic staff from the four selected universities in Kenya. The number of students (undergraduate & postgraduate) consisted of 50,000 from University of Nairobi, 29674 Moi University, 8500 USIU-A and 4826 Strathmore University while the number of academic staff consisted of 1500 University of Nairobi, 650 Moi University, 200 USIU-A and 113 Strathmore University. All the four (4) university librarians, four (4) system librarians and four (4) research directors were purposively selected respectively. Table 3.1 below shows the selected universities along with their populations of academic staff and students from which the sample for the study was taken.

Table 3.1: Universities Population Sizes for Academic Staff and Students

S/No.	University	No. of Academic Staff	No. of Students
1.	University of Nairobi	1500	50000
2.	Moi University	650	29674
3.	Strathmore University	113	4826
4.	United States International University-Africa	200	8500
	TOTAL	**2463**	**93000**

Source: KNBS (Kenya National Bureau of Statistics, 2017)

3.6 Sampling Procedure

According to Creswell (2014) sampling refers to specific ways of selecting subjects or simply who will be studied. The purpose of sampling is to get a representative sample from a much larger population, study it and produce accurate generalizations about the larger group (Neuman, 2006). Sampling also is the use of definite and defined

procedure(s) in the selection of a part of a total population for the purpose of obtaining from it, descriptions, estimates and analysis of certain properties and characteristics of the whole (VanderStoep & Johnston, 2009; Feurstein, 1986). Mulwa (2002) adds that it also has the crucial purpose of predetermining from where or from whom information is to be obtained before commencing data collection, and thus avoiding bias. This study used both probability sampling (students and academic staff) and non- probability sampling (university librarians, system librarians and research directors) methods.

3.6.1 Probability Sampling

According to Neumann (2014), the probability sampling approach relies on random process such that each element has an equal probability of being selected. Examples of probability sampling are stratified random sampling, simple random sampling and systematic random sampling. This study applied a stratified random sampling on both academic staff and students from the four universities and then employed a simple random sample within each group (strata). This is because the two groups despite having a shared attribute of being institutional repository users still had their unique requirements such as academic staffs are considered the main contributors and determinants of IR in terms of usage, particularly in teaching & research and students were considered the main beneficiaries of the contributed content in IRs (learning).

Saunders *et al*. (2009) noted that stratified random sampling is a process of selecting respondents using well-defined strata. Stratified random sample was useful blend of randomization and categorization, which ensures inclusion, in the sample of subgroups, which otherwise, would be omitted entirely by other sampling methods because of their

small numbers in the population (Tabachnick & Fidell, 2013). In addition, stratified sampling enabled the researcher to obtain representation in every selected university. Stratification also gave an equal chance to students and academic staff from the four selected universities as part of the study. This method was employed to select samples which were proportional to the number of students and academic staff in each category. For instance, in this study, sampling of students had three strata: type of university, whether undergraduate or postgraduate and the schools they belonged to (studies have found IR use to be dependent on the type of academic discipline). For academic staff, two strata were identified, the university and the schools. The study therefore used a multi-stage stratification, first classifying respondents into university, then undergraduate or postgraduate (for students) and lastly, into schools.

3.6.2 Non-Probability Sampling

Creswell (2014), Kemper *et al*. (2003) argue that one advantage of qualitative approach is that the sample can be chosen purposively. This had the advantage of allowing the researcher to target the part of the population that had specific answers to the research questions. This sampling method ensured that the study interview targeted the key informants (University Librarians, System Librarians and Research Directors) who had expert knowledge about IR use and were the key decision makers on issues of content management. This ensured the data collected was credible.

3.7 Sampling Techniques

Collection of data from all the students and academic staff was not feasible due to constraints imposed by limited time and financial resources. Thus, a representative

sample was chosen from the target population and used in the study. According to Kombo and Tromp (2010) and Booth, Colomb and Williams (2008) an effective sample should possess diversity, representativeness, reliability, accessibility and knowledge.

This study obtained its sample sizes using Saunders, Lewis and Thornhill (2012), formula which generates the table 3.1 for obtaining sample size. Krejcie & Morgan (1970) was also considered as another model for calculating the sample sizes, however, it was found to be similar as Saunders *et al* (2012). Therefore, Saunders et al sampling table was used because it was considered as more recent than Krejcie & Morgan (1970). The sample size was achieved from the target population of 93000 students and 2463 academic staff

Table 3.2: Sample Size Determination Table

Population	**Margin Error**			
	5%	3%	2%	1%
50	44	48	49	50
100	79	91	96	99
150	108	132	141	148
200	132	168	185	196
250	151	203	226	244
300	168	234	267	291
400	196	291	434	384
500	217	340	414	475
750	254	440	571	696
1,000	278	516	706	906
2,000	322	696	1091	1655
5,000	357	879	1622	3288
10,000	370	964	1936	4899
100,000	383	1056	2345	8762
1,000,000	384	1066	2395	9513
10,000,000	384	1067	2400	9595

Source: Saunders et al. 2012

3.7.1 Sample Size

Sample size refers to the number of items selected from the population to constitute a sample (Kothari 2004). To make valid statistical conclusions, it was important to

determine the appropriate sample size of both students and academic staff. This is because, if the sample size is too small, one may not be able to detect an important existing effect, whereas samples that are too large may waste time, resources and money. In determining sample size, Noordzij *et al*. (2010) proposed that there is need to consider the level of precision or sampling error, the level of confidence or risk, and the degree of variability in the attributes to be measured whether homogenous or heterogeneous. The size of the sample determines the statistical precision of the findings and generally, larger samples result in more precise statistical findings as noted by Wegner (2015), VanderStoep, and Johnston (2009). Given that this study adopted pragmatic stance, it was important to get a representative sample from a much larger population to be able to make generalization about the larger group as noted by Wegner (2015); VanderStoep, and Johnston (2009).

This study target population of 93000 students, and academic staff was 2463, respectively. In order to obtain a 95% confidence level and a sampling error of 5%, this study consequently sampled 370 students and 322 members of academic staff (Saunders *et al*. 2012).

To ensure a proportionate representation of respondents from all strata, the sample contributed by each group was weighted according to stratum's target population. For example, the population size of students from UoN was 50000 against a total of 93000 students from all the four universities while the sample size of students was 370. Thus, the number of students sampled from UoN was 199 (50000/93000 * 370). Table 3.3 and 3.4 respectively shows the sample sizes for the students and academic staff.

Table 3.3: Sample Sizes for Students (Undergraduate and Postgraduate)

University	Students Population (SP)	Sample (SP/93000)*370
UON	50000	199
Moi	29674	118
Strathmore	4826	19
USIU-A	8500	34
TOTAL	**93000**	**370**

In order to obtain representative proportional sample sizes for academic staff in four selected universities, the researcher calculated the proportional sample sizes as follows University of Nairobi with 1500 academic staff, the sample size was calculated as follows: 1500/2463*322 =196. The rest of the samples are shown below.

Table 3.4: Sample Sizes for Academic Staff

University	Academic Staff population (SP)	Sample (ASP/2463)*322
U ON	1500	196
Moi	650	85
Strathmore	113	15
USIU-A	200	26
TOTAL	**2463**	**322**

Simple random sampling was then used to select participants from each of the strata. For instance, the type of university, school they belonged to and whether undergraduate or postgraduate (students). Saunders *et al*. (2009) defined simple random sampling as a process of selecting respondents without any particular sequence where all subjects in the study population have an equal chance of being selected. A sampling frame of all the respondents were obtained from each university and used to select participants in the study using simple random sampling that was conducted with a table of random numbers. A sampling frame is a complete list of all the members of the population that the researcher wished to study (Tabachnick & Fidell, 2013).

Random sampling was appropriate for this study because since it is representative, the findings will have greater external validity and generalizability. In addition, random sampling is a necessary assumption of many statistical tests (Norusis, 2010).

For the university librarians, system librarians and research director since their number was less numerous, four of them were purposively selected from each university in the study. This study included these respondents as the key informants because they were the right people to provide information and issues related to content and content recruitment, content discovery and their contribution towards the use of IRs. The study deliberately selected these respondents because they either dealt directly with IR management or sat at the apex of library administration and were likely to have deep knowledge of the working of the library and research office.

Table 3.5: Sample Sizes for University Librarians, System Librarians and Research Directors

University	University Librarian	System Librarian	Research Director
University of Nairobi	1	1	1
Moi University	1	1	1
Strathmore University	1	1	1
United States International University – Africa	1	1	1
Total	**4**	**4**	**4**

Source: Field Data (2019)

3.8 Data Collection Instruments

Data collection is the process of acquiring subjects and gathering information needed for a study. Methods of collection vary depending on the study design (Greener, 2008). This study used two instruments; questionnaires and interview schedules. Semi-structured

questionnaires were administered to students and academic staff since (Appendix I & II); this instrument was considered appropriate because it permitted collection of data from a large population and was relatively cheap to deploy (Ogula, 2010). On the other hand, interviews were conducted on university librarians, system Librarians and research directors as they were few (Appendix III) and this enabled the researcher to get in-depth analysis. Questionnaires consisted of both closed and open-ended questions. Closed questions have predetermined answers and usually collect quantitative data while open-ended questions give the respondents free will to answer and usually collect qualitative data. The use of questionnaires ensured the collection of data from many respondents within a short time and respondents were free to give relevant information because they were assured of their anonymity (Vanderstoep and Johnston, 2009). The selections of these tools were guided by the nature of data to be collected and time available as well as the objectives of the study.

3.8.1 Questionnaire

Semi-structured questionnaires were administered to students and academic staff in four selected universities because theyformed the largest stratum of the target population. It consisted of both closed and open-ended questions. Closed questions had predetermined answers and collected quantitative data while open-ended questions gave the respondents free will to answer and collected qualitative data. The use of questionnaires ensured the collection of data from many respondents within a short time and respondents were free to give relevant information because they were assured of their anonymity (Vanderstoep and Johnston, 2009).

3.8.2 Interview Schedule

An interview is a conversation between the interviewer and the interviewee where questions are asked by the interviewer to obtain information from the interviewee (Neuman, 2006). In the context of this particular study, interview schedule targeted a smaller group of individuals in the population strata. For example, the use of structured interviews collected data from the university librarians, system librarians and research directors. This involved face-to-face interviews between the researcher and the respondents. The interviews were easy to carry out because the questions were prepared in advance. Interviews helped to eliminate bias that is often associated with the other methods of data collection like questionnaires. They also provided an opportunity for clarifications where a misunderstanding between the researcher and the respondent through probing. The interview schedule gave the respondents freedom of answering questions.

3.9 Data Collection Procedure

This involved taking the research instruments to the field for the purpose of data collection. Before the start of data collection, the researcher obtained an introductory letter from relevant institutions, to enable the application for research permits from the National Council for Science and Technology and institutional Research and Ethics Committee (IREC). Then, a research permit was sought from the National Council for Science and Technology after which the request for research was sent to each of the four universities. The researcher identified and trained two research assistants who helped in the administration of questionnaires

3.9.1 Recruitment of Participants

The following section presents a discussion on how the respondents in the study were selected.

3.9.1.1 Recruitment of Students

A week before actual data collection, the researcher visited the schools to be sampled, carrying an introductory letter from Moi University and research permits from National Council for Science and Technology and IREC. The researcher explained to the heads of schools the purpose of the study, how the recruitment process was to be conducted and requested to sample students from the schools. Briefly, the researcher requested for the timetable of lessons in the schools and therefore identified the classes in session. The timetable also helped to identify when specific classes could be sampled. The full list of students in each class (sampling frame) was also requested for. This allowed for the researcher to identify the exact number of undergraduate and postgraduate students in each school. This enabled the researcher to determine which groups of students to be sampled.

Having noted the number of students in each class, the researcher used a table of random numbers, to randomly select potential participants from the list. The researcher deliberately selected five more students than the specified number, to replace the identified students who were absent during data collection. A copy of this list was left with the school chair and a request made that the lecturer of the specific class be informed when the researcher will sample students from the class. In addition, the lecturer was also requested to inform the students about the study and the date of data

collection. This procedure was repeated for all the schools that took part in the study. Thus, during this exercise, the complete list of students from a university, randomly selected, to take part in the study was identified. In addition, the specific day for sampling of each class was known.

On the material day of data collection, the researcher (together with assistants), armed with the sampling frame and timetable walked to the specific classes, informed the lecturers (who had previously been informed) about the study and requested to collect data in the last 50 minutes of the class. The researcher talked to students about the study. The names of students selected from the sampling frame were called out, assembled them in the classroom, explained to them the purpose of the study, and distributed questionnaires to them. If any selected student was absent, the extra students replaced them.

The respondents were given 30-45 minutes to fill the questionnaires after which they were collected. The researcher then thanked the respondents before leaving.

3.9.1.2 Recruitment of Academic Staff

As for Academic staff, the researcher a week before data collection went to the specific schools, carrying relevant permits and requested the school chair for permission to sample academic staff from the schools. The researcher requested for the list of academic staff in the schools and the days they normally come to university. The sampling list of the academic staff listed all the assistant lecturers, lecturers, senior lecturers, professors, and associate professors in each school, enabling the researcher to determine which group to be sampled.

Again, using a table of random numbers, the researcher randomly identified the staff to take part in the study according to sample size and requested the chairperson of the school to inform them on the specific day of data collection. On the material day of data collection, the researcher visited the respective schools, identified the selected staff, explained to them the purpose of study and distributed questionnaires to them. If an academic staff was absent, the researcher returned another day, convenient to the staff, having obtained their contacts.

3.9.1.3 Recruitment of University Librarians, System Librarians and Research Directors

Since these officers are specific and known, the researcher went to them on the data collection day and requested them to participate in the study, after showing the relevant permits and explaining the purpose of the study. Hence, their recruitment was automatic by virtue of the positions they hold.

The researcher conducted face-to-face interviews with university librarians, system librarians and research directors. This involved introduction, explaining the purpose of the study and procedure, obtaining their consent, conducting the interview and thanking them at the end. The researcher took notes during the interview and auto recorded the conversation for back up and clarification. Interviews were conducted in strict privacy. Respondents who needed clarification got a chance through probing.

3.10 Validity and Reliability of the Research Instruments

Before data was collected in this study, the instruments were tested to ensure validity and reliability of the research tools.

3.10.1 Validity of Research Instruments

Validity refers to the extent to which an instrument can measure what it ought to measure, that is, the extent to which an instrument asks the right questions in terms of accuracy. Vanderstoep and Johnston (2009) looked at validity as the accuracy and meaningfulness of inferences, based on research results. Content validity, which refers to the instrument adequately covering the aspects of the constructs being measured (Saunders *et al*., 2009), was achieved through literature reviewed and discussion and refinement of the items in the instrument with supervisors who are experts in the field of information Science. Since the determination of content validity (face validity) is judgmental, experts from the school helped to refine the definition of the topic of concern, the items to be scaled and the scales to be used (Saunders *et al*., 2009). Therefore, this study used content validity to measure the degree to which data collected using a particular instrument represent a specific domain of indicators or content of a particular concept.

Construct validity, is the extent to which measurement questions actually measure the presence of the construct that the researcher intended them to measure or rather these are the theoretical relationship of a variable to other variables (De Vellis, 2003) were established by adapting constructs developed by other scholars, which were found through literature review. These procedures applied to both questionnaires and interview schedules.

3.10.2 Reliability of the Research Instruments

According to Saunders *et al*. (2009), the reliability of an instrument is the measure of the degree to which a research instrument yields consistent results or data after repeated trials. Reliability of the test items in instruments was tested by calculating a Cronbach alpha during piloting. Piloting is a process that is carried out before the main research takes place. The main purpose of the pilot study was to ensure that the data collected achieved the right results. In other words, the pilot study was used to test the research instruments for validity and reliability. Pilot study was conducted in Kisii University (public) and Mt. Kenya University (private).These universities were selected because they are similar to other universities in the study in terms of academic objectives; work practices and have a well-established IR. Interview schedules were administered to university librarians, system librarians and research directors from each university selected, while questionnaires were administered to 16 students and 8 academics from information sciences and humanities schools of Kisii and Mt. Kenya Universities, making a total of 30 respondents.

This number was informed by Brooks (2010) who suggests that 30 representative participants is a reasonable maximum recommended for a pilot study. These schools were chosen because Information Sciences staff and students are likely to be aware of IRs and using them actively. On the other hand, school of humanities is reputed to be averse to use of IRs (Tsunoda *et al*., 2016). When the pilot study was complete the outcome of questionnaires and interviews were checked with the experts in the field or supervisors. The statistician used the results from the questionnaires to test the reliability of the instruments using Cronbach values of above 0.7. Whereby the Cronbach alpha values

were found to be above the threshold of 0.7, and the items were judged as being reliable. This figure is usually considered desirable for consistency levels (Campbell & Wraight, 2007; Cohen & Swerdlik, 2005). Where the value was less than 0.7, the items were revised. Cronbach's coefficient alpha method was used to determine internal consistency of the items. This method was appropriate owing to the fact that it required only one administration of the test (Cohen & Swerdlik, 2005) and the items had choices.

In addition, since the study had qualitative aspects, it was important to establish the trustworthiness of the research findings. There are four elements of trustworthiness that are critical: credibility, dependability, transferability, and confirmability (Korstjens & Moser, 2018). Credibility or internal validity refers to the confidence that can be put in the truth of the research findings, that is, do the reported results represent original data, correctly interpreted? (Korstjens & Moser, 2018). This aspect was ensured with the researcher personally listening to the interviewees, recording their answers and playing them back several times. Meticulous notes were also kept during interviews and several methods were used to collect data (triangulation).

The stability of research findings over time is called dependability whereas the degree to which the findings can be confirmed by other scholars is referred to as confirmability (Korstjens & Moser, 2018). Both aspects were assured by completely explaining the procedures of data collection and analysis, including how samples were chosen. Thus, the procedures could be repeated by other researchers. Transferability or external validity is the extent to which the findings can be generalized to other settings (Korstjens & Moser,

2018). This was ensured by selecting respondents randomly from the target population and by clearly and fully describing the methods of data collection.

3.11 Data Presentation and Analysis

This study collected both quantitative and qualitative data. Quantitative data was analysed using descriptive statistics and presented using frequency distribution tables, bar graphs and pie charts while qualitative data was analysed thematically based on the objectives and research questions and presented in form of narrative.

Descriptive and inferential statistics were used to describe, summarize, and organize the data. Three sets of these methods were used: frequency distributions, measures of central tendency, and measures of dispersion. Frequency distributions, ordered arrangement of all variables, showing the number of occurrences in each category (Norusis, 2010), were used to summarize data. The data was then displayed using tables, bar graphs and pie charts. Average or typical values of the data were given by the measures of central tendency (mean). The mean is the arithmetic average of values in a set. The range (the difference between the highest and lowest value) and the standard deviation (the average difference between observed values and the mean) gave dispersion (variability) of data.

Using chi-square test at 95% confidence level and 5% significance level and a probability value (P-value) of 0.05 Chi-square (χ^2) cross tabulations were used to test if there were any significant relationship between various categorical variables in the study. For instance, this test was used to determine if the respondents' biographical characteristics influenced their use of IRs (Field, 2005).

Qualitative data (arising from interviews and open-ended items in questionnaires) were analyzed by the method of content analysis. The purpose of doing qualitative data analysis was to reduce the amount of text and organize responses to identify broad trends and themes in the data. Content analysis was used to create a structure that allows the organization of open-ended information.

The study proposed an IR model by analyzing and synthesizing the whole range of the respondents' answers. To empirically test and validate the proposed model, the respondents' answers to open-ended items in the questionnaire (qualitative answers) were coded and entered into Statistical Package of Social Sciences (SPSS). The proposed model was tested using structural equation modelling – path analysis (SEMPATH), which was undertaken using the AMOS statistical program (Version 23). Structural equation modelling is an approach that has been used to describe a large number of statistical models used to evaluate the validity substantive theories with empirical data.

3.12 Ethical Considerations

Ethics define what is or is not legitimate to do, or what "moral" research procedure involves (Neuman, 2006). Ethical issues are of importance to all kinds of social and behavioural research and of importance when human subjects are involved. The goal of ethics in research is to ensure that no one is harmed or suffers adverse consequences from research activities. The researcher ensured that rights, needs, values and desires of the respondents were respected by seeking formal approval of the respondents as well as institutions before the onset of data collection, provided them with information about the purpose of the study, and above all respected their privacy and confidentiality. The nature

and purpose of the research was explained to the respondents by the researcher in order to obtain consent. The researcher strived to adhere to these issues in each step of the research process from data collection, data analysis and reporting of information. Specifically, the following ethical elements were considered in the study:

3.12.1 Risks

This study carried no risks whatsoever for the participants. This is because students and members of the academic staff merely filled questionnaires. On the other hand, university librarians, system librarians and research directors answered questions related to their work in face-to-face interviews.

3.12.2 Benefits to Subjects

There were no direct benefits to subjects participating in the study. However, since the participants were members of the Academy, they will benefit indirectly from the findings and recommendations arising from the study.

3.12.3 Informed Consent

The study applied to the Research Ethics Committee (IREC) of the various universities for approval before data was collected. The principles of informed consent were upheld throughout the study. First, the study determined whether participants had authority to provide consent, based on their communication abilities and well-being. Secondly, the researcher provided standard information to potential participants, such as, the purpose of the study, reason for the consent, name of investigator, benefits and risks of the study. Next, the researcher confirmed understanding of the information given by assessing non-verbal cues, asking questions and clarifying reasons for silence or refusal to engage in the

ongoing discussion. This was followed by providing opportunity for questions by participants and answering them appropriately. Next, the consent was confirmed by asking the potential respondents whether they were ready to proceed. This was followed by signing a consent form by both the participant and the investigator as proof that consent had been given. The participants were then reminded that they could withdraw from the study at any given time.

3.12.4 Confidentiality

The participants were told not to write their name or any form of identification on the questionnaire. Interview schedules also did not contain any personal details of the interviewee. Instead, all forms were assigned numbers. The questionnaires and the recorded audio were kept under lock and key. Personal details of the interviewee in the recorded audio were deleted. These steps safeguarded the privacy and confidentiality of respondents.

3.13 Chapter Summary

This chapter presented the methodology of the study. The study adopted a mixed methods research approach and the multiple case embedded research design, which enabled it to collect and analyse both qualitative and quantitative data. Consequently, the ontology of the study was pluralism, which holds that there are many ways to approach truth. On the other hand, the paradigm of the study was pragmatism, which helped to generate both objective and subjective knowledge on the research problem. The study combined both non-probability (purposive) and probability (random) sampling methods to choose its sample. The research instruments and how their validity and reliability were established

were also presented. The next chapter covers data presentation, analysis and interpretation.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter discusses the presentation, analysis and interpretation of data collected on assessing institutional repositories' (IRs) capacities in supporting teaching, learning and research activities in four selected universities in Kenya

4.2 Response Rate

Overall, of the 370 and 322 questionnaires administered to students and members of academic staff from the four universities, 332 (89.7%) and 293 (91%), were returned, respectively. The actual number of questionnaires given out to each of the four universities and the numbers returned are presented in Table 4.1.

Table 4.1: Response Rate in the Study

Respondent type	University	Number of questionnaires given	Number of useful questionnaires returned	Response rate (%)
Students	Moi	118	107	90.7
	UoN	199	172	86.4
	Strathmore	19	19	100
	USIU	34	34	100
	Total	**370**	**332**	**89.7**
Academic staff	Moi	85	72	84.7
	UoN	196	180	91.8
	Strathmore	15	15	100
	USIU	26	26	100
	Total	**322**	**293**	**91.0**

Source: Computed from survey data, 2020

In addition, the study selected one university librarian, system librarian and research director from each of the four universities, yielding a total of 12 key informants. Consequently, the response rate for this cadre of participants was 100%. The response rate for all types of respondents in all the universities was relatively high, ranging from

84.7% to 100%, suggesting that they were keen to contribute on the subject matter. The response rate reflected the view of Mugenda and Mugenda (2003) who indicated that a response rate of 70% and over is very good as it gives a representative sample for meaningful generalization and minimizes errors.

4.3 Demographic Profile of Respondents

The data from this section gives biographical information of the respondents (students and members of academic staff) in the study in order to understand their profiles. This information was important for two reasons. One, to assess the suitability of the sample respondents for the study. Secondly, to help determine whether the sample was balanced enough, in order to avoid systematic bias in the answers to study questions.

4.3.1 Demographic Profile of Academic Staff and Students

The information sought included the respondents' university, its status (whether public or private), school, gender, age, and academic qualification. In addition, the lecturer's rank and the average number of courses they teach at the university and the student's mode of study and the period spent in study were also obtained. Descriptive results (Table 4.2) showed that the study sampled a majority of students (52%) and academic staff (61%) from UoN, followed by Moi University (academic staff, 25%; students, 32%), and USIU (students, 10%; academic staff, 9%).

Table 4.2: Bio-Graphical Information of Academic Staff and Students

Bio-graphical information	Respondent type	Categories	Frequency	Percent
University	Student	Moi	107	32.2
		UoN	172	51.8
		Strathmore	19	5.7
		USIU	34	10.3
		Total	**332**	**100.0**
	Academic staff	Moi	72	24.6
		UoN	180	61.4
		Strathmore	15	5.1
		USIU	26	8.9
		Total	**293**	**100.0**
University type	Student	Public	279	84.0
		Private	53	16.0
		Total	**332**	**100.0**
	Academic staff	Public	252	86.0
		Private	41	14.0
		Total	**293**	**100.0**
Respondent's gender	Student	Male	205	61.8
		Female	127	38.2
		Total	**332**	**100.0**
	Academic staff	Male	127	43.3
		Female	166	56.7
		Total	**293**	**100.0**
Respondent's age	Student	20-30 years	118	35.5
		31-40 years	84	25.3
		41-50 years	75	22.6
		51-60 years	49	14.9
		61 years and above	6	1.8
		Total	**332**	**100.0**
	Academic staff	20-30 years	44	15.0
		31-40 years	100	34.1
		41-50 years	50	17.1
		51-60 years	52	17.7
		61 years and above	47	16.0
		Total	**293**	**100.0**
Respondent's highest academic qualification	Student	KCSE	164	49.4
		Bachelors	115	34.6
		Masters	53	16.0
		Total	**332**	**100.0**
	Academic staff	Bachelors	61	20.8
		Masters	125	42.7
		PhD	107	36.5
		Total	**293**	**100.0**
Current program	Student	Undergraduate	208	62.6
		Masters	80	24.1
		PhD	44	13.3
		Total	**332**	**100.0**
Academic rank	Academic staff	Assistant lecturer	73	24.9
		Lecturer	64	21.8
		Senior lecturer	79	27.0
		Associate professor	51	17.4
		Professor	26	8.9
		Total	**293**	**100.0**
Student's mode of study	Student	Full-time	254	76.5
		Part-time	**78**	23.5
		Total	332	**100.0**

Source: Survey Data, 2020

The least proportion of students (6%) and academic staff (5%) in the study were from Strathmore University. These proportions reflected the relative populations of academic and students in each university as set out in the methodology section. Of the four universities, UoN and Moi were public whereas Strathmore and USIU were private. Consequently, the study sampled 279 students (84%) and 252 academic staff (86%) from public universities, while 53 students (16%) and 41 (14%) academic staff came from private universities.

Table 4.2 above indicates that male students were more (*n*=205, 62%) relative to female students (*n*=127, 38%). On the other hand, the study sampled slightly more female academic staff members (57%) than male counterparts (43%). Given that significant proportions of both genders were sampled, the external validity of the study's findings was ensured.

There was a progressive decrease in the number of students as age increased, with 118 (36%), 84 (25%), and 75 (23%) of the students aged between 20 to 30 years, 31 to 40 years, and 41 to 50 years, respectively. Six students were over 60 years. This reflected the fact that students, especially undergraduates, at an academic university tend to be younger, having recently finished secondary education. Most members of the academic staff were aged between 31 to 40 years (*n*=100, 34%), followed by those aged between 51 to 60 years (both *n*=52, 18%), and 41 to 50 years (*n*=50, 17%). Fewer members of staff were very young and very old (15 and 16 per cent of the sample, respectively). Since the study sampled respondents from all cadres of age, the findings are likely to reflect the

opinions of most segments of the academic community, thereby, increasing their external validity.

Most of the sampled students were undergraduates (*n*=208, 63%). A significant proportion of students (24%) were studying for masters' degrees while 13% of them were studying for PhD. This was reflected in the finding that most students had KCSE certificates (*n*=164, 49%) as their highest academic qualification, followed by those with bachelor's degrees (*n*=115, 35%) and master's degrees (*n*=53, 16%). The discrepancy between the number of students studying for the current program and the student's highest academic qualification could arise because some students with master's and PhD degrees could be studying for different undergraduate degrees. Majority of the academic staff sampled had masters' degrees (*n*=125, 43%), followed by PhD holders (*n*=107, 37%). A sizeable proportion (*n*=61, 21%) of them, however, had bachelors' degrees as their highest academic qualification. This was reflected in the fact that most members of the academic staff were senior lecturers (27%), assistant lecturers (25%) or lecturers (22%). The results showed that the sample was relatively well educated and could offer useful insights on the role of IRs in supporting teaching, learning and research. Only 9% (*n*=26) of the respondents sampled were professors. Majority of the students (77%) were full time compared to 23% who studied on part-time basis.

4.3.1 Demographic Profile of Key Informants

The key informants consisted of four university librarians, four system librarians and four research directors, each from the universities in the study. Their demographic profile is presented in Table 4.3.

Table 4.3: Bio-Graphical Information of Key Informants

Informant type	Bio-graphical information	Categories	Frequency	Percent
University librarians	Gender	Male	1	25
		Female	3	75
		Total	**4**	**100.0**
	Age	31-40 years	0	0.0
		41-50 years	3	75
		51-60 years	1	25
		Total	**4**	**100.0**
	Highest education level	Masters	3	75
		PhD	1	25
		Total	**4**	**100.0**
System librarians	Gender	Male	3	75
		Female	1	25
		Total	**4**	**100.0**
	Age	31-40 years	1	25
		41-50 years	3	75
		51-60 years	0	0.0
		Total	**4**	**100.0**
	Highest education level	Masters	4	100.0
		PhD	0	0.0
		Total	**4**	**100.0**
Research directors	Gender	Male	4	100.0
		Female	0	0.0
		Total	**4**	**100.0**
	Age	31-40 years	0	0.0
		41-50 years	2	50
		51-60 years	2	50
		Total	**4**	**100.0**
	Highest education level	Masters	1	25
		PhD	3	75
		Total	**4**	**100.0**

Source: Survey Data, 2020

Most university librarians were found to be female (75%), aged between 41 and 50 years (75%) and with masters' degrees as their highest educational level. The study therefore found a biasness towards female, with respect to librarians and individuals who tend to relatively older and middle level educational qualifications.

In contrast, system librarians, tended to be younger (all were less than 51 years) and predominantly male (75%). However, like university librarians, they had middle level educational qualifications (all had masters' degrees). The most educated were research

directors (75% of them had PhDs) and were found to be exclusively male. Research directors were also relatively older (50% were aged between 51 and 60 years).

4.4 Schools, Students' Years in University and Lecturers' Course Numbers

Table 4.4 presents results on the schools to which the respondents belonged (panel A), the number of years' students had spent in the universities, and the average number of courses academic staff taught (panel B). Six major schools were sampled: engineering, information sciences, education, sciences, humanities and business. Most of the students sampled belonged to humanities (29%), followed by information sciences (24%), sciences (15%), and business (14%).

Table 4.4: Academic Schools, Students' Years in University and Lecturers' Course numbers

Panel A: Respondent type	School	Frequency	Percent
Student	Engineering	37	11.1
	Information science	78	23.5
	Education	29	8.7
	Science	48	14.5
	Humanities	95	28.6
	Business	45	13.6
	Total	**332**	**100.0**
Academic staff	Engineering	9	3.1
	Information science	53	18.1
	Education	3	1.0
	Science	35	12.0
	Humanities	161	54.9
	Business	32	10.9
	Total	**293**	**100.0**
Panel B: Variable	Range	Mean	Std. Dev.
Students' years in university (n=370)	1 – 11 years	3.81 years	2.06 years
Lecturers' number of courses taught	1 – 6	2.59	0.93

Key: Std. Dev = standard deviation; n = number of respondents; Science consists Biological and Physical Sciences
Source: Survey Data, 2020

The least came from education (9%). Similarly, a majority of academic staff belonged to humanities (55%), followed by information sciences (18%), science (12%) and business (11%).

The number of years that students had spent in the university ranged from one year to 11 years, with an average of 4 years. The standard deviation was two years. This suggested that sampled students had been in the university for a reasonable period to enable them answer questions on IRs. The academic staff's number of courses taught in a semester ranged from one to six, with an average of three and a standard deviation of one.

4.5 Effectiveness of Content and Content Recruitment in IRs

This section presents findings on the effectiveness of content and content recruitment in IRs.

4.5.1 IRs' Scholarly Content

The study sought the opinions of respondents on the types of scholarly content present in their IRs. Table 4.5 shows that, according to respondents, IRs in the four universities contained over 12 types of scholarly content, including preprints, book reviews, journal articles, thesis, working papers, and conference papers. Others were technical reports, datasets, book chapter, software, books and multimedia.

Table 4.5: Types of Scholarly Content Present in IRs

IRs' content	Academic staff			Students		
	Responses			Responses		
	N	%	% of cases	N	%	% of cases
Preprints	109	6.8	37.5	74	4.9	22.9
Book Reviews	114	7.1	39.2	93	6.1	28.8
Journal Article	148	9.2	50.9	189	12.4	58.5
Thesis	183	11.4	62.9	188	12.3	58.2
Working papers	124	7.7	42.6	118	7.7	36.5
Conference Papers	110	6.9	37.8	91	6.0	28.2
Technical Reports	143	8.9	49.1	98	6.4	30.3
Datasets	105	6.6	36.1	120	7.9	37.2
Book Chapter	146	9.1	50.2	99	6.5	30.7
Software	183	11.4	62.9	130	8.5	40.2
Book	134	8.4	46.0	171	11.2	52.9
Multimedia	104	6.5	35.7	152	10.0	47.1
Total	**1,603**	**100.0**	**550.9**	**1,523**	**100.0**	**471.5**

The number of responses for this question was 1,603 for members of academic staff and 1,523 for students, which was more than the number of academic staff (293) and students (332) in the study. This was because most respondents answered that IR contained more than one type of scholarly content, that is, the question was a multiple response type.

The results showed IRs, according to respondents, mainly contained theses (staff: 11% of the 1,603 responses and students: 12% of the 1,523 responses), journal articles (staff: 9% and students: 12%), and software (staff: 11% and students: 9%). The least prevalent items in IRs, according to the opinions of respondents, were preprints, conference papers, and book reviews. Whereas staff answered that IRs did not contain much multimedia, students thought the opposite.

The total percentage of cases was 550.9 and 471.5 for academic staff and students, respectively, indicating that on average, each academic staff answered that the IR contained about six types (550.9/100) of scholarly content compared to a student's four types (471.5/100). This suggested that academic staff thought the IR had more content than students did.

According to answers from university librarians, system librarians and research directors, IRs, in addition, contained graduation speeches, press briefings, research projects, media clippings, newspaper articles, university calendars, almanacs, ISO manuals, and school magazines. Others included examination papers, historical documents of the university, research questions, past papers, lectures, speeches, manuscripts, pictures, policies, newsletters, microfilms, workshop, and seminar proceedings.

Removing journal articles, book reviews, book chapters and books, which made up about 35% of the IR content, the rest of the material (about two thirds) consisted of grey literature that had not been peer reviewed. The type of IR content was compared between the four universities in the study and the results are presented in Figure 4.1.

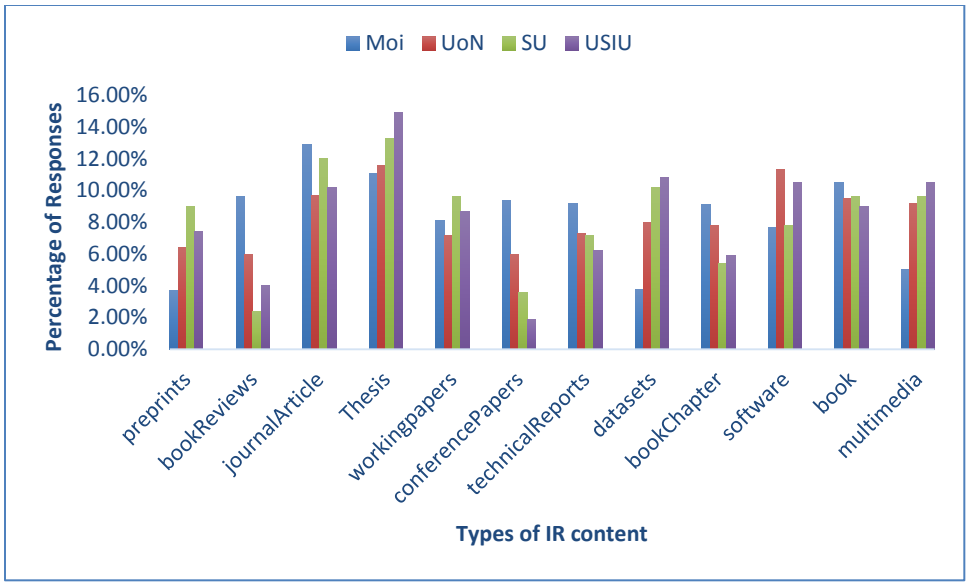

Figure 4.1: IR Content in the Selected Universities in the Study

Slight differences in the type of content were observed in the universities, notably conferences and book reviews, which were more in public universities whereas theses, datasets and multimedia were predominant in private universities. Nevertheless, generally, IRs from the selected universities contained similar materials, as can be seen from Appendices 15 and 16, which display the IR interfaces from the four universities.

Analysis of the selected IRs also showed that all of them used the same type of software platform, DSpace, which could explain the similarity of their content. No university was found to use other software, whether proprietary or OSS, such as EPrints, Digital Commons, Fedora, Greenstone, Aigainon, BRICKS or Invenio.

4.5.2 Type of Content Deposited in IRs

The study also asked respondents the type of content they had ever deposited in their IR. This information is presented in Table 4.6.

Table 4.6: Types of Content Academic Staff and Students Deposit in IRs

IRs' content	Responses		
	N	%	% of cases
Journal Articles	283	28.2	58.2
Theses	217	21.6	44.7
Grey literature	126	12.6	25.9
Books	98	9.8	20.2
Conference Presentation	279	27.8	57.4
Total	**1,003**	**100.0**	**206.4**

Overall, the study found that the content consisted of mainly journal articles and conference presentations (both 28% of the 1,003 responses), followed by theses (22%) and grey literature (13%). The least were books (10%).

This question was also a multiple response type, as the number of responses (1,003) is more than the number of respondents.

The type of content deposited in IRs, according to respondents, was compared between members of the academic staff and students, and the school's respondents belonged to. Table 4.7 presents results of the comparison of the volume of content deposition between students and academic staff

Table 4.7: Comparison of Content Deposition by Staff and Students

			Respondent Type		
			Student	Academic staff	Total
Content deposited	Journal articles	Frequency	102	181	283
		%	36.0	64.0	
	Theses	Frequency	30	187	217
		%	13.8	86.2	
	Grey literature	Frequency	60	66	126
		%	47.6	52.4	
	Books	Frequency	21	77	98
		%	21.4	78.6	
	Conference presentation	Frequency	82	197	279
		%	29.4	70.6	
	Total		295	708	1,003

Findings showed that, in absolute numbers, academic staffs have deposited more items in IRs (708) relative to students (295). Compared to students, members of academic staff were found to have deposited larger proportions of theses (86%), books (79%), conference presentations (71%), and journal articles (64%). However, with grey literature, deposition by staff (52%) was comparable to that of students (48%). Table 4.8 shows the type of content deposited in IRs across different schools in study.

Table 4.8: Comparison of Content Deposition across Various Schools

		Content deposited					
School		**Journal Article**	**Theses**	**Grey literature**	**Books**	**Conference Presentation**	**Total**
engineering	Frequency	4	0	13	5	9	31
	% within school	12.9%	0.0%	41.9%	16.1%	29.0%	
Information Science	Frequency	64	68	21	2	48	203
	% within school	31.5%	33.5%	10.3%	1.0%	23.6%	
education	Frequency	13	1	5	1	9	29
	% within school	44.8%	3.4%	17.2%	3.4%	31.0%	
science	Frequency	33	25	16	15	48	137
	% within school	24.1%	18.2%	11.7%	10.9%	35.0%	
Humanities	Frequency	117	105	52	52	126	452
	% within school	25.9%	23.2%	11.5%	11.5%	27.9%	
Business	Frequency	42	8	19	15	38	122
	% within school	34.4%	6.6%	15.6%	12.3%	31.1%	
Total	Frequency	273	207	126	90	278	974

Key: Percentages and totals are based on responses

Results showed that books are deposited mainly by Engineering (16%), Humanities (12%), Business (12%) and Science (11%) schools, but rarely by information science (1%) and Education schools (3%). Engineering, Education and Business schools deposited limited or no theses while Engineering deposited a lot of grey literature.

Generally, every school deposited their journal articles and conference presentations into their IRs.

4.5.3 Content Deposited in IRs in the Last Five Years

Respondents were also asked about the approximate number of content that they had deposited in IRs in the last five years (Table 4.9).

Table 4.9: Frequencies of Academic Staffs' and Students IR's Content Deposit in Last Five Years

Quantity of deposits in IRs in last five years										
Type of content	**None**		**1**		**2**		**3**		**4 or <**	
	Fq	**%**	**Fq**	**%**	**Fq**	**%**	**Fq**	**%**	**Fq**	**%**
Journal article	522	83.5	45	7.2	17	2.7	27	4.3	14	2.2
Theses	583	93.3	28	4.5	13	2.1	1	0.2	0	0.0
Grey literature	585	93.6	21	3.4	7	1.1	8	1.3	4	0.6
Books	612	97.9	9	1.4	3	0.5	0	0.0	1	0.2
Conference presentation	547	87.5	45	7.2	21	3.4	6	1.0	6	1.0

Results showed that only tiny fractions of respondents had deposited content in IRs. Proportions of respondents who had not made any deposits were 98% for books, 94% for grey literature, 93% for theses, 88% of conference presentations, and 84% of journal articles.

Conversely, the study found that items mostly deposited in IRs were journal articles, followed by conference presentations, theses, grey literature, and lastly, books.

4.5.4 Preferred Publishing Modes

Members of the academic staff were asked about their most preferred mode for scholarly publishing. Figure 4.2 shows these results.

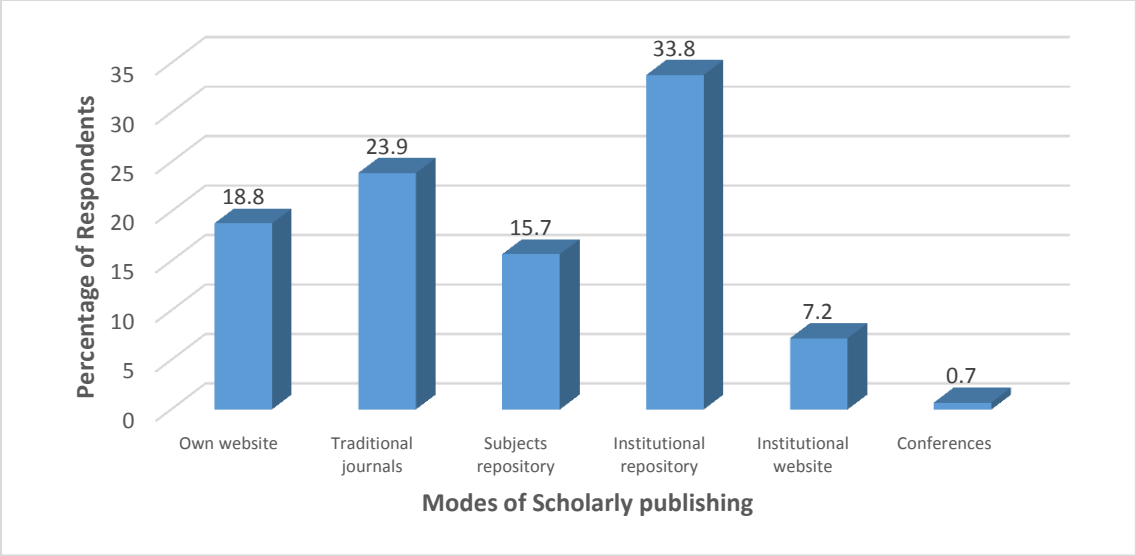

Figure 4.2: Preferred Modes of Scholarly Publishing by Academic Staff

Results in the figure indicated that staff mostly preferred to publish in IRs (*n*=99, 34%), followed by traditional journals (*n*=70, 24%), own websites (*n*=55, 19%), and subject repositories (*n*=46, 16%).

The least preferred modes of scholarly publishing were found to be conferences (n=2, 1%) and institutional websites (*n*=21, 7%).

Those who preferred publishing in their own websites said that it was most secure. Those who preferred subject repositories stated that finding information was faster than others. One academic staff stated about subject repository thus:

Scanning information takes less time and therefore speedily. It is the most accessible

[Academic staff]

Some who publish in IRs appear not to have any specific reason other than because others were doing so. One academic staff stated that it "…*it is commonly used*…" This implies that some staff did not see any tangible benefits in publishing in IRs; only being compelled because others were doing so.

The preferred mode of scholarly publishing by academic staff was compared with their school and academic ranks. Table 4.10 presents the results of comparisons between the preferred mode of publishing by academic staff and the school they belonged to.

Table 4.10: Preferred Modes of Publishing in Schools

		Preferred mode of publishing						
School		**Own Website**	**Traditional Journals**	**Subject Repository**	**Institutional Repository**	**Institution Website**	**conference**	**Total**
Information	Frequency	26	20	4	1	2	0	**53**
Science	%	49.1	37.7	7.5	1.9	3.8	0.0	
Education	Frequency	2	0	0	1	0	0	**3**
	%	66.7	0.0	0.0	33.3	0.0	0.0	
Science	Frequency	3	1	0	31	0	0	**35**
	%	8.6	2.9	0.0	88.6	0.0	0.0	
Humanities	Frequency	15	38	38	49	19	2	**161**
	%	9.3	23.6	23.6	30.4	11.8	1.2	
Business	Frequency	1	11	4	16	0	0	**32**
	%	3.1	34.4	12.5	50.0	0.0	0.0	
Engineering	Frequency	0	5	3	1	0	0	**9**
	%	0.0	55.6	33.3	11.1	0.0	0.0	
Total	Frequency	47	70	46	98	21	2	**284**

Key: *SR=subject repository, IR=institutional repository, IW=institutional website*

Results indicated that science (89%) and business (50%) schools' staff preferred publishing in IRs relative to other modes. Information science was the least likely school to publish in IR (2%), followed by engineering (11%), humanities (30%) and education (33%). Information science and education preferred to publish in their own websites or traditional journals.

Table 4.11 presents results on the relationship between the mode of scholarly publishing by academic staff and their academic ranks.

Table 4.11: Preferred Modes of Publishing among Academic Staff of Different Ranks

			Preferred publishing mode						
			Own Website	**Traditional Journals**	**SR**	**IR**	**IW**	**Conferences**	**Total**
Academic rank	Assistant lecturer	Frequency	22	23	15	12	0	1	**73**
		%	30.1%	31.5%	20.5%	16.4%	0.0%	1.4%	
	Lecturer	Frequency	14	2	9	27	11	1	**64**
		%	21.9%	3.1%	14.1%	42.2%	17.2%	1.6%	
	Senior lecturer	Frequency	14	19	11	35	0	0	**79**
		%	17.7%	24.1%	13.9%	44.3%	0.0%	0.0%	
	Associate professor	Frequency	5	18	11	17	0	0	**51**
		%	9.8%	35.3%	21.6%	33.3%	0.0%	0.0%	
	Professor	Frequency	0	8	0	8	10	0	**26**
		%	0.0%	30.8%	0.0%	30.8%	38.5%	0.0%	
Total		Frequency	55	70	46	99	21	2	**293**

Key: *SR=subject repository, IR=institutional repository, IW=institutional website*

Lecturers (42%) and senior lecturers (44%) preferred publishing in IRs relative to other publication modes (Table 4.10). However, associate professors (35%) and assistant lecturers (32%) preferred publishing in traditional journals rather than using other modes of publication. On the other hand, professors favoured institutional websites compared to other modes.

4.5.5 Deposition of IR Contents and Preparation of Metadata

The study asked university librarians, system librarians and research directors on who normally makes deposits into IRs. The answers ranged from IR administrators, system administrators, IR staff, university librarian, system librarian, digital repository librarian, and research directors. The results suggest that the universities use mainly used mediated archiving in IR content recruitment. In mediated archiving, a specialised and dedicated IR

staff, usually in the library, managed IRs and made deposits to them. The staffs are variously called system librarians, digital repository librarians, IR staffs, and system administrators in different universities.

One respondent put it thus;

> *We have members of staff whose sole work is to manage the repository. So they collect the materials that need to be digitalised and they scan them and upload them. In other situations, we get materials in soft format and it is just uploaded directly.*

Nevertheless, some content deposition was found to occur by self (or green)-archiving, in which the authors themselves describe and upload contents to IRs. For instance, one university librarian answered:

A system librarian thus answered:

> *We have staffs that do that. We have types of dissemination; mediated archiving where there are some members of staff who submit documents on behalf of others like our students do not interact with IR bucket so all their documents come to the library then we have librarian who upload. Secondly, self-archiving where lecturers can submit a document themselves although it may be subjected to some checks before being deposited in IR so librarian will be there to check.*

The study found that essentially the same members of staffs who upload content to IRs are the same ones responsible for generating metadata. The answers ranged from IR administrators, system administrators, librarians, school administrators, and library staff working at IR section, information technologists, and depository librarian.

4.5.6 Challenges that Limit IR Content Recruitment

The study asked respondents what they perceived to be the greatest challenges that limit deposition of materials in IRs. Typical responses were as follows:

> *Lack of awareness and overdependence on traditional teaching and research materials.*
> [Student]
>
> *Lack of willingness to share materials amongst students and researchers*.
>
> [Member of academic staff]
>
> *Inadequate experts to guide others on the whole process of getting materials deposited in institutional repositories.*
>
> [Member of academic staff]
>
> *Insecurities in institutional repositories, there is the issue of intellectual property rights*
>
> [Member of academic staff]
>
> *Fear of plagiarism*
>
> [Member of academic staff]
>
> *There are too many steps needed in deposition of any IRs materials……hence difficulty in content recruitment*
>
> [Student]

Respondents were also asked on how IRs could be improved so that more people could deposit materials in them. One recurring theme was to ask universities to advertise IRs and the potential roles that they could play. For instance, in the words of a member of academic staff:

> *Advertise institutional repository in order to make it available to many people……..those responsible with IR should announce and publicise IR contents through library website or institutional bulletin.*
> [Member of academic staff]

More funds should be put in place to curb the deprivation or lack of such materials in institutional repositories'

[Member of academic staff]

Library should liaise with schools to ensure they submit academic materials to IRs……also librarians should be sending notices to academic staff and students on IR updates.

[Student]

4.6 Content Utilization of IR in Supporting Teaching, Learning, and Research Activities

This section presents results on how content in IRs is discovered and utilized to support teaching, learning and research in universities.

4.6.1 Content Discovery

Respondents were asked on how they came to know about the contents in IRs. Figure 4.3 displays these results.

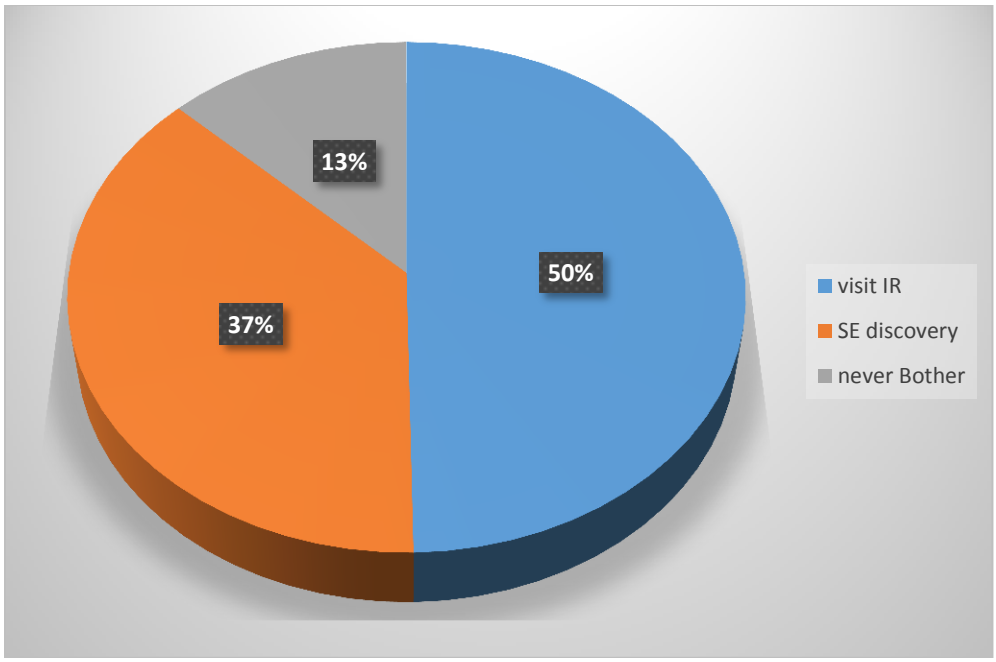

Figure 4.3: Methods of Content Discovery among Respondents

Results (Figure 4.3) showed that half of the respondents (*n*=298, 50%) discover content in IRs by directly visiting them. Nevertheless, a significant proportion (*n*=225, 38%) discover IR content inadvertently, when using search engines, for instance, Google. In addition, one in every ten respondents (*n*=77, 13%) never bother to know the contents of IRs.

Respondents who visit IR directly pointed out that it is secure. In the words of one academic staff member, IRs are "…*more secure as creating unique accounts are established*…" Another felt they were "…*easy and convenient and also reliable*…"

There were several reasons why respondents preferred using search engines, for instance, Google. They include:

Provides the most relevant and comprehensive content results

[Member of academic staff]

Google is very reliable because it is able to detect up-to-date and lately updated materials in their platform

[Student]

It is easier

[Student]

Google is faster in getting the required information compared with institutional repository

[Member of academic staff]

Respondents who did not bother to know IR contents gave several explanations, such as, "*...lack of adequate time*…", "…*IR is not very active in my university*…", "…*not aware about IRs*…", "…*never thought it important*…", "…*IR not responsive*…", and "…*not helpful*…"

Methods of content discovery in IRs were compared between the respondent type (whether student or staff) and schools. Table 4.12 shows the relationship between content discovery and the type of respondent.

Table 4.12: IR Content Discovery Compared among Students and Academic Staff

			Methods of IR content discovery			
			Visit IR	**SE discovery**	**Never bother**	**Total**
Respondent Type	Student	Frequency	124	123	60	**307**
		%	40.4	40.1	19.5	
	Academic staff	Frequency	174	102	17	**293**
		%	59.4	34.8	5.8	
Total		Frequency	298	225	77	**600**

Some students did not answer this question, explaining the discrepancy in the number of students sampled by the study and those who answered this question. The results showed that more staff (59%) visited IR directly compared to students. In addition, a greater proportion of students (20%) never bothered to know what IRs contain relative to only 6% of academic staff.

The relationship between content discovery and the type of school is shown in Table 4.13. This table combined data for both students and members of academic staff.

Table 4.13: IR Content Discovery Compared among Various Schools

		Methods of content discovery			
Schools		**Visit IR**	**SE discovery**	**Never bother**	**Total**
Engineering	Frequency	4	18	7	**29**
	%	13.8	62.1%	24.1%	
Information Science	Frequency	58	55	12	**125**
	%	46.4	44.0%	9.6%	
Education	Frequency	4	19	3	**26**
	%	15.4	73.1%	11.5%	
Science	Frequency	43	34	5	**82**
	%	52.4	41.5%	6.1%	
Humanities	Frequency	144	71	30	**245**
	%	58.8	29.0%	12.2%	
Business	Frequency	34	27	15	**76**
	%	44.7	35.5%	19.7%	
Total	Frequency	287	224	72	**583**

Most respondents from education (73%) and engineering (62%) schools discovered IR content accidently when using Search engines. University members who never bothered with what IRs contained likely belonged to engineering school (24%). Respondents from humanities (59%), science (52%), and business (45%) schools were likely to discover IR content by visiting them directly. On the other hand, members from information science school visited IR directly or discover its content indirectly through search engines (Table 4.13).

4.6.2 IR Content Most Accessed/Used

The study sought respondents' opinions on IR content they mostly used or accessed. These results are displayed in Table 4.14. The data comprises both students and members of academic staff.

Table 4.14: Scholarly Content Accessed from IRs

	Responses		
IR Content used	N	Percent	**Percent of Cases**
Preprints	191	6.6	32.3
Journal Article	270	9.4	45.6
Working Papers	233	8.1	39.4
Technical Reports	221	7.7	37.3
Book Chapter	281	9.7	47.5
Book	287	10.0	48.5
Book Reviews	179	6.2	30.2
Thesis	345	12.0	58.3
Conference Paper	143	5.0	24.2
Datasets	212	7.4	35.8
Software	311	10.8	52.5
Multimedia	211	7.3	35.6
Total	**2,884**	**100.0**	**487.2**

The number of responses for this question was 2,884, which was more than the number of students and academic staff combined (625). This indicated that most respondents accessed more than one type of scholarly content from IR, that is, the question was a multiple response type.

Findings showed that the most accessed content was thesis (12% of the 2,884 responses), followed by software (11%), books and book chapters (both 10%) and journal articles (9%). The least used content was conference papers (5%), book reviews (6%), preprints and datasets (both 7%). The total percentage of cases was 487.2%, indicating that on average, each respondent used about five types (487.2/100) of content from IR.

The type of content accessed from IR was compared between various schools in the study (Table 4.15). The data contains information from both students and members of the academic staff.

Table 4.15: Comparison of IR Content Access in Various Schools

		Schools						
IR content		**Engineering**	**Information Science**	**Education**	**Science**	**Humanities**	**Business**	Total
Preprints	Frequency	12	19	8	26	82	33	180
	%	8.9	3.5	7.0	6.5	6.6	8.8	
Journal Article	Frequency	13	58	14	33	117	19	254
	%	9.6	10.5	12.2	8.2	9.5	5.1	
Working Papers	Frequency	13	37	3	35	113	31	232
	%	9.6	6.7	2.6	8.7	9.1	8.3	
Technical Reports	Frequency	14	35	10	31	105	25	220
	%	10.4	6.4	8.7	7.7	8.5	6.7	
Book Chapter	Frequency	16	66	11	39	120	25	277
	%	11.9	12.0	9.6	9.7	9.7	6.7	
Book	Frequency	18	54	20	31	122	33	278
	%	13.3	9.8	17.4	7.7	9.9	8.8	
Book Reviews	Frequency	4	46	15	30	71	12	178
	%	3.0	8.4	13.0	7.5	5.7	3.2	
Thesis	Frequency	6	86	5	51	140	52	340
	%	4.4	15.6	4.3	12.7	11.3	13.9	
Conference	Frequency	2	34	0	16	68	21	141
	%	1.5	6.2	0.0	4.0	5.5	5.6	
Datasets	Frequency	7	22	5	36	93	47	210
	%	5.2	4.0	4.3	9.0	7.5	12.6	
Software	Frequency	24	51	14	35	133	40	297
	%	17.8	9.3	12.2	8.7	10.8	10.7	
Multimedia	Frequency	6	42	10	39	73	36	206
	%	4.4	7.6	8.7	9.7	5.9	9.6	
Total	Frequency	135	550	115	402	1,237	374	2,813

Key: Percentages and totals are based on responses

Findings showed that engineering, science and humanities schools' students and staff used mainly books and book chapters, journal articles and grey literature such as working papers, technical reports, preprints and software. On the other hand, library and education schools accessed predominantly journal articles and theses.

4.6.3 Preferred Medium for obtaining Material for Learning/Research

Respondents were asked about modes of scholarly publishing that they preferred to obtain material for use in learning or research. These results are presented in Figure 4.4. The data comprises both students and members of academic staff.

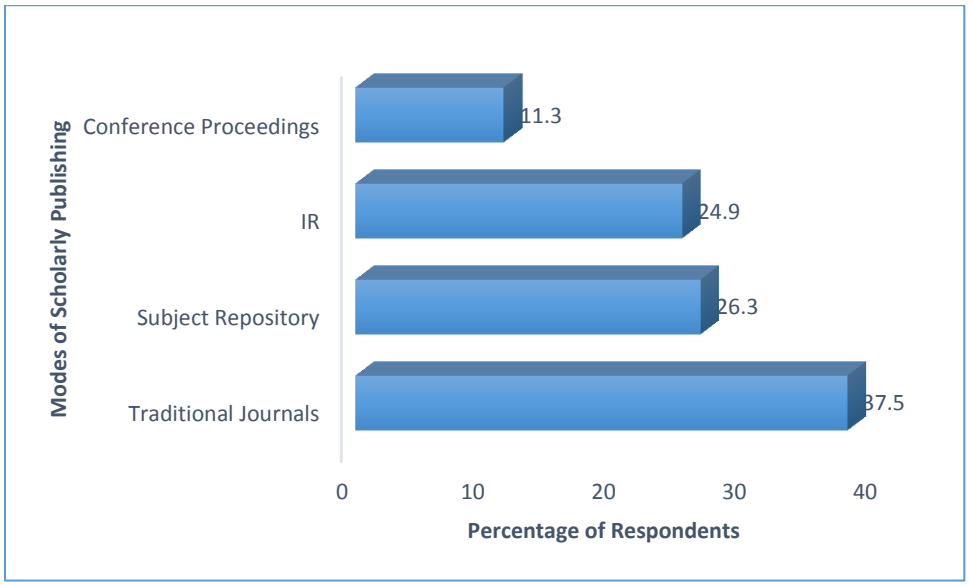

Figure 4.4: Preferred Modes for Obtaining Research/Learning Material

The results showed that the most preferred medium for obtaining material for learning/teaching or research was traditional journals (*n*=220, 38%), followed by subject/discipline repositories (*n*=154, 26%), and IRs (*n*=146, 25%). The least preferred mode of obtaining the material was conference proceedings (*n*=66, 11%).

The preferred medium for learning/teaching and research materials was compared across schools in the study and results presented in Table 4.16. The data presented in the table comprises both students and members of academic staff.

Table 4.16: Preferred Modes for Research/Learning Materials Compared in Various Schools

			Preferred medium for research/learning				
			Traditional Journals	Subject Repository	IR	conference	Total
Schools	Engineering	Frequency	11	6	14	0	**31**
		%	35.5	19.4	45.2	0.0	
	Information Science	Frequency	55	24	34	9	**122**
		%	45.1	19.7	27.9	7.4	
	Education	Frequency	2	8	5	2	**17**
		%	11.8	47.1	29.4	11.8	
	Science	Frequency	6	44	28	4	**82**
		%	7.3	53.7	34.1	4.9	
	Humanities	Frequency	110	46	51	36	**243**
		%	45.3	18.9	21.0	14.8	
	Business	Frequency	33	21	13	7	**74**
		%	44.6	28.4	17.6	9.5	
Total		Frequency	217	149	145	58	**569**

Key: Percentages and totals are based on responses

Results showed that only the engineering schools sourced most research/learning materials from IRs (45%) compared to other modes. The predominant source for research/learning material in information science (45%), humanities (45%) and business (45%) schools was traditional journals whereas education (47%) and science (54%) preferred subject repositories. The least preferred medium in all schools was conference proceedings.

4.6.4 Challenges Limiting use of Materials in IRs

Students and academic staff were asked about the greatest challenges that limited the use of materials in IRs. The predominant reason cited was ignorance of the academic community about IRs. In the words of a student:

> *That many people are not aware of the existence of the institutional repository*.

Another often-cited explanation was that materials in IRs were out of date and scant. For example, a member of academic staff stated:

> *There are no adequate materials in IR for research. The materials are out-dated. The materials are so poor.*
>
> *I do not use IR because of fear of wasting time and because of inadequate resources present in them*
>
> [Student]
>
> *I rarely use IRs because there is inconsistent updating of materials*.

[Member of academic staff]

Other reasons given included:

> *Mostly the students and academic staff are not that interested*.
>
> [Student]
>
> *Some of the information are not easily found and are time consuming*.
>
> [Academic staff]
>
> *IR lack offline content*
>
> [Student]

Respondents were also asked on how IRs may be improved so that materials/content in them can be easily discovered and used by the university community. The overwhelming answers from respondents were that universities should create awareness about IRs and improve the quality of materials within them. The following are a sample of their answers:

By creating awareness in the institution since many people do not know about institutional repositories……librarians should help students in searching and retrieving content in IR

[Student]

Use [the universities] frequently used platforms like WhatsApp, Facebook etc. in advertising the IRs materials. Individuals to be shown how to reach IRs' materials and their importance in learning.

[Student]

By creating awareness in the institution since many people do not know about it. They should notify the individual of the availability and the importance of IRs.

[Member of academic staff]

Regular and adequate advertisement of materials. By making posters so that it can be marketed to many students.

[Member of academic staff]

Remove out-dated material. Constant review and revision of content materials in IRs. By bringing update information. Improve the collection. Making also submission of research output to the IR as part of the requirement for appraisal.

[Student]

Respondents also stressed the importance of organising material in IRs so that it could easily be found, without wasting too much time. A member of academic staff put it this way:

Label the materials present there for specific schools to make searches easy. By putting specific information or allocating information in various sectors.

Study participants also proposed for an IR that could be used offline because of poor connectivity sometimes.

Set up a system that one can use even while offline.

[Student]

Improve internet bandwidth for easy access.

4.7 Contribution of University Librarians, System Librarians and Research Directors toward use of IRs to support Teaching, Learning and Research

The study interviewed university librarians, system librarians and research directors to determine their roles in IRs ability to support teaching, learning and research activities. The roles of university librarians were found to be coming up with policy guidelines and requesting academic heads to forward their articles. They also structured data in IRs, prepared abstracts and determined the interface of the IRs. The functions of system librarians included uploading content to IRs, editing the content, creating metadata, describing and managing the content. The following are verbatim accounts of some key informants:

> *System librarian carries out installation of repository and how to manage and giving the report to the management*
>
> [Repository administrator, USIU]

> *System librarians are responsible for: upgrading IRs; uploading content; and training new faculty members/informing them of the existence of IR.*
>
> [Strathmore]

> *Our structure is somehow different because we have repository librarian and assistant librarian. So repository librarian is the one in charge of repository and we have staff under repository librarian who do day to day activities which include submission of content, doping of content, ensuring that all the thesis which when students graduate the repository librarian ensure that all thesis have been submitted into the repository. She is also in charge of staffs working in the repository sections.*
>
> *She also briefs the management on the progress of repository and ensures that repository has been upgraded whenever it is necessary. When a new version has been released, repository librarian ensures that it is stable and work together with ICT to ensure that repository is upgraded.*
>
> *Ensures that there is backup in the ICT. She also manages repository.*
>
> [System Librarian, UoN]

Research directors were found to be in charge of the university research office. They were responsible for collecting research publications, especially those funded by the institution and uploading them into IRs.

The study also asked librarians and research directors on the challenges they faced in promoting the use of IRs by academic staff and students. They included weaknesses in IR software, deficient content, and minimal awareness of IRs by university community and lack of cooperation between the key actors. The following were sample answers:

> *IR Dspace [the software] being off; software, hardware failure; unreliable internet connectivity; and lack or minimal awareness of IR*
>
> [System Librarian, MU]
>
> *On usage I would say a major challenge on the quality of whatever has been uploaded and I think content is still missing out.*
>
> [Repository administrator]
>
> *IRs are not widely publicized. There is lack of enough workshop/seminar.*
>
> [Research director]
>
> *There is lack of cooperation especially when training on IR are called/organized*
>
> [Strathmore]
>
> *Some of the challenge is when we have a document which is restricted because the owner maybe has not accepted to submit content. With that, it hinders the use of repository.*
>
> *Also when the researchers are very busy and they don't have time to do self-archiving to the repository.*
>
> *Also we realized that there is a grey literature so sometimes they are not considered as reviewed and this hinders usage.*
>
> [System Librarian, UoN]
>
> *Negative attitudes from lecturers who are content creators; lack of management support; and inadequate funds*
>
> [University librarian, MU]

4.8 Effectiveness of IRs to support Teaching, Learning and Research Activities

This section presents results on the effectiveness of IRs to support teaching, learning and research activities.

4.8.1 Use of IRs

The study asked the respondents whether they had ever used an IR in teaching, learning or research (Figure 4.5).

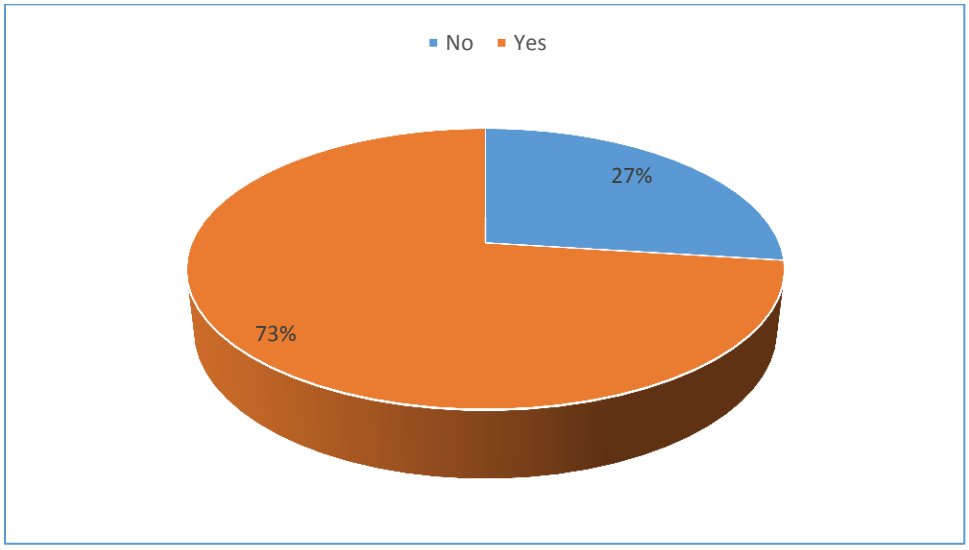

Figure 4.5: Use of IRs by Respondents in Teaching, Learning and Research

The findings indicated that three out of every four respondents (*n*=424, 73%) had used IRs for teaching, learning and research activities. Only one in every four respondents (*n*=157, 27%) had not.

Chi-square (χ^2) cross tabulations were used to test if there were any significant relationship between the use of IRs and respondents' biographical characteristics (whether student or academic staff, type of university, school, and gender). Table 4.17 presents these findings.

Table 4.17: Relationship between using IRs and Biographical Variables

			Ever used IR for Teaching, Learning and Research		
Variable category	**Respondents'**		No	Yes	Total
Respondent type	Student	Frequency	80	219	299
		Percentage	26.8	73.2	100.0
	Academic staff	Frequency	77	205	282
		Percentage	27.3	72.7	100.0
	Total	**Frequency**	**157**	**424**	**581**
		Percentage	**27.0**	**73.0**	**100.0**
University type	Public	Frequency	146	342	488
		Percentage	29.9	70.1	100.0
	Private	Frequency	11	78	89
		Percentage	12.4	87.6	100.0
	Total	**Frequency**	**157**	**420**	**577**
		Percentage	**27.2**	**72.8**	**100.0**
School	Engineering	Frequency	5	26	31
		Percentage	16.1	83.9	100.0
	Information science	Frequency	19	105	124
	Education	Percentage	15.3	84.7	100.0
		Frequency	5	17	22
	Science	Percentage	22.7	77.3	100.0
		Frequency	13	53	66
	Humanities	Percentage	19.7	80.3	100.0
		Frequency	84	165	249
	Business	Percentage	33.7	66.3	100.0
		Frequency	31	41	72
	Total	Percentage	43.1	56.9	100.0
		Frequency	**157**	**407**	**564**
	Male	**Percentage**	**27.8**	**72.2**	**100.0**
Gender		Frequency	102	198	300
	Female	Percentage	34.0	66.0	100.0
		Frequency	55	224	279
	Total	Percentage	19.7	80.3	100.0
		Frequency	157	422	579
		Percentage	27.1	72.9	100.0

Respondents type (χ^2 = 0.022, *df*=1, *p*=.882); University type (χ^2 = 11.717, *df*=1, *p*=.001); school (χ^2 = 26.859, *df*=5, *p*<0.0001); Gender (χ^2 = 14.930, *df*=1, *p*<0.0001)

There are extant discrepancies in the number of students and academic staff presented in this table and the number that was sampled. This is because, some respondents did not answer this question. Nevertheless, this number was relatively few and was not likely to change the thrust of the findings.

The results showed that there was no significant difference between students and members of academic staff on their usage of IRs for teaching, learning and research, χ^2 =

0.022, *df*=1, *p*=. 882. Put differently, similar proportions of students and staff are likely to use IRs.

Respondents' university type (χ^2 = 11.717, *df*=1, *p*=.001), school (χ^2 = 26.859, *df*=5, *p*<0.0001), and gender (χ^2 = 14.930, *df*=1, *p*<0.0001) were found to significantly influence their usage of IRs. More respondents (88%) from private universities used IRs compared to those from public universities (70%). The top schools which use IRs for teaching, learning and research were found to be information sciences (85%), engineering (84%), science (80%) and education (77%). However, those that use IRs less frequently were business (57%) and humanities (66%). Female respondents (80%) used IRs for teaching, learning and research more frequently relative to their male companions.

In addition, chi-square (χ^2) cross tabulations were conducted to test if significant relationships existed between the use of IRs and the students' academic program and the staffs' rank (Table 4.18). The discrepancies in the number of students and academic staff presented in this table and the number that was sampled was because some respondents did not answer this question. However, they were only a few.

Table 4.18: Students' Program, Academic Staff's Rank and Use of IRs

			Ever used IR for Teaching, Learning and Research		
Variable category	**Respondents'**		No	Yes	Total
Student's academic program	Undergraduate	Frequency	48	129	177
		Percentage	27.1	72.9	100.0
	Masters	Frequency	24	54	78
		Percentage	30.8	69.2	100.0
	PhD	Frequency	8	32	40
		Percentage	20.0	80.0	100.0
	Total	**Frequency**	80	215	295
		Percentage	27.1	72.9	100.0
Academic staff's Rank	Assistant lecturer	Frequency	1	72	73
		Percentage	1.4	97.6	100.0
	Lecturer	Frequency	3	51	54
		Percentage	5.6	94.4	100.0
	Senior lecturer	Frequency	34	44	78
		Percentage	43.6	56.4	100.0
	Associate professor	Frequency	22	29	51
		Percentage	43.1	56.9	100.0
	Professor	Frequency	17	9	26
		Percentage	65.4	34.6	100.0
	Total	**Frequency**	77	205	282
		Percentage	27.3	72.7	100.0

Key: Student's academic program (χ^2 = 1.552, *df*=2, *p*=.460); Academic staff's Rank (χ^2 = 73.462, *df*=4, *p*<0.0001).

Results showed that the student's academic program did not significantly influence (χ^2 = 1.552, *df*=2, *p*=.460) their use of IRs for learning and research. This suggested that students used IRs similarly, regardless of whether they were undergraduates, masters, or PhD students. On the other hand, use of IRs for teaching, learning and research was found to significantly (χ^2 = 73.462, *df*=4, *p*<0.0001) decrease as the staff's academic rank rose. Professors seldom used IRs (35%), followed by senior lecturers (56%) and associate professors (57%). However, use of IRs was highest in assistant lecturers (98%) and lecturers (94%).

4.8.2 Importance of IRs

The respondents were asked whether IRs were important in supporting teaching, learning and research in universities and the results are presented in Table 4.19.

Table 4.19: Importance of IRs in Supporting Teaching, Learning and Research

IRs are very important in supporting teaching, learning and research											
Variable	Respondent type	SD		Disagree		Undecided		Agree		SA	
		Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
IRS very important in education & research	Student Academic staff	13 2	4.3 0.7	7 22	2.3 7.5	31 105	10.2 36.0	140 95	46.1 32.5	113 68	37.2 23.3

Key: S. D=strongly disagree, S. A=strongly agree, Fq=frequency
χ^2 = 75.684, *df*=4, *p*<0.0001).

Discrepancies in the number of students and academic staff presented in this table and the number that was sampled arose from non-response to this question from some respondents. However, they were very few. While eight in every ten students (83% agreed or strongly agreed) thought that IRs are very pertinent in supporting teaching, learning and research, only five in every ten members of staff (56 % agreed or strongly agreed) thought so. The differences were found to be significant, (χ^2 = 75.684, df=4, p<0.0001).

This suggested that more students are likely to see IRs as being important in learning and research but only a half of the academic staff are likely to think so. This can be seen graphically in Figure 4.6, which compares students and members of academic staff on the importance of IRs in teaching, learning and research.

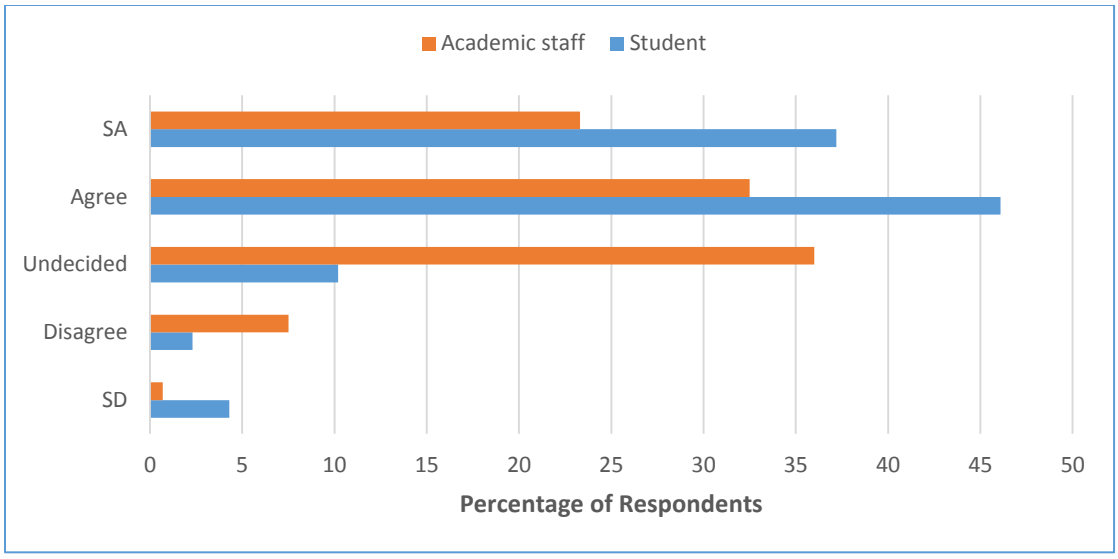

Figure 4.6: Comparison of Students and Staff on the Importance of IR

In addition, there was a significant proportion of lecturers (36%) who could not make up their mind as to whether IRs were important for teaching, learning, and research.

On the other hand, all the university librarians, system librarians, and research directors interviewed in the study thought that IRs were important in teaching, learning, and research. Typically, their answers on the importance of IRs included the following:

> *Yes, open access to information at anywhere at any time of convenience*.
> [System librarian, MU]
>
> *Very important since they form part of the institutional memory and important reference material for students and staff for generations*.
>
> [Research director, MU]
>
> *Institutional repository is extremely important because it exposes staff researchers with students' theses and dissertations to a wider international audience, hence provide opportunities to research collaborations*

[System librarian, UoN]

Yes, they aid in teaching, learning and research by bringing the information online and making it more accessible.

[University librarian, MU]

Chi-square (χ^2) cross tabulations were conducted to test if significant relationships existed between importance of IRs and respondents' biographical characteristics (type of university, school, gender, student's academic program and staff's academic rank). Table 4.20 presents these results.

Table 4.20: Relationship between using IRs and Biographical Variables

IRs are very important in Teaching, Learning & Research								
Variable			*SD*	*D*	*N*	*A*	*SA*	Total
University type	Public	*F*	12	29	129	182	149	501
		%	2.4	5.8	25.7	36.3	29.7	100.0
	Private	*F*	3	0	7	53	28	91
		%	3.3	0.0	7.7	58.2	30.8	100.0
	Total	***F***	**15**	**29**	**136**	**235**	**177**	**592**
		%	**2.5**	**4.9**	**23.0**	**39.7**	**29.9**	**100.0**
School	Engineering	*F*	0	0	5	14	12	31
		%	0.0	0.0	16.1	45.2	38.7	100.0
	Info. Science.	*F*	5	1	20	35	68	129
	Education	*%*	3.9	0.8	15.5	27.1	52.7	100.0
		F	5	0	6	4	7	22
	Science	*%*	22.7	0.0	27.3	18.2	31.8	100.0
		F	0	0	12	37	26	75
	Humanities	*%*	0.0	0.0	16.0	49.3	34.7	100.0
		F	3	15	78	101	51	248
	Business	*%*	1.2	6.0	31.5	40.7	20.6	100.0
		F	2	13	15	32	12	74
	Total	*%*	2.7	17.6	20.3	43.2	16.2	100.0
		F	**15**	**29**	**136**	**223**	**176**	**579**
	Male	***%***	**2.6**	**5.0**	**23.5**	**38.5**	**30.4**	**100.0**
Gender		*F*	8	15	85	119	83	310
	Female	*%*	2.6	4.8	27.4	38.4	26.8	100.0
		F	7	14	49	116	98	284
	Total	*%*	2.5	4.9	17.3	40.8	34.5	100.0
		F	**15**	**29**	**134**	**235**	**181**	**594**
	Undergrad.	***%***	**2.5**	**4.9**	**22.6**	**39.6**	**30.5**	**100.0**
Student's academic program		*F*	8	4	17	86	61	176
	Masters	*%*	4.5	2.3	9.7	48.9	34.7	100.0
		F	0	3	8	29	38	78
	PhD	*%*	0.0	3.8	10.3	37.2	48.7	100.0
		F	0	0	6	21	14	41
	Total	*%*	0.0	0.0	14.6	51.2	34.1	100.0
		F	**8**	**7**	**31**	**136**	**113**	**295**
	Assistant	***%***	**2.7**	**2.4**	**10.5**	**46.1**	**38.3**	**100.0**
Academic staff's Rank	**lecturer**	*F*	2	0	13	33	25	73
	Lecturer	*%*	2.7	0.0	17.8	45.2	34.2	100.0
		F	0	0	11	36	16	63
	Senior	*%*	0.0	0.0	17.5	57.1	25.4	100.0
	lecturer	*F*	0	0	54	12	13	79
	Associate	*%*	0.0	0.0	68.4	15.2	16.5	100.0
	professor	*F*	0	22	10	6	13	51
	Professor	*%*	0.0	43.1	19.6	11.8	25.5	100.0
		F	0	0	17	8	1	26
	Total	*%*	0.0	0.0	65.4	30.8	3.8	100.0
		F	**2**	**22**	**105**	**95**	**68**	**292**
		%	**0.7**	**7.5**	**36.0**	**32.5**	**23.3**	**100.0**

Key: SD=Strongly disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly agree; F=Frequency; University type (χ^2 = 25.788, *df*=4, *p*<0.0001); School (χ^2 = 133.027, *df*=20, *p*<0.0001); Gender (χ^2 = 9.935, *df*=4, *p*=0.042); Student's academic program (χ^2 = 12.767, *df*=8, *p*=0.120); Academic staff's rank (χ^2 = 194.969, *df*=16, *p<0.0001*)

Results indicated significant differences in the way respondents from public and private universities perceived the importance of IRs (χ^2 = 25.788, *df*=4, *p*<0.0001). A greater proportion of respondents from private universities (89%) either agreed or strongly agreed that IRs are very important in teaching, learning and research compared to those from public universities (66%). In addition, a greater percentage of participants from public universities were undecided (26%) relative to those from private universities (8%).

Respondent's school also significantly influenced their perception of IR importance, χ^2 = 133.027, *df*=20, *p*<0.0001. Schools which strongly believed IRs were very important in teaching, learning, and research were engineering, science, and information science, (84%, 84%, 80% answered agreed or strongly agreed, respectively). Education felt that IRs are not important (23% strongly disagreed whereas 27% were undecided). Support for IRs was less strong in business and humanities (59% and 61% answered agreed or strongly agreed, respectively). More female respondents significantly (χ^2 = 9.935, *df*=4, *p*=0.042) felt that IRs are very important in teaching, learning and research compared with their male counterparts (75% and 65% answered agreed and strongly agreed, respectively). In addition, more male respondents (27%) were undecided relative to females (17%).

The student's academic program did not significantly influence (χ^2 = 12.767, *df*=8, *p*=0.120) their perception of the importance of IRs. Thus, students thought IRs are very important in education and research, regardless of whether they were undergraduates, masters, or PhD students. More associate professors thought IRs were not important in teaching, learning and research (43%) whereas a majority of professors and senior

lecturers were likely to be undecided (65% and 68%, respectively). On the other hand, lecturers and assistant lecturers felt that IRs were very important in teaching, learning and research (83% and 79% answered agreed and strongly agreed, respectively).

4.8.3 Use of IRs in Teaching, Learning and Research

Respondents were asked whether they used IRs specifically in teaching, learning and research activities. The results are presented in Table 4.21.

Table 4.21: Use of IRs in Teaching, Learning and Research

Uses	Respondent type	SD		Disagree		Undecided		Agree		SA	
		Fq	%	Fq	%	Fq	%	Fq	%	Fq	%
Use IR for teaching	Academic staff	8	2.7	80	27.4	79	27.1	57	19.5	68	23.3
Use IR for research	Student	7	2.3	3	1.0	22	7.3	80	26.5	190	62.9
	Academic staff	8	2.7	30	10.3	96	32.9	40	13.7	118	40.4
Use IR for learning	Student	5	1.6	2	0.7	22	7.2	75	24.7	200	65.8
	Academic staff	53	18.2	48	16.4	54	18.5	51	17.5	86	29.5

Key: S. D=strongly disagree, S. A=strongly agree, Fq=frequency
Cronbach alpha: 0.870

Less than half of the members of academic staff used IRs for teaching (43% agreed or strongly agreed), again with a substantial proportion of them (27%) unable to make up their minds. Nine in every ten students (90% answered agree or strongly agree) used IRs for research while only five in every ten academic staff (54% agreed or strongly agreed) did so. Again, many staff (33%) were unsure. Most students used IRs for learning (91% agreed or strongly agreed) relative to only 47% (answered agreed or strongly agreed) of academic staff who did.

4.8.4 Factors that Hinder IRs to Support Teaching, Learning, and Research and how they can be Improved

The study sought respondents' opinions on the factors that hindered the ability of IRs to support teaching, learning, and research activities and how they might be mitigated. Results showed that the major barriers were poor quality and quantity of the collection in IRs, lack of awareness about IRs, and ignorance in using IRs, especially in deposition of content. These reasons were cited by both students and members of academic staff. The following are a sample of the responses on what they thought was greatest hindrances:

> *Inadequate materials cutting across all the faculties*
>
> [Member of academic staff]
>
> *Lack of variety of materials cutting across the institution*
>
> [Member of academic staff]
>
> *Lack of enough materials. Old materials. Hard to get the required materials*.
>
> [Student]
>
> *Inadequate and ineffective collections in institutional repositories make it difficult to find content you are searching for*
>
> [Member of academic staff]
>
> *Lecturers and students not submitting articles, thesis and publications*.
>
> [System librarian, MU]
>
> *Poor organization of collections within the institutional repository*.
>
> [Member of academic staff]
>
> *Ignorance of students and staff about IR*
>
> [Member of academic staff]
>
> *It is hard to get the required materials*
>
> [Student]

Procedures of depositing collection in institutional repository can be a barrier

[Student]

Respondents also cited inadequacies in IR software and poor organization of materials within IRs. A sample of their comments are as follows:

The IR suffers from a lack of experts and poor software's

[Member of academic staff]

Failure to upgrade the IRs software

[Member of academic staff]

The institutional repository has a complex website where the IR materials are put

[Member of academic staff]

The software in IR is not user friendly

[Student]

Lack of internet by students to use IR. Poor ICT support in terms of devices to access IR materials e.g. computers and laptops

[Student]

University librarians, system librarians and research directors also cited the challenge of la

…By having so much work which are easy to access in open access there is incidents where students are attempted to copy and paste…

[University librarian, UoN]

The respondents proposed several recommendations that could help IRs support teaching, learning and research in higher education institutions. Most of them were geared towards redressing the poor quality and quantity of IR materials, lack of awareness of IRs, poor organization of the collections in IR, and requirement for internet before accessing the materials. Typical answers included the following:

Update content in IRs. Expand scope of material covered.

[Member of academic staff]

Improve the size of materials in institutional repository i.e. limited scope and content

[Student]

The better way to improving learning is by putting forward the basics of learning; that is learning materials

[Member of academic staff]

Students and staff to be informed on the importance of using IR materials

[Student]

IR page to be advertised in the frequently used applications like WhatsApp, Facebook etc.

[Student]

More marketing to involve more people in the university. Train both staff and students on the importance of IRs.

[Member of academic staff]

Making the materials available in all faculties. Encourage researchers so that they can deposit more materials in IRs.

[Member of academic staff]

Ensure that collections in IR can be assessed offline. Otherwise, improve network issues and provide free internet

[Student]

Adopting plagiarism detection software to ensure that contents and materials in the repository are enough. Ensuring there are enough facilities to ensure that depositories are available throughout. Ensuring that repository are visible like search engines. Collaboration and register your repository by registries.

[System librarian, UoN]

4.8.5 Institutional Policy on IR Content Recruitment

The study asked respondents whether their institutions had a policy regarding content recruitment by students and staff (Figure 4.7).

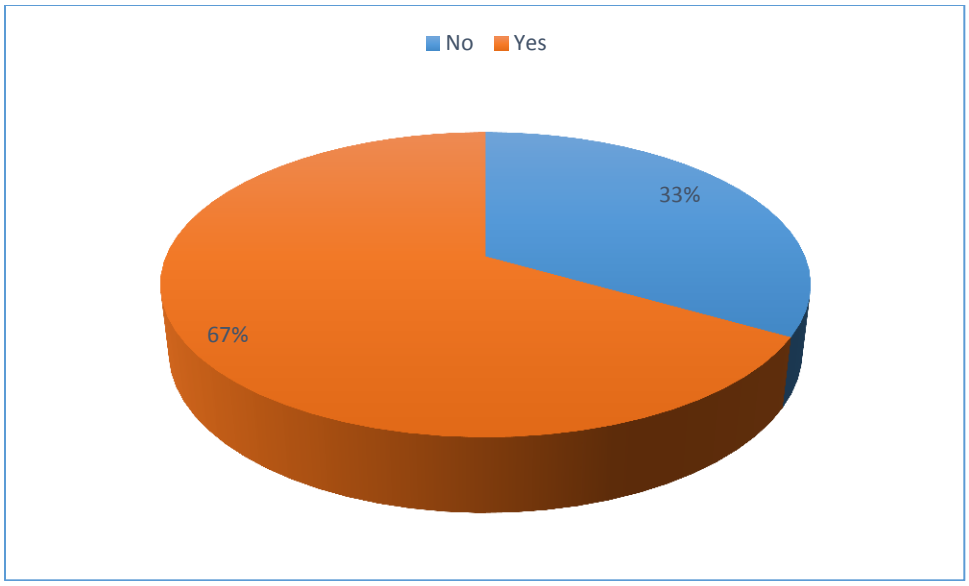

Figure 4.7: Existence of an IR Policy

Results showed that most respondents (n=198, 67%) answered that there was a policy compared to 33% (n=99) who thought there was none.

4.9 Chapter Summary

The chapter presented research findings of this study. The study collected both quantitative and qualitative data. Frequencies, chi-square cross tabulations and measures of central tendency (mean and standard deviation) were used to analyse quantitative data. The results were then presented using frequency distribution tables, bar graphs and pie charts. On the other hand, qualitative data was analysed thematically based on the objectives and research questions and presented in form of narrative. These methods helped to explain the institutional repositories capacities in supporting teaching, learning and research activities in four selected universities in Kenya.

IR content was found to be dominated by grey literature. It was also broad but not sufficiently deep. All the universities in the study used the same type of IR software,

DSpace. Content recruitment in the selected IRs was found to be very low. Most respondents preferred traditional journals and subject/discipline repositories as sources for material for teaching/learning and research, rather than IRs.

System librarians, university librarians and research directors were found to both market IRs and archive their content. Many members of academic staff (especially the senior most) never used IRs for either teaching; learning or research. The next chapter discusses these findings.

CHAPTER FIVE

DISCUSSION OF THE FINDINGS

5.1 Introduction

This chapter presents the discussion of the research findings contained in Chapter Four. The discussion is made in relation to the study objectives and hypothesis. The findings were used to draw conclusions and the recommendations made were based on the conclusions drawn. The conclusions and recommendations are presented in the next chapter. Further, the study proposes a model for IRs, synthesized from findings and literature review, in the next chapter. The general objective of this study was to assess institutional repositories' (IRs) capacities in supporting teaching, learning and research activities in four selected universities in Kenya with a view to proposing an appropriate model to improve teaching, learning and research.

The chapter discusses the research findings, structured according to the objectives of the study. Section 5.2 discusses the effectiveness of content and content recruitment in IRs in selected Kenyan universities whereas section 5.3 looks at how content utilization of IRs support teaching, learning and research activities. The contribution of university librarians, system librarians and research directors toward use of institutional repositories to support teaching, learning and research activities in the selected universities in Kenya is discussed in Section 5.4. The discussion on effectiveness and suitability of IRs in supporting teaching, learning and research activities in selected Kenyan universities is made in Section 5.5. Finally, the chapter summary is presented in Section 5.6.

5.2 Effectiveness of Content and Content Recruitment in IRs

The study found that IRs in selected universities contain over 12 types of scholarly content, including preprints, book reviews, journal article, thesis, working papers, and conference papers. Others were technical reports, datasets, book chapter, software, books and multimedia. This finding is similar to conclusions by the University of Nottingham's Directory of Open Access Repositories (OpenDOAR, 2008) which found that IR content of the world's top 100 universities could be classified into 12 main document types. These are journal articles, theses and dissertations, conference and workshop papers, books, chapter and section, datasets, and multimedia and audio-visual materials. Others are unpublished reports and working papers, learning objects, patents, software, bibliographic references, and other special item types (Tsunoda, Sun, Nishizawa, and Liu, 2016). Thus, IRs in the four selected universities contains content that is broadly similar to content found in other top university IRs in the world.

The study found that IRs mainly contain theses (staff: 11% of the 1,603 responses and students: 12% of the 1,523 responses), journal articles (staff: 9% and students: 12%), and software (staff: 11% and students: 9%). These finding parallels that of Allen (2005), Thomas and McDonald (2007) and McDowell (2007) who reported that the largest proportion of deposits in IRs theses. For instance, Allen (2005) and McDowell (2007) reported IRs' that the largest proportion of deposits in IRs consisted of PhD and other theses, followed by faculty research output, of which only 13% was peer reviewed. This study also found that content in selected IRs was dominated by grey literature as in studies by McDowell (2007) and Tsunoda *et al*. (2016).

The less prevalent content in the selected IRs was found to be preprints, conference papers, data sets, multimedia, book reviews and technical reports. In addition, the IRs were also found to contain graduation speeches, press briefings, research projects, media clippings, newspaper articles, university calendars, almanacs, ISO manuals, and school magazines. Others included examination papers, historical documents of the university, research questions, past papers, lectures, speeches, manuscripts, pictures, policies, newsletters, microfilms, workshop, and seminar proceedings. This study found that about two thirds of selected IRs' content consisted of grey literature.

Grey literature is pertinent content in IRs. For instance, past papers, lectures, research questions, and research projects could be important in supporting teaching, learning and research activities. Press briefings, media clippings, policies, newsletters and graduation speeches could be a useful corpus of communication. However, the predominance of grey literature in the IRs could be problematic. First, this content is not peer-reviewed. Consequently, it is unlikely to attract scholars looking for serious literature. Secondly, this breeds a vicious cycle. If scholars are unwilling to visit IRs and search for research articles, it is unlikely that they would voluntarily deposit their research outputs in them. Thirdly, grey literature is not tracked in citation indices like Web of Science or Scopus, and hence, they are not very visible to scholars (Adie, 2014). Thus, while IRs may be great at archiving this type of university intellectual output, they are unlikely to increase the academic profile, visibility and prestige of the institutions because the output is not seen.

Generally, IRs from the selected universities contained similar materials although slight differences in the type of content were observed in the universities. For instance, conferences and book reviews were more prevalent in public universities whereas theses, datasets and multimedia were dominant in private universities. These differences reflect Shirky's (2005) argument, that because content in IRs is institutionally defined, each university decides on which content to recruit, leading to subtle variability. Nevertheless, the similarity in content reflects the Lynch (2003) IR model that has become dominant in many parts of the world, which contains mostly grey literature and a few journal articles.

All the selected IRs were found to use the same type of software platform, DSpace. This was found to explain the similarity in content organisation in the four universities, which consisted of similar communities. Although there exists a multiplicity of IR software, both open-source software (OSS) and proprietary, no university was found to use these alternatives.

DSpace has several advantages. It has the largest community of users and developers relative to any other library management software with an estimated 800 digital repositories using it all over the world. It is an open-source library management software, which implies that institutions can freely download and install the software, without violating any copyright issues. Since its code is open source, it can easily be customised to meet unique institutional needs. In addition, the use of open standards allows the ease of interoperability with other software (Verma, & Kumar, 2018). It has a function called Withdraw, which can allow an item to be removed from public view and yet continue retaining it in the archive.

Nevertheless, DSpace has important weaknesses. It has a poor user interface compared for instance with EPrints, limited reporting capabilities, constrained metadata functions, limited API (application programing interface), poor extensibility and scalability and inability to support linked data (Verma, & Kumar, 2018; Abdulkadir, 2014). DSpace does not conduct duplicate checking, which can allow a digital document to be deposited in an IR multiple times. It therefore follows those multiple copies of the same document might be present in IR. Digital objects cannot be deposited in DSpace from existing URLs; only when they occur on local disks (Verma, & Kumar, 2018). All these weaknesses of the software reduce the user comfort experience, which was cited by many respondents as a major reason why they did not use IRs for teaching, learning or research activities.

The decreased functionality of the DSpace could reduce both the perceived usefulness (PU) and perceived ease of use (PEU) of IRs, again a finding pointed out by respondents. PU and PEU are the central variables in the TAM model, which influence an individual's attitude towards using a technology. Attitudes in turn affect behavioural intention, which determine actual usage. Limited API, a software intermediary that allows different applications to interact and communicate together, inextensibility and non-scalability of the DSpace, inability to support linked data and constrained metadata functions reduce both the PU and PEU of IRs. On the other hand, poor user interface and limited reporting capacities decrease the IRs' PEU.

Dubinsky (2014) and Richardson and Wolski (2012) have argued that IRs should carry both broad and deep content, for them to support teaching, learning and research. This

study found selected IR content to be sufficiently broad to support teaching, learning and research, since virtually every educational content is present. Nevertheless, the content, as presented in Sections 4.6.4 and 4.8.4 was found to be inadequate, sometimes out-dated and of poor quality, according to many respondents. Objective analysis of the four selected IRs supported the respondents' opinions. For instance, in one public university, only 672 and 203 research publications were present in the 2010-2020 and 2000 – 2009-year communities, respectively. A public university with the largest collection contained a total of 28,088 journal articles, 2,032 books, and 2,308 research papers while research and publications in a private university's IR were 2,294, as of June 2020. This is markedly in contrast with MEDLINE, which consisted of 5,617 journals and 24,335,332 total citations in in 2017 alone (NLM, 2018). On the other hand, ResearchGate, a European commercial and social networking site for scientists and researchers, consisted of over 135,000,000 publications and over 700,000 research projects in June 2020 (Research Gate, 2020). Thus, although IRs in the selected universities contained many types of material covering many subjects, each specific subject area contained only a few materials. This implies that content in the IRs may not be deep. Consequently, content in IRs is not effective in supporting teaching, learning and research.

The study found that the material mostly deposited in IRs were journal articles and conference presentations (both 28% of the 1,003 responses), followed by theses (22%) and grey literature (13%). The least were books (10%). These numbers reflect the relative proportions of the different communities' resident in the selected IRs, with the major ones being theses and dissertations, journal articles and research papers, and conference proceedings. Combining conferences, theses, and other non-peer reviewed material; the

results indicated that the predominant material deposited in the IRs was still grey literature.

Comparatively, members of academic staff deposit more content in IRs than students. This is logical, as members of staff are expected to have a greater scholarly output relative to students and thus, more deposition. Whereas every school deposit journal articles and conference presentations, significant differences were observed with regard to other materials. For instance, books are deposited mainly by Engineering, Science, Humanities and Business schools but rarely by Library and Education schools. Engineering, Education and Business schools deposit limited or no theses while Engineering deposit a lot of grey literature. Differences between schools in their rates of IR deposition have been documented elsewhere. For example, Kim (2010) noted that disciplines that have a self-archiving culture and with members possessing the requisite technical skills have higher rates of self-archiving.

The study found the rate of content recruitment in the selected IRs to be very low, with only minute fractions of respondents having made deposits in the last five years. Proportions of respondents who had not made any deposits were 98% for books, 94% for grey literature, 93% for theses, 88% of conference presentations, and 84% of journal articles. The low rates of content recruitment could explain why the selected IRs had relatively little content. This suggests that the IRs may not be effective in supporting teaching, learning and research activities. Covey (2011) has argued that content recruitment is the core of an IR, because it determines whether people will visit an IR. Since IRs have few papers only a few people visit them, diminishing their ability to

support teaching, learning and research as the quality of the papers will be low. This conclusion is supported by opinions of numerous respondents who felt that the IRs contained inadequate content that was not helpful, as presented in Sections 4.6.4 and 4.8.4.

This finding is similar to other studies that have found content recruitment in IRs to be largely inefficient, for instance Cullen and Chawner (2009), Bangani (2018) and Dubinsky (2014). For example, McDowell (2007) reported that all respondents in the Census of Institutional Repositories in the US had difficulty recruiting content from faculty and graduate students. The National Institute Informatics (2014) detailed the large content registration during inception of repositories in Japanese universities, which taper off and give way to mundane, routine content registration, inevitably leading to a decline in the number of new materials. These findings appear to challenge the foundational basis of IRs as alternative tools for the current scholarly publishing model (McDowell, 2007).

Casey (2012) in a survey of the Association of Research Libraries (ARL) reported that most faculty members were not contributing materials to IRs. Similarly, Schonfeld and Houseright (2010) found that less than 30 percent of faculty in U.S. colleges and universities were contributing to IRs. Reasons for reluctance to contribute include steep learning curve for IRs, fear of copyright infringement, concerns about plagiarism, fear that low quality of some material in the IR would taint the research, and concerns over whether contributing to the IR is equated with publishing. Others included perceived quality of self-archived materials, disciplinary culture and practices, lack of time, lack of technical skills, and concerns regarding promotion of materials (Arlitsch & Grant, 2018).

Respondents in the Census of Institutional Repositories in the US reported having problems in getting faculty and students to deposit materials in IRs. In addition, the study found that the more mature the repository is, the more sceptical are the faculty when it comes to depositing (McDowell, 2007).

What appears to be the case is that university community (both faculty and students) after getting exposed and using IRs get dissatisfied and some discontinue their use. Both theoretical models underpinning the study could account for these actions. The Diffusion of Innovations (DOI) theory predicts that in the first step, an individual learns about the existence of innovation by seeking information about it. Given that 73% of the respondents had used IRs for teaching, learning and research activities against 27% who had not, it followed that most of the university community, in fact, had knowledge about IRs. For the respondents to have actually used IRs, they must have been persuaded to do so, the second step in the innovation-decision process. During the third step, users must have used IRs but some could have discontinued their use after weighing the advantages and disadvantages, engaging in what Rogers (2003) termed as active rejection or discontinuance. IRs could have gone through the fourth step, in which technical assistance from the change agents could have been given to those not very knowledgeable. Finally, at the last step, some individuals could have evaluated IRs and decided to stop using them, leading to a late discontinuance. This could explain why after the initial burst of interest in using IRs, the interest tails off.

The TAM model could explain the low rates of content recruitment in the IRs as follows: communities in the universities who get exposed to IRs find them to have low perceived

usefulness (PU) and perceived ease of use (PEU). This is not untrue as respondents pointed out several instances in which the current IR model had decreased PU and PEU. This resulted in poor attitudes towards IRs, decreased behavioral intention and actual usage.

Ease of use of a technology (IR) is often associated with high levels of knowledge and skills which are necessary to use a technology. For instance, for academic staff to accept and deposit content in IR, they need training to help them understand self-archiving, appreciate its benefits and be able to upload the content on the IR. The study found that the selected universities used mainly mediated archiving to recruit IR content. Nevertheless, self-archiving was also present to some degree. This was because, when respondents were asked on who makes deposits into IRs, their answer was IR administrators, system administrators, IR staff, university librarian, system librarian, digital repository librarian, and research directors. All these cadre of university employees are either library or IR staff and but not faculty. This showed that the library/IR staff is usually involved during archiving of materials, suggesting mediated archiving.

In mediated archiving, a specialised and dedicated IR staff, usually in the library, manage IRs and make deposits to them. This usually involves the faculty submitting the material to the IR staff, which goes ahead to prepare the metadata and deposit the material into the repository. In addition, the respondents answered that students are not allowed to deposit materials in IR. Consequently, if they want to upload material into IRs, they must submit it to the university librarian or system librarian. Either way, the form of the material

submitted is soft copy and is usually sent as an email attachment. The university librarian or system librarian, after satisfying themselves, about the suitability of content, proceeds to upload it into the IR system and describe it.

In self-archiving, which is also referred to as green archiving, the authors themselves prepare metadata and proceed to deposit the material into the IR. This avenue is used by some academic staff who are knowledgeable about the workings of IRs. They can log into the IR system; upload the material they want and go ahead to describe it.

There are advantages and disadvantages associated with each type of archiving method. According to the early vision of IRs, content recruitment was to occur through green archiving with faculty staff and researchers depositing material in IRs and describing it. This would have been in line with Crow's (2000) and Saini's (2018) views of ensuring that the Academy can control the whole process of scholarly publishing. In addition, green archiving allows individuals most knowledgeable about the material to be deposited to create its metadata.

However, in institutions where it has been practised, green archiving has been found to be relatively inefficient in content recruitment (McDowell, 2007), as the faculty lack the ability or willingness to make deposits. Furthermore, although the faculty might be knowledgeable about the document, they might not know how to describe the work in such a way that it optimises their chances of discovery by search engines such as Google, by providing appropriate key words and expressive abstract (Giesecke, 2011). Thirdly, if left to their own devises, faculty and researchers might deposit inferior materials that may

not meet quality standards. Consequently, the work needs to be corrected and improved to ensure continued reputed quality of IRs.

The question of who should police the filling up of the repository, whether librarians or faculty staff (Chapman *et al*., 2009), remains a perennial one. This study found that the ultimate mediator of the IR content appears, theoretically speaking, to be the university librarian or system librarian. This is because even when faculty and researchers self-archive, the university librarian or system librarian can delete the offending content if it does not meet the standards of the IR. It is this study's conclusion that the best way to recruit IR content is where the university librarian or system librarians work, 'hand in glove', with the faculty and researchers to deposit content in IRs. This way, the university librarian or system librarians' expertise in search engine optimization, IR system operations, and cataloguing could be combined with the authors' intimate knowledge of the document to upload it and create the best metadata for it. Since this method combines elements of mediated and green archiving, it might be described as mediated green archiving (Davis-Kahl, 2016; Chapman *et al*., 2009).

The study found the major challenges that limit recruitment in IRs to be lack of awareness about it, lack of willingness to share materials, ignorance on how to deposit materials, lengthy process of deposition, and fear of plagiarism. These reasons are similar to those documented by Arlitsch and Grant (2018).

5.3 Content Utilization of IRs in Supporting Teaching, Learning and Research Activities

Results showed that half of the respondents (*n*=298, 50%) discover content in IRs by directly visiting them. This finding is in opposition to that of Tay (2017), who observed that users do not usually visit directly the IRs' websites, rather they discover content through search engines such Google Scholar that link them to the page. This is significant because it suggests that given appropriate incentives (such as adequate and well-structured content in IRs) the academic community is willing to visit and use content in IRs. Nevertheless, a significant proportion (*n*=225, 38%) discover IR content inadvertently, when using search engines, for instance, Google.Consequently, these individuals never actually see IR pages.

Those who prefer search engines felt they were faster, easier, reliable, and provide the most relevant and comprehensive results. If respondents argue that Google provides the most relevant and comprehensive results relative to IRs, it may be because they never visit IRs which they consider to contain inadequate and out-dated content. It also implies that repository managers should optimize content for search engines, before uploading it into IRs to increase its chances of discovery by search engines (Luther, 2018). In addition, one in every ten respondents (*n*=77, 13%) never bother to know the contents of IRs. This is because they felt IRs are not helpful, responsive, important, active, and ignorance about them.

Results showed that more staff (59%) visit IR directly compared to students. In addition, a greater proportion of students (20%) never bother to know what IRs contain relative to

only 6% of academic staff. The explanation could be that members of the academic staff are more informed about IRs and modes of online searching than students, and hence, they could visit IRs more. This implies that greater education efforts on IR content discovery should be directed to students. Similar efforts should be applied to education and engineering schools, which discover IR content accidentally or do not bother.

Findings showed that the most accessed content in IR was thesis (12% of the 2,884 responses), followed by software (11%), books and book chapters (both 10%) and journal articles (9%).The least used content was conference papers (5%), book reviews (6%), preprints and datasets (both 7%).This finding is analogous to results by Jean *et al*. (2011), Bamigbola (2014) and Shukla and Ahmad (2018) who reported that staff and students visit IRs to search for journal articles, conference papers, theses and dissertations, raw data, lectures, presentations and newsletters in IRs. They also wanted to access course content for use in their work, access raw data for use in research projects, and identify colleagues and research students interested in collaboration.

The study showed that respondents preferred traditional journals as sources for material for teaching/learning and research (38%), followed by subject/discipline repositories (26%) and IRs (25%). This suggested that respondents prefer to use traditional journals and subject repositories, rather than IRs for teaching, learning and research. Thus, IRs do not fully support teaching, learning and research in the universities as a greater proportion (75%) of the academic community prefer other modes of scholarly publishing. The least preferred mode was conference proceedings (11%).

According to respondents, traditional journals were preferred relative to IRs because they contained more in-depth and up-to-date content. Subject repositories were favored because they concentrated on the subject's area of specialization. They also carried useful content and were easily available. Respondents who chose IRs answered that they provide large overview of subject areas as many individuals may be exposed to them. They were also found to be cheaper and available. These findings are in tandem with those of Shukla and Ahmad (2018); Van de Velde (2017); Bamigbola (2014); Stanton and Liew (2012); and Jean *et al*. (2011). For instance, Bamigbola (2014) found that although there was a general positive attitude towards IRs, only 8% of them had both searched them for academic information and submitted their research to them whereas 33% had neither searched nor submitted their scholarly work to IRs. Arlitsch and Grant (2018) argued that few users bother to search individual IRs, preferring to use aggregators such as Google Scholar (GS). Stanton and Liew (2012) found that only a small number of students used repositories and open journals in their own research.

This study found that only engineering schools preferred to obtain teaching/learning and research materials from IRs, with library, humanities and business schools favouring traditional journals while education and science preferring subject repositories. The low preference for IRs by information science is unreasonable since the school is central in implementation of IRS. Academic staff members from information school were also the least likely to publish in IRs. The result suggests that education and promotion of the importance of IRs should begin with the mother school itself – library. The preference of traditional journals by humanities is similar to Chandra and Halder (2012), who reported that humanities and social science researchers had low levels of awareness of the IR.

5.4 Contribution of University Librarians, System Librarians and Research Directors toward use of IRs to support Teaching, Learning and Research

The study found that university librarians, system librarians and research directors were involved in all the stages of IR implementation: system development, content recruitment and content preparation. This finding is similar to those of Andayani (2017), Kamraninia and Abrizah (2010), Casella and Morando (2012), and Joint (2006). During pre-implementation, university librarians and system librarians work together with IT to design and develop the system, identify user needs, design metadata requirements, work with faculty to recruit content, and deposit old materials. During implementation, system librarians, university librarians and research directors are important during submission and publishing. During submission, they create metadata and upload files attachment. During publishing, they verify metadata, format, and content type, validate content, approve contents and facilitate the digital creative common license. In post-implementation, university librarians, system librarians and research directors provide repository services, promote IR among faculty and conduct IR-related training.

The foregoing discussion suggests that system librarians, university librarians and research directors play dual roles of awareness (by promoting and marketing the use of IRs) and archiving (by describing and uploading contents to IRs). According to Roosendaal and Geurts (1997) and Crow (2002), the process of scholarly communication has four elements: registration (identifying the real author), certification (validating the quality of research), awareness (making the research available to others), and archiving (long-run preservation of results for future). Whereas the traditional journal model of publishing (print or digital) encompasses all the four components, the repository model

consists of only two features, awareness and archiving, both performed by system librarians, university librarians and research directors. It follows that if IRs are to support teaching, learning and research, the contribution (in the execution of the above roles) of university librarians, system librarians and research directors will be critical.

Every key informant in the study felt that IRs are pertinent in supporting teaching, learning and research. Nevertheless, they also presented weaknesses in the current IR model. The content was inadequate and sometimes, of poor quality; software problems, lack of awareness of IRs, lack of cooperation among university community, and negative attitudes from academic staff.

5.5 Effectiveness and Suitability of IRs in Supporting Teaching, Learning and Research

The study used two questions to assess the effectiveness of IRs to support teaching, learning and research activities: are IRs very important in supporting teaching, learning and research; do you use IRs for teaching; learning; and research? While eight in every ten students (83% agreed or strongly agreed) thought that IRs are very pertinent in supporting teaching, learning and research, only five in every ten members of staff (56 % agreed or strongly agreed) thought so. In addition, less than half of the members of academic staff used IRs for teaching whereas 74% of the students answered that they did. Nine in every ten students were found to use IRs for research while only five in every ten academic staff did. Lastly, most students used IRs for learning relative to only 47% of academic staff who did. The results show that only about half of the members of academic staff use IRs for teaching, learning and research. In addition, there were a

significant proportion of academic staff who could not make up their minds as to whether IRs were important for teaching, learning, and research.

Academic staff members such as lecturers are very important in the education process; facilitating learning by providing consciously designed pre-structured knowledge or specific influences, to bring about permanent behaviour changes in learners (Sequeira, 2012; Niemi, 2009; Abbatt & McMahon, 1993. Academic staffs also spearhead research in the universities, carrying out their own research, collaborating with other researchers and guiding post-graduate research activities (Koutras and Bottis, 2013). Consequently, the major determinants of teaching, learning and research are members of the academic staff. It follows that if about 50% of them never use IRs, then, they cannot be effective in supporting teaching, learning and research. The study suggests that whereas most students, university librarians, system librarians, and research directors are very receptive to use of IRs in teaching, learning and research, members of the academic staff appear to be the Achilles heel.

The study found that respondents from private universities were more willing to the use of IRs in teaching, learning and research compared to those from public universities. This suggested that IRs could be more acceptable in the former institutions than in the latter and thus, more intensive promotion campaigns should be implemented in the latter. The study also found out there was a schools' bias in the use of IRs, with engineering, science and information science believing they are very important in teaching, learning and research while support for IRs was less strong in business and humanities. Chandra and

Halder (2012) have reported that humanities and social science researchers had low levels of awareness of the IR.

The study found an apparent contradiction with respect to information sciences school members: they are the least likely to publish in IRs and yet they like to access its material for education and research. This suggested that although they know the potentially important roles that IRs can play (they are the promoters), they themselves are not willing to invest in them, for instance, by deposition of content. Salo (2008) argued that most librarians do not understand how or why they should promote IRs, and when asked to deposit their own content, they are as reluctant as faculty.

More female respondents significantly felt that IRs are very important in teaching, learning and research compared with their male counterparts, suggesting that IR promotion activities should be directed more to male students and academic staff. The study found that all students, whether undergraduates, masters, or PhD thought IRs are very important in education and research. Junior academic staff (assistant lecturers and lecturers) felt that IRs are very important in teaching, learning and research while senior staff (professors, associate professors and senior lecturers) were less inclined to think so. This is even more serious as it is the *crème de la crème* (the professors, associate professors and senior lecturers) who do not use IRs. Kim (2010) found that younger faculty deposit more because of familiarity with technology compared with older faculty.

The study found that that the major barriers that hinder the ability of IRs to support teaching, learning and research were poor quality and quantity of the collection in IRs, lack of awareness about IRs, and ignorance in using IRs, especially in deposition of

content. Other reasons included about inadequacies in IR software, poor organization of materials within IRs, plagiarized content, restricted material and grey literature in IRs. Many of these weaknesses have been cited by other studies. Salo (2008) and Tay (2017) reported on IRs' inappropriate software, Jean et al. (2011) highlighted lack of visibility of the IR and absence of content in IRs while Bamigbola (2014) described the reticence among scholars to deposit materials in IRs and difficulties in navigating content. This study contends that the weaknesses it uncovered could hinder their ability to support teaching, learning and research through the operation of the Technology Acceptance Model (Davis *et al*. 1989) and Diffusion of Innovations/DOI (Rogers et al., 2009) model. Factors such as poor quality and quantity of the collection in IRs, plagiarized content, restricted material and grey literature in IRs could reduce their perceived usefulness. On the other hand, inadequacies in IR software, and poor organization of materials within IRs could reduce their perceived ease of use, leading them to be less used and hence, ineffective in teaching and research. Lack of awareness about IRs and ignorance in using IRs could be explained by DOI, in the sense that the innovations disseminated to all individuals in the academic community.

Arlitsch and Grant (2018), Tay (2017), Wenzler (2017) and Van de Velde, (2017), argued that the disaggregated nature of IRs, although affording local control, creates problems of small mass and siloed content, which discourages scholars from using them. In addition, they argued that the institutional nature of repositories does not align well with the social networks of scholars, which are more attune with disciplinary repositories (which may be global) than with institutions, making many faculties may choose to deposit their scholarly work in subject repositories rather than institutional ones. Furthermore, while

IRs are often impermanent, subject/discipline affiliations tend to be more stable, with academics continuing to research in their specific areas even when they changed institutions. Jean *et al*. (2011) and Arlitsch and Grant (2018) reported that many IRs have difficulty in functionality, whereby it is difficult to create metadata and articles that can be found on the internet. Lastly, the lack of certification for materials deposited in IRs has led to a predominance of grey literature in them, some of dubious quality. Because of this, some scholars prefer to publish their papers in peer-reviewed journals than in IRs (Arlitsch & Grant, 2018; McDowell, 2007; Shirky, 2005).

5.6 Chapter Summary

The chapter discussed the research findings on the capacity of institutional repositories in supporting teaching, learning and research activities in four selected universities in Kenya.IR content was found to be dominated by grey literature, sufficiently broad but lacking depth, with inadequate and sometimes out-dated material. Thus, the content is not effective in supporting teaching, learning and research. All the universities in the study used the same type of IR software, giving rise to similarity in content of the repositories. Content recruitment in the selected IRs was found to be very low, which could explain the inadequate content in the repositories. Most respondents prefer traditional journals and subject/discipline repositories as sources for material for teaching/learning and research, rather than IRs. This indicated that IRs are not fully effective in supporting teaching and research.

System librarians, university librarians and research directors were found to both market IRs and archive their content, critical roles new system of scholarly communication.

Since members of academic staff facilitate learning and spearhead research in universities, findings showed that IRs are not effective in supporting teaching and learning, as many staff (especially the senior most) never use them. The next chapter presents the summary of the research findings, conclusion and recommendations made by this study.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This study assessed institutional repositories capacities in supporting teaching, learning and research activities in four selected universities in Kenya with a view to proposing an appropriate model to improve teaching, learning and research activities. This chapter presents a summary of the major findings, conclusion and recommendations made.

Two theoretical frameworks, Technology Acceptance Model (TAM) and Diffusion of Innovations (DOI), guided the study. This study adopted a pragmatic paradigm associated with mixed method approach and a multiple-case (embedded) research design. A combination of stratified random and purposive sampling techniques was employed to obtain 370 students, 322 academic staff and 12 key informants from the four selected universities. Data was collected using questionnaires and interview schedules.

The study was guided by the following research questions:

i. How effective are content and content recruitment in institutional repositories in selected universities in Kenya?
ii. How does content utilization of institutional repositories support teaching, learning and research activities?
iii. What is the contribution of university librarians, system librarians and research directors toward use of institutional repositories to support teaching, learning and research activities?

iv. How effective are institutional repositories in supporting teaching, learning and research activities?

v. What model would be suitable to improve institutional repositories capacities to support teaching, learning and research in selected universities in Kenya?

6.2 Summary of Findings

The salient findings emanating from this study are presented in the following sections, in line with the research objectives and questions as outlined above.

6.2.1 Effectiveness of Content and Content Recruitment in IRs

The study found that content in IRs assessed was wide-ranging, consisting of over 12 types of scholarly content. These included preprints, book reviews, journal articles, theses, working papers, and conference papers. Others were technical reports, datasets, book chapters, software, books, media clippings, almanacs, school magazines, newspaper articles, examination papers, past papers, speeches, pictures, and multimedia. Nevertheless, the study found that the content was not effective in supporting teaching, learning and research activities because of two findings. First, the IR content in the universities assessed was dominated by grey literature (about two thirds) that had not been peer reviewed. Secondly, the content, though broad was found not to be deep, with many respondents finding it to be inadequate, sometimes out-dated and of poor quality. This was substantiated by objective analysis of the selected IRs, which for instance, showed that the university with the largest collection contained just 28,088 journal articles compared with 135,000,000 publications in Research Gate by June 2020.

Despite slight differences, content in the four selected universities' IRs was found to be broadly similar. This could be explained by the finding that all the selected universities used DSpace as the IR software platform. Since the four selected universities typified other universities in the country, the results suggested that IRs in other higher institutions of learning could be similarly constructed. Slight differences in the type of content were observed in the universities, notably conferences and book reviews were more in public universities whereas theses, datasets and multimedia were predominant in private universities.

The study found that the rate of content recruitment in the selected IRs was very low, with only minute fractions of respondents having made deposits in the last five years. Specifically, only 2%, 6%, 7%, 12% and 16% of the respondents had deposited books, grey literature, theses, conference presentations and journal articles in IRs, respectively, in the last five years. The low rates of content recruitment could explain why the selected IRs have relatively little content. This could be the main obstacle in the ability of the IRs to support teaching, learning and research activities and could explain why the most enlightened group in the university community (members of academic staff) never bothers to use them.

The study found that the material mostly deposited in IRs were journal articles and conference presentations (both 28% of the 1,003 responses), followed by theses (22%) and grey literature (13%) while the least were books (10%). These numbers reflected the relative proportions of the different communities found in the selected IRs, with the major ones being theses and dissertations, journal articles and research papers, and

conference proceedings. However, when conferences, theses, and other non-peer reviewed material are combined, the results indicated that grey literature was still the paramount material deposited in the IRs.

Members of academic staff deposited more content in IRs than students while books were deposited mainly by Engineering, Science, Humanities and Business schools but rarely by information science and Education schools. On the other hand, Engineering, Education and Business schools deposited limited or no theses while Engineering deposited a lot of grey literature.

The mode of content recruitment in the selected universities was found to be either mediated or self-archiving. The study found the major challenges that limited recruitment in IRs to be lack of awareness about it, lack of willingness to share materials, ignorance on how to deposit materials, lengthy process of deposition, and fear of plagiarism.

6.2.2 Content Utilization of IRs in Supporting Teaching, Learning and Research Activities

Unlike other researchers, the study found that half of the respondents (*n*=298, 50%) discovered content in IRs by directly visiting them. This was important because it suggested that if the IRs were greatly improved, through having adequate and well-structured content, for instance, the academic community was willing to visit and use content in IRs. However, a significant proportion (*n*=225, 38%) was found to discover IR content accidentally, when using search engines, for instance, Google. In addition, one in every ten respondents in the university community never bothered to know the contents

of IRs because they felt they were not helpful, responsive, important, active, and ignorance about them.

Results showed that more staff (59%) visited IR directly compared to students. In addition, a greater proportion of students (20%) never bothered to know what IRs contained relative to only 6% of academic staff. The most accessed content in IR were theses, followed by software, books and book chapters and journal articles while the least used content was conference papers, book reviews, preprints and datasets.

The study showed that respondents preferred traditional journals as sources for material for teaching/learning and research (38%), followed by subject/discipline repositories (26%) and IRs (25%). The least preferred mode was conference proceedings. This suggested that respondents preferred to use traditional journals and subject repositories, rather than IRs for teaching, learning and research. Thus, the vision of IRs as alternative gateway to scholarly publishing has not come to full fruition. This study found that only engineering school preferred to obtain teaching/learning and research materials from IRs, with library, humanities and business schools favouring traditional journals while education and science preferring subject repositories. The low preference for IRs by information science was found to be unconscionable since the school is at the heart of IR implementation.

6.2.3 Contribution of University Librarians, System Librarians and Research Directors toward use of IRs to support Teaching, Learning and Research

The study found that university librarians, system librarians and research directors were involved in all the stages of IR implementation: system development, content recruitment

and content preparation. During pre-implementation, they work together to design and develop the system, identify user needs, design metadata requirements, work with faculty to recruit content, and deposit old materials. During implementation, they created metadata and uploaded files attachment; verify metadata, format, and content type; validate content; approve contents; and facilitate the digital creative common license. In post-implementation, they provided repository services, promoted IR among faculty and conducted IR-related training.

Thus, the study found that system librarians, university librarians and research directors played dual roles of awareness (by promoting and marketing the use of IRs) and archiving (by describing and uploading contents to IRs). Since these are the only functions in a repository model of scholarly communication, it follows that university librarians, system librarians and research directors must perform these functions maximally if IRs are to support teaching, learning and research.

According to key informants, weaknesses in the current IR model included inadequate content and sometimes, of poor quality; software problems, lack of awareness of IRs, lack of cooperation among university community, and negative attitudes from academic staff.

6.2.4 Effectiveness of IRs to support Teaching, Learning and Research Activities

While eight in every ten students thought that IRs were very important in supporting teaching, learning and research, only five in every ten members of staff thought so. In addition, less than half of the members of academic staff used IRs for teaching whereas 74% of the students answered that they did. Nine in every ten students were found to use

IRs for research while only five in every ten academic staff did. Lastly, most students used IRs for learning relative to only 47% of academic staff who did. Thus, the study showed that whereas most students, university librarians, system librarians, and research directors were very receptive to the use of IRs in teaching, learning and research, about half of the members of the academic staff never used them. Consequently, if the major determinants of teaching, learning and research are members of the academic staff, it follows that IRs are not effective in supporting teaching, learning and research since 50% of them never used them. To make matters worse, the elite of the academic staff (professors, associate professors and senior lecturers) were the ones who were not likely to use them.

Respondents from private universities were more likely to use IRs in teaching, learning and research compared to those from public universities. The study also found out that there was a bias in the use of IRs, with engineering, science and information science believing they are very important in teaching, learning and research. Education felt that IRs were not important while support for IRs was less strong in business and humanities.

More female respondents significantly felt that IRs were very important in teaching, learning and research compared with their male counterparts, suggesting that IR promotion activities should be directed more to male students and academic staff. Junior academic staff (assistant lecturers and lecturers) felt that IRs were very important in teaching, learning and research while senior staff (professors, associate professors and senior lecturers) were less inclined to think so.

The study found that that the major barriers that hindered the ability of IRs to support teaching, learning and research were poor quality and quantity of the collection in IRs, lack of awareness about IRs, and ignorance in using IRs, especially in deposition of content. Other reasons included inadequacies in IR software, poor organization of materials within IRs, plagiarized content, restricted material and grey literature in IRs.

6.2.5 Proposed Model to improve IRs' Capacities in Support of Teaching, Learning and Research Activities in selected universities in Kenya

The last objective of the study was to propose an appropriate model for improvement of service. Based on the literature that was reviewed and the findings of this study, a proposed model is rooted on the technology acceptance model (TAM) which informed this study.

Section 4.8.1 presented results on the use of IRs in selected Kenyan universities, which showed that most respondents had at least used an IR in teaching, learning or research. However, results in Section 4.8.2 and 4.8.3 showed that half of the academic staff does not use them for teaching, learning or research. This implies that although most of the respondents had been exposed to IRs, only some, especially students used them in learning and research. With regard to theories underpinning the study, results suggested that IRs have diffused to most members of the academic community. After all, it is illogical to argue that exposure of IRs to members of academic staff had been lower relative to students on the basis that usage in the latter group is higher than in the former. Members of the academic staff are expected to be more knowledgeable about IRs than students because of their greater exposure to research, longevity in the university, and

their participation in administrative and decision-making functions in the university. What appears to be the case is that although most of the academic communities were aware of IRs, they had not embraced them (especially staff) for teaching, learning, and research. Thus, to propose a model that can improve their usage, this study used the Technology Acceptance Model (TAM).

The basic TAM model (Figure 2.1) theorizes that if a user perceives a technology as being useful and easy to use, they will have a favourable attitude towards it. Consequently, they will likely use it (behavioral intention), leading to actual usage (Farahat, 2012; Davis *et al*. (1989). This study retains the basic elements of the original TAM model, namely, perceived usefulness (PU), perceived ease of use (PEU), attitudes towards use, behavioural intention and actual usage. However, it adds on it the antecedents of PU and PEU, explicitly showing which factors affect PU and PEU, respectively. Thus, the new elements in the proposed model are the antecedents of PU and the antecedents of PEU (Figure 6.1).

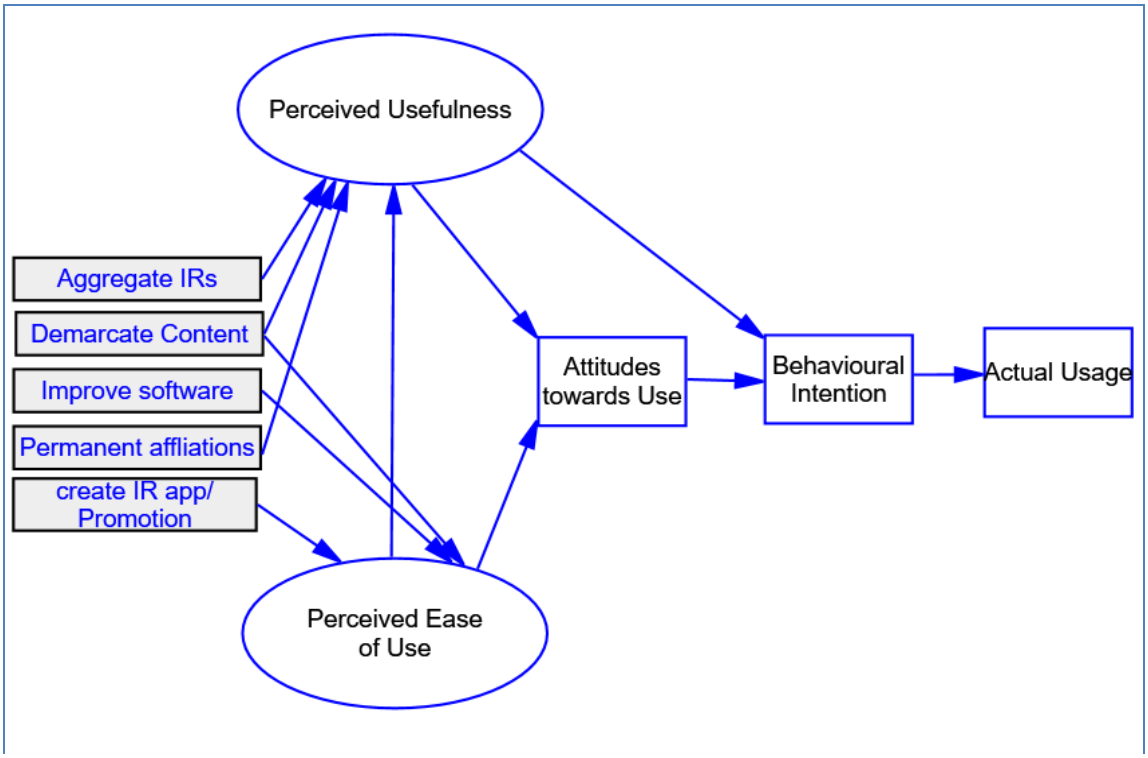

Figure 6.1: Proposed IR Model to Support Teaching, Learning And Research. (Adapted from Davis et al., 1989)

Context of the Problem

This study argued that respondents who knew about IRs but did not use them (for instance, the academic staff) because of two reasons: they perceived IRs as not being useful and not easy to use. Most of the barriers to the use of IRs that this study found fall under the two categories. Poor quality and quantity of materials, plagiarized content, abundance of grey literature, lack of willingness to share content, insecurities in IRs, out-of- date content, inconsistent updating of materials, and lack of interest from students and academic staff, all contributed to a perceived lack of usefulness of IRs. On the other hand, ignorance in using IRs, poor organization of content in IRs, inadequacies in IR software, difficulty in finding the required content, and lack of offline content all resulted in a lack of perceived ease of use.

Consequently, to improve IRs to better support teaching, learning and research, then, their perceived usefulness and perceived ease of use must be improved. This way, the attitudes of students and academic staff will improve, leading to an increased in their behavioral intention and therefore usage of IRs.

There are two contrasting philosophical viewpoints about the objectives of IRs: one that considers IRs as competition and possible replacement for traditional publishing (Harnard, 1995; Crow, 2002); the other that views IRs as a supplement to traditional publishing (Lynch, 2003). Harnad (1995) argued that academics should publish their work in IRs to circumvent the economic barriers put up by publishers that limit scholarly accessed to research. Crow (2002) similarly argued that IRs should take over all the traditional functions of traditional publishing, namely, registration, certification, dissemination, and archiving, and hence, placing the function of scholarly publishing rightfully into the hands of the Academy. Lynch (2003), on the other hand, viewed IRs' roles as supplementary, arguing against them taking on the function of certification during the course scholarly publishing.

And, herein laid the crux of the matter: which model had dominated the selected universities? Findings showed that Lynch (2003) model had dominated, with all IRs assessed containing significant grey literature and scant journal articles. Studies by McDowell (2007) and Bailey *et al*. (2006) suggest that this model had resulted in unreliable coverage that are neither likely to reform scholarly publishing nor meet long-term preservation goals. Moreover, evidence from this study suggested that academic staff do not find IR contents useful.

If repositories are to be credible new communication models, constructed and controlled by scholars themselves, as envisioned by Crow (2002), then, the following changes are proposed as shown in Figure 6.1. Some of the changes required are structural.

Antecedents of Perceived Usefulness

This study argues that to improve the PU of IRs, the following changes were proposed:

(I) Aggregation of IRs

The institutional nature of repositories is at variance with the social networks of scholars, which are more attune with disciplinary repositories (which may be global) than with institutions (Arlitsch & Grant, 2018; Tay, 2017; Van de Velde, 2017; Wenzler, 2017; Coalition for Networked Information, 2017). This study therefore proposes for the aggregation of several IRs, even across countries. However, this should be done in such a way that the unique characteristics of each institution are preserved. After all, IRs are supposed to showcase the achievements of each institution. For instance, if the four IRs in this study were linked, such that each institution remained as a distinct community but at the same time allowing a scholar to scroll through all the intellectual inputs of the institution at once, it could solve problems such as inadequate, outdated and poor-quality content.

The disaggregated nature of IRs, although affording local control, creates problems of small mass and siloed content, which discouraged scholars from using them (Arlitsch & Grant, 2018; Tay, 2017; Van de Velde, 2017). Aggregation of IRs as suggested above will help to reduce the challenged of small content. This will enhance the PU of IRs.

(II) Permanent IR Affiliations

IRs are often impermanent while subject/discipline affiliations tend to be more stable, with academics continuing to research in their specific areas even when they changed institutions. For example, when a scholar leaves an institution, they tend to sever their relationship with IRs. Consequently, they are more likely to put papers in subject repositories such as SSRN where they can share with their colleagues rather than in IRs. This study proposed that even when a scholar leaves an institution, they should retain lifelong controlled of their articles.

(III) Demarcation of IR Content

The lack of certification for materials deposited in IRs has led to a predominance of grey literature in them, some of dubious quality. Because of this, some scholars prefer to publish their papers in peer-reviewed journals than in IRs (Arlitsch & Grant, 2018; McDowell, 2007; Shirky, 2005). This study proposed that IRs should be demarcated between grey literature materials and those peers reviewed. In traditional publishing, other scholars do peer review and this should be replicated for IRs, with such materials entering the peer-reviewed section. Findings from this study revealed that currently, there is virtually no peer review of articles entering IRs, with only IR managers giving consent for the publication. This way, a huge volume of high-quality articles could find their way to IRs, attracting both scholars wanting to deposit and access articles, because of the increased mass. The IR could then contain high quality articles that can be shared between serious scholars and the grey literature for consumption by those who want.

Nevertheless, demarcation of IR content will not only attract serious scholars and those less so but it will also help organize content in an orderly manner. For instance, when searching for a scholarly article, one can go to the peer-reviewed section rather than looking in the whole IR. Thus, demarcation of content will help to improve both the PU and PEU of IRs.

Antecedents of Perceived Ease of Use

This study argues that to improve the PEU of IRs, the following changes were proposed:

(I) Improvement of IR Software

Many researchers, including this study, have reported on the difficulty in functionality of IRs, with uploading difficult by having to create metadata and articles difficult to find on the internet (Jean *et al*., 2011; Arlitsch & Grant, 2018). This study proposed an improvement in the software used, that could improve the perceived ease of use. Such modifications could tell a researcher who read their paper, viewed their record or downloaded it, and allows the researcher to communicate with the user as it happens with subject repositories.

The software used in all IRs in this study was DSpace, which the study found displaying statistics about collections and items. However, there was no evidence of the software reporting article usage to authors and IR managers nor did it display an 'Author Dashboard', showing download counts and search terms harvested by Google Analytics, as in other software, such as Digital Commons, (Konkiel & Scherer, 2013). Thus, the universities could consider using other and newer versions of software that could provide

more sophisticated usage statistics. DSpace is also an open-source software, which implies that repository managers can attempt to modify and improve it.

Because of their absence, this study recommended that IRs in Kenyan universities should report both usage (citations and downloads) and altmetrics statistics, such as social media metrics. This will make scholarly work in IRs to be known immediately upon publishing, which could increase their prestige and attract more users and depositors.

(II) Create IR Applications/Promotion of IRs

This study found that IRs could only be assessed by first logging online, which requires an active internet service. Students reported on inability to use IRs because of lack of internet. Clicking on some of the items in the IRs returned error messages or links to other sites that could not allow the full access to the articles. This study recommends that universities could develop their own IR Applications, which could be downloaded by members of the academic community, informing them of when and which new content has been uploaded in the IRs. The Apps could have more appealing and better formatted content that could easily fit and be read from a mobile phone, tablet, laptop or desktop computer. Having an App could also help access content, especially old, without needing internet. This way, the IRs' PEU could be improved.

This study found that only a small proportion of the university community were ignorant of IRs. Continuous and educative promotion of the possibilities of IRs could help improve attitudes about IRs. Consequently, university librarians, system librarians and research directors should continue promoting and marketing IRs. There should also be intensive education on those who are supposed to upload content on how it can be done.

One of the most frequently used applications by the technology-savvy academic community is social media. Consequently, advertising IR pages in the frequently used applications like WhatsApp, Facebook (and its associated Facebook Messenger), Twitter, Tumblr, TikTok, WeChat, Instagram, QZone, Weibo, Baidu and LinkedIn. Others include YouTube, QQ, Quora, Telegram, LINE, Snapchat, Pinterest, Viber, Reddit and Discord. Being widely shared on such media could increase the popularity of IRs, without directly affecting their PU or PEU.

Validation of the Proposed Model

The recommendations proposed in the model emanated from the respondents' answers to open-ended items in the questionnaire (qualitative answers). To empirically test and validate the proposed model, these answers were coded and entered into SPSS. The proposed model was tested using structural equation modelling – path analysis (SEMPATH), which was undertaken using the AMOS statistical program (Version 23). The resultant model is shown in Figure 6.2.

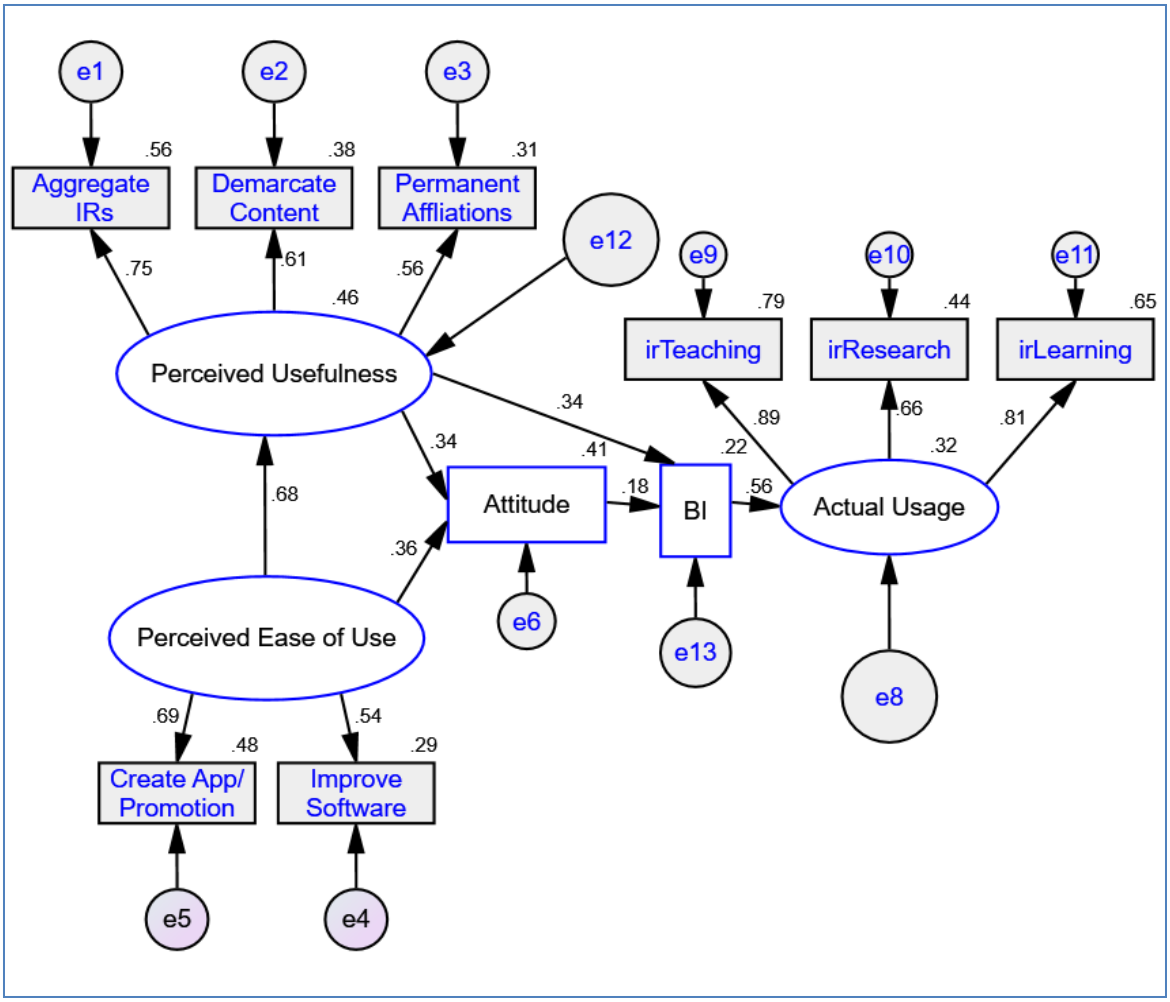

Figure 6.2: Validation of the IR Proposed Model

Several fit measures indicated that the overall fit of the model to the data was reasonable. Although the chi-square goodness of fit was significant, *P* (*CMIN*) = 315.11, *df* =31, *p* = <0.0001, test has been considered as too conservative (Tabachnick & Fidell, 2007). On the other hand, the baseline measures, normed fit index (NFI), also called the Bentler-Bennett normed fit index, the Tucker-Lewis index (TLI) and the comparative fit index (CFI) were 0.923, 0.914 and 0.93, respectively, indicating that the model fitted the data well. The baseline comparison measures compare the fit of a model to the independence model (the one that assumes all relationships among measured variables are zero). Most

of these measures range from 0 to 1. These measures should be above 0.90 to indicate good model fit (Tabachnick & Fidell, 2007; Kline, 2005; Hair *et al*., 2006).

Table 6.1: Regression Weights of the Proposed Model Parameters

			Estimate	S.E.	C.R.	P	Label
PU	<---	PEU	.932	.123	7.605	***	par_8
Attitude	<---	PU	.366	.089	4.124	***	par_6
Attitude	<---	PEU	.525	.139	3.776	***	par_7
BI	<---	Attitude	.138	.040	3.464	***	par_9
BI	<---	PU	.281	.051	5.528	***	par_11
Actual Usage	<---	BI	.620	.043	14.297	***	par_10
irTeaching	<---	F3	1.000				
irResearch	<---	F3	.659	.040	16.684	***	par_1
irLearning	<---	F3	1.009	.050	20.270	***	par_2
aggregateIR	<---	PU	1.000				
demarcateContent	<---	PU	.643	.058	11.095	***	par_3
permanentAffliations	<---	PU	.620	.052	11.867	***	par_4
improveSoftware	<---	PEU	1.000				
createAPP	<---	PEU	.831	.096	8.628	***	par_5

Key: (PU) Perceived Usefulness, (PEU)Perceived Ease of Use, (BI) Behavioural Intention (SE)Standard Error, (CR) Critical Ratio, (P)Probability value, (***) P value is less than 0.01

The regression weight, also called a path coefficient, *p* coefficient or a beta weight, estimates the strength of the relationship between a predictor and a criterion variable by predicting the amount of change in the dependent variable for each one unit change in the independent variable.

Perceived usefulness (PU), perceived ease of use (PEU) and actual usage could not be measured directly and were treated as latent variables. The indicator (manifest) variables for PU were theorised (as in proposed model) as aggregate IRs, demarcate IR content and

make permanent IR affiliations. The results in Table 6.1 showed that PU could significantly predict each of the recommendation (demarcate content: b=0.64, p<0.0001; permanent affiliations: b=0.62, p<0.0001). The path coefficient for aggregate IR was fixed at one to allow for estimation.

The standardized regression weights (shown on the path diagram of 6.2) are measured in standard deviation units and are therefore not dependent on the units of measurement of the variables and are therefore, more amenable for comparing several independent variables. Thus, comparatively, the strongest correlation between PU and the proposed recommendations was found with aggregate IRs (β=0.75), followed by demarcate content (β=0.61) and lastly, permanent affiliations (β=0.56) (Figure 6.2). These results showed that aggregating IRs, demarcation of content and making permanent IR affiliations could improve the PU of IRs. This was a validation of the proposed IR model.

For PEU, the manifest variables in the proposed IR model were to improve the IR software and create IR APP/promotion. Similarly, the association between PEU and create APP/promotion was significant (b=0.831, p<0.0001) whereas the b coefficient for improving software was fixed at one. These results validated the proposed model, which predicted an association between improving software and creating APP/promotion with PEU.

Actual IR usage was indicated by using the IR in teaching, research and learning, all of which had a significant association with the latent variable. The other parts of the TAM model were largely validated by the resultant model. PEU significantly influenced PU (b=0.93, p<0.0001), explaining about 46% of the variance in PU (R square in Figure 6.2

was 0.46). Both PU (b=0.37, p<0.0001) and PEU (b=0.53, p<0.0001) significantly and positively influenced attitude, explaining about 41% of its variation. Attitude, on the other hand, significantly and positively affected behavioural intention (BI) (b=0.14, p<0.0001). both PU (b=0.28, p<0.0001) and attitude could account for about 22% of the variance in BI. Finally, BI positively and significantly influenced actual usage (b=0.62, p<0.0001), explaining 32% of its variance.

6.3 Conclusion

This study assessed institutional repositories capacities in supporting teaching, learning and research activities in four selected universities in Kenya with a view to proposing an appropriate model to improve service provision. The study concluded that IRs in Kenyan universities, were not effective in supporting teaching, learning and research activities. This is because whereas most students, university librarians, system librarians, and research directors are very receptive to the use of IRs in teaching, learning and research, about 50% of the members of the academic staff never used them. Consequently, since the major determinants of teaching, learning and research in universities were members of the academic staff, it follows that IRs were not effective in supporting teaching, learning and research since 50% of them never used them. Furthermore, it is the *crème de la crème* of the universities (professors, associate professors and senior lecturers) who were less likely to use IRs for teaching, research and learning.

Other findings from the study support the conclusion that IRs might not be effective in supporting teaching, learning, and research activities. The study found that content in selected IRs was dominated by grey literature. This study found selected IR

content to be sufficiently broad to support teaching, learning and research, since virtually every educational content was present. Nevertheless, the content, was found to be inadequate, sometimes out-dated and of poor quality, according to many respondents. Consequently, content in IRs is not effective in supporting teaching, learning and research. The study found the rate of content recruitment in the selected IRs to be very low, with only minute fractions of respondents having made deposits in the last five years. This suggests that the IRs may not be effective in supporting teaching, learning and research activities.

Results showed that half of the respondents discovered content in IRs by directly visiting them. This is significant because it suggests that given appropriate incentives (such as adequate and well-structured content in IRs) the academic community was willing to visit and use content in IRs. Nevertheless, significant proportions discovered IR content inadvertently, when using search engines, for instance, Google. Findings showed that the most accessed content in IR was theses, followed by software, books and book chapters and journal articles whereas the least used content was conference papers, book reviews, preprints and datasets. The study showed that respondents preferred traditional journals as sources for material for teaching/learning and research, followed by subject/discipline repositories and IRs. Suggesting that respondents preferred to use traditional journals and subject repositories, rather than IRs for teaching, learning and research. Thus, IRs do not fully support teaching, learning and research in the universities.

The study found that university librarians, system librarians and research directors were involved in all the stages of IR implementation: system development, content recruitment and content preparation, showing that these cadres play the dual roles of awareness and archiving in the scholarly mode of communication. Consequently, their roles are crucial if IRs are to support teaching, learning, and research.

6.4 Recommendations

Based on the research findings of the study, the interpretation and conclusion the following recommendations were made.

6.4.1 Promote and Market IRs

The study found a lack of awareness, cooperation, negative attitudes, unwillingness amongst members of academic community to use IRs in public universities as compared to their counterpart in private universities. Therefore, the study recommends that university librarians, system librarians and research directors should aggressively promote and market the benefits IRs through conducting of seminars, workshops forums, conferences and meetings. They should also campaign through university official website, university social media, use of posters and notice boards to explain the benefits of IRs to students and academic staff.

6.4.2 Soliciting for Adequate Funds/Financial Support

University Librarians should come up with a comprehensive budget and request the university top management to increase funding for innovative research in the universities so that articles resulting from the research are published in the IRs, thus improving content recruitment. A comprehensive budget will also help in the planning and

supporting the activities and functions of IR including seminars, workshops, training, maintenance and improvement of the system.

6.4.3 Review and Implement IR Policies

The study found out that the selected universities had IR policy in place, however, the policy was not clear on deposition requirements. Therefore, University librarian in liaison with the university top management should review and update the requirements on deposition which will mandate all academic articles produced at the university to be deposited. For instance, PhD and master's students should be a mandatory to deposit their theses or dissertations in IR with the help of the system librarians. Thus, this may help to increase content in IR.

6.4.4 Instituting a Framework of Incentives and Rewards

This study found a variance in rates of content recruitment by various schools. In that, some schools deposited more content than others. Therefore, universities top management should redress the imbalances in deposition of materials in IRs by different schools. This may be done through a way of recognition and promotion so as to motivate academic staff and students.

6.4.5 Optimize IR content for greater Search Engine Visibility

A significant proportion of respondents, especially students, were found to discover IR content accidently when using search engines. This is because they were faster, easier, reliable, and provide the most relevant and comprehensive results. University librarians and System librarians should optimize content for search engines, before uploading it into

IRs to increase its chances of discovery or improve the visibility of content in IRs on the web.

6.4.6 Increase Utility and Appeal of IRs

The study found that respondents preferred to use traditional journals and subject repositories, rather than IRs, for teaching, learning and research. The utility and appeal of IRs must be increased by the university librarians and system librarians above those of traditional journals and subject repositories to make them useful in teaching and learning. For instance, the IR interface should be improved by preparing a well-structured content to make it attractive and to quickly search through and find what one is looking for. The university librarians should also improve the IR software by adopting new versions which are easier to upgrade and less vulnerable to attacks by viruses.

6.4.7 Describe and Upload Contents to IRs (Archiving)

The study found IRs deficient in content, especially the peer reviewed ones, hence, hindering their ability to support teaching, learning and research. This study recommends that university librarians, system librarians and research directors should encourage and help academic staff, researchers and students in describing and uploading IR content.

6.5 Suggestions for Further Study

This study assessed institutional repositories capacities in supporting teaching, learning and research activities in four selected universities in Kenya with a view to proposing an appropriate model to improve teaching, learning and research activities. This study makes the following suggestions for further study:

- This study was a case investigation of four selected universities in Kenya. Other investigators can replicate the study in other universities to determine whether the results from this study apply.
- This study found that female students significantly felt that IRs are important in teaching, learning and research relative to male students. Studies could be conducted to determine the provenance of this gender-based difference.
- Private universities were found to have better usage of IRs compared to public universities. Studies could be carried out to understand the underlying reasons for this difference.
- Studies could be conducted to assess if other reasons other than those found in this study could explain why the higher ranked members of academic staff do not make use of IRs frequently.

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APPENDICES

APPENDIX I: QUESTIONNAIRE FOR STUDENTS

Dear Respondent,
My name is Lucy Sang, a PhD student at Moi University. I am conducting a study that seeks to assess the capacity of institutional repositories (IRs) in supporting teaching, learning and research activities in universities in Kenya.The study aims to determine the capacity of IRs in supporting teaching, learning and research and looks at how the process of putting content in IRs (recruitment), how it is discovered and used affects teaching, learning and research. In addition, it seeks to understand the role librarians and research directors play in using IRs.

You have been selected as one of the respondents for this study. Kindly assist me in filling this questionnaire. Your personal opinion matters and there are no right or wrong answers. Your responses will be treated with utmost confidentiality and will be used for purposes of this study only.
Thanking you for your cooperation and invaluable support.
Lucy Jelagat Sang
IS/PHD/LIS/01/16
sanglucy45@gmail.com

SECTION 1: BIOGRAPHICAL INFORMATION

1. a) Please indicate the name of your university ____
   b) Indicate whether it is Public [] or Private []
   c) Schools_____
   d) Current program? Undergraduate [] Masters [ ] PhD []
   e) Which year did you enrol for the program? _____

2. Gender: Male [] Female []
3. Age profile
   20-30 yrs. [] 31-40 yrs. []41-50 yrs. []51-60 yrs. [] ≥ 61yrs []

4. Highest academic qualification
   KCSE [] Bachelor's Degree [] Master's Degree []
   Other (*specify)*: _____
5. What is the mode of your studies? Full-time [ ] Part-time []

SECTION 2: EFFECTIVENESS OF CONTENT AND CONTENT RECRUITMENT IN IRS

2I. What types of scholarly content are present in your IR? (Tick all that apply)

Preprints []
Journal article []
Working papers []
Technical reports []
Book chapter []
Book []
Book reviews []
Thesis []
Conference paper []
Datasets []
Software []
Multimedia []
Other_____

2II. Which type of content/material have you ever deposited in your IR? (Select all that apply by ticking the first box). For each material, give the approximate number that you have deposited in the IR in the last five years (Write the number in the second box for every material).

Journal articles [][] Theses [][]
Grey literature (e.g. reports, working papers) [][]Books [][]
Conference presentation [][]
Other _____

2III. What do you think are the greatest challenges that limit deposition of materials in IRs?

_____
_____

2IV. How may IRs be improved so that more people can deposit materials in them?

_____
_____

_____

SECTION 3: INSTITUTIONAL REPOSITORY SOFTWARE

3I. The following statements talk about the various features of the IR. Rate the statements on a scale of 1 – 5, where,

1-strongly disagree 5- Strongly agree

		1	**2**	**3**	**4**	**5**
1	I can easily upload/deposit material into the IR					
2	The contents in the IR are well organized, appealing and I can get easily all I want					
3	I can easily download material/content from the IR					
4	I can get reports/usage statistics when other people download/view my material inside the IR					
5	I can easily edit the work I deposited in IR					

SECTION 4: CONTENT DISCOVERY AND USE OF IR IN SUPPORTING TEACHING, LEARNING AND RESEARCH ACTIVITIES

4I. Which of the following do you MOSTLY use to discover/know the content of IRs (Tick only one option)

I visit the IR website directly []
I discover the content when I am using a search engine e.g. Google []
I have never bothered to know the contents of IRs []

b) Please indicate the reasons for your preference:

_____
_____

4II. What types of scholarly content do you mostly access/use from IR? (Tick all that apply)

Preprints []	Book reviews []
Journal article []	Thesis []
Working papers []	Conference paper []
Technical reports []	Datasets []
Book chapter []	Software []
Book []	Multimedia []

Other_____

4III. What do you think are the greatest challenges that limit the use of materials in IRs by students and academic staff?

_____
_____

4IV. How may IRs be improved so that materials/content can be easily discovered and used by students, academic staff and other staff of the university?

_____
_____

_____

4V. Rank the following modes of scholarly publishing according to the ones that you most prefer to get your material for use in learning/research (use 1 for the most preferred and 4 for the least preferred)

Traditional journals []
Subject/discipline repository [ ]
Institutional repository [ ]
Conference proceedings []
Other_____

b) Please indicate the reasons for your preference:

_____
_____

SECTION 5: EFFECTIVENESS OF INSTITUTIONAL REPOSITORIES (IR) TO SUPPORT TEACHING, LEARNING AND RESEARCH ACTIVITIES

5IA. Have you ever used an institutional repository for learning or research? Yes []No[]

B. If your answer to Question 5IA above is yes, which activities do you like carrying out using your IR?

_____

_____

_____

5II. Show the extent of your agreement with the following statements:
SD-Strongly Disagree, D-Disagree, N-Neutral, A-Agree, SA-Strongly Agree

		SD	**D**	**N**	**A**	**SA**
1	IRs are very important in supporting teaching, learning and research in universities					
2	I use IR for teaching activities					
3	I use IRs for research activities					
4	I use IRs for learning activities					

5III What research and learning activities do you use IRs for?

Research _____

Learning _____

5IV Please does your institution has a policy regarding content recruitment by students &staff? Yes []No[]

B. If your answer to Question 5IV above is yes, has it be implemented?

SECTION 6: FACTORS THAT HINDER IRS TO SUPPORT TEACHING, LEARNING AND RESEARCH ACTIVITIES AND HOW THEY CAN BE IMPROVED

6I. What are the greatest barriers that hinder IRs from supporting teaching, learning and research activities in universities?

_____

_____

_____

_____

6II. How may IRs be improved so that they can support teaching, learning and research activities in universities?

_____

_____

_____

_____

END

THANK YOU

APPENDIX 2: QUESTIONNAIRE FOR ACADEMIC STAFF

Dear Respondent,
My name is Lucy Sang, a PhD student at Moi University. I am conducting a study that seeks to assess the capacity of institutional repositories (IRs) in supporting teaching, learning and research in universities in Kenya.The study aims to determine the capacity IRs in supporting teaching, learning and research and looks at how the process of putting content in IRs (recruitment), how it is discovered and used affects teaching, learning and research. In addition, it seeks to understand the role librarians and research directors play in using IRs.

You have been selected as one of the respondents for this study. Kindly assist me in filling this questionnaire. Your personal opinion matters and there are no right or wrong answers. Your responses will be treated with utmost confidentiality and will be used for purposes of this study only.
Thanking you for your cooperation and invaluable support.
Lucy Jelagat Sang
IS/PHD/LIS/01/16
sanglucy45@gmail.com

SECTION 1: BIOGRAPHICAL INFORMATION

1 a) Please indicate the name of your university
_____

b) Indicate whether it is Public [] or Private []
c) Schools: _____

2. Gender: Male [] Female [ ]

3. Age profile
20-30 yrs. [] 31-40 yrs. [] 41-50 yrs. [] 51-60 yrs. [] ≥ 61yrs []

4. Highest academic qualification
Bachelor's Degree [ ] Master's Degree [] PhD []
Other (*specify)*: _____

5. Academic rank at the university?
Assistant Lecturer [] Lecturer [] Senior Lecturer []
Associate Professor [] Professor []

6. On average, how many courses do you teach each semester as part of your official load? _____

SECTION 2: EFFECTIVENESS OF CONTENT AND CONTENT RECRUITMENT IN IRS ON TEACHING, LEARNING AND RESEARCH ACTIVITIES

2I. What types of scholarly content are present in your IR? (Tick all that apply)

Preprints []
Journal article []
Working papers []
Technical reports []
Book chapter []
Book []
Book reviews []
Thesis []
Conference paper []
Datasets []
Software []
Multimedia []
Other_____

2II. Which type of content/material have you ever deposited in your IR? (Select all that apply by ticking the first box). For each material, give the approximate number that you have deposited in the IR in the last five years (Write in the second box for every material).

Journal articles [][] Theses [][]
Grey literature (e.g. reports, working papers) [][]Books [][]
Conference presentation [][]
Other _____

2III. What do you think are the greatest challenges that limit deposition of materials in IRs?

_____
_____

2IV. How may IRs be improved so that more people can deposit materials in them?

_____
_____

2V. Rank the following modes of scholarly publishing according to the ones that you most prefer for publishing your work (use 1 for the most preferred and 6 for the least preferred)

Own website/blog []
Traditional journals []
Subject/discipline repository [ ]
Institutional repository [ ]
Institutional website []
Conferences []
Other_____

b) Please indicate the reasons for your preference:

_____
_____

SECTION 3: INSTITUTIONAL REPOSITORY SOFTWARE

3I. The following statements talk about the various features of the IR. Rate the statements on a scale of 1 – 5, where,

1-strongly disagree 5- Strongly agree

		1	**2**	**3**	**4**	**5**
1	I can easily upload/deposit material into the IR					
2	The contents in the IR are well organized, appealing and I can get easily all I want					
3	I can easily download material/content from the IR					
4	I can get reports/usage statistics when other people download/view my material inside the IR					
5	I can easily edit the work I deposited in IR					

SECTION 4: CONTENT DISCOVERY AND USE OF IR IN SUPPORTING TEACHING, LEARNING AND RESEARCH ACTIVITIES

4I. Which of the following do you MOSTLY use to discover/know the content of IRs (Tick only one option)

I visit the IR website directly []
I discover the content when I am using a search engine e.g. Google []
I have never bothered to know the contents of IRs []

b) Please indicate the reasons for your preference:

_____
_____

4II. What types of scholarly content do you mostly access/use from IR? (Tick all that apply)

Preprints []
Journal article []
Working papers []
Technical reports []
Book chapter []
Book []
Other_____
Book reviews []
Thesis []
Conference paper []
Datasets []
Software []
Multimedia []

4III. What do you think are the greatest challenges that limit the use of materials in IRs by students and academic staff?

_____
_____

4IV. How may IRs be improved so that materials/content can be easily discovered and used by students, academic staff and other staff of the university?

_____
_____

_____

4V. Rank the following modes of scholarly publishing according to the ones that you most prefer to get your material for use in teaching/research (use 1 for the most preferred and 4 for the least preferred)

Traditional journals []
Subject/discipline repository [ ]
Institutional repository [ ]
Conference proceedings []
Other_____

b) Please indicate the reasons for your preference:

_____

_____

Section 5: Extent to which institutional repositories (IR) support teaching, learning and research activities

5IA. Have you ever used an institutional repository in teaching, learning or research? Yes [] No []

B. If your answer to Question 5IA above is yes, which activities do you like carrying out using your IR?

_____

_____

_____

5II. Show the extent of your agreement with the following statements:
SD-Strongly Disagree, D-Disagree, N-Neutral, A-Agree, SA-Strongly Agree

		SD	**D**	**N**	**A**	**SA**
1	IRs are very important in supporting teaching, learning and research in universities					
2	I use IR for teaching activities					
3	I use IRs for research activities					
4	I use IRs for learning activities					

5III What teaching, research and learning activities do you use IRs for?

Teaching_____
Research _____
Learning _____

SECTION 6: FACTORS THAT HINDER IRS TO SUPPORT TEACHING, LEARNING AND RESEARCH ACTIVITIES AND HOW THEY CAN BE IMPROVED

6I. What are the greatest barriers that hinder IRs from supporting teaching, learning and research activities in universities?

_____

_____

6II. How may IRs be improved so that they can support teaching, learning and research activities in universities?

_____

_____

APPENDIX 3: INTERVIEW SCHEDULE FOR UNIVERSITY LIBRARIANS AND SYSTEM LIBRARIANS

Dear Respondent,

My name is Lucy Sang, a PhD student at Moi University. I am conducting a study that seeks to assess the capacity of institutional repositories (IRs) in supporting teaching, learning and research in universities in Kenya. The study aims to determine the extent to which IRs support teaching, learning and research and looks at how the process of putting content in IRs (recruitment), how it is discovered and used affects teaching, learning and research. In addition, it seeks to understand the role University librarians and System Librarians play in using IRs.

1. (a) Do you think IRs are important in teaching, learning and research?

(b) If so, why do you think so?

2. (a) What are the main types of materials/content that are deposited in your IR?

(b) Who normally makes deposits into IRs?

(c) Who prepared metadata for the repository items? (d) What do you think are the major challenges that limit content recruitment in IRs?

3(a) what are the strengths and weaknesses of the software you use for your IR?

(b) Does it allow easy uploading and downloading?

(c) Can it be easily installed, configured, customised, and maintained?

(d) Which version is it?

(e) When was it last upgraded?

(f) Does it allow for easy editing, reviewing and writing of metadata?

(g) Is your system integrated with others?

(h) Does it generate usage reports and do these reach the depositors?

4. (a) Comment on the current content discovery and usage of your IR by students and academic staff.

(b) What can be done to improve the usage of IRs by students and academic staff?

5. (a) What are the current roles that, university librarians, system librarians and research directors carry out with respect to IRs?

(b)Please describe your institution's policy (if any) regarding content recruitment by students & academic staff

(c) What challenges do you face in promoting the use of IRs by academic staff and students?

6. What do you think are the most important factors that hinder IRs from supporting teaching, learning and research?

7. Suggest ways in which IRs may be improved in order for them to support effectively teaching, learning and research

APPENDIX 4: RESEARCH AUTHORIZATION LETTER FROM DEPARTMENT

MOI UNIVERSITY
SCHOOL OF INFORMATION SCIENCES
DEPARTMENT OF LIBRARY, RECORDS MANAGEMENT AND INFORMATION STUDIES

Tel: (053) 43231
Fax No: (053) 43797
Telex NO: 35047 MOIVARSITY
E-Mail: [illegible]

P. O. Box 3900
Eldoret
Kenya.

REF: IS/PHD/LIS/01/16

10[th] December, 2019

TO WHOM IT MAY CONCERN

RE: DATA COLLECTION : LUCY JELAGAT SANG (IS/PHD/LIS/01/16)

The above named is a postgraduate student in the Department of Library, Records Management and Information Studies, School of Information Sciences, Moi University pursuing a Doctor of Philosophy degree in Library and Information Studies. She is carrying out a research thesis entitled ***"Analysing the Role of Institutional Repositories in Supporting Teaching, Learning and Research in Four Selected Universities in Kenya"*** under the supervision of Prof. Cephas Odini and Prof. Justus Wamukoya.

The purpose of writing is to request you kindly to allow Ms. Sang conduct the research and request your staff to assist her collect the necessary data. The information given will be treated with utmost confidentiality and will be used only for the purpose of writing the research thesis and it will not impact the institution in any way. We look forward to continued support and co-operation.

Any assistance accorded to her will be most appreciated.

Yours sincerely,

10 DEC 2017

DR. ELSEBAH MASEH
SENIOR LECTURER AND HEAD,
DEPARTMENT OF LIBRARY, RECORDS MANAGEMENT & INFORMATION STUDIES

EM/mn

9001:2015 Certified Institution)

APPENDIX 5: RESEARCH PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Ref No: **660529**

Date of Issue: **21/August/2019**

RESEARCH LICENSE

This is to Certify that Miss.. LUCY SANG of Moi University, has been licensed to conduct research in Nairobi, Uasin-Gishu on the topic: ANALYZING THE ROLE OF INSTITUTIONAL REPOSITORIES IN SUPPORTING TEACHING LEARNING AND RESEARCH IN FOUR SELECTED UNIVERSITIES IN KENYA. for the period ending : 21/August/2020.

License No: **NACOSTI/P/19/629**

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E-mail: dg@nacosti.go.ke / registry@nacosti.go.ke

Website: www.nacosti.go.ke

APPENDIX 6: AUTHORIZATION LETTER-INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

Reference: IREC/2019/222
Approval Number: 0003521

5th December, 2019

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
05 DEC 2019
APPROVED
P.O. Box 4606-30100 ELDORET

Ms. Lucy Jelagat Sang,
Moi University,
School of Medicine,
P.O Box 4606-30100,
ELDORET-KENYA

Dear Ms. Sang,

ANALYZING THE ROLE OF INSTITUTIONAL REPOSITORIES IN SUPPORTING TEACHING, LEARNING AND RESEARCH IN FOUR SELECTED UNIVERSITIES IN KENYA

This is to inform you that ***MU/MTRH-IREC*** has reviewed and approved your above research proposal. Your application approval number is ***FAN: 0003521***. The approval period is ***5th December, 2019 – 4th December, 2020.***

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***MU/MTRH-IREC***.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***MU/MTRH-IREC*** within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***MU/MTRH-IREC*** within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to ***MU/MTRH-IREC***.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and also obtain other clearances needed.

Sincerely,

for

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc CEO - MTRH Dean - SOP Dean - SOM
Principa - CHS Dean - SON Dean - SOD

APPENDIX 7: REQUEST TO CONDUCT RESEARCH-MOI UNIVERSITY

Lucy Jelagat Sang
School of Information Sciences,
Moi University,
P.O. Box 3900-30100,
Eldoret
Cell: 0724421544
E-mail: sanglucy45@gmail.com
3/09/2019

The DVC Research, Planning and Extension
Moi University
P.O Box 3900
Eldoret
Kenya

Dear Sir,

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT MOI UNIVERSITY

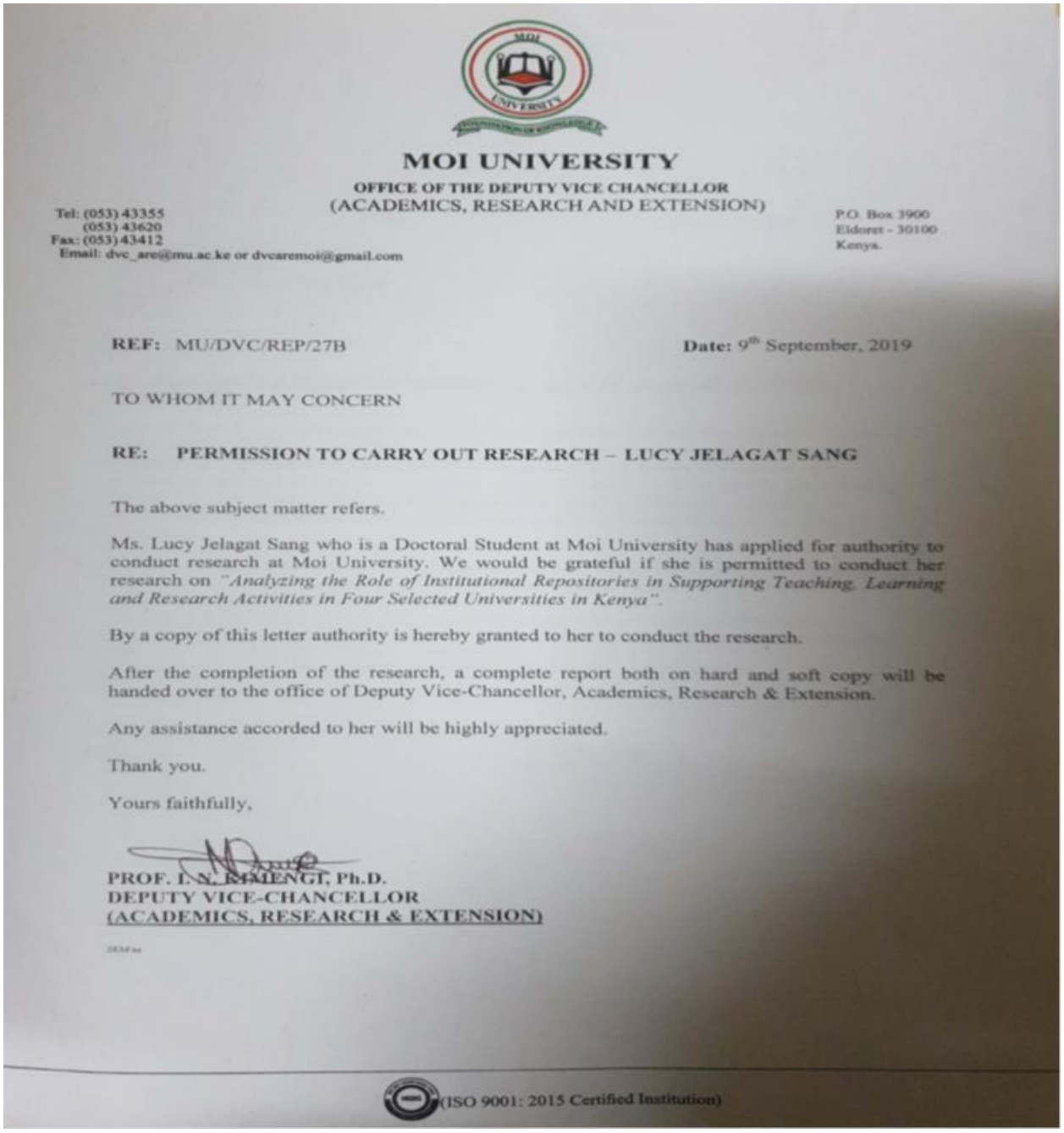
I am a PhD student currently enrolled at the School of Information Sciences, Moi University, Eldoret. I am conducting a study on *analyzing the role of institutional repositories in supporting teaching, learning and research activities in four selected universities in Kenya,* and haveselected Moi University as one of my case studies. The aim of the study is to investigate the role of institutional repositories (IRs) in supporting teaching, learning and research activities in universities in Kenya with a view to proposing an appropriate model to improve service provision.

I will be collecting data using interviews and questionnaires from respondents who are postgraduate and undergraduate students' academic staff, the University Librarian, System Librarian and Representative of Research Department at Moi University
Attached herewith, please find a copy of my research permit issued by the National Commission for Science, Technology and Innovation and copies of my data collection instruments.
I am kindly requesting that you allow me to conduct research in your institution.

Yours Sincerely.

Lucy Jelagat Sang

APPENDIX 8: RESEARCH AUTHORIZATION-MOI UNIVERSITY



MOI UNIVERSITY

OFFICE OF THE DEPUTY VICE CHANCELLOR
(ACADEMICS, RESEARCH AND EXTENSION)

Tel: (053) 43355
(053) 43620
Fax: (053) 43412
Email: dvc_are@mu.ac.ke or dvcaremoi@gmail.com

P.O. Box 3900
Eldoret - 30100
Kenya.

REF: MU/DVC/REP/27B **Date:** 9th September, 2019

TO WHOM IT MAY CONCERN

RE: PERMISSION TO CARRY OUT RESEARCH – LUCY JELAGAT SANG

The above subject matter refers.

Ms. Lucy Jelagat Sang who is a Doctoral Student at Moi University has applied for authority to conduct research at Moi University. We would be grateful if she is permitted to conduct her research on *"Analyzing the Role of Institutional Repositories in Supporting Teaching. Learning and Research Activities in Four Selected Universities in Kenya"*.

By a copy of this letter authority is hereby granted to her to conduct the research.

After the completion of the research, a complete report both on hard and soft copy will be handed over to the office of Deputy Vice-Chancellor, Academics, Research & Extension.

Any assistance accorded to her will be highly appreciated.

Thank you.

Yours faithfully,

PROF. I. N. KIMENGI, Ph.D.
DEPUTY VICE-CHANCELLOR
(ACADEMICS, RESEARCH & EXTENSION)

(ISO 9001: 2015 Certified Institution)

APPENDIX 9: REQUEST TO CONDUCT RESEARCH-UNIVERSITY OF NAIROBI

Lucy Jelagat Sang
School of Information Sciences,
Moi University,
P.O. Box 3900-30100,
Eldoret
Cell: 0724421544
E-mail: sanglucy15@gmail.com
30/08/2019

The DVC Research, Production and Extension
University Of Nairobi
P.O Box 30197, G.P.O
Nairobi
Kenya

Dear Sir/Madam,

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT UNIVERSITY OF NAIROBI

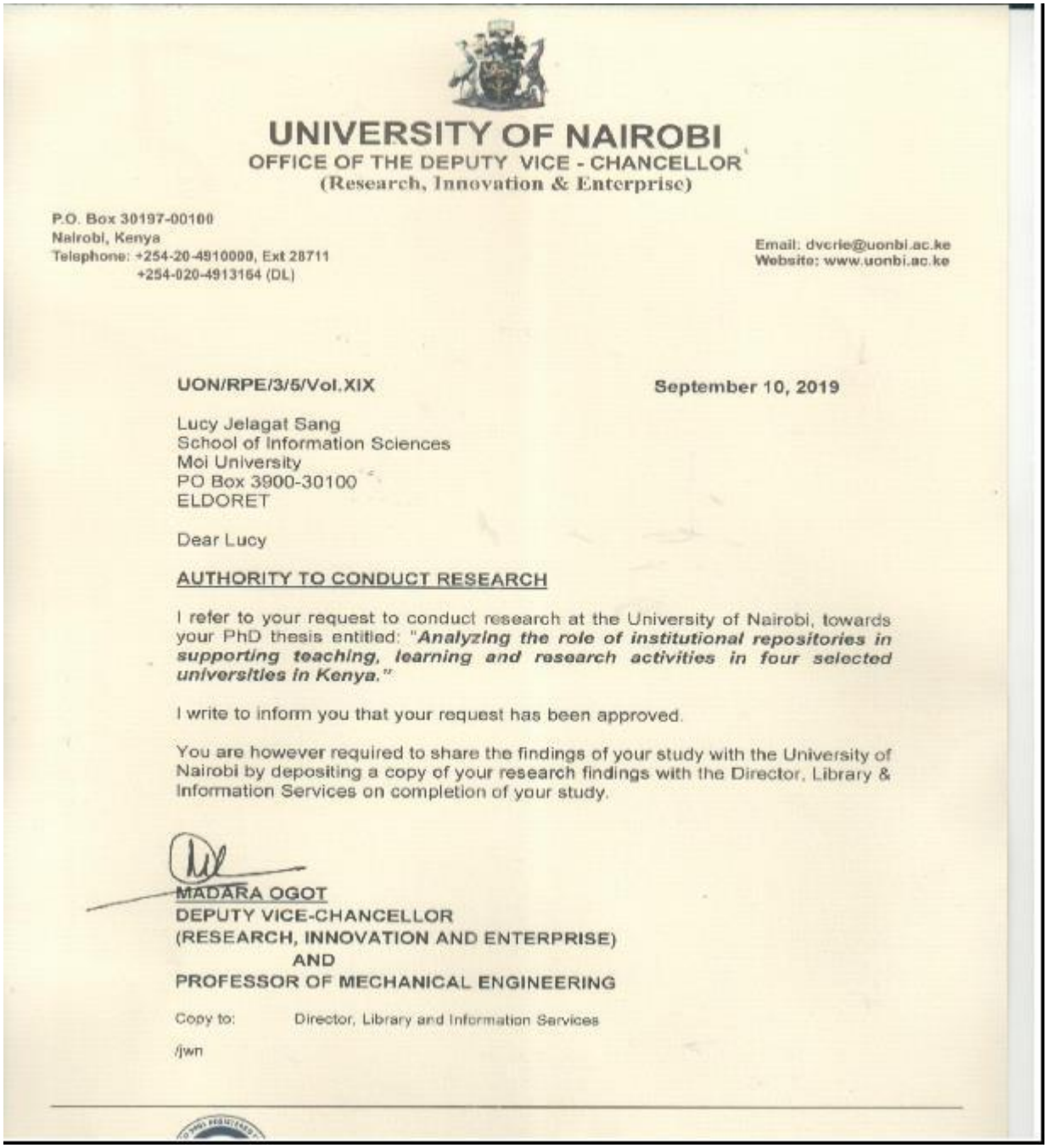
I am a PhD student currently enrolled at the School of Information Sciences, Moi University, Eldoret. I am conducting a study on *analyzing the role of institutional repositories in supporting teaching, learning and research activities in four selected universities in Kenya*, and have selected University of Nairobi as one of my case studies. The aim of the study is to investigate the role of institutional repositories (IRs) in supporting teaching, learning and research activities in universities in Kenya with a view to proposing an appropriate model to improve service provision.

I will be collecting data using interviews and questionnaires from respondents who are postgraduate and undergraduate students' academic staff; the University Librarian, System Librarian and Representative of Research Department at University of Nairobi.
Attached herewith, please find a copy of my research permit issued by the National Commission for Science, Technology and Innovation and copies of my data collection instruments.
I am kindly requesting that you allow me to conduct research in your institution.

Yours Sincerely,

Lucy Jelagat Sang

APENDIX 10: RESEARCH AUTHORIZATION-UNIVERSITY OF NAIROBI



UNIVERSITY OF NAIROBI
OFFICE OF THE DEPUTY VICE - CHANCELLOR
(Research, Innovation & Enterprise)

P.O. Box 30197-00100
Nairobi, Kenya
Telephone: +254-20-4910000, Ext 28711
+254-020-4913164 (DL)

Email: dvcrie@uonbi.ac.ke
Website: www.uonbi.ac.ke

UON/RPE/3/5/Vol.XIX

September 10, 2019

Lucy Jelagat Sang
School of Information Sciences
Moi University
PO Box 3900-30100
ELDORET

Dear Lucy

AUTHORITY TO CONDUCT RESEARCH

I refer to your request to conduct research at the University of Nairobi, towards your PhD thesis entitled: "***Analyzing the role of institutional repositories in supporting teaching, learning and research activities in four selected universities in Kenya.***"

I write to inform you that your request has been approved.

You are however required to share the findings of your study with the University of Nairobi by depositing a copy of your research findings with the Director, Library & Information Services on completion of your study.

MADARA OGOT
DEPUTY VICE-CHANCELLOR
(RESEARCH, INNOVATION AND ENTERPRISE)
AND
PROFESSOR OF MECHANICAL ENGINEERING

Copy to: Director, Library and Information Services

/jwn

APPENDIX 11: REQUEST TO CONDUCT RESEARCH-STRATHMORE

Lucy Jelagat Sang
P.O. Box 673-30100,
Eldoret
Cell: 0721421544
E-mail: sanglucy45@gmail.com
15/12/2019

The Dean, Research and Innovation
Strathmore University
P.O Box 59857, 00200, City Square
Nairobi
Kenya

Dear Sir/Madam,

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT STRATHMORE UNIVERSITY

I am a PhD student currently enrolled at the School of Information Sciences, Moi University, Eldoret. I am conducting a study on *analyzing the role of institutional repositories in supporting teaching, learning and research activities in four selected universities in Kenya*, and have selected Strathmore University as one of my case studies. The aim of the study is to investigate the role of institutional repositories (IRs) in supporting teaching, learning and research activities in universities in Kenya with a view to proposing an appropriate model to improve service provision.

I will be collecting data using interviews and questionnaires from respondents who are postgraduate and undergraduate students', Academic staff, the University Librarian, System Librarian and Representative of Research Department at Strathmore University.
Attached herewith, please find a written request letter; a copy of my research permit issued by the National Commission for Science, Technology and Innovation; introductory letter from the institution and extract of the proposal with data collection tools.
I am kindly requesting that you allow me to conduct research in your institution.

Yours Sincerely,

Lucy Jelagat Sang

APPENDIX 12: REQUEST TO CONDUCT RESEARCH-USIU-A

Lucy Jelagat Sang
School of Information Sciences,
Moi University,
P.O. Box 3900-30100,
Eldoret
Cell: 0724421544
E-mail: sanglucy45@gmail.com
9/01/2020

The DVC Research and Program Development
United States International University-Africa
P.O Box 14634-00800,
Nairobi
Kenya

Dear Sir/Madam,

RE: REQUEST FOR PERMISSION TO CONDUCT RESEARCH AT UNITED STATES INTERNATIONAL UNIVERSITY-AFRICA

I am a PhD student currently enrolled at the School of Information Sciences, Moi University, Eldoret. I am conducting a study on *analyzing the role of institutional repositories in supporting teaching, learning and research activities in four selected universities in Kenya*, and have selected United States International University -Africa as one of my case studies. The aim of the study is to investigate the role of institutional repositories (IRs) in supporting teaching, learning and research activities in universities in Kenya with a view to proposing an appropriate model to improve service provision.

I will be collecting data using interviews and questionnaires from respondents who are postgraduate and undergraduate students', Academic staff, the University Librarian, System Librarian and Representative of Research Department at United States International University-Africa

Attached herewith, please find a copy of my research permit issued by the National Commission for Science, Technology and Innovation; introduction letter from the institution; my request letter; IRB approval and research proposal with data collection instruments
I am kindly requesting that you allow me to conduct research in your institution.

Yours Sincerely,

Lucy Jelagat Sang

APPENDIX 13: RESEARCH APPROVAL-USIU-A

United States International University-Africa

USIU-A Institutional Review Board (IRB)

7th January, 2020

Lucy Sang
United States International University-Africa
sanglucy45@gmail.com
USIU-A/IRB/102-2020

Dear Lucy,

IRB-RESEARCH APPROVAL.

The USIU-A IRB has reviewed and granted an ethical approval for the research proposal titled "**Analyzing the Role of Institutional Repositories in Supporting Teaching, Learning and Research in Four Selected Universities in Kenya.**"

The approval is for **twelve months** from the date of IRB. A Continuing Review application must be approved within this interval to avoid expiration of IRB approval and cessation of all research activities. A mid-term report and a final report must be provided to the IRB within the twelve months approval period. All records relating to the research (including signed consent forms) must be retained and available for audit for at least 3 years after the research has ended.

You are advised to follow the approved methodology and report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

Should you or study participants have any queries regarding IRB's consideration of this project, please contact irb@usiu.ac.ke.

Sincerely,

Dr. Juliana Namada,
IRB chair
Tel: +254 730 116 628
Email: jnamada@usiu.ac.ke

APPENDIX 14: RESEARCH AUTHORIZATION –USIU-A

United States International University-Africa

Lucy Sang
sanglucy45@gmail.com

10th January 2020

Dear Lucy,

REF: PERMISSION TO CONDUCT RESEARCH AT USIU-AFRICA

Following your request to conduct research at USIU-Africa on the topic "**Analyzing the Role of Institutional Repositories in Supporting Teaching, Learning and Research in Four Selected Universities in Kenya**" the university's Research Office has authorized you to collect data from the respondents in the Institution.

However the university imposes the following conditions:

1. No personal information will be asked of the respondents.
2. You will share the preliminary report findings with us prior to completion.
3. You will provide a copy of the completed research to us.
4. Under no circumstances will the information obtained from USIU-Africa be re-used or disclosed for other purposes.

Your research period expires on 10 April, 2020. Kindly contact the undersigned to confirm your acceptance to the condition stated above.

Sincerely,

Prof. Amos Njuguna,
Dean- School of Graduate Studies, Research and Extension.
Tel: 0730116442
Email: amnjuguna@usiu.ac.ke

APPENDIX 15: INTERFACES OF MOI UNIVERSITY AND UoN IRs

Communities in DSpace Moi University

Choose a community to browse its collections.

Archives (/jspui/handle/123456789/1)
Conferences, Workshops and Seminars (/jspui/handle /123456789/2)
Doctor of Philosophy Theses (/jspui/handle/123456789/3)
Inaugural Lectures (/jspui/handle/123456789/4)
Masters Theses (/jspui/handle/123456789/5)
Policies (/jspui/handle/123456789/1483)
Research Publications (/jspui/handle/123456789/7)

Communities in UoN Digital Repository

Select a community to browse its collections.

Archives [8758]

Books [2032]
Conference/ Workshop/ Seminar/ Proceedings [7304]
Journal Articles [28088]
Lectures and Speeches [106]
Microfilm Collection [16233]
Policies/ Reports/ Newsletters [601]
Policy Briefs [4]
Research Papers [2308]
Theses and Dissertations [40358]
University Projects / Collaborations [538]
UoN Digital Health Repository [558]

Source: MU and UoN IRs

APPENDIX 16: INTERFACES OF STRATHMORE UNIVERSITY (SU) AND USIU-AIRs

Communities in SU+

Select a community to browse its collections.

Conferences / Workshops / Seminars + [215]
Digital Archives [174]
Research and Publications [2294]
Strathmore Heritage Collection [41]
SU+ Depository [1]
University CaseBank [4]
University ExamsBank [196]

USIU-A Digital Repository

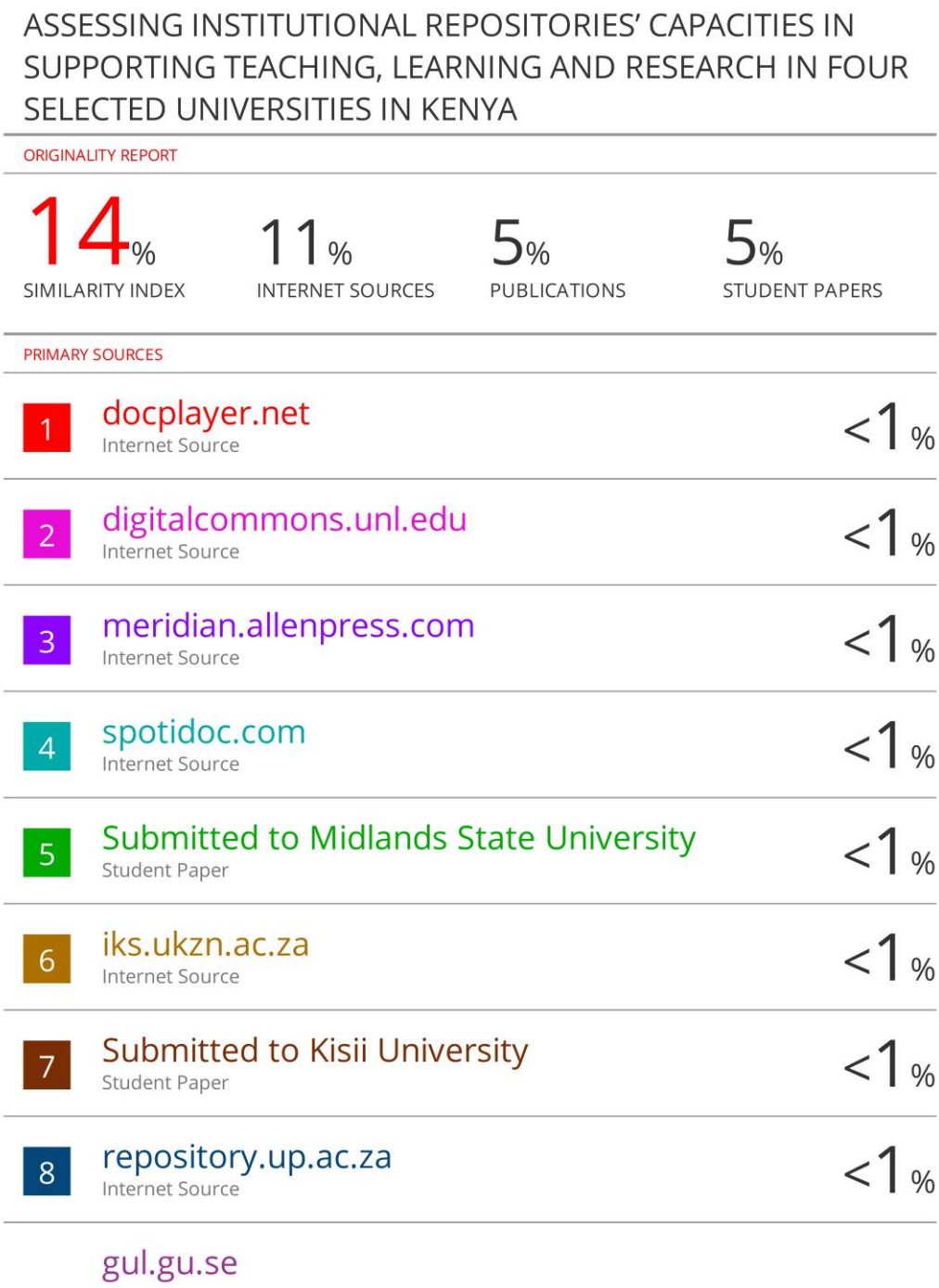
Welcome to the United States International University Digital repository that collects, preserves, and distributes Scholarly outputs of USIU-A.

Communities in Repository

Select a community to browse its collections.
Archives (/handle/11732/1097) [90]
Books and Book chapters (/handle/11732/269) [149]
Conferences/Workshops/Seminars (/handle/11732/1) [364]
Journal Articles (/handle/11732/7) [1321]
Newsletters and Magazines (/handle/11732/15) [199]
Newspaper Articles (/handle/11732/1468) [183]
Press Releases and Media Mentions (/handle/11732/3436) [93]
Research Centre Collection (/handle/11732/16) [85]
Theses and Dissertations (/handle/11732/17) [2851]
Undergraduate Projects (/handle/11732/22) [0]

Source: SU and USIU-A IRs

APPENDIX 17: PLAGIARISM REPORT



ASSESSING INSTITUTIONAL REPOSITORIES' CAPACITIES IN SUPPORTING TEACHING, LEARNING AND RESEARCH IN FOUR SELECTED UNIVERSITIES IN KENYA

ORIGINALITY REPORT

14%	11%	5%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

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4	spotidoc.com Internet Source	<1%
5	Submitted to Midlands State University Student Paper	<1%
6	iks.ukzn.ac.za Internet Source	<1%
7	Submitted to Kisii University Student Paper	<1%
8	repository.up.ac.za Internet Source	<1%
	gul.gu.se	