SUSTAINABILITY OF INSTITUTIONAL REPOSITORIES IN SELECTED PUBLIC UNIVERSITIES IN GHANA

by

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Open Rubric

DECLARATION

Student Number: **55772676**

I declare that this study, **"Sustainability of institutional repositories in selected public universities in Ghana"**, is my work and that works cited in this study have been acknowledged by using complete references.

I further declare that that no of this work has been presented for another degree in this university or elsewhere and that this thesis has been subjected to Turnitin check and found to be within the accepted originality requirement.

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……

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DEDICATION

To late father, Mr. Benjamin Imoro Chamooh and my children, Alhassan, Aisha and Raheem.

"He grants Hikmah to whom He pleases, and he, to whom Hikmah is granted, is indeed granted abundant good. But none remember except men of understanding."

Quran (Surah Al-Baqara, Verse 269)

ABSTRACT

Institutional repositories are increasingly being adopted by universities in Ghana to preserve and communicate research findings and intellectual outputs to audiences within and outside the institution. Nonetheless, there is a growing concern about the sustainability of these repositories. In view of this, the study investigated the managerial and technical issues that confront the sustainability of institutional repositories (IRs) of selected public universities in Ghana. The dynamics of innovation model and the diffusion of innovation theory served as the lens that guided the study. Eight hundred and thirty (830) respondents comprising of IR managers, Library Staff (Digitalization and E-resources Units), Post Graduate Students, Lecturers, and University Librarians from five public universities in Ghana were sampled for the study using multiple sampling techniques. The study yielded an overall response rate of 92.8%. Data was collected using self-administered questionnaires, a semi-structured interview guide, and the analysis of IR policies and websites. The internal consistency reliability of the research instruments was tested using the Cronbach alpha (α=0.81).

The quantitative data that was collected through a questionnaire was analysed descriptively using the SPSS software. The qualitative data was analysed using NVivo software. The transcribed interview responses were imported into NVivo software and categorised into nodes or themes based on the research questions. Both the qualitative data and quantitative data were integrated at the discussion stage of the study.

The findings of the study revealed that the concept of IRs is not new in Ghana. However, inadequate funding, ICT Infrastructure, bandwidth, publisher copyright restrictions and the lack of technical staff for system development and management of IRs were identified as major challenges that confront IR participation and threatens its long-term survival and sustainability in Ghana. Also, IR policies guided content submission, usage, operation and management of repositories in public universities in Ghana. However, content submission to IRs by faculty members was found to be low. This was largely attributed to the persuasive nature of the IR policies. The study recommends the need for a policy implementation strategy and

underscores the importance of policy in addressing the numerous challenges that threatens the sustainability of the IRs. Consequently, it proposes a framework that may contribute to ensuring the sustainability of the IRs in public universities in Ghana.

KEY WORDS

Electronic resources; Information Communication Technology; Institutional Repositories; Open access; Technical; Managerial; Public University, Sustainability; Ghana; Policy; Dspace.

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ACRONYMS AND ABBREVIATIONS

ANBL	Alfa Network Babel Library
ANT	Actor-Network Theory
BSD	Berkeley Source Distribution
CARLIGH	Consortium of Academic and Research Libraries in Ghana
DOI Theory	Diffusion of Innovation Theory
e-book	Electronic book
e-governance	Electronic governance
e-resource	Electronic resource
HP	Hewlett-Packard
ICT	Information and communication technology
INASP	International Network for the Availability of Scientific Publications
IR	Institutional repository
IT	Information technology
KIT	Karisruhe Institute of Technology
KNUST	Kwame Nkrumah University of Science and Technology
LAMP	Linux, Apache, MySQL, PHP/Perl/Python
LIS	Library and Information Science
MIT	Massachusetts Institute of Technology
MS	Microsoft
OAIR	Open Access Institutional Repository
OpenDOAR	Directory of Open Access Repositories
OSS	Open Source Software
PDF	Portable document format
ROAR	Registry of Open Access Repositories
SCOT theory	Social Construction of Technology theory
SIN theory	Socio-technical Interactions Networks theory
SPSS	Statistical Package for the Social Sciences
SST Theory	Social Shaping of Technology Theory
THE	Times Higher Education
TPaCK	Technological pedagogical content knowledge
UCC	University of Cape Coast

UDS	University for Development Studies
UENR	University of Energy and Natural Resources
UEW	University of Education, Winneba
UG	University of Ghana
UHAS	University of Health and Allied Sciences
UMaT	University of Mines and Technology, Tarkwa
Unisa	University of South Africa
UPSA	University of Professional Studies, Accra
USA	United States of America

CHAPTER ONE:
INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 INTRODUCTION

Institutional repositories (IRs) have widely been accepted because of its perceived benefits to institutions, authors, and users. Ashikuzzaman (2018) believes that IRs provide academics, researchers, and students with the opportunity to communicate their research findings and intellectual outputs to audiences outside their institutions. As online archives, IRs may contain scholarly papers, data sets, institutional policies, speeches, course outlines, handouts, or presentations. They provide a platform for preserving and disseminating these information resources in a manner that promotes quick, unlimited access and retrieval (Ukwoma & Dike 2017). Lynch (2003:330) defines IRs 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". Burns, Lana and Budd (2013:1) identify IRs as electronic libraries that collect scholarly and intellectual writings authored by members of an institution. IRs provide tools that help faculty members, students, and researchers to disseminate an institution's scholarly and intellectual resources to audiences within and outside the institution.

Information and communication technologies (ICTs) have brought about an evolution in the way universities and their libraries collect, store, preserve and make accessible to others their research outputs and intellectual collections. However, one area that seems to have gained the attention of researchers, librarians, and users of digital information is the preservation of these information resources for future consumption (Gaur & Tripathi 2012). According to Li and Banach (2011), even though ICTs have resulted in a remarkable increase in our capacity to record information over time, the rapid and continuous changes in storage mediums, software, and information technology (IT) infrastructure poses a serious preservation challenge for librarians and archivists. The archiving of electronic/digital information has now become a challenge for most libraries and other information centres due to the complexities involved in preservation, such as funding, personnel, and

technological obsolescence (Debreczeni 2015; Li & Banach 2011; Rinehart, Prud'homme & Huot 2014; Houghton 2015; Adu & Ngulube 2017).

In the quest to preserve their digital and non-digital collections amidst budgetary cuts (Savova & Price 2019; American Library Association 2018; Sutton 2017; Hoskins & Stilwell 2011), the increasing cost of scholarly information (Shu, Mongeon, Haustein, Siler, Alperin & Larivière 2018; Rose-Wiles 2011; Harnad, Brody, Vallières, Carr, Hitchcock, Gingras & Hilf 2008), and an increase in advocacy for open science (Kodua-Ntim & Fombad 2020; Sanjeeva & Powdwal 2017; Tennant, Waldner, Jacques, Masuzzo, Collister & Hartgerink 2016), most university libraries have now resorted to Open Access Institutional Repositories (OAIRs) as a way of promoting, preserving, and distributing institutional scholarly output. In recent times, Open Access has become one of the most discussed modes of scholarly communication, largely because of the proliferation of scholarly writings, budget cuts, and advocacy in support of open access to research outputs (Budd 2013; Agyen-Gyasi, Corletey & Frempong 2012; Suber 2012). The Open Access initiative strongly advocates for the removal of monetary or legal barriers to the dissemination of scholarly information (Heller, Moshiri & Bhargava 2013) and has facilitated the scholarly communication process by ensuring quick and universal access to intellectual content that might otherwise be available to only a select few (Tennant et al. 2016). Open Access therefore allows all categories of persons to fully participate in the scholarly communication process.

Despite an increase in the adoption of IRs globally, there is a growing concern regarding the sustainability of OAIRs (Francke, Gamalielsson, & Lundell 2017; Nkiko, Bolu & Chijioke 2014; Burns et al. 2013). Like all new ICT driven innovations, maintenance and running cost, perceptions or attitudes towards change or innovations, ICT infrastructure, content quality, institutional policies, copyright, and skill sets or competencies of personnel have been identified as critical to the sustenance of IRs in Ghana (Corletey 2011; Thompson et al. 2016; Martin-Yeboah et al. 2018; Anyaoku et al. 2019). Addressing these factors offers academic institutions in Ghana the opportunity to contribute effectively to the scholarly communication process and the country's socio-economic development, especially in

this current information and knowledge economy where access to information has been identified to be critical to societal development and growth.

In view of this, access to information and knowledge is enshrined in goal 16, target 10, of the Sustainable Development Goals. The Sustainable Development Goals, a global initiative to promote peace and prosperity, end poverty and hunger, and protect human freedoms, are anchored in public access to quality information. Goal 16, Target 10, emphasises the need for strong solid institutions to promote or guarantee citizens' right to information based on national and international laws and treaties. Institutional repositories, therefore, present nations with the opportunity to ensure that their citizens have unlimited access to high-quality research outputs.

1.2 CONTEXTUAL SETTING

Ghana was fully connected to the Internet in 1995 (Quarshie & Ami-Narh 2012). With a population of 28.83 million, mobile data subscriptions accounted for 76.8% of the population as of June 2017 (National Communication Authority 2017). About 10.1 million Ghanaians, representing 34.3% of the population, used the Internet as at December 2017 (World Internet Stats 2018). The high increases in mobile penetration rates and internet usage has largely been attributed to the alteration of the average Ghanaian's social, economic, and cultural life, especially in the area of education, commerce, and entertainment (Quarshie & Ami-Narh 2012; Yebowaah 2018; Asare-Donkoh 2018). Over the years, the Government of Ghana has made numerous investments and enacted several policies to ensure the integration and utilisation of ICTs in the educational sector. Indeed, the impact of the Internet on education has become even more profound due to the emergence of digital learning (Adarkwah 2021), as more and more educational institutions are adopting online or blended approaches to teaching and learning due to the COVID-19 pandemic.

Various studies have outlined the importance of the Internet and ICTs for educational outcomes (Quarshie & Ami-Narh 2012; Kumar & Manjunath 2013; Yebowaah 2018; Asare-Donkoh 2018). In view of this, ICT education forms a crucial part of the Ghanaian education syllabus, especially at the elementary and second cycle school levels. Education in Ghana is divided into three phases: basic school education

(kindergarten, primary school, and junior high school), second cycle education (senior high school, technical and vocational education, and training schools) and tertiary education (universities, technical universities, colleges of agriculture, colleges of education, and nursing training colleges). Currently, Ghana boasts 164 tertiary institutions (nine public universities, eight professional institutions, 65 private tertiary education institutions, 10 technical universities, three colleges of agriculture, 44 colleges of education, and 25 nursing training colleges) (National Accreditation Board 2018).

The National Accreditation Board (2018) reports a steady increase in student enrolment into tertiary institutions. The increased demand for tertiary education in Ghana has largely been attributed to an increased awareness of the benefits of higher education among the Ghanaian populace, the adoption of ICT tools for teaching and learning, and the introduction of distance education, sandwich, and weekend school models by most tertiary institutions (Hordzi 2013). The Internet and ICTs have transformed the scholarly environment and the management of information resources (Eghworo, Ogo & Ayomanor 2015). This is because the Internet and ICT tools have led to the creation of borderless platforms that offer researchers and students the opportunity to work collaboratively and widely access resources and knowledge (Mohammed 2013; Tiwari & Gandotra 2018). In view of this, university libraries in Ghana are increasingly using ICT tools for the preservation, dissemination, and delivery of information resources and services to their clients (Amofah-Serwaa 2018; Ibrahim, Asiedu & Aikins 2017; Arman 2009). One such tool is IRs.

IRs are online archives responsible for the preservation and dissemination of an institution's research and scholarly outputs. These are usually generated by members of the institution (McCord 2003). The basic role of an IR is to showcase the scientific and scholarly publications of an institution to audiences both within and outside that institution (Alfa Network Babel Library 2007). For many academic and research institutions, their IRs would typically contain materials such as preprints of journal publications, peer reviews, and electronic or digitised versions of theses and

dissertations, as well as other institutional documents such as speeches, inaugural lectures, and administrative notes.

Currently, five out of the nine public universities in Ghana have IRs (National Accreditation Board 2018). The Kwame Nkrumah University of Science and Technology (KNUST) was the first university in Ghana to establish a fully-functional IR and did so in October 2008 (Corletey 2011; Agyen-Gyasi et al. 2012), followed by the University of Ghana (UG), the University of Cape Coast (UCC), the University of Education, Winneba (UEW) (Corletey 2011), and the University for Development Studies (UDS) (Thompson, Akeriwe & Achia 2016). All the above-mentioned IRs were created to promote academic scholarship, productivity, and prestige, as well as to boost the global visibility and utility of the institutions' research (Tiwari & Gandotra 2018). However, content quality, lack of deposits, copyright issues, and a lack of personnel able to manage these repositories have been identified as major constraints that threaten the sustainability of IRs (Li & Banach 2011; Okoroma 2018a; Anyaoku, Echedom & Baro 2019). This study therefore sought to investigate the above sustainability issues, suggest measures that may contribute towards solving the problem, and possibly also serve as a blueprint for other institutions that are planning to set up repositories.

1.2.1 Public universities in Ghana

Universities are institutions of higher learning incorporated basically to impact knowledge and drive social change through the production of highly skilled personnel in consonance with national and international manpower needs. According to Chan (2016:5), university education is a critical component of human development, as it is the level within any educational system where individuals develop the critical thinking and analytical skills needed to drive social and economic change. In view of this, universities are not established in isolation; they are established with the aim of addressing industrial and market demands.

At the commencement of this research, Ghana had nine fully-functional public universities, namely: University of Ghana (UG); University of Cape Coast (UG); Kwame Nkrumah University of Science and Technology (KNUST); University of

Education, Winneba (UEW); University for Development Studies (UDS); University of Mines and Technology (UMaT), Tarkwa; the University of Professional Studies, Accra (UPSA); the University of Energy and Natural Resources (UENR); and the University of Health and Allied Sciences (UHAS). As briefly outlined, all of the aforementioned universities were established at different times to address the manpower needs of the country at that particular time.

1.2.1.1 University of Ghana

Located in Accra, the capital of Ghana, the UG is the premier and oldest university in Ghana, established on 11 August 1948. It was initially established as the University College of the Gold Coast with the primary aim of providing and enhancing university education within the Gold Coast. From a humble beginning as a university college and looking to the Inter-Universities Council of the Great Britain and the University of London for policy guidance, quality control, and accreditation, the university college become a fully-fledged university on 1 October 1961 under the University of Ghana Act (Act No 79) of 1961. The then President of the Republic of Ghana, Dr Kwame Nkrumah, became the first chancellor of the university, with Nana Kobina Nketsia IV (Omanhene of Essikado) as the (interim) vice chancellor.

With a student population of about 36,819 and a male to female ratio of about 45:55, the UG is ranked the 20th best university in Africa by the Times Higher Education (THE) Ranking of 2020 (THE 2020). Currently, the university offers more than 60 diploma and degree programmes at both the graduate and undergraduate levels in various disciplines. As the pioneer of university education in Ghana, the university has made significant investments in upgrading its ICT infrastructure and had a fully-functional IR by 2011. The IR manager is responsible for the day to day operation of the UG IR (UGSpace) with the University Librarian having oversight responsibility. Currently, the UGSpace holds a total of 2,261 theses/dissertations and 2,080 research articles. The university's IR is connected to the Internet at http://ugspace.ug.edu.gh/.

1.2.1.2 University of Cape Coast

The UCC is located in Cape Coast, the capital of the Central Region of Ghana. The UCC was established as a university college in October 1962 with the sole mandate of training graduate professional teachers for Ghana's second cycle institutions and the Ministry of Education. This was to ensure that the manpower needs of the country's accelerated educational programme were adequately met. As a university college, the college was placed under the supervision of the UG until October 1971, when it attained the status of a fully independent university (University of Cape Coast Act, Act No 390 of 1971).

With an initial mandate of providing degrees, diplomas, and certificates in education, economics, and social studies, UCC now offers over 70 programmes across various academic disciplines. From an initial student enrolment of 155 in 1963, the UCC now has a total student population of 74,720 (comprising of regular, sandwich, and distance students) at both graduate and undergraduate levels (UCC 2020). The university is ranked the 4th best university in Africa by the THE Ranking of 2022 (THE 2022).

Taking after the successes of the KNUST, the UCC, with support from the Consortium of Academic and Research Libraries in Ghana (CARLIGH) and the International Network for the Availability of Scientific Publications (INASP), established its IR in 2011 (Corletey 2011). From an initial upload of about 436 full text theses/dissertations, the UCC's IR (UCCSpace) currently holds a total of 1,874 full text theses/dissertations and 173 university publications. The UCCSpace is managed by a management committee, a sub-committee of the Library Board (UCC, 2012). The management committee is chaired by the University Librarian and is responsible for determining the policies and standards that governs the submission, preservation and dissemination of the contents of the UCCSpace. However, the IR manager is tasked with the day to day operation of the IR. The UCCSpace is connected to the Internet at https://erl.ucc.edu.gh/dspace/.

1.2.1.3 Kwame Nkrumah University of Science and Technology

Located in Kumasi, the Ashanti region of Ghana, KNUST was initially established as the Kumasi College of Technology under ordinance on 22 January 1952. The KNUST became a full-fledged university on 22 August 1961 by the Kwame Nkrumah University of Science and Technology, Kumasi Act (Act No 80) of 1961. Its mandate was to provide higher education, undertake research, disseminate knowledge, and foster relationships in the areas of science and technology. It is the second largest university in Ghana with an estimated student population of 55,000 students undergoing both graduate and undergraduate programmes.

The KNUST was the first university in Ghana to establish a fully-functional IR in 2008. With an initial deposit of 560 postgraduate theses (Agyen-Gyasi et al. 2012), KNUST's IR (KNUSTSpace) currently hosts 505 conference proceedings, 4,756 research articles, 337 speeches, and 9,318 thesis and dissertations. The KNUSTSpace is managed by a management committee, a sub-committee of the Library Committee (KNUST, 2008). The management committee is chaired by the University Librarian meets every quarter. Its sole responsible is to determine policies and standards that governs content submission, preservation and dissemination as well ensure the smooth running of KNUSTSpace services. However, the IR manager is tasked with the day to day operation of the IR. The KNUSTSpace is host on the Internet at http://ir.knust.edu.gh/

1.2.1.4 University of Education, Winneba

Originally the University College of Education of Winneba, the UEW became a fully-fledged university on 14 May 2004 under the University of Education, Winneba Act (Act No 672) of 2004. Formed out of the amalgamation of seven diploma awarding institutions, the UEW was established with the sole purpose of training professional educators to spearhead Ghana's educational reform efforts along the path of rapid economic and social development. The university has a student population of 59,916 (comprising regular, sandwich, and distance students) at both graduate and undergraduate levels (UEW 2017) offering over 140 academic programmes.

With training and technical support from the CARLIGH and the INASP, the UEW established its first IR in 2011 (Corletey 2011). However, the first server crashed, bringing the project to a halt until 2016 when the project was revived. Currently, the UEW's IR (UEWRep) hosts 165 theses and dissertations, 8 conference proceedings, 10 book chapters and reviews, and 99 works in progress. The UEWRep is managed by a Management Committee chaired by the Pro-Vice Chancellor (UEW, n.d). The University Library is responsible for the day to day running of the UEWRep under the supervision of a three-member Working Committee (UEW, n.d). The Working Committee consisting of the University Librarian, the IR Manager and a Librarian not below the rank of Assistant Librarian submits quarterly reports to the Management Committee. The UEWRep is connected to the Internet at http://ir.uew.edu.gh/.

1.2.1.5 University for Development Studies

Located in Tamale, the capital of the Northern Region of Ghana, the UDS was established in May 1992 under the Provisional National Defence Council Law 279. The sole purpose of establishing the university was to accelerate developments in the northern parts of Ghana. With an initial population of 40 students, the UDS currently has a student population of 19,720 and offers 120 academic programmes at both graduate and undergraduate levels. The UDS has four campuses (Tamale, Nyankpala, Navrongo, and Wa). Tamale hosts both the main and city campuses. They city campus hosts most of its postgraduate programmes.

The UDS's IR (UDSspace) was established in 2011 with training and technical support from the CARLIGH and the INASP. Currently, the UDSspace hosts a total of 2,225 publications, comprising theses and dissertations, inaugural lectures, seminars, and conference proceedings. They UDSspace is managed by a working committee called the UDSspace team. The UDSspace team is made of the IR manager, Librarians and Library IT staff (Thompson, Akeriwe & Aikins, 2016). The team is responsible for the day to day operation of the UDSSpace and reports to the University Librarian. The UDSSpace is hosted online at http://udsspace.uds.edu.gh/.

1.2.1.6 University of Mines and Technology, Tarkwa

Situated in Tarkwa, the mining hub of the western region, UMaT was established on 3 November 1952 as the Tarkwa Technical Institute. It became a fully-fledged university in November 2004 by an Act of the Parliament of the Republic of Ghana, namely the University of Mines and Technology, Tarkwa Act (Act No 667) of 2004, with the sole mandate of providing high level education and professional services in mining, petroleum, technology, and allied disciplines. The UMaT has a current student population of about 1,527, consisting of 1,350 undergraduate students and 177 graduate students. The university as two-storey modern library complex that serves as the main library, with satellite libraries located in the various colleges, departments, and halls.

The library houses a wide range of relevant printed and electronic material across the various academic programmes offered at the university itself. The library's collection consists of print monographs, periodicals, online databases, and electronic books (e-books). At the commencement of this study in March, 2021, the University did not have a functional IR. The university library is connected to the Internet at http://www2.umat.edu.gh/sd/library/.

1.2.1.7 University of Professional Studies, Accra

Formerly known as the Institute of Professional Studies, the UPSA become a fully-fledged university in 2012 by an Act of the Parliament of the Republic of Ghana, namely the University of Professional Studies Act (Act No 850) of 2012. Situated in Accra, it is the first university in Ghana to provide both academic and professional business education. From a population of only five students in 1965, UPSA currently has a total of 15,000 students at both graduate and undergraduate levels and was ranked 301st by the THE Ranking of 2019 (THE 2019). As at December, 2021, the University did not have a functional IR. However, the university has well-resourced library, with some of its resources hosted online at https://upsa.edu.gh/index.php/library/library-services.

1.2.1.8 University of Energy and Natural Resources

The UENR was established on 31 December 2011 under the University of Energy and Natural Resources Act (Act No 830) of 2011. It was established with the focus of training high level manpower with expertise for the management and exploitation of the country's energy and natural resources. The university has three campuses, namely, Sunyani, Nsoatre, and Dormaa Ahenkro. The main campus is in Sunyani, the capital of Bono Region. The university offers 43 academic programmes at both graduate and undergraduate levels. At the commencement of this study, the University did not have an IR. The university is connected to the Internet at https://www.uenr.edu.gh/.

1.2.1.9 University of Health and Allied Sciences

Located in the Volta Region of Ghana, the UHAS is one of the youngest universities in Ghana. Established in December 2011 under the University of Health and Allied Sciences Act (Act No 828 of 2011) by the Parliament of the Republic of Ghana, the UHAS is mandated to provide practical and community-oriented health education at both graduate and undergraduate levels. The university has campuses at Ho and Hohoe. The Ho campus is the main and central administrative campus, while the Hohoe campus hosts the School of Public Health. From an initial population of 154 students, the UHAS currently has a student population of 3,752 (3,727 undergraduates and 25 postgraduates). The UHAS library has a growing collection of over 6,000 print monographs, online databases, and electronic resources (e-resources). At the commencement of this study, the University did not have an IR. The university library is connected to the Internet at https://library.uhas.edu.gh/.

1.3 PROBLEM STATEMENT

IRs have been identified as a way of ensuring the preservation of organisational intellectual resources, as well as improving access, knowledge dissemination, and scholarly communication (Agyen-Gyasi et al. 2012; Shampa 2012; Mohammed 2013; Bhardwaj 2014). IRs are increasingly being deployed in academic and research institutions for the management of the institution's intellectual resources in digital or non-print formats (Mohammed 2013).

Nonetheless, there is a growing concern regarding the sustainability of these repositories in developing countries such as Ghana. Few studies on the attrition of repositories in Ghana have focused on setup cost, software engineering protocols, marketing, and promotion (Corletey 2011; Thompson et al. 2016; Martin-Yeboah, Alemna & Adjei 2018a). Similarly, others studies have identified funding, content quality, institutional policies, copyright, and personnel competencies as key technical and managerial issues that confront the sustainability of repositories in Africa (Dawson & Yang, 2016; Oguche, 2018; Baker & Kunda, 2019). Anyaoku et al. (2019) investigated the digital preservation practices of university libraries in sub-Saharan Africa. They revealed that university libraries in sub-Saharan Africa lacked funding and the technical expertise required to effectively and efficiently manage their IRs. Aliyu, Musa and Amin (2014) examined the challenges and prospects of IRs in Nigeria. They identified the constant change in hardware and software, copyright issues, and technical support as the major challenges facing IRs in Nigeria. In a similar study conducted in Ghana, Agyen-Gyasi et al. (2012) identified inadequate ICT connectivity and infrastructure, unreliable power supply, inadequate funding, copyright issues, and technical barriers as major challenges that threaten the sustainability of IRs.

These technical and managerial challenges, if not adequately addressed can negatively affect content submission and usage, thereby threatening the sustainability of these IRs. It is, therefore, paramount that challenges that threaten the survival of IRs are properly investigated and addressed. However, there is limited research from Ghana on the long-term sustainability and operations of IRs, especially within the academic setting (Corletey 2011; Thompson et al. 2016; Martin-Yeboah et al. 2018b; Anyaoku et al. 2019). The current study, therefore, examined the technical and managerial that threaten the longevity of the IRs in public universities in Ghana and suggests measures to curb these threats. The recommended measures will form part of a framework that might enable libraries and other stakeholders to gain adequate insights into the factors that threaten the longevity of IRs and counteractions, which will contribute to the sustainability of IRs in public universities in Ghana.

1.4 PURPOSE, OBJECTIVES, AND RESEARCH QUESTIONS OF THE STUDY

The following purpose, objectives, and research questions guided the study.

1.4.1 Purpose of the study

This study aimed to explore the managerial and technical issues confronting the sustainability of IRs in public universities in Ghana and makes recommendations that will help ensure the sustainability of IRs at these universities.

1.4.2 Research objectives

The study objectives were:

1. To examine how the various stakeholder groups (faculty members, students, and librarians) in public universities in Ghana perceive institutional repositories.
2. To examine the role of IR policies on the sustainability of institutional repositories in public universities in Ghana.
3. To assess the technical and managerial competencies of personnel assigned to work on the institutional repositories in public universities in Ghana.
4. To examine the technical specifications of institutional repositories in Ghana.
5. To examine the contents of institutional repositories in Ghana.
6. To examine the procedures for submitting content to institutional repositories in Ghana.
7. To identify challenges to the sustainability of institutional repositories in Ghana.
8. To recommend to stakeholders strategies for improving on the sustainability of institutional repositories in Ghana.

1.4.3 Research questions

The following research questions guided the study:

1. How do the various stakeholder groups (faculty members, students and IR staff) perceive institutional repositories?
2. What is the role of IR policies in ensuring the sustainability of institutional repositories in Ghana?

3. What are the technical and managerial competencies or skill sets required of institutional repository professionals?
4. What are the technical specifications of institutional repositories in Ghana?
5. What type of documents are archived in the institutional repositories in Ghana?
6. What are the procedures for submitting content to institutional repositories in Ghana?
7. What challenges confront the sustainability of institutional repositories, according to the participants and administrators of institutional repositories at the selected public universities in Ghana?

1.5 JUSTIFICATION FOR THE STUDY

The primary reason for the justification of a study is to address fundamental questions of how the study is going to add to existing literature and improve policy and practice in that field of inquiry (Creswell, 2014:117). According to Given (2008:781), the main purpose of research justification is to illustrate the rationale for the research and show how the research will address lapses in the existing knowledge base or contribute newer dimensions or perspectives to a particular phenomenon. This study sought to investigate the management and sustainability of IRs from a technical and managerial perspective. Seemingly there is limited literature on this perspective, especially in Ghana.

The study will complement existing empirical studies on IRs in Ghana and Africa like those by Corletey (2011), Agyen-Gyasi et al. (2012), Thompson et al. (2016), Martin-Yeboah et al. (2018), and Anyaoku et al. (2019). Unlike previous studies in this area, which examined the phenomenon using purely qualitative or quantitative methods or approaches, the current research regards IRs as a technological innovation or phenomenon which can better be understood from a multivariant perspective. This study examined the technical and managerial challenges that inhibit the effective management and long-term sustainability of IRs in Ghana and suggests a framework that could ensure the sustainability of the IRs. The findings of the study will be shared among all stakeholders. Hopefully, the findings of the study study will serve as source of insightful information for future researchers, organisations and agencies

users interested in the promotion, preservation, and dissemination of high-quality scholarly and educational resources.

This study examined the IR policies that are used by individual institutions to identify the discrepancies within these policies. Based on the study findings, the study makes recommendations aimed at improving on the sustainability of institutional repositories in Ghana. Consequently, the study proposes a framework that may guide the formulation of policies for the effective operation and management IRs in public universities in Ghana.

1.6 ORIGINALITY OF THE STUDY

According to Clarke and Lunt (2014:804), originality is increasingly becoming a principal criterion for the assessment of a doctoral dissertation or thesis. The originality of a study has been referred to by many authors as the valuable insights that a study brings to an existing body of knowledge (Clarke & Lunt 2014; Cryer 1997; Gill & Dolan 2015; Phillips & Pugh 2010). Even though the concept of originality can vary greatly across academic disciplines, it commonly refers to conducting original research, providing an original technique, making improvements to past works, and replicating studies under different conditions or settings (Phillips & Pugh 2010).

A review of literature sources on IRs indicated that a significant number of research studies have been done on IRs in Ghana. However, these studies focused on the benefits, marketing, and promotion of IRs. Most of the studies (Corletey 2011; Agyen-Gyasi et al. 2012; Thompson et al. 2016; Martin-Yeboah et al. 2018) on IRs in Ghana have identified several challenges that confront the smooth operation of IRs and have recommended or provided suggestions on how these challenges may be curtailed, if not eliminated. Despite the insightful contributions of previous studies on IRs in Ghana, none of these studies have given in-depth attention to technical and managerial issues, such as content quality, copyright, intellectual property, and personnel. This study therefore sought to contribute to the body of knowledge by

providing an examination of the factors that account for the technical and managerial challenges faced by IR managers of public universities in Ghana.

As noted by Cryer (1997:193), originality of research could be based on employing different methodologies to an existing phenomenon with the view of presenting a new angle or perspective about the phenomenon under study. This study therefore sought to add to the literature by studying the phenomenon using the mixed methods approach. It is hoped that through the combination of both quantitative and qualitative methodologies, the researcher will be able to paint a holistic picture of the nature of IRs in Ghana. The information generated from this study contributed to the literature by highlighting the critical role of institutional policies in addressing the challenges confronting institutional repositories.

1.7 SIGNIFICANCE OF THE STUDY

Various scholars have acknowledged the vital role IRs play in ensuring the preservation of organisational intellectual resources and promoting organisational image and scholarship (Agyen-Gyasi et al. 2012; Shampa 2012; Mohammed 2013; Bhardwaj 2014). Given this, Richardson and Wolski (2012) noticed that IRs are increasingly being acknowledged as an essential element in the scholarly communication landscape and are increasingly being used in academic and research institutions for the management of the institution's intellectual resources (Mohammed 2013). Koler-Povh, Mikoš and Turk (2014) concluded that IRs are beneficial to everyone (authors, users, and host institutions). It is therefore important that more empirical studies on the sustainability of IRs are conducted to enable policymakers, educationists, scholars, and librarians gain adequate insights into the factors that threaten the longevity of these repositories.

Even though many studies have focused on the challenges connected to setting up IRs and the benefits of IRs for scholarship and organisational image (Agyen-Gyasi et al. 2012; Corletey 2011; Thompson et al. 2016; Anyaoku et al. 2019), there is limited research on their long-term sustainability and operation, especially within public universities in Ghana. Public universities in Ghana are the main institutions

responsible for the production and dissemination of high-quality research in Ghana and are geared towards the identification and resolution of societal problems or challenges. Therefore, this work could serve as a source of insightful information for future researchers interested in the promotion, preservation, and dissemination of scholarly research.

Secondly, certain organisations and agencies might find the findings of this study useful. Among these are academic and research institutions, regulatory agencies, libraries, and the Ministry of Education in Ghana, as these organisations share the common goal of ensuring the promotion and dissemination of high-quality scholarly and educational resources.

Thirdly, this study would be of benefit to researchers and users. For researchers seeking to improve on the theory and practice of institutional repositories, this study may serve as reference point and offer insights or suggestions on areas for further research. For researchers seeking to archive their research outputs in institutional repositories, this study hopes to clear the doubts or misconceptions about archiving in institutional repositories. It is hoped that this study would also contribute to improving repository services offered by public universities in Ghana, thereby ensuring that users have unrestricted access to high-quality intellectual and research outputs generated in public universities in Ghana.

Fourthly, the study proposed a framework for the sustainability of IRs within the Ghanaian context (see Figure 7.1). This would of benefit not only researchers and users of IRs, but might also influence management policy and decision making. It is expected to create insights on how the technical and managerial challenges that threaten the survival of IRs can be addressed.

Finally, the study provides insight into the sustainability of IRs. The findings could serve as a valuable reference to educationists and stakeholders in the academic and research institutions and help address some of the challenges confronting the management and operation of IRs.

1.8 DEFINITION OF KEY CONCEPTS

This section provides a brief overview of key concepts used throughout this study. Wherever necessary, detailed explanations of these concepts have been provided in the relevant chapters.

- *Electronic resources*

  According to Pawar and Moghe (2014:1), e-resources are “digital objects containing electronic representation of books, journals and other forms of reading materials converted into a digitized form in order to be read by a computer”. However, within the context of this study, e-resources refer to digitised intellectual or scholarly materials stored electronically and made accessible through electronic systems and computer networks.

- *Information and Communication Technology*

  ICT has been defined simply as the integration of information and telecommunication technologies for capturing, processing, storing, and transmitting information (Aliyu 2015). For the purposes of this study, ICT means any technological innovation that provides access to information electronically.

- *Institutional repositories*

  Foster and Gibbons (2005) define IRs as “electronic systems that capture, preserve and provide access to the digital work products of a community”. Burns et al. (2013) view IRs as online archives of the intellectual or scholarly outputs of an institution. In this study, IRs refer to electronic platforms that host the scientific and research outputs of a university authored by the students, faculty members, and staff of that university, which are made available to internal and external users through the Internet or World Wide Web.

- *Open Access*

  Open Access is basically based on the principle of ensuring that scientific and scholarly literature is made easily and freely accessible. According to Suber (2012), Open Access refers to universal, digital, and unconstrained online

access to institutional intellectual or scholarly outputs free from most copyright and licensing restrictions. Within the context of this study, Open Access refers to unlimited or unconstrained online access to the resources of an IR.

- *University*

  According to the National Accreditation Board (2018), a university is an educational institution designed for advanced instruction and research in several branches of learning, conferring degrees in various faculties, and often embodying colleges, schools and similar institutions. However, within the context of this study, a university refers to a tertiary level educational establishment established by an Act of Parliament of Ghana, accredited by the National Accreditation Board, and regulated by the National Council for Tertiary Education and funded by the state.

- *Sustainability*

  Sustainability is a broad term that involves the synchronisation of social, environmental, and economic factors to ensure the long-term survival of a system, be it physical or abstract (Elkington 1999). In this study, however, sustainability refers to processes and activities geared towards protecting, maintaining, developing, and increasing the value of IRs.

1.9 OVERVIEW ON THE CONCEPTUAL FRAMEWORK

The study was guided by a conceptual framework. The Dynamics of IR Innovation Model and Diffusion of Innovation (DOI) Theory were theoretical models that influenced the proposed conceptual framework. Aspects of the Dynamics of IR Innovation Model and DOI Theory were adopted because they provided an in-depth explanation of various constructs that influence the establishment, operation, and sustainability of IRs and other technical systems.

The Dynamics of IR Innovation Model is based on the proposition that IRs can only be sustainable when stakeholder intentions, concepts, and opinions are adequately identified and captured in the management and operation of IRs. The DOI Theory,

on the other hand, is a social science theory that addresses the factors that influence a person's acceptance, adoption, rejection, or continued use of IT systems. The conceptual framework formed the basis for addressing the research objectives. An in-depth explanation of the conceptual framework and how it was used in addressing the research objectives is outlined in Chapter Two.

1.10 OVERVIEW OF THE RESEARCH METHODOLOGY

The pragmatic research paradigm served as the philosophical foundation for the study. This research approach was adopted because of its flexibility, which offered the researcher the ability to look at the sustainability of IRs in Ghana from multiple viewpoints. The study was designed based on the convergent parallel mixed methods design. A total of five publicly owned universities (UG; UCC; KNUST; UEW; and UDS) in Ghana were sampled for the study using cluster, stratified, and purposive sampling techniques. These sampling techniques were adopted due to the specialised and varying characteristics of the study population. Public universities in Ghana were group into three clusters based on their geographical location. This was to ensure that the study cover all three (Northern, Middle and Southern) zones of the country. Universities in each zones were then stratified into universities with functional IRs and universities with no IRs. The universities with functional IRs were then purposively sampled for the study. This was to ensure that only universities that had some level of experience with the setting up, operation and management of IRs were selected for the study.

A total of 830 respondents comprising IR managers, library staff (Digitization and E-Resources Units), postgraduate students, lecturers, and university librarians from five public universities in Ghana were sampled for the study. Study participants were sampled using purposive and convenient sampling techniques. These techniques were adopted because of the specialised nature of the study and because it was difficult to gain access to certain categories of respondents (lecturers and university librarians), mainly due to their busy schedules. The main instruments used for data collection were a questionnaire and a semi-structured interview guide. Interviews were personally conducted by the researcher, whilst the questionnaires were

administered with the help of five research assistants. The interviews were recorded using an Olympus VN-2100PC digital voice recorder.

A total of four months was used for the data collection process. The recorded interviews were transcribed into a Microsoft (MS) Word document and analysed using NVivo software. The data collected through the questionnaires was analysed descriptively using the Statistical Package for the Social Sciences (SPSS) software. An in-depth explanation of the study findings is presented in Chapter Five.

1.11 ETHICAL CONSIDERATIONS

According to Bryman and Bell (2007), ethical considerations form an important and critical component of any research endeavour. This is because it provides the standards with which the conduct of researchers can be regulated (Byrne 2017). Bryman and Bell (2007) identified the elements of ethical consideration as the protection of the dignity of research participants, informed consent, anonymity, confidentiality, honesty, transparency, and objectivity.

With these issues in mind, the researcher took steps to ensure that the above-stated considerations were adhered to in this study. Firstly, upon completion of his research instruments, the researcher sought ethical clearance for the study, as indicated in the University of South Africa's (Unisa) Policy on Research and Ethics (Unisa 2016). Secondly, the researcher sought the consent of the research participants through a consent form. The consent form clearly explained to participants the aims, objectives, and purpose of the study. The respondents were given two days to indicate their acceptance or decline participation in the study. Study participants were assured of the anonymity and confidentiality of their responses. To ensure the anonymity and confidentiality, study participants were not required write their names, emails, phone numbers or any information that can reveal their identity on the survey instruments. Consequently, the consent forms that were attached to the questionnaires were removed after receiving them from study participants. Also, the audio files obtained from the interview recordings were password protected and kept in the researcher private dropbox account. They were then permanently deleted from

the Olympus VN-2100PC digital voice recorder. The transcribed interview responses were labelled using researcher developed codes (eg. University Librarian 1, IR Manager 2, etc). This was to done to protect the identity of the study participants. Only participants who agreed to take part in the study were sampled for the study.

Thirdly, the researcher ensured that the study was conducted in accordance with Unisa's Policy on Research and Ethics as approved by the University Council on 15 September 2016. In view of this, the research results were presented strictly in accordance with the ethical principles of honesty, transparency, and objectivity. Objectivity in research reporting was given important consideration in the study. It was ensured that the personal opinions and biases of the researcher did not get in the way of the research. The researcher reported findings from the survey and interviews as objectively as possible. Objectivity in research reporting was given important consideration in the study. It was ensured that the personal opinions and biases of the researcher did not get in the way of the research.

1.12 SCOPE AND LIMITATIONS OF THE STUDY

The study investigated the sustainability of IRs as an avenue for ensuring free and unlimited access to scientific and scholarly literature produced by universities in Ghana. The study focused mainly on IRs in public universities in Ghana. The study focused on only Ghanaian public universities rather than incorporating other public universities across the continent or, better still, incorporating private Ghanaian universities due financial and time constraints. This was also largely due to the principle that since public universities are funded by the state, they are obliged to make their research findings and scholarly publications freely available to the general public.

The UG, the UCC, the UEW, the KNUST, and the UDS were sampled for the study because, as at the time of the study, these were the only public universities in Ghana that had fully-functional IRs (Directory of Open Access Repositories 2020; Registry of Open Access Repositories 2020) and they are at the forefront of the national

movement for the establishment of IRs in Ghana. Additionally, technical and private universities were excluded from the study due to financial and resource constraints.

Since this is a country-wide study, the researcher acquired approval from the central administration of the selected universities for the participation of students, librarians, and academic staff in this study. This hindered the progress of the survey, as the ethical review processes in the selected public universities in Ghana were bureaucratic and time-consuming. Also, since this is a country-wide study, the researcher had to recruit research assistants for the data collection process, which placed an additional financial burden on the researcher.

The geographical distribution of the selected universities also hindered the progress of this work. This was because they researcher had to travel to the selected universities using the public transportation which was sometimes unreliable. This led to a situation where some interviews had to be rescheduled because the researcher could not honour the interview appointments due to transportation contraints. Notwithstanding these limitations, the researcher deemed the above-mentioned approach helped in the successful completion of the study.

1.13 DISSEMINATION OF THE FINDINGS

A copy of the thesis shall also be archived in Unisa's IR, which will make the findings of the study globally accessible to students, researchers, and policy makers interested in the sustainability of IRs.

The outcome of this research is likely to be published in a Scopus indexed Library and Information Science (LIS) journal. The findings of the study may be presented at local and international conferences, seminars, and workshops. Journal preprints of the study findings will be archived on the author's ResearchGate account. The author will give written permission to libraries, archives, and academic institutions that may want to archive the unpublished dissertation as part of their collection.

1.14 REFERENCING CONVENTIONS USED IN THE STUDY

The researcher ensured that all works used in the study were properly acknowledged as outlined in the 2019 Department of Information Science tutorial letter. The researcher used the same referencing and citation conventions used for the study proposal for this thesis. The Harvard referencing style, as recommended by the Department of Information Science (Unisa 2019:59), was adopted for the study.

1.15 STRUCTURE OF THE THESIS

The thesis is organised into seven chapters as follows:

Chapter One: Introduction and Background to the Study

This chapter provides the background of the study; the problem statement; the purpose, objectives, and research questions of the study; the significance of the study; limitations; the definition of key concepts; and, lastly, the structure of the thesis. The chapter provides the context for the study and addresses issues such as the originality of the study, ethical considerations, research methods adopted, and the dissemination of findings.

Chapter Two: Conceptual Framework

The chapter outlines the theoretical basis for the study and highlights the theories and theoretical models that guided the study. Particular attention is given to the ontological and epistemological grounding of the study.

Chapter Three: Review of Literature Related to Institutional Repositories

This chapter reviewed literature related to the research topic, focusing on existing empirical literature. The chapter explores the literature in order to clarify the nature of the problem, address the study objectives, and identify the gap within the literature that the study intended to address.

Chapter Four: Research Methodology

Chapter four outlines the research methodology adopted for the study. This chapter also provides a detailed description of activities undertaken by the researcher in the conduct of the study. These activities are outlined under the following headings: target population, sample, instrument for data collection, pretesting, reliability of data collection instrument, procedures for data collection, and data analysis.

Chapter Five: Research Findings

This chapter outlines the study results. The results are presented in accordance with the research questions. The research data was analysed using SPSS and NVivo software. The analysed data is interpreted and presented using tables and figures.

Chapter Six: Discussion of Research Findings

This is chapter provides a detailed discussion of the study findings and relates the findings to previous studies. The discussion is presented in accordance with the research questions and objectives of the study.

Chapter Seven: Summary of Research Findings, Conclusions, and Recommendations

The final chapter provides a summary of the study findings, conclusions, policy and practice implications, and suggestions for further studies.

1.16 SUMMARY

Chapter One provided both a general and contextual background to the study. It outlined the research problem and set up the stage for the whole study. The chapter discussed the purpose and significance of the study. The peculiar issues concerning the sustainability of IRs were highlighted.

The objectives of the study, the research questions, an overview of the research methodology, and the limitations of the study were presented. The organisation of the thesis and how the study findings will be disseminated are outlined. Other sections covered included the justification for the study and the referencing style

adopted. The next chapter will provide an overview of the conceptual framework that guided the study. It reviews and highlights the theories and theoretical models that influenced the construction and adoption of the conceptual framework.

CHAPTER TWO:
CONCEPTUAL FRAMEWORK

2.1 INTRODUCTION

Chapter One provided a contextual overview of IRs in public universities in Ghana, introduced the research problem, and outlined the purpose of the study, its objectives, research questions, and limitations. The study sought to examine the factors that threaten the sustainability of IRs in public universities in Ghana and suggest measures that would help address these challenges. This chapter provides an overview of the various theories found in IR literature. It reviews and highlights theories that have been used by previous IR researchers in order to provide a sound theoretical basis for the conceptual framework of the current study. Particularly, this chapter will address the first research objective: to examine how the various stakeholder groups (faculty members, students, and librarians) in public universities in Ghana perceive IRs. The Institutional Theory, Stakeholder Theory, Dynamics of IR Innovation Model, Social Shaping of Technology (SST) theory, and Diffusion of Innovation (DOI) Theory are extensively reviewed and discussed. This enabled the researcher to identify the variables that influence stakeholders' perceptions, as well as the conceptualisation and sustainability of IRs. Finally, the chapter will conclude with the formulation of the conceptual framework that guided this study.

2.2 BRIEF OVERVIEW OF THE CONCEPTUAL FRAMEWORK

A conceptual framework is basically a structure or a system of ideas that a researcher believes can best provide a comprehensive understanding of the phenomenon under study (Jabareen 2009; Camp 2001). Through the conceptual framework, researchers are able to integrate concepts, theories, and empirical data in order to offer explanations or meanings for the research problem (Adom, Hussein & Agyem 2018). In other words, the conceptual framework is the researcher's perspective on how the research problem should be explored based on sound theoretical and empirical evidence. Unlike the theoretical framework, a conceptual framework provides an understanding of a phenomenon, instead of proffering

theoretical explanations (Jabareen 2009:51). It is instructive to note that the benefit of a conceptual framework to research is enormous (Latham 2017; Grant & Osanloo 2014; Rogers 2012). This is generally because a conceptual framework provides the grounds on which researchers identify and apply remedies to a particular problem (Akintoye 2015; Grant & Osanloo 2014) and accentuates the reasons why it is worth being investigated (Adom et al. 2018). In this study, the conceptual framework is used to document the perspectives of various researchers on the factors that threaten the sustainability of IRs. Specifically, the conceptual framework is used as a lens to examine stakeholders' perceptions of IRs in the quest to offer some remedies for the managerial and technical challenges confronting IRs in public universities in Ghana.

According to Rogers (2012), a conceptual framework is an essential tool for research because it offers researcher the opportunity to focus on the sensitive experiences of the respondents which the researcher seeks to examine. Since the study sought to examine stakeholders' perceptions of IRs, it was important that the researcher identify exactly what informed stakeholders' perceptions. The conceptual framework, therefore, served as the blueprint for identifying these constructs and was used to clarify, justify, and explain the data collection methods and procedures (Latham 2017; Ravitch & Riggan 2012) adopted for the study. The Institutional Theory, Stakeholder Theory, Dynamics of IR Innovation Model, SST theory, and DOI Theory were the main theories that informed the conceptual framework. However, only the aspects of these theories that the researcher believed would help address the study objectives were adapted.

Conceptual frameworks are either graphic or narrative, or a combination of the two (Adom et al. 2018; Ngulube, Mathipa & Gumbo 2015). This study adopted a graphical conceptual framework, with each construct clearly defined by a diagram. Arrows are used to show the relationship between individual constructs. A graphical framework was adopted because it is more flexible and user friendly than a narrative framework, and therefore it served as a valuable reference throughout the entire study. The next section discusses the importance of concepts to the design and construction of a conceptual framework.

2.3 CONCEPTS DEFINED

Concepts are an accepted collection of meanings, attributions, associations, or characteristics given to specific events, objects, conditions, situations, and behaviours (Leggett 2011). Neuman (2000:62) views concepts as logically developed ideas about the classes of a phenomenon that a researcher seeks to investigate. They are the building blocks of human beliefs, thoughts, and expressions. Consequently, they are crucial to the classification and categorisation of human environments, as well as cognitive processes such as memory, learning, and decision making (Carey 1991). Shoemaker, Tankard and Lasorsa (2004) refer to concepts as abstractions of certain portions of reality aimed at describing specific instances of a phenomenon. Similarly, LeRoy and Corbet (2006:25) define a 'concept' as "an abstraction based on characteristics of a perceived reality". Concepts are created through the classification or categorisation of an object or event beyond a single observation (Leggett 2011).

Through experience with the phenomenon or object of study, researchers are able to abstract concepts or meanings out of their experiences. According to Volchok (2015), concepts are based on human experiences with real phenomena and are generalised ideas of something of meaning. Concepts are the foundation upon which theory is built and vary based on the degree or level of abstraction (Bergdahl & Berterö 2016; Shoemaker et al. 2004; Leggett 2011; Rodgers 2000). They are on a continuum from the most concrete to the most abstract (LeRoy & Corbet 2006; Neuman 2000). However, it must be noted that whether concrete or abstract, concepts must be clearly defined in order to be measurable. In this chapter, concepts such as relative advantage, compatibility, complexity, trialability, and observability are discussed in order to highlight their impact on the sustainability of IRs.

The next section provides an explanation of the importance of theories as building blocks for the design and construction of a conceptual framework.

2.4 THEORIES DEFINED

Theories are a “set of interrelated constructs (variables), definitions, and propositions that presents a systematic view of a phenomena by specifying relations among variables, with the purpose of explaining natural phenomena” (Kerlinger 1979:64). Similarly, Swanson (2013:175) views theory as a set of related ideas, concepts, or prepositions linked together for the purpose of offering an explanation or interpretation of the occurrence of a particular phenomenon. These propositions, ideas, and concepts provide basic principles through which researchers analyse, predict, explain, or document human understanding of the natural world (Creswell 2014:86; Mittelstraß 2004; Mautner 1996:426). Theories offer the researchers the opportunity to systematically analyse a phenomenon, irrespective of the context within which it naturally occurs (Weber 2012:4), thereby enabling researchers to offer generalised explanations for the occurrence that phenomenon. However, it must be noted that theories are tested within certain boundaries (Mueller & Urbach 2013:5).

Theories are generally a system of words or statements that are used to describe, explain, and predict real world phenomena. This system of words and their interrelations provide a logical, structured, and comprehensive explanation of the natural environment within certain limitations (Mueller & Urbach 2013:5). Theories are therefore used by scientists and researchers to guide their observations of the natural environment and to determine or predict the relationship between the various components of the natural environment. According to Swanson (2013), theories are not only espoused to offer an explanation, prediction, or understanding of a phenomenon, but in many cases to extend the frontiers of existing knowledge. Therefore, for many scientific enquiries, theories are used as a basis to establish relationships “between the abstract and the concrete; the theoretical and the empirical; thought statements and observational statements” (Sunday, n.d.:3) in order to provide legitimacy to the explanations offered for the occurrence of a phenomenon.

In this study, the proposed conceptual framework was influenced by theory (i.e., Dynamics of IR Innovation model and DOI Theory). These theories also influenced

the research paradigm, design, and methods adopted for the study. According to Mueller and Urbach (2013), in a scientific enquiry a theoretical base is crucial to answering the what, how, and why questions regarding the phenomenon being studied. It may be used at the beginning to shape the entire research process or may serve as the final outcome of a study, or both (Creswell 2014:83). In quantitative studies, theories are usually tested as an explanation to a question or hypothesis and may be presented in the form of an argument, a discussion, a figure, or a rationale. In qualitative studies, however, theories are usually the by-product of a scientific enquiry, whilst in mixed methods studies theories may be tested or generated.

The next section outlines the application of theories as guiding principles in research.

2.5 THE USE OF THEORY IN RESEARCH

Theories are generally used in research as the overarching thought upon which many other thoughts are expressed (Collins & Stockton 2018). They provide researchers with tips on how a particular problem should be investigated in order to achieve the desired results. Through theories, researchers are able to show the interconnections or relationships between the various elements of a phenomenon and provide the basis for its subsequent generalisation (Cohen-Miller & Pate 2019).

IRs have been adopted by many institutions as online archives for the preservation of their research and scholarly outputs (Tiwari & Gandotra 2018; Okoroma 2018a; Thompson et al. 2016; Nkiko et al. 2014) and public universities in Ghana are no exception. Currently, five out of the nine public universities in Ghana have a functional IR (National Accreditation Board 2018) with the aim of promoting academic scholarship, productivity, prestige, global visibility, and the utility of their research (Tiwari & Gandotra 2018). However, these repositories are confronted with technical and managerial challenges that threaten their survival. The conceptual framework which was developed using elements of existing theories was used to examine the impact of these challenges on the survival of repositories in order to suggest practical remedies. Theories have been used in many studies to express the

paradigmatic or epistemological dispositions of authors, identify the logic behind methodological choices, and serve as a lens or framework that guides an entire study (Mngadi 2018; Collins & Stockton 2018). Similarly, Stewart and Klein (2016:3) assert that theories are applied at many stages of the research processes to:

1) provide a justification for the study;
2) define the aim and research questions;
3) justify epistemological positions;
4) develop research instruments; and
5) provide a framework for data analysis and interpretation.

In fact, paradigms and theories go hand-in-hand to explain concepts in science and assist researchers to better understand and appreciate their object of study (Collins & Stockton 2018; Creswell 2008). This is because, just as theories are generally used to explain the occurrence of a phenomenon, a paradigm provides the background or the frame that allows a theory to be tested and measured. According Decarlo (2018), theories shape not only the way researchers ask questions about a problem, but also how they view or investigate the problem. The current study addresses the managerial and technical challenges that confront the IRs in public universities in Ghana. The primary objective of the study was to examine how the various stakeholder groups conceptualise IRs. The researcher believes that the survival of IRs can only be assured when the viewpoints of all stakeholder groups are integrated to form a holistic picture or a viewpoint that resonates with all stakeholders. The Institutional Theory, Stakeholder Theory, Dynamics of IR Innovation Model, and DOI Theory were the major theories that shaped the current study. These theories influenced the research objectives, the kinds of questions posed on the research instrument, and the data collection and analysis methods utilised.

Theory provides direction and sequence for the conduct of any scientific enquiry by directing attention to the aspects of a phenomenon that are feasible, that is, aspects of a phenomenon in which logical connections or linkages between variables are likely to be found. Thus, theories establish reasonable relations between variables or a set of constructs, outlining how a phenomenon can be understood or investigated

(Rukumini 2020). According to Whitworth (2007:2), “theories propose and connect abstract constructs/variables, and research transforms them into the physical data”. A study that does not apply the right theories is likely to produce findings of low quality, irrespective of stringent methods applied or observations and inferences made (Kawulich 2009; Neuman 2006). It is therefore important that theories are specified in the early stages of the study to avoid confusion during data collection and analysis (Klein, Dansereau & Hall 1994; Neuman 2006).

However, the position of theory in the hierarchy of the research process is often governed by epistemological dispositions. In quantitative research, theories are tested in order to offer an explanation for answers to research questions and are introduced at the early stages of the research (Creswell 2008; Neuman 1997). According to Creswell (2008), quantitative dissertations usually devote an entire section to the presentation of theory, as it forms the basis upon which the entire study evolves. In qualitative studies, theories are used in multiple ways. In some qualitative studies, theories may be formulated as the by-product of the study and are presented at the end of the study. In other qualitative studies, theories are selected at the beginning and provide a lens through which researchers view complicated social problems, direct attention to varying aspects of the data, and provide a structure for analysing the collected data (Reeves, Mathieu & Kuper 2008). In mixed methods research, however, theories may either be tested or generated, or both. Therefore, theories are an essential ingredient or by-product of any scientific enquiry.

This study was conducted from a pragmatic viewpoint and, as such, adopted the mixed methods design approach. This was because it allowed the researcher to examine the sustainability of IRs from varying viewpoints. The choice of paradigm, research design, methods, and approaches were influenced by the Dynamics of IR Innovation Model and the DOI Theory. According to Grant and Osanloo (2014:24), by using multiple theories, researchers are able to view a phenomenon from various perspectives. Also, the Dynamic of IR Innovation Model and the DOI Theory formed the basis for formulating, testing, and validating the proposed conceptual model, as well as the identification and categorisation of study participants as outlined in

subsequent sections of this chapter. This clearly influenced the data collection procedures adopted for the study. According to Whitworth (2007), data collection without theory guidance may result in the collection of irrelevant data, wasting the researcher's time and effort. Finally, DOI Theory was used to provide deeper insights into the factors that confront the sustainability of IRs in public universities in Ghana, as outlined in Chapter Five of this thesis.

2.6 CONCEPTUAL FRAMEWORK

The essential channel for enhancing scientific innovations in the social sciences is the construction of concepts or ideas in an attempt to make meaning out of empirical data (Timmermans & Tavory 2012:1). A conceptual framework therefore serves as an analytical tool for exploring specific aspects of a phenomenon within different contexts in order to offer solutions to existing problems, spark innovations, and transform less desirable situations to preferred situations (Friedman 2003). The concepts adopted in this study were derived from existing theories and literature on IRs. These concepts were linked together for the purposes of providing a comprehensive understanding about the factors that threaten the sustainability of IRs in public universities in Ghana.

A conceptual framework showcases the researcher's thoughts on how a particular problem is to be investigated, what methods are to be adopted, and which theories will be applied (Ravitch & Riggan 2017; Regoniel 2015a). Markovsky and Webster (2015:1) view a conceptual framework as a formulation or the assemblage of several theories into a coherent whole. Theories are by nature abstract and only "become useful when filled with practical topics, goals, and problems" (National Cancer Institute 2005:4). Therefore, a conceptual framework offers researchers the opportunity to semantically and logically synthesise various theories in the quest to offer explanations for research questions or hypotheses. According to McGaghie, Bordage and Shea (2001), the conceptual framework "sets the stage" for researchers to present the particular problem their study seeks to address. This allows researchers to provide explanations for unique cases other than broad explanatory principles (Friedman 2003). In other words, the conceptual framework is

the researcher's understanding of how study variables relate to each other based on existing literature or theories and assists both the researcher and the reader in acknowledging the contributions of the current study to the existing body of knowledge on the research topic.

A conceptual framework was adapted for the study because, unlike a theoretical framework, a conceptual framework offered the researcher the opportunity to provide an understanding of specific challenges that confront the sustainability of IRs, rather than offering broad theoretical explanations (Jabareen 2009:51). Secondly, using a conceptual framework allowed the researcher to incorporate constructs or variables that the researcher deemed relevant to exploring the research problem (Ravitch & Riggan 2017; Regoniel 2015a). Finally, the use of a conceptual framework allowed the researcher to describe the relationship between specific variables identified in this study. The following subsections will briefly describe the three sources of a conceptual framework and specify how they influenced this current study.

2.6.1 Experience

Personal interest, experiences, and intuition have been identified as important traits of a good researcher (Senanayake 2013; Klein 2004). This is because these traits influence the choices a researcher makes and the perspectives from which he/she views a particular phenomenon. In this regard, personal interests, experiences, intuitions, and hunches have been identified as having a stimulus effect in the design and construction of a conceptual framework (Crawford 2020; Ravitch & Riggan 2017; Robson & McCartan 2016). However, it must be noted that personal interests, experiences, and intuitions are not the only ingredients needed for the construction of a framework, as there must be evidence that other researchers in the field share similar insights or concerns and that addressing those concerns will lead to the advancement of knowledge (Crawford 2020). In this study, the researcher's personal experience with IRs influenced the choice of research topic, as well as the methods adopted to address the research questions.

2.6.2 Literature

Literature plays a critical role in the design of a conceptual framework (Crawford 2020; Ravitch & Riggan 2017). This is because it allows researchers to convey to their audience experiences and thoughts that have been gained on a given topic, as well as the strengths and shortcomings (Taylor 2010) of the methods adopted. Through the literature, researchers are able provide a critical evaluation of concepts and ideas expressed by previous researchers in order to demonstrate to the reader how the current study fits within the larger body of knowledge in a particular field (Fink 2014). In this study, literature was used as a basis to establish the need for the study. Even though the desire to conduct this study began with the researcher's experiences with IRs, the decision to embark on the study was affirmed after a critical evaluation of the literature on the research topic. As aptly posited by Crawford (2020), a conceptual framework must be firmly rooted in literature. Through the literature, this study provides the rationale for the study by exposing the technical and managerial challenges facing the IRs in public universities in Ghana. Furthermore, literature is used to justify the selection and inclusion of all the variables contained in the proposed conceptual framework.

2.6.3 Theory

Testing or generating theoretical assumptions is essential to the advancement of scientific knowledge. Therefore, theory plays an integral role in the quest to offer explanations for the linkage between concepts expressed in a conceptual framework (Crawford 2020; Ravitch & Riggan 2017). According Adom et al. (2018), a conceptual framework must be firmly grounded or directed by theory. In this study, the researcher relied extensively on existing theory as a major source for the identification of concepts for the design of the proposed conceptual framework. The researcher adopted the deductive approach to theorising in research. This approach was adopted because of its ability to help the researcher address the research questions, as well as test or validate the proposed conceptual framework. According to Wilson (2010), deductive reasoning is extremely important in the development of concepts based on existing theory and the design of a research strategy to test these concepts. By adopting the deductive approach in this study, only data relevant to explaining relationships between concepts outlined in the proposed research

model was collected from study participants. This was useful in validating the research model, as will be noted in the subsequent chapters of this thesis.

2.7 THEORIES APPLIED IN IR RESEARCH

Various theories have been constructed by different researchers to explain the establishment, operation, and sustainability of technical systems. However, the following subsections will briefly review the Institutional Theory, Stakeholder Theory, SST theory, DOI Theory, and the Dynamics of IR Innovation Model, as well as describing how these theories influenced the formulation of the conceptual framework proposed for this study.

2.7.1 Institutional Theory

The Institutional Theory provides a broader or more robust dimension of social organisations. It considers the mechanisms by which systems are formed as authoritative guidelines for social behaviour (Scott 2004). Institutional Theory shows how pre-existing rules, beliefs, and environmental factors such as regulatory, legal, and policy frameworks, influence organisational and behavioural change (Currie 2011). These environmental factors lead to the development of rules and regulations to which individual organisations must conform if they are to receive acceptance and legitimacy (Scott 2004; Lawrence, Hardy & Phillips 2002). Hinings, Gegenhuber and Greenwood (2018) assert that the Institutional Theory is a prolific lens for the study of digital innovations. In this study, the researcher views IRs as IT innovations aimed at bringing a paradigm shift in the way institutional scholarly and intellectual assets are preserved and disseminated.

The Institutional Theory has gained momentum over the last decade, especially in the social sciences, and has been used extensively as a theoretical basis for examining scholarly and empirical writings aimed at addressing the adaption and use of digital or IT innovations. However, many scholars have questioned its ability to addresses institutional complexities and its lack of account for the role of change agents in ensuring organisational and behavioural change (Hinings et al. 2018; Boxenbaum & Jonsson 2017). Nevertheless, many proponents of the Institutional

Theory have stressed its ability to merge existing norms and practices with novel or new ones (Hinings et al. 2018; Asefa & Nuhu 2017; Lopes & Sá-Soares 2014; Currie & Swanson 2009; Liao 1996). Liao (1996) examined the factors that influence IT investments in organisations. The study, grounded in Institutional Theory, revealed that organisations make investments on IT as a response to internal and external pressures in order to maintain legitimacy and reduce uncertainty. Asefa and Nuhu (2017) used the Institutional Theory as an analytical lens to examine the institutional constraints to the digitalisation of government budgeting in Ghana. The study identified that outdated legal frameworks and organisational practices, such as paper-based documentation practices, are major constraints to the digitalisation of government budgets. Hinings et al. (2018) examined the adaptation of digital innovations from an institutional perspective. They examined stakeholder appreciation and approval of novel arrangements in relation to existing institutional arrangements using the Institutional Theory.

Jan, Lu and Chou (2012), drawing inspiration from the Institutional Theory, proposed a framework to examine coercive, normative, and mimetic pressures in order to provide an in-depth appreciation of the social factors that promote the use of electronic systems. Lopes and Sá-Soares (2014) aimed to identify the factors which conditioned the adoption of information systems security policies by organisations. Using the Institutional Theory as theoretical foundation for the study, Lopes and Sá-Soares (2014) identified the external and internal factors promoting and hindering the adoption of information system security policies in 44 town councils in Portugal. From the above studies, it is clear that an examination of the internal and external factors is crucial to the adaptation and sustainability of a digital system.

Therefore, this study examined the impact of pre-existing beliefs, rules, regulations, and policies on stakeholders' conceptualisation of IRs as stated in the second and fifth research objectives.

2.7.2 Stakeholder Theory

Originally postulated by Edward Freeman in 1984, the Stakeholder Theory seeks to address the interconnected relationships between an organisation and those who

have a stake in it (Phillips 2003; Flak & Rose 2005; Lin 2018). It accounts for the various internal and external constituencies that are affected by the operations of an organisation (Lin 2018). According to Freeman, Harrison and Zyglidopoulos (2018), the stakeholder viewpoint provides an alternative avenue for organisations to understand how to create value and wealth for their principal actors. Phillips (2003) views the Stakeholder Theory as a capitalist theory that stresses the interconnected relationships between all who have a stake in an organisation and emphasises the need for organisations to create value for all stakeholders. Over the years, various authors have sought to analyse the Stakeholder Theory based on stakeholder characteristics, relationships, and functions (Flak & Rose 2005; Mitchell, Agle & Wood 1997; Donaldson & Preston 1995).

Donaldson and Preston (1995) divided the Stakeholder Theory into three mutual supportive components or aspects (i.e., descriptive, instrumental, and normative). The descriptive aspect outlines and explains the features, characteristics, and operations of organisations (i.e., organisational management processes, ethics, and culture). The instrumental aspect establishes the connection between the various stakeholder groups and their role in ensuring the attainment of organisational objectives based on empirical data. The normative aspect establishes ethical or moral guidelines for the operation and management of the organisation. Mitchell et al. (1997), on the other hand, identified organisational stakeholders based on characteristics such as power, legitimacy, and urgency. Power refers to the ability of a stakeholder to enforce their will in a relationship, legitimacy talks about socially accepted and expected organisational norms or ethics, and urgency refers to the time-bound nature of a stakeholder's claims. According Mitchell et al. (1997), by examining stakeholders using these attributes one is able to paint a comprehensive picture of the impact of various stakeholder groups on the operations of an organisation.

The Stakeholder Theory was used to establish the interconnected relationships between IRs and the various stakeholder groups within public universities in Ghana. IR managers, library staff (digitalisation and e-resources units), postgraduate students, lecturers, and university librarians were identified as major stakeholders of

the IRs in public universities in Ghana. IR managers were identified because they are the professionals responsible for managing the technical and intellectual contents of IRs. Library staff members (Digitization and E-Resources Unit) were selected because they are responsible for the digitisation, uploading, marketing, and dissemination of the e-resources of the library. Lecturers and postgraduate students were identified as major stakeholders because they are the primary users and content authors for IRs in public universities in Ghana. Finally, university librarians were also identified because they have oversight responsibility for the management and operation of IRs within their respective institutions.

Although originally a management theory, Stakeholder Theory has been applied in various sectors and information systems research is no exception. This is because it equips managers with the tools and skills to better understand stakeholder views and thoughts in order create value with and for them (Freeman et al. 2018). However, some scholars have questioned its ability to align stakeholders' expectations and perceptions of IT systems with organisational values and strategies (Pouloudi 1999; Lacity & Hirschheim 1995; Benjamin & Levinson 1993). This notwithstanding, the researcher deems the Stakeholder Theory useful for examining stakeholders' perceptions. According to Mishra and Mishra (2013), many scholars are starting to realise what impact the Stakeholder Theory has on the various stages of the adoption and implementation of information or IT systems. Uribe, Ortiz-Marcos and Uruburu (2018) conducted a nine-year systematic review of the literature on Stakeholder Theory in relation to the sustainability of technological innovations. They identified that the Stakeholder Theory helped researchers address the issue of sustainability in four main areas, namely: stakeholder identification, communication, project risk, and integration management. They therefore concluded that the Stakeholder Theory continues to be an essential theory for addressing some of the critical issues in project management and sustainability (Uribe et al. 2018). Flak and Rose (2005) examined the adaption of the Stakeholder Theory to electronic governance (e-governance). They conclude that insights from stakeholders can be applied in part to public sector settings and in particular to the context of managerial decisions regarding major e-governance initiatives. Mishra and Mishra (2013) examined the application of the Stakeholder Theory to information systems. Upon

extensive review of related literature and an examination of the various viewpoints, they concluded that the Stakeholder Theory can be a very useful tool for addressing most of the challenges encountered at the various stages of the adoption and implementation of information systems. Ravenwood, Muir and Matthews (2015) examined the role and responsibility of various stakeholders in the selection of digital materials for preservation. They revealed that some stakeholders, especially senior managers, had greater influence on the choice of material for preservation.

Thus, this study investigated the specific challenges that confront each stakeholder group. This enabled the researcher to offer stakeholder targeted recommendations for the challenges that confront the sustainability of the IRs in public universities in Ghana, as stated in the sixth objective of the study.

2.7.3 Social Shaping of Technology Theory

Unlike traditional approaches that seek to investigate the outcome of technological innovations, STT theory seeks to address the political, social, organisational, and cultural factors that drive technological innovations (Mackenzie & Wajcman 1985). According to Pinch and Bijker (1984), technological innovations are socially constructed and the 'success' or 'failure' of an innovation depends how the innovation meets the goals, objectives, and aspirations of the relevant social groups. SST Theory is not a well-defined theory and a number of distinctively different modifications of the SST Theory have been postulated (Williams & Pollock 2002). Prominent among these modifications are the Social Construction of Technology (SCOT) Theory, Actor-Network Theory (ANT), and the socio-technical interactions networks (SIN) theory (Rieger 2008). Nonetheless, each of these modifications make some claim to general applicability.

The SCOT theory focuses on how the design and construction of information systems and technological artifacts are determined by human actions. The ANT, on the other hand, identifies central actors as a network of varying interests, while the SIN theory provides an alternative way to investigate the use of ICTs in an interdisciplinary manner and address some of the limitations of social constructivist methods (Oostveen 2007).

Many studies have emphasised the growing popularity and application of SST approaches in information systems research (Mwenya & Brown 2017; Alexander & Silvis 2014; Iyamu, Sekgweleo & Mkhomazi 2013). This has largely been attributed to its emphasis on the importance of human behaviour to the deployment, adoption, and usage of information systems (Mwenya & Brown 2017). However, Alexander and Silvis (2014) argue that the utility of SST approaches in information systems research can be enhanced by adjusting them to local situations. Cooley (2004) opines that in order to make effective socio-technological analyses using SST theories, it is important to make the necessary adjustments to cater for localised situations. Alexander and Silvis (2014) further stress the need to move the focus of analysis from “innovation” to the issue of “success or failure”.

Rieger (2008), in contextualising the design and adaptation of IRs as a new scholarly communication technology, employed the SCOT theory, ANT, and the SIN model to paint a holistic picture of the varying viewpoints that framed the design and adaptation of IRs. Similarly, Joris (2016) adopted social constructivist approaches to examine the role and usage of technology in society. Using the STT theory, the study revealed that the relationship between technology and society is not deterministic, but rather negotiable. This is because the interaction between users and the designers of technology determined the outcome of the technology both in its form and function. Yousefikhah (2007) adopted perspectives from the SCOT theory (flexibility of interpretation, relevant social groups, and technological frame) to describe the impact of human behaviour on technological innovations and explored how innovation may flourish or be diminished in society.

Thus, the current study examined the impact of internal policies, processes, and procedures on the adoption and use of IRs by the various stakeholder groups as outlined in the second research objective, namely, to examine the role of institutional policies on the sustainability of IRs in public universities in Ghana.

2.7.4 Diffusion of Innovation Theory

Postulated in 1962 by EM Rogers, the DOI Theory is among one of the earlier social science theories. It started as a communication theory to explain how an idea or product gains prominence over time within a specific population or social system. The theory is based on the notion that technology adoption is fundamentally a function of communication channels and social systems (Maull, Saldivar & Sumner n.d.). This basically means that a person's acceptance of an innovation and his/her adoption, rejection, or continued use of this innovation is influenced by factors such as relative advantage (the superiority of an innovation as compared to existing ideas, products, or services), compatibility (consistent with existing needs, norms, values, and experiences), complexity (difficulty of usage), trialability (extent to which an innovation can be experimented with), and observability (extent to which the innovation provides tangible results).

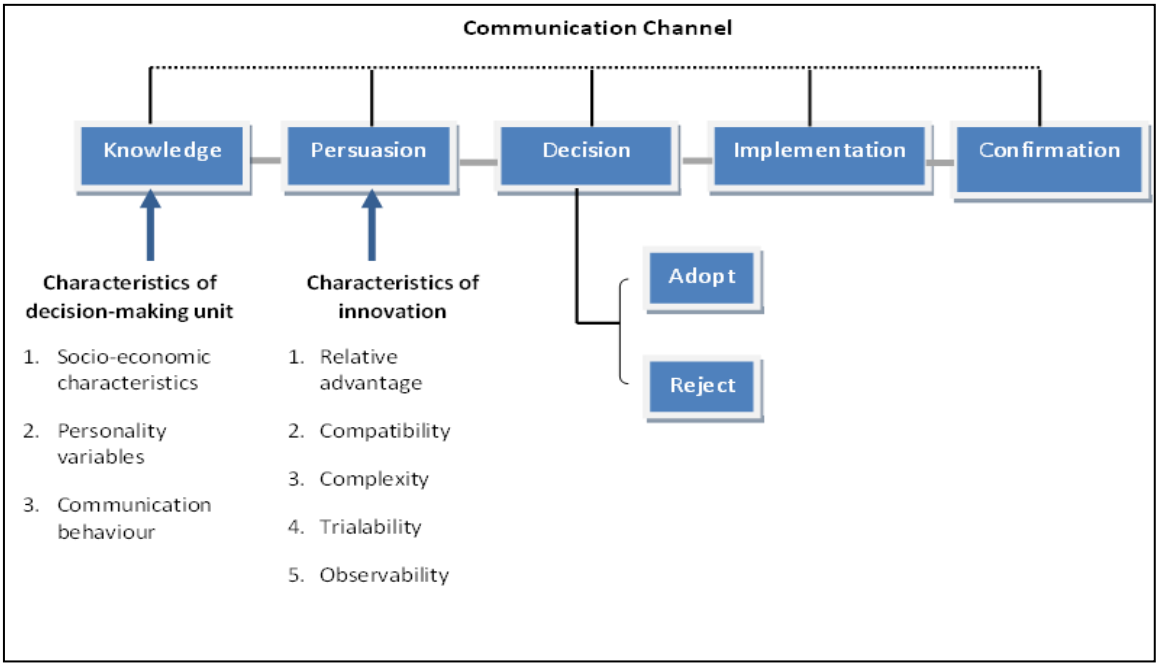

Figure 2.1: Innovation-decision process

Source: Rogers (2003:78)

The DOI Theory has been used extensively by researchers to examine the adaptation and use of information systems (Nemutanzhela & Iyamu 2015; Jones, Andrew & MacColl 2006). According to Nemutanzhela and Iyamu (2015), the theory of DOI has been extensively applied in information systems research as an analytical

lens aimed at bringing together multiple viewpoints in gaining an understanding of the factors that promote acceptability or diffusion of innovations within the information system environment. Almobarraz (2007) used the DOI Theory to identify the predicators of internet adaptation by faculty members at the Imam Mohammed Ibn Saud University in Saudi Arabia. Zhang, Yu and Yan (2015) employed the DOI Theory to understand the factors that influence patients' adoption and utilisation of electronic health care services in Australia. Similarly, Makovhololo, Batyashe, Sekgweleo and Iyamu (2017) used the DOI Theory to examine the main factors and decision-making procedures that influence the adoption of technology by South African firms. Blackburn (2011) also employed the DOI Theory in analysing the factors that facilitate the adoption of new technologies by libraries. Ibrahim, Gbaje and Monsurat (2015) employed the DOI Theory to examine the non-use of digital library services and resources.

Kim (2011a) examined the self-archiving practices of 109 professors and their perceptions of IRs using the DOI Theory. Revell and Dorner (2009) employed the DOI Theory to analyse the views of subject librarians on the sustainability of IRs as an information source. Swanepoel (2013) examined the factors that contribute to the acceptance of IRs and their impact on the book industry using DOI Theory. Nakitare and Chege (2017) analysed factors that users consider when accessing information from IRs using the DOI Theory. Martin-Yeboah et al. (2018), guided by DOI Theory, examined the factors that led to the creation and sustainability of IRs in Ghana. Similarly, Nunda and Elia (2019) adopted the DOI Theory to explore the adoption and use of IRs among postgraduate students in the Muhimbili University of Health and Allied Sciences and the Sokoine University of Agriculture.

Despite its wide range of applications, it must be noted there are inherent challenges and ramifications for employing any theory (Makovhololo et al. 2017; Nemutanzhela & Iyamu 2015). According to Chile (2017) the DOI theory is often simplified to focus solely on a product or innovation, disregarding the complex societal, cultural, economic and other factors that determine how the product is adopted into society. Similarly, Lyytinen and Damsgaard (2001) argues that the DOI theory fails to recognise that technological innovations are socially constructed and that different

stakeholder would perceive an innovation differently based on local culture, economic structure and the supporting infrastructure. Thus, this study employed certain aspects (i.e characteristics of decision unit and characteristics of innovation) of the DOI Theory to serve as a lens through which to view and understand how IRs can be accepted by all stakeholders. Specifically, the DOI Theory was used to examine the characteristics of existing IRs in public universities in Ghana and to determine how these characteristics influence the adoption and use of IRs by individual stakeholder.

2.7.5 The Dynamics of IR Innovation Model

The Dynamics of IR Innovation Model views IR innovations from a sociocultural point of view by identifying all stakeholders involved to provide a justification for their inclusion (Utulu & Ngwenyama 2017). The model emerged from efforts to establish a connection between the Institutional Theory, Stakeholder Theory, and SST Theory. The model holds the opinion that IR innovations can only be sustainable when stakeholders' IR concepts, intentions, and strategies are synthesised with the institutional IR concepts, intentions, and strategies in order to form a holistic IR that resonates meaningfully with all stakeholders.

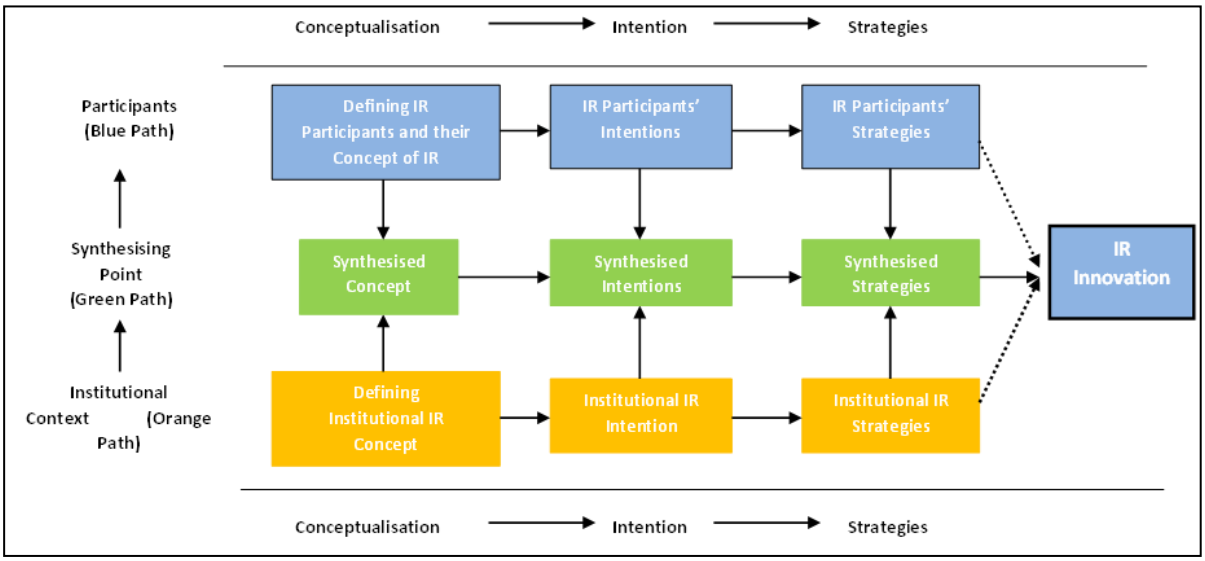

Figure 2.2: Dynamics of IR Innovation

Source: Utulu and Ngwenyama (2017)

The horizontal side of the framework outlines indicators such conceptualisation, intentions, and strategies, while the vertical side outlines indicators such as participants, synthesising points, and institutional concepts. It identifies the various stakeholders (i.e., authors, researchers, and librarians) and institutions in an IR innovation and their conceptualisation, intentions, and strategies. These individual IR concepts, intentions, and strategies are fused or synthesised together to provide a holistic IR concept, intention, and strategy that capture the views of all stakeholders. Thus, the Dynamics of IR Innovation Model was used to synthesise the IR concepts, intentions, and strategies of the various stakeholder groups in order to paint a holistic picture of IRs that resonates with all stakeholders.

The next section presents the conceptual framework proposed for the study based on the theories and model as outlined above.

2.8 PROPOSED CONCEPTUAL MODEL

Concepts are labels, descriptions, or attributions given to aspects or components of a phenomenon. A conceptual framework therefore shows the linkage or associations between the various aspects or components of the phenomenon (Ngulube et al. 2015). This is usually depicted graphically or in a narrative. According to Miles and Huberman (1994:18), conceptual frameworks are theory driven and provide the basis for researchers to link empirical observations to the phenomenon being investigated. The researcher therefore adapted aspects of the Dynamics of IR Innovation Model and the DOI Theory as the conceptual framework for the study.

The fundamental concept underlying the proposed conceptual model was adapted from Utulu and Ngwenyama (2017) and Rogers (2003), as illustrated in Figure 2.3. It is postulated that stakeholder IR usage behaviour is influenced by their IR concepts and use intentions. Also, IR use intentions may subsequently be influenced by IR promotional strategies and the characteristics of the IR. Furthermore, it is postulated that sustainability or continuous use behaviour is influenced by IR conceptualisation, intension and promotional strategies.

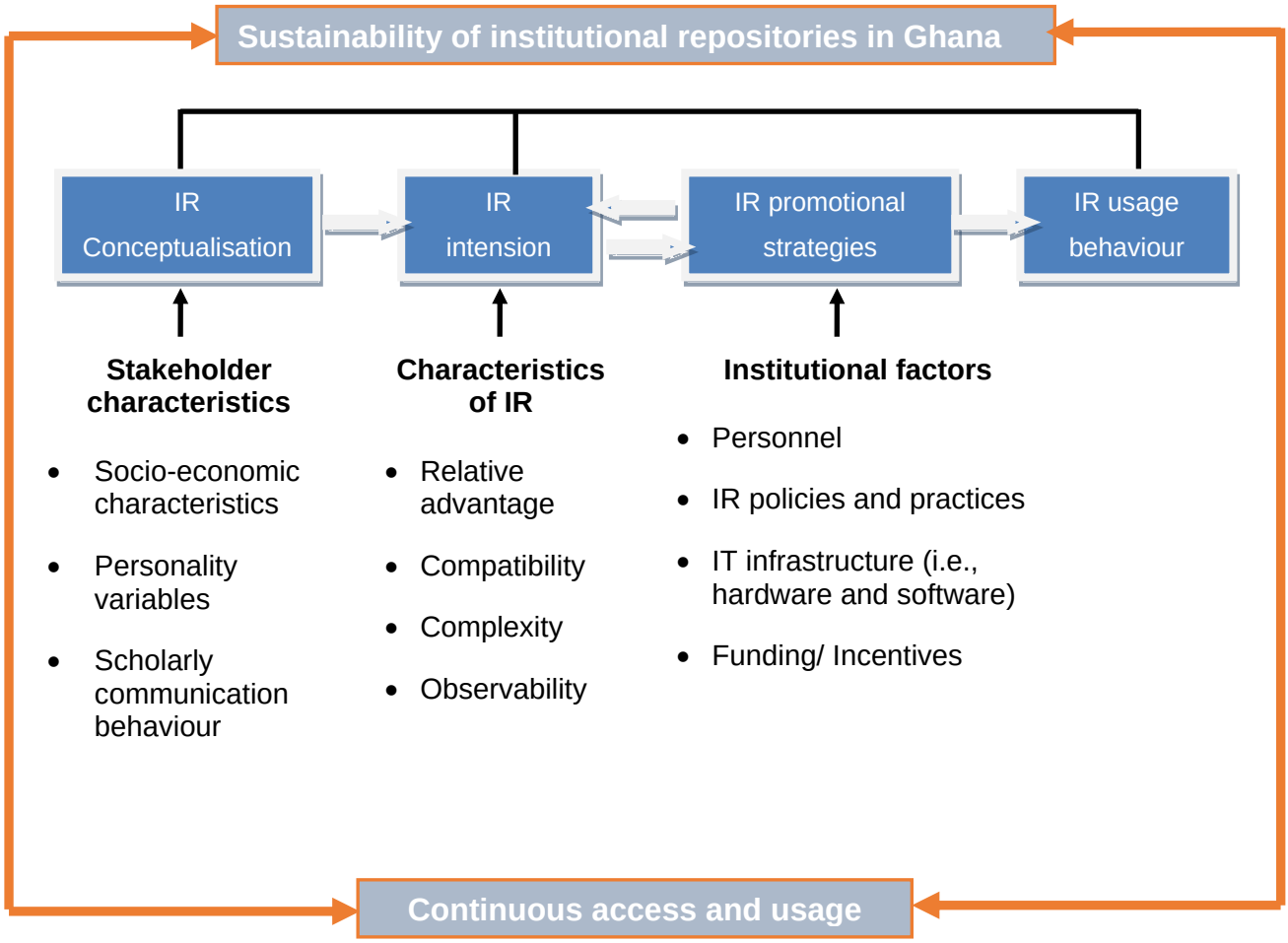

Figure 2.3: Proposed conceptual framework for the study

Adapted from: Utulu and Ngwenyama (2017) and Rogers (2003)

The proposed research model also postulates that a stakeholder's conceptualisation of the IR is influenced by the stakeholder's characteristics, such as socio-economic characteristics (i.e., academic status and social influence) and personality variables (i.e., age, gender, and academic level). Furthermore, a stakeholder's IR intensions are influenced by IR characteristics, such as relative advantage, compatibility, complexity and observability. Lastly IR promotional strategies are influenced by institutional factors such personnel, institutional IR policies and practices, IT infrastructure (i.e., hardware and software), and funding/incentives. Thus, the sustainability of IRs can be achieved when there is a connection between IR conceptualisation, use intension, and promotional strategies across the various stakeholders. In view of this, the following hypotheses were proposed:

H_1: There is statistically significant relationship between IR conceptualisation and use intentions.
H_2: There is statistically significant relationship between promotional strategies and use intentions.
H_3: There is statistically significant relationship between personality variables (age, gender and academic status) and conceptualisation of IRs.
H_4: There is statistically significant relationship between IR characteristics and use intension.
H_5: There is statistically significant relationship between IR policies and use intension.
H_6: There is statistically significant relationship between IT infrastructure and IR use intension.

The proposed research model emerged from efforts to establish a connection between the Dynamics of IR Innovation Model and DOI Theory. In view of this, new constructs were added based on their demonstrated applicability in previous studies. The following subsections provide an empirical review of the selected constructs.

2.8.1 Relative advantage

Relative advantage is the perceived benefits of an innovation as compared to previous or existing innovations. The DOI Theory considers relative advantage as a key factor in the adoption of technological innovations. According to Rogers (2003), an innovation that presents its users with superior benefits as compared to its predecessors is more likely to be adopted and implemented. Current empirical evidence shows that relative advantage has a significantly high impact on use intensions and behaviour (Kapoor, Dwivedi & Williams 2013; Scott, Plotnikoff & Karunamuni 2008; Hsu, Lu & Hsu 2007; Greenhalgh, Robert, Macfarlane, Bate & Kyriakidou 2004). Greenhalgh et al. (2004) conducted an extensive literature review on the sustainability of innovations in the health sector. They reported that relative advantage positively influenced use intension and behaviour. Hsu et al. (2007) studied the use of the Multimedia Messaging Service by employing the DOI Theory and concluded that relative advantage significantly influenced user intentions.

Similarly, Kapoor et al. (2013) found relative advantage to be a dominant determinant of customers' intention to use the interbank mobile payment services.

2.8.2 Compatibility

Compatibility outlines the extent to which an innovation is considered to be consistent with the predetermined values, experiences, and aspirations of potential adopters (Rogers 2003). This attribute has received a lot of attention by information systems researchers and experts. For example, in a qualitative study to examine the perception of subject librarians about IRs as an informational resource, Revell and Dornor (2009) reported that the identified similarities of IRs to other channels of scholarly communication increased the acceptance of Open Access scientific information. In addition, the general belief that IRs fit into current scholarly communication models influenced its adoption as an information source by faculty members (Dornor 2009). Slyke, Lou and Day (2002) examined the factors that influenced the adoption of e-commerce applications and found that compatibility significantly influenced use intentions. This finding was affirmed in a similar study by Kapoor et al. (2013). Mndzebele (2013) reported that compatibility has a positive impact on the extent of IT adoption in the hospitality industry. Kapoor et al. (2013) found compatibility to be a significant determinant of consumers' intention to use interbank mobile payment application services. Clearly, one of the major challenges to the adoption of information systems is their incompatibility with present organisational standards and procedures (Esselaar & Miller 2002). Thus, IRs will receive the necessary funding, personnel, and university commitment when they are consistent with existing norms of digital communication, storage, and preservation practices.

2.8.3 Complexity

Complexity describes the ease of use or simplicity of a perceived innovation. The impact of the complexity construct on use intension and behaviour has been well expressed in previous studies, such as those by Mndzebele (2013), Ntemana and Olatokun (2012), Murillo (2004), and Rogers (2003). According to Mndzebele (2013), the likelihood that any organisation will implement an information system that is complex or difficult to use is very low. Rogers (2003) opines that the complexity of a

technological innovation influences its level of acceptability within a given social environment. That is, in the event that the innovation is anything but difficult to utilise, more individuals are probably going to adjust to its utilisation. Murillo (2004) concludes that the adoption or rejection of an IT system is highly dependent on its perceived complexity. Ntemana and Olatokun (2012) found that complexity positively influenced the attitude of lecturers toward the adaptation of ICTs for teaching. The positive impact of complexity on the adoption and use of IT systems makes it imperative for IR administrators and university authorities to deploy easy to use IR systems to enhance their adoption and usage by all stakeholders.

2.8.4 Observability

Observability is the measure of the tangible and intangible benefits of an innovation. This is a very important construct to the adoption of an innovation, since it focuses on the benefits of an innovation as experienced by others (Ibrahim et al. 2015). Kim and Rha (2018) analysed the predictors of mobile services in South Korea. They found that compatibility and observability significantly influenced the adoption and usage of e-learning platforms. Ntemana and Olatokun (2012) examined the impact of the five determinants of ICT adoption on the attitude of lecturers towards the use of ICTs according to the DOI Theory and found that observability significantly influenced the attitude of lecturers. Similarly, Choi, Choi, Kim and Yu (2003) also showed that observability significantly impacted attitudes toward the adoption of information technologies. Also, Khalil et al. (2010) revealed that observability had a significant impact on customer adoption of internet banking services. However, studies by Kapoor et al. (2013) revealed observability had little to no impact on behavioural intentions. Thus, the sustainability of IRs is assured when students, librarians, and faculty and policy makers perceive IRs to have a positive impact on organisational image, prestige, and scholarship.

2.8.5 Socio-economic characteristics and personality variables

The impact of socio-economic characteristics and personality variables on perception and attitude towards the adoption of IT innovations has been studied extensively across many disciplines (Sikundla, Mushunje & Akinyemi 2018; Sánchez-Torres, Arroyo-Cañada, Montoya-Restrepo & Rivera-González 2017;

Aizstrauta, Ginters & Miquel-Angel 2015; Tambotoh, Manuputty & Banunaek 2015; Albert & Jonhson 2011). Sikundla et al. (2018) examined the socio-economic drivers of mobile phone adoption by small-scale irrigation farmers in South Africa and it was revealed that socio-economic variables such as gender, income source, marketing channels or networks, monthly income, and political and economic factors influenced mobile phone adoption in agricultural marketing. Similarly, Jiriko, Obianuko and Jiriko (2015) found that age, education, and training positively influenced the utilisation of ICTs by fish farmers in Kaduna State. Tambotoh et al. (2015) showed that demographic factors, social influence, and facilitating conditions influenced the adoption and use of technological innovation in rural communities. Albert and Johnson (2011) analysed university students' perception of e-learning systems and it was revealed that socio-economic status influenced students' conceptualisation and understanding of e-learning systems. Similarly, in a study examining the predicators of faculty adoption and utilisation of Open Access scholarly resources, Lwoga and Questier (2014) revealed that individual characteristics such academic rank or status, IT skills or competencies, and number of publications influenced faculty perception and utilisation of Open Access resources.

2.8.6 Scholarly communication behaviour

Scholarly communication is a critical component of the research process and therefore a key variable in analysing how researchers perceive or conceptualise a particular scholarly communication outlet or channel. Numerous studies have examined the impact of students and faculty members' scholarly communication practices on their perception or conceptualisation of open access institutional repositories (OAIRs). Gunasekera (2017) revealed that most scholars learnt about IRs as a result of a web search engine or by word of mouth. Shukla and Ahmad's (2018) examination of the impact of IRs on scholarly practices of scientists revealed that wider accessibility and quick dissemination influenced scholars' communication behaviour and use of IRs. Oguz and Assefa (2014) revealed that faculty members' perception of IRs and their desire to donate content to IRs is intimately linked with their scholarly productivity and communication behaviour. Lwoga and Questier (2014), in an attempt to develop a suitable framework for examining the adoption and usage of Open Access resources in academic institutions, identified academic

reward, accessibility, publicity, professional recognition, trustworthiness, and preservation as major predictors of faculty scholarly communication and self-archiving practices. It is clear that faculty members' and students' conceptualisation of IT innovation is influenced by their communication behaviour and practices.

2.8.7 Promotional strategies

Promotional strategies are essential in ensuring that prospective users are aware of the existence of an innovation. This allows prospective users to know about the benefits of an innovation. The main aim of any promotional strategy is getting the word out about an innovation using an array of methods (Martin-Yeboah et al. 2018). According to Yang and Li (2015), the success of any IR innovation depends on its popularity across all the stakeholder groups. This clearly depends upon the nature of the promotional strategies embarked upon by librarians and promoters of IRs. Promotional strategies consist of a series of activities, messages, and communication channels aimed at informing, reminding, and persuading prospective users (Akporhonor & Olise 2015; Holtzhausen 2010). However, many studies have suggested that IR promotional strategies are influenced by institutional factors such as personnel, institutional policies, IT infrastructure, and funding.

According to Kocken and Wical (2013), the success of any IR marketing strategy depends on the ability of librarians and IR managers to build awareness. Revell and Dorner (2009) identified subject librarians and IR managers as critical agents in the promotion of an IR as an innovative resource. They suggested that subject librarians promote IRs by assisting students and faculty members meet their information needs, while IR managers furnish users with how to troubleshoot access challenges. Similarly, Gunasekera (2017) suggested that institutional policies play a critical role in the promotion, acceptance, and usage of Open Access resources. Peekhaus and Proferes (2015) revealed that faculty engagement with Open Access IT innovations is influenced by institutional policies on Open Access publications. Muriithi, Horner and Pemberton (2016) concluded that institutional policies play a major role in creating and facilitating the adoption and use of ICTs in the research environment. They further identified funding and ICT resources as a key and emergent factor in analysing researchers' adoption and use of ICT.

The above theories are the most commonly used theories used in IR research. However, this study focused on two such theories and they were used to guide the study. Variables from the Dynamics of IR Innovation Model and the DOI Theory constituted the proposed framework that guided the study, as outlined in Chapter Seven.

2.9 SUMMARY

This chapter discussed the conceptual framework that guided this study. It reviewed some of the existing theories used in IRs and information systems research. The researcher took a detailed look at the DOI Theory, Institutional Theory, Stakeholder Theory, SST Theory, and the Dynamics of IR Innovation Model. The researcher concluded with a proposed conceptual framework, taking inspiration from the DOI Theory and the Dynamics of IR Innovation Model. The proposed conceptual model postulated that stakeholder IR intension and usage behaviour is influenced by their IR concepts and use intentions. The proposed conceptual model provided direction for the study and was tested and further verified using empirical data collected from respondents from the selected public universities in Ghana. The next chapter presents a review of the literature related to the sustainability of IRs. It provides a deeper understanding of the concept of IRs through the acknowledgement of the works done by previous researchers in this area.

CHAPTER THREE: REVIEW OF LITERATURE RELATED TO INSTITUTIONAL REPOSITORIES

3.1 INTRODUCTION

Chapter Two highlighted the various theories that have been used by previous IR researchers and provided a sound theoretical basis for the proposed conceptual framework. This chapter presents a review of the literature related to the sustainability of IRs. It provides a deeper understanding of the concept of IRs through the acknowledgement of the work of other researchers in this area. It explores the literature and addresses the study objectives as outlined in Chapter One. Based on the study objectives, this chapter discusses the concept of IRs and factors contributing to their emergence, especially in Africa. It further highlights the characteristics of IRs and provides an overview of its emergence in Ghana.

Chapter Three will also discuss the standard software and hardware requirements for IRs, followed by the analysis of stakeholders' awareness, usage, and perception of OAIRs, as well as a discussion of factors impeding the sustainability of OAIRs. Finally, in order to enhance the potential of the study to make a significant contribution towards the sustainability of IRs, this chapter ends with a synthesis of African and international studies on the sustainability of IRs.

The next section highlights the importance of a literature review in a scientific enquiry.

3.2 THE SIGNIFICANCE OF A LITERATURE REVIEW

Fink (2014:14) describes a literature review as a systematic, detailed, and comprehensive survey of scholarly publications, such as research articles, books, magazines, and other sources relevant to the phenomenon under study. It forms an integral part of the research process, because it provides the context within which the study is to conducted, establishes the significance of the study as well as a benchmark for comparing the results with the findings of others (Thomas & Hodges

2010; Creswell 2014). The literature review acknowledges the work of previous researchers and, in so doing, provides a description, summary, and critical evaluation of these works in relation to the research problem being investigated. According to Thomas and Hodges (2010:105), when planning a new research project, the literature review provides the researcher with an opportunity to:

- identify key information relevant to a topic;
- find out what is already known about a topic;
- assess the status or quality of existing research;
- critically examine support for alternative theories or arguments;
- evaluate research methods used in previous studies;
- highlight questions or issues that need further study; and
- select suitable research methods to use in a project.

To achieve the purposes stated above, the current literature review was designed to provide an overview of the sources explored while conducting this study, in order to demonstrate to the reader how the current study fits within the larger body of studies on IRs. A study of this nature required that literature be collected from various sources. Literature was obtained from both print and non-print versions of textbooks, journals, magazines, newspapers, conference proceedings, and institutional and archival records. These sources were accessed through the Unisa library website, blogs, newspaper venders, online libraries, IRs, and organisational websites.

Due to the vast body of knowledge available on IRs, it was therefore paramount that the literature review is structured or streamlined in a manner that reflects what is known and unknown about the phenomenon under study. To achieve this, authors such as Creswell (2014), Machi and McEvoy (2008), and Kamler and Thomson (2006) recommend the use of literature review maps. Hart (1998:162) suggests that the “mapping of ideas, arguments and concepts from existing body of literature is an important part of the review of literature.” Creswell (2014:36) views a literature map as a “visual summary of the research that has been conducted by others and it is typically represented in a figure”, thereby providing ‘tangible evidence’ (Kamler & Thomson 2006) of a researcher’s understanding and an interpretation of the existing body of literature about the problem under investigation.

In view of this, the researcher developed a literature map to guide the literature review process. The literature map was used to show the linkages between the study objectives and the conceptual framework that underpinned the study.

The literature review was based on the research objectives as outlined in section 1.4.2. The literature review begins by providing a general understanding of the concept of IRs, which is then contextualised to take into consideration African and Ghanaian perspectives on the sustainability of IRs. The literature review ends with various factors that influenced the sustainability of IRs in Africa, with particular emphasis on Ghana. As shown in Figure 3.1, these factors are outlined with the intention of providing a justification for the current study.

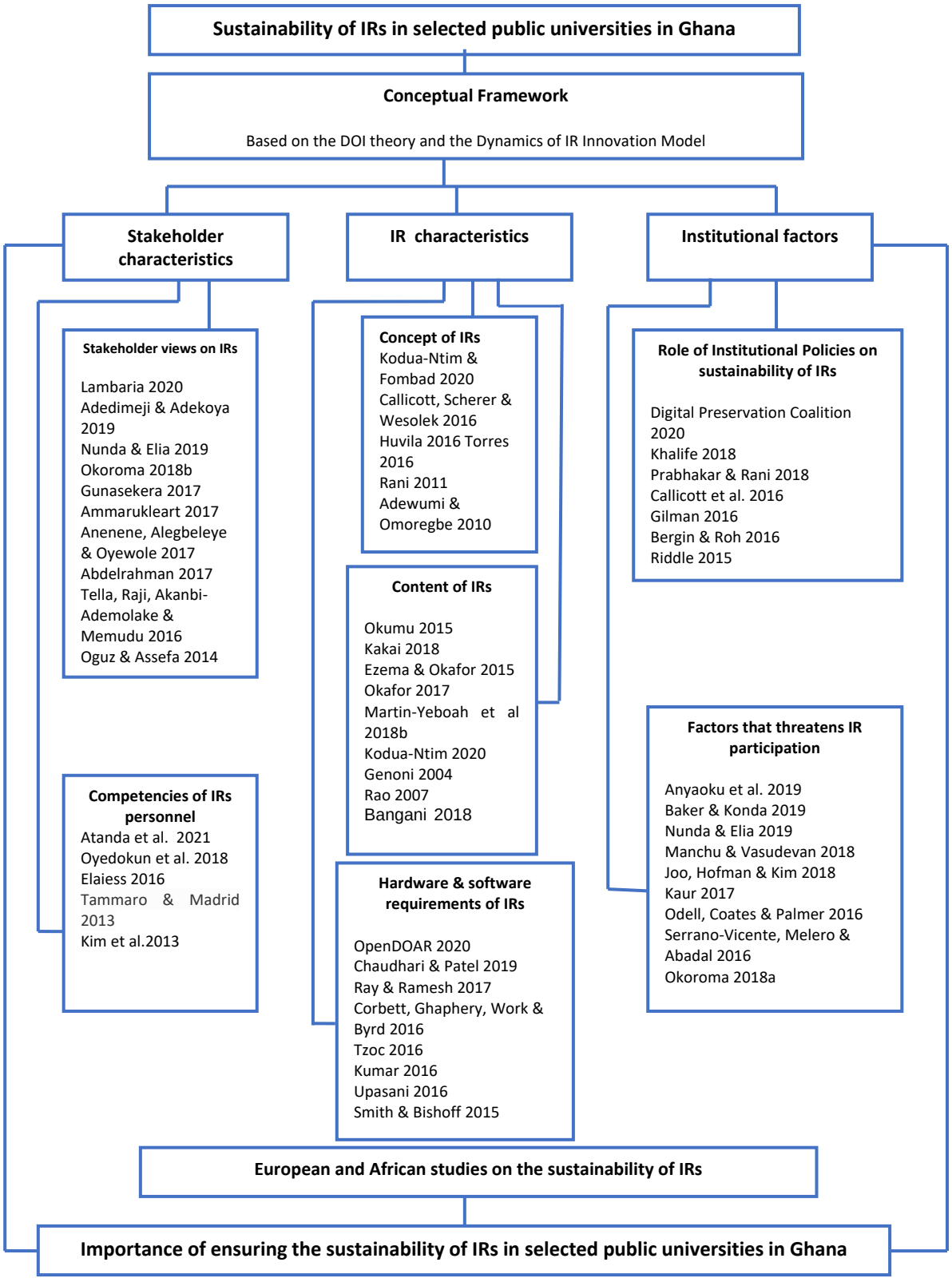

Figure 3.1: Literature Map

The next section of the chapter focuses on a review of the existing literature on the concept of IRs.

3.3 THE CONCEPT OF IRs

Repositories began with the first efforts to organise records for storage, preservation, and long-term use. Repositories have long existed in the form of libraries, museums, and archives (Huvila 2016; Torres 2016; Rani 2011). From the era of clay tablets and papyrus, to books and e-resources, technological innovations have shaped the nature and format of the collections stored by these repositories. Contemporary advancements in ICTs continue to transform the scholarly environment, as well as the collection, management, and preservation of scholarly information. According to Tiwari and Gandotra (2018), ICTs have become the core resources required for the creation of any modern repository. This is because they provide the platform and opportunity for researchers, scholars, and academics to work collaboratively as well as access resources and knowledge services within borderless environments.

The concept of IRs began with the global advocating for open access to scholarly and scientific information and digital libraries (Kodua-Ntim & Fombad 2020; Callicott et al. 2016). However, the concept gained a lot of momentum and attention when the Massachusetts Institute of Technology (MIT) and Hewlett-Packard (HP) Labs launched the DSpace project in 2000 (Callicott et al. 2016; Mackenzie 2002). The idea behind the project was to build a flexible and robust electronic archive that explored technical and ethical issues such as interoperability, copyright, intellectual property, versioning, electronic publishing, information retrieval and community feedback that had confronted earlier Open Access initiatives (Cullen & Chawner 2011). Since then, the growth of IRs has soared due to the rapid growth of e-resources and its attendant challenges to IR usage, management, and preservation (Ternenge & Kashimana 2019; Tiwari & Gandotra 2018; Kumar 2016; Kavishe & Dulle 2016).

The concept of IRs has also gained prominence due to the global desire to manage educational, research, scholarly, and scientific resources in a more efficient,

transparent, and open manner. In an era of digital publishing and archiving, academic and research institutions are increasingly recognising IRs as an important feature of modern-day scholarly communication, preservation, and dissemination (Nunda & Elia 2019; Saini 2018; Ogenga 2015; Jain, Bentley & Oladiran 2014). The Alfa Network Babel Library (ANBL) (2007:63) believes that making research and scientific findings freely accessible will help enhance collaboration among both local and international research institutions, thereby helping to advance and share new knowledge. The concept of IRs therefore provides a useful tool for institutions to manage the digital scholarship produced by its community members, improve on access to scholarly research outputs, and increase the visibility and academic prestige of both the institution and its scholars.

3.3.1 Evolution of Institutional Repository

Institutional repositories were initially developed as an online solution for the collection, preservation, and dissemination of institutional scholarship and research (Tsunoda, Sun, Nishizawa & Liu, 2016). However, over the years IRs have evolved into a platform for institutions to showcase and communicate the entire breadth of their scholarship, including articles, books, theses, dissertations, and journals (Kodua-Ntim & Fombad 2020; Nunda & Elia 2019; Bangani 2018; Kaladhar, Naick & Rio 2018; Ukwoma & Okafor 2017). In view of this, IRs must have mechanisms or data labels that facilitate easy discovery and retrieval of its contents (ANBL 2007). This is usually achieved through that adaptation or application of web-based performance optimisation techniques and advanced internet technologies. The adaptation of these techniques and technologies has moved IRs from being just electronic archives to online archives that host a variety of services.

Consequently, IRs are increasingly being used by many academic and research institutions as a crucial part of their information strategy due to the varied range of services they offer (Bangani 2018; Ukwoma & Okafor 2017; Tsunoda et al. 2016; Bankier & Gleason 2014). Prominent among these benefits is an IR's ability to link users to each other (ANBL 2007). By linking users to other repositories, IRs can help improve and address the challenges associated with scholarly communication, especially in Africa and other less developed and developing countries where the

cost of access to scientific and scholarly resources is excruciatingly high. The high or increasing cost of scientific journals or databases has resulted in many organisations archiving experimental and observational data authored by members of their organisations (Ukwoma & Dike 2017; Adu & Ngulube 2017; Debreczeni 2015; Osif 2012; McCord 2003). While most academic and scholarly databases can only be accessed on a subscription basis and are not retrievable by general search tools such as Google, research papers in an IR are fully accessible by general search engines, free of charge (Tsay, Wu & Tseng 2017; Kelly & Eells 2016; Williamson & Mirza 2015). Therefore, an IR presents a clear opportunity for institutions seeking to expand the frontier of knowledge through open science and data.

3.3.2 Features of IRs

Repositories have been in existence since the collection of knowledge and artefacts for preservation and long-term use began. Throughout history, repositories have evolved to meet the demands of the time and also as a reflection of the technology available at the time. This is adequately portrayed by the long and rich history of repositories, such as libraries, archives, and museums. All these repositories have their own unique characteristics and IRs are no exception. According to Jones (2006), IRs tend to have different meanings to different people and are characterised in a variety of ways. However, there seems to be some broad consensus in the literature around the key features of an IR (Gibbons 2004; Genoni 2004; Jones 2006; Adewumi & Omoregbe 2010).

According to Crow (2002), an IR must have scholarly content, be digital or electronic in nature, contain the research output of the entire institution, be cumulative and perpetual, be interoperable, and be freely accessible. Similarly, Kaladhar et al. (2018) perceived IRs as an extension of the institutional support activities aimed at promoting an institution's research and scholarly communication activities. They provide an ideal platform for publicising, disseminating, and managing an institution's scholarly and academic resources (Demetres**,** Delgado & Wright 2020; Kakai 2018; Anenene et al. 2017).

Genoni (2004:301) identified IRs to be institutionally defined, scholarly, cumulative and perpetual, open, and interoperable. Also, Gibbons (2004:6) outlined other key features such as being community-driven and focused, and having institutional support, durability, permanence, and accessible content as core features of an IR. Subsequently, Jones (2006) took inspiration from the works of Crow (2002) and Genoni (2004) and identified features such as capturing and preserving the events of campus life and being searchable within constraints in addition to the features mentioned above. Similarly, Adewumi and Omoregbe (2010:2) introduced new features, such as open source or proprietary, software or hosted service, support, user validation, content, metadata formats, advanced searching, default subject classes, syndication, and administrator functions as essential features of an IR.

In summary, according to Kaladhar et al. (2018), Kakai (2018), Anenene et al. (2017:2), Gibbons (2004:6), and Genoni (2004:301) there is a general consensus about the attributes and features of an IR. Common among these are:

- Scholarly: collects published or unpublished academic or scholarly materials such as theses, preprints, post-prints, administrative reports, technical reports, etc.
- Digital/electronic: collects digitised or digitally born information.
- Institutionally defined: unlike the traditional discipline-specific and digital libraries, an IR captures the research of the entire population of the institution.
- Cumulative and perpetual: this refers to the long-term nature of data preservation and accessibility through the IR.
- Open Access: a key defining feature of an IR is the free and open access to its contents.
- Web-based: accessible over the Internet.
- Easily accessible: user friendly interface that facilitates easy access and retrieval.
- Interoperable: this refers to the fact that the IR can be operated on various platforms.

3.3.3 Content of IRs

Institutional repositories as digital archives are mandated to store or archive intellectual or scholarly outputs of members within their parent institutions. This largely stems from its wide acceptance as tool for the collection, storage and dissemination information to advance scholarly communication (Rao, 2007). Saini (2018) posits that institutional repositories are increasingly being used a platform for showcasing original and peer-reviewed contents within the open access environment. Content therefore has become an important topic of interest for many researchers and practitioners interested in the successful implementation, operation and stainability of IRs. As a medium for showcasing the intellectual outputs of an organisation, the IR for many academic and research institutions, would typically contain materials such as preprints of scientific journal articles, peer reviews, electronic versions of theses and dissertations, and other digital assets generated by normal academic life, such as administrative documents, course notes, or learning objects (Genoni, 2004; Rao, 2007; Bangani 2018).

According to Rao (2007) the content of IRs for a university would commonly include published research articles, articles undergoing reviews, digital versions of theses and dissertations, administrative documents and course material. Similarly, Okumu (2015) posited that thesis, journals, books and conference papers are the commonest documents that can found in institutional repositories in Kenya. Also, Kakai (2018) assessing the achievements, challenges and way forward for institutional repositories in East Africa observed that much of much of the grey literature, such as research reports, theses and dissertations, seminar and conference papers that were unpublished and previously could only be found in print format, are now being hosted online in institutional repositories.

Ezema and Okafor (2015) examined advocacy for open access institutional repositories among Nigerian academic libraries. They posited that Nigerian academic libraries archived resources that project more of the activities of the institution. They further identified theses and dissertations, staff publications, conference proceedings, faculty/departmental journals, inaugural lectures, conference/seminar papers, public lectures, senate publications, and Vice

Chancellor's addresses as the commonest document types archived by Nigerian academic libraries. Similarly, Ukwoma and Okafor (2017) in their study to examine IRs trends and development in Nigerian universities revealed that theses and dissertations, inaugural lectures, journal articles and conference proceedings were archived items in Nigerian IRs. A study conducted by Martin-Yeboah et al (2018b) on the scholarly communication practices via institutional repositories in Ghanaian universities revealed that the contents Ghanaian institutional repositories largely included conference papers, electronic theses and dissertations, lecture notes and examination questions and university publications. Similarly, Kodua-Ntim (2020) in a study that sought to analysed the usage of open access institutional repositories in university libraries in Ghana identified conference proceedings, seminar papers, reports, thesis and dissertations (abstract and full text), books, book chapters, images, audio and video files as the commonest document types archived by Ghanaian university libraries.

From the above reviews, it is clear that although there are variations in the types of documents archived in IRs, there are some documents that are generally archived in repositories globally. Common among these are:

- Postgraduate thesis and dissertation
- Pre-print/post print of research articles
- Conference proceedings
- Faculty/departmental journals
- Administrative papers
- Newsletters and bulletins
- Teaching notes
- Committee reports and memoranda
- Inaugural lectures
- Past examination questions

3.3.4 Benefits of IRs

IRs have been identified as one of the cheapest solutions to the increased demand for credible, reliable, and verifiable scientific information. According to Kaur (2017),

the growing demand for scholarly information and a global movement towards open science requires that academic institutions to provide centralised access to institutional digital resources. Laxminarsaiah and Rajgoli (2007) posit that the need for IRs is even more eminent in this era of information explosion. Many advocates have argued that IRs have the potential to spearhead a new scholarly publishing paradigm. According to Xia and Opperman (2009:17), the global acceptance and establishment of IRs over the past years have helped to accumulate necessary experience and provide appropriate platforms for libraries to function as Open Access publishers. Cohen (2001) identifies IRs as publishing outlets that have the potential to increase the readership of institutional publications. Royster (2008:7) recounted the experiences of the University of Nebraska IR and asserted that by making the contents of the university's IR open, as opposed to limited-access or subscription-access, the University of Nebraska was able to increase the downloads of published and unpublished institutional assets like theses and dissertations to about 60%. Clearly, the benefits of IRs in this digital era are enormous. Academic and research institutions are increasingly recognising the importance of IRs. The creation of IRs provides enormous research benefits for academics, staff, and students in institutions of higher education. According to Kaur (2017), many educational institutions and their libraries are pushing for the establishment of IRs because the IRs provide a convenient avenue for improving, preserving, and ensuring immediate global access to library collections. In today's competitive global higher education market, it is has become imperative that academic institutions showcase their scholarly and intellectual outputs to audiences both within and outside the institution. IRs therefore offer academic institutions the opportunity to widely disseminate their intellectual output (Prabhakar & Rani 2018:6907).

IRs provide institutions with the opportunity to establish a centralised system for the collection and preservation of their intellectual and scholarly resources in digital form. Kim (2007:3) suggests that IRs have both intrinsic and extrinsic benefits. The extrinsic benefits relate to the external benefits an individual or institution gains from having or depositing content into an IR, such as visibility, recognition or rewards, prestige, and public value of contributors. The intrinsic benefits, on the other hand, relate more to the incessant desire of depositors to make their works easily

accessible to the wider academic society. These benefits have been corroborated by many other researchers (Lambaria 2020; Wu 2015; Bolu 2012; Jones 2007: Chan 2004; Yeates 2003; Crow 2002). Kaladhar et al. (2018) identify the preservation of institutional digital assets, lowering the barrier to information dissemination, and centralised control over institutional digital assets in order to facilitate teaching, learning, and research as major benefits of IRs. Prabhakar and Rani (2018) attribute the increased popularity of IRs to the increasing need of organisations to archive their scholarly materials, improve document security, increase global visibility and accessibility, and deal with technological changes and limited physical storage space. Wu (2015) identifies wider dissemination, preservation, and stewardship of scholarly output as the pivotal benefits of IRs within an academic environment.

Prabhakar and Rani (2018) argue that repositories provide organisations with the opportunity to create a comprehensive database of their intellectual and scholarly outputs, which in turn facilitates better management of research knowledge, better visibility and wider access, rapid communication of research, and long-term preservation. According to Lambaria (2020), the benefits faculty members seek to gain from depositing works in an IR include the ability to use deposited content for promotional purposes and to foster collaborations. Furthermore, Yu (2006) argues that in addition to authors who gain visibility and users who find information easily, institutions increase their research profile through wider dissemination of institutional research outputs. In summary, the benefits of IRs to the academic community are as follows:

- Knowledge development and sharing.
- Academic recognition and visibility.
- Preservation of institutional outputs.

However, like all technological innovation, IRs are faced with numerous challenges that threaten their long-term existence, especially those situated in developing continents like Africa. The next subsection addresses these challenges, especially within the African context.

3.3.5 Experiences of IRs in Africa

Global advocacy for open access to scientific and scholarly publications has engineered efforts for the establishment and development of IRs across the continent. According to Abrizah, Noorhidawat and Kiran (2017), the idea and push to remove all barriers or constraints to accessing knowledge has charted the course for the establishment of OAIRs in Africa. IRs provide institutions in Africa the opportunity to showcase the rich cultural heritage of the continent, as well as the potential to enhance access and sharing of research-based information generated in Africa (Yusuf, Ifijeh & Owolabi 2019; Malekani & Kavishe 2018; Dlamini & Snyman 2017). This fosters development and places Africa on the global knowledge generation landscape. However, many African countries and institutions have not fully embraced the concept of IRs, with the majority of the IRs in Africa still at the inception stage (Yusuf et al. 2019; Abrizah et al. 2017; Van Wyk & Mostert 2014).

This has been attributed to the many challenges that confront IRs on the continent. As aptly put by Malekani and Kavishe (2018), “many problems make the work of Africa’s repository managers difficult and frustrating”. Prominent among these are intermittent power supply (Yusif et al. 2019; Oguche 2018; Fasae, Larnyoh, ESew, Alanyo & Holmner 2017; Siyao, Whong, Martin-Yeboah & Namamonde 2017); poor internet connectivity and inadequate bandwidth (Dzandza 2020; Bhardwaj & Banks 2019; Ukwoma & Ngulube 2019; Ibrahim 2019; Thompson et al. 2016); lack of financial support (Anyaoku et al. 2019; Prabhakar & Rani 2018; Joo et al. 2018); lack of ICT infrastructure (Ukwoma & Ngulube 2019; Malekani & Kavishe 2018); lack of personnel with the requisite IT expertise to manage IRs (Dzandza 2019; Oguche 2018; Emezie & Ngozi 2013); copyright issues (Baker & Kunda 2019; Kaur 2017; Peekhaus & Proferes 2015); and the general attitude of African researchers towards Open Access publishing (Mutwiri, Karia & Muriungi 2017; Raju, Classeen & Moll 2017; Fox & Hanlon 2015).

Despite these challenges, statistics from international registries such as the Registry of Open Access Repositories (ROAR) and the Directory of Open Access Repositories (OpenDOAR) suggest a steady increase in the number of IRs on the continent (Dlamini & Snyman 2017; Ezema & Onyancha 2016).

Despite steady improvements, Africa still lags behind other developing continents like Asia (930 IRs) and South America (521 IRs). Many African countries still do not have functional IRs. In fact, only 21 out of 55 countries in Africa have fully-functional IRs (ROAR 2020). The majority of IRs in Africa can be found in South Africa (43 IRs), Kenya (23 IRs), Nigeria (14 IRs), Sudan (12 IRs), and Algeria (12 IRs). This therefore calls for an increase in awareness of and advocacy for the benefits of IRs, as well as the need to work towards the removal of the challenges that confront IRs on the continent. Particularly in an era where the COVID-19 global pandemic and the resultant lockdown policies forced libraries globally to provide remote access to their collections by leveraging their websites, IRs, and other computer systems in order to deal with the demand (International Federation of Library Associations and Institutions 2020; Okike 2020; Martin & Schwartz 2020).

3.3.6 Experiences of IRs in Ghana

Ghana, like many countries in the developing world, has embraced the concept of Open Access to scientific research largely because of the huge financial commitment involved in accessing scientific and scholarly publications. In view of this, many academic institutions in Ghana, with support from organisations such as the CARLIGH, the Carnegie Corporation of New York, and the INASP, began efforts towards establishing their own repositories. The KNUST was the first university in Ghana to have a fully-functional IR in 2008 (Malekani & Kavishe 2018; Corletey 2011). The establishment of the IR was a key contributing factor to the university being ranked 52nd on the world webometric ranking of the best 100 universities in Africa. This achievement motivated other universities to intensify efforts towards the establishment of their own IRs. Currently, only six universities in Ghana have a fully-functional IR (ROAR 2020). This is woefully inadequate considering the number of research-based academic institutions in the country.

These existing IRs have over the years ensured that the research that is generated in their respective institutions are preserved to meet the current and future information needs of their community members and the larger society. In order to enhance visibility and increase access to their archived resources, all six the IRs in

Ghana have been indexed by Google and also registered by international repositories such ROAR and OpenDOAR (Thompson et al. 2016; Corletey 2011). However, repositories in Ghana are confronted with a myriad of challenges as outlined in Section 3.8. Previous studies by Dzandza (2020), Kodua-Ntim and Fombad (2020), Anyaoku et al. (2019), Martin-Yeboah et al. (2018), Kumah, Adzadi and Imoro (2018), Thompson et al. (2016), and Bossaller and Atiso (2015) have also identified some of these challenges that undermine the efforts of IR managers. All these studies focused attention on the challenges and strategies for promoting IRs as a viable platform for preserving institutional research outputs, heritage, and rare collections so as to reap the advantages that these collections offer in terms of prestige, visibility, and intellectual development. There is therefore the need for governmental and institutional support geared towards the removal of these barriers in order for the country and its scholars to accrue the full benefits of archiving knowledge generated in the country in IRs.

3.4 MARKETING AND PROMOTION OF IRs IN GHANA

The marketing and promotion of information services have been identified as key competencies of the modern-day information professional (Soo-Yeon, Elkins, Hanson, Shotwell & Thompson 2020; Osinulu, Adekunmis, Okewale & Oyewusi 2018; Osinulu, Adekunmisi & Okewale 2017). This is because, in an era of the proliferation of information services and outlets, information professionals must make conscious efforts to make their services and products known to their targeted audiences. According to Yi (2016), in order to increase patronage and raise awareness, information professionals, particularly librarians, must find innovative ways to market and promote services and resources to clients as effectively as possible. The IR is one such library resource that must be effectively marketed and promoted in order to ensure its sustainability. According to Hayibor (2017:45), “the main reasons for the identification of stakeholders are for consultation and promotional purposes”. This is because it provides IR managers the opportunity to plan stakeholder-specific marketing and promotional activities aimed at communicating the value or the benefits (personal and organisational) that can be

can accrued by supporting the repository efforts (Martin-Yeboah et al. 2018; Hayibor 2017; Thompson et al. 2016).

The marketing and promotion of IRs in Ghana began with the establishment of the first IR set up by the KNUST in 2008 (Malekani & Kavishe 2018; Corletey 2011). The KNUST Library, in conjunction with the Karisruhe Institute of Technology (KIT), organised various sensitisation workshops for faculty members and librarians from the various universities in the country in order to create the awareness and prospects of IRs. Based on the giant step taken by the KNUST Library, the CARLIGH designated the KNUST as the National Repository Centre of Ghana to be the focal point for research publications in the nation. However, up until 2012 the KNUST was the only institution that had a fully-functional IR. This was mainly attributed to the lack of funding and the initial cost of establishing these repositories. In 2011 the INASP and the CARLIGH embarked on a campaign to initiate the setting up of IR platforms for some CARLIGH member institutions. Currently, six of them have IR platforms, with the onus being on each institution to populate its own IR (ROAR 2020). Although this initiative was successfully implemented, creating awareness about the importance and value of these repositories seems to be a great challenge for most academic libraries in Ghana (Kodua-Ntim & Fombad 2020; Martin-Yeboah et al. 2018; Kumah et al. 2018; Thompson et al. 2016).

Over the years, many of these academic libraries have embarked on various marketing and promotional activities aimed at creating awareness and communicating to their stakeholders the value that an IR brings to the university community. These promotional strategies are usually centred on formal and informal user education programmes such as workshops, flyers, personal visits to faculty, presentations at academic board meetings, and notifications through the university's e-mailing system, newsletters, and notice boards (Martin-Yeboah et al. 2018; Hayibor 2017; Thompson et al. 2016; Bossaller & Atiso 2015). Even though these promotional activities have achieved some gains, they have not gained the needed impact, especially among faculty members (Lambaria 2020; Okoroma 2018b; Ammarukleart 2017; Hall 2014). In view of this, many have recommended comprehensive policies that address sensitive marketing and promotion issues

(Kodua-Ntim & Fombad 2020; Martin-Yeboah et al. 2018; Thompson et al. 2016). In the absence of such policies, repository managers must continue to create and intensify awareness activities for the university community.

It must, however, be noted that any awareness or promotional activities must take into consideration the unique characteristics of all stakeholders. In view of this, the next section outlines the concept of IRs from the perspective of students, academic staff, and librarians.

3.5 VIEWS OF STUDENTS, ACADEMIC STAFF, AND LIBRARIANS ON IRs

Students, academic staff, and library staff are critical to the sustainability of IRs. This is because they form the stakeholder group responsible for content submission, content generation, and the management and operation of IRs. Therefore, how these stakeholder groups perceive or view IRs has an impact on their level of participation and commitment to any repository project.

3.5.1 Academic staff members' views on IRs

The introduction of the concept of free and open access to knowledge has greatly transformed the scholarly communication landscape and has been redefined by centuries-old scholarly publishing traditions and practices (Oguz & Assefa 2014) across many academic disciplines. There seems to be a growing perception among scholars regarding the need to make scholarly literature freely available to public and with little or no licensing restrictions (Oguz & Assefa 2014; Keeffe 2012; Van Noorden 2009). IRs have been identified by many as one of the ways to attain this noble goal. However, one of the critical challenges most IRs face is how to attract content from faculty members. Many of the studies that have attempted to examine faculty participation in IRs have largely focused on the self-archiving and depositing practices of faculty members in an attempt to explore disciplinary variations or differences (Lwoga & Questier 2014; Anderson, Dwyer & Leahy 2012; Xia 2008); understand their self-archiving and depositing behaviour or experiences (Betz & Hall 2015); and investigate the factors that facilitate or impede their participation in IRs (Covey 2009; Davis & Connolly 2007; Kim 2010).

Anderson et al. (2012) specifically evaluated the self-archiving behaviour of researchers in the music discipline. Through an analysis of articles in top music journals and the contents of the authors' IRs, they discovered that music faculty members were not in the habit of self-archiving or making their work openly available in IRs. However, Gunasekera (2017) explored the attitudes and knowledge of social science scholars about Open Access publishing and IRs and their participation in the university's digital repository. The results showed that the majority (57%) of the respondents reported their willingness to contribute to the university's digital repository in future, while 14% of them were not willing to contribute. A survey conducted by Pelizari (2005) on the social science faculty's knowledge about Open Access reported a positive acceptance of Open Access principles among academic staff of the social science discipline. Similarly, Hall (2014) also revealed that researchers with quantitative data and researchers in the humanities are more likely to share data than those with qualitative or mixed data, which is more open to interpretation and inference.

Davis and Connolly (2007) comprehensively examined the information seeking behaviours of faculty through IR and revealed that issues such as redundancy, fear of plagiarism, learning curve, and confusion with copyright hindered faculty deposits and usage of IRs. Alemayehu (2010) investigated the attitude of the researchers of Oslo University towards using IRs and found that they have a low awareness of IRs, but were interested in contributing their work to the university's repository and have a very positive attitude towards providing free access to their work through their university's IR. In a study exploring faculty members' attitudes towards IRs in order to better understand their research habits and preferences, Hall (2014) revealed that although faculty members perceived IRs as something that would be beneficial for increasing the impact and accessibility of their research, copyright and licensing restrictions were major impairments to depositing their work in a repository. He further revealed that senior faculty members were more likely than junior faculty members to publish with Open Access publishers or deposit in repositories. Keeffe (2012), with the objective to examine the factors that facilitate or impede faculty members' willingness to deposit into repositories, revealed that even though a substantial majority of faculty members agreed with the stated institutional and

personal benefits associated with IR contribution, they hardly deposited their works onto IRs. Similarly, Okoroma (2018b) examined the utilisation of IRs by faculty members in five Nigerian universities and revealed that faculty members were reluctant to submit work to their university's IR.

Dulle and Minishi-Majanja (2009) explored Tanzanian researchers' awareness and usage of IRs. The study revealed that the majority of researchers in Tanzanian public universities were aware of IRs for scholarly communication and use these resources to access scholarly content, rather than to disseminate their research findings. A study by Manjunatha and Thandavamoorthy (2011) showed that despite researchers' low level of awareness of the benefits of IRs, the majority (56.80%, n=969) of researchers indicated their interest to deposit their work in the IR. However, concerns such as plagiarism, copyright, unclear submission procedures, and time constraints were identified as impeding factors. Similarly, Lwoga and Questier (2014) identified the fear of violating the publisher's copyright policies and plagiarism as major factors that inhibited faculty members' actual usage of OAIRs. Also, Lambaria (2020) outlined barriers such as financial constraints, uncertainty about ownership of deposited work, copyright, concerns about the sharing of co-authored works, and time constraints as major impediments to faculty participation and usage of IRs. Kim (2011b) conducted a study on academic scholars' perceptions of IRs among Carnegie doctorate-granting universities in the United States of America (USA). The findings established that 60% were unaware of their university IRs. The study further investigated factors that encourage faculty contribution, as well as the factors that hinder faculty contributions to IRs. The study found copyright issues and more time and effort spent on self-archiving as major barriers that accounted for the low levels of faculty contributions to the university IR. According to Ammarukleart (2017), shortening and simplifying submission processes, strengthening digital preservation, and copyright management in IRs are key to ensuring and increasing faculty participation.

In order to improve participation, many researchers have advocated the need for institutions to make it mandatory for faculty members to deposit their research work into the IR as a requirement for tenure or promotion (Stanton & Liew 2012, Smith

2008; Sale 2006). However, other authors hold a contrary view (Oguz & Assefa 2014; Cervone 2011). Oguz and Assefa (2014) argue that the IRs have brought changes to established scholarly communication practices. However, as is often the case with changes, they have been met with resistance. In managing such resistance, one needs to adopt persuasive rather than coercive measures. According to Cervone (2011), in order to improve faculty participation in IRs, there is the need to create “allies” or “friends” among faculty members. This can be done by making a convincing case to peers for change, effectively leveraging and repurposing existing intellectual and physical resources, and mobilising politically within and outside the institution in support of IRs.

3.5.2 Library staff members’ views on IRs

Despite the numerous benefits associated with the establishment of IRs, many universities in Africa are still battling to overcome the many challenging issues that surround their attempt to make their research outputs openly accessible and available by means of internet technologies like IRs (Anyaoku et al. 2019; Dlamini & Snyman 2017; Ukwoma & Okafor 2017). Library staff are the major proponents or custodians of IRs, as the library is viewed as the hub of information for any academic institution (Kodua-Ntim & Fombad 2020; Joo, Hofman & Kim 2019). In fact, the library is the fulcrum around which any successful IR project revolves. This is because libraries, particularly university libraries, have been the main pioneers of Open Access initiatives aimed at removing barriers to the dissemination of scholarly or scientific literature (Kiran & Yip Ping 2009). In view of this, many studies have sought to explore the views and perceptions of library staff about IRs. Studies by Dorner and Revell (2012:268) revealed that librarians have varying perceptions about the usefulness of IRs as an information resource and hold both positive and negative perceptions.

Ugwuanyi, Eze, Obi and Ugwuanyi (2013) examined the perception of college librarians in Nigeria about Open Access platforms such as IRs as a medium for the delivery of quality scientific knowledge and for accessing the publications of scholars to global knowledge. The study sampled 55 professional librarians in the seven colleges of education in the South East Zone of Nigeria. The study revealed that

professional librarians generally had a positive perception of Open Access scholarly publishing. However, their level of involvement in creating awareness and contributing to the development of Open Access at the time of this study was low. This Ugwuanyi et al. (2013) attributed to the fact that most librarians did not fully understand the concept of Open Access. Anenene et al. (2017:10) descriptively examined the adoption of IRs by universities in South-West Nigeria from the perspective of library staff. A total of 32 library staff members were selected from seven universities. The study revealed that the majority (86.7%) of library staff had a positive perception of IRs. They identified IRs as a very useful tool for the preservation and dissemination of scholarly information. Rieh, Jean, Yakel, Markey and Kim (2008) explored the factors surrounding the successful planning and implementation of IRs in the USA. Data was collected from 36 IR staff members through telephone interviews. The findings indicated that IR staff viewed the IR as an essential infrastructure for their university's participation in the Open Access movement and the staff members were confident about the IR's long-term sustainability. Over the years, librarians and their libraries are increasingly taking a leadership role in reducing barriers to IR participation (Engeszer & Sarli 2014). However, a study by Dorner and Revell (2012) aimed at understanding subject librarians' perception of IRs as a valuable information resource had both positive and negative results. This was mainly due to the fact that most IRs in Africa are still in their infancy, offering limited value to students even though they are good resources for accessing theses.

Based on the reviewed literature, it is clear that library staff members play a critical role in ensuring the sustainability of IRs. This is because they form the fulcrum around which IR promotional or awareness strategies revolve. It is therefore important that library staff members stay abreast with current Open Access trends in order to be able to educate others (Dandawate & Dhanamjaya 2019; Sanjeeva & Powdwal 2017; Dang 2017). It must be noted that educating others has always been one of the core functions of librarians**.** However, to be able to perform this traditional role more effectively, it is important for libraries take a more proactive role in promoting the benefits of OAIRs and this can only be achieved when librarians themselves develop a positive conceptualisation of IRs.

3.5.3 Students' views on IRs

Student deposits constitute a significantly high portion of the growing contents of IRs worldwide. According to Swan (2005), the preservation of students' research works continues to be one of the major reasons why universities set up repositories. It is therefore common to find undergraduate and graduate research works archived in IRs. An examination of 283 repositories in the USA using the Bepress or DSpace platforms showed that 71% of the contents of these repositories were deposited by students (Barandiaran, Rozum & Thoms 2014). This has largely been attributed to the mandatory thesis archiving policies that have been adopted by many academic institutions and the willingness of students to comply with such mandates (Sale 2006; Pickton & McKnight 2006; Palmer, Teffeau & Newton 2008). Despite these mandates, many scholars have sought to examine students' perceptions and experiences with IRs in order to create repository services that are responsive to students' needs. According to Stanton and Liew (2012), students are generally supportive of a mandatory thesis submission policy. Nunda and Elia (2019) explored the adoption and use of IRs among postgraduate students in the Muhimbili University of Health and Allied Sciences and Sokoine University of Agriculture in Tanzania using the mixed methods research design. The study showed a high awareness and usage rate (87.2% and 78.2% respectively) of IRs among students. The study further revealed that visibility and information sharing were the key factors that influenced students' perception and usage of IRs.

Stanton and Liew (2012) examined doctoral students' awareness of and attitudes towards Open Access publications and the concept of IRs in New Zealand using the mixed methods research design. The study revealed that while awareness of Open Access and repository archiving is still low among postgraduate students, the majority of them were supportive or had a positive perception of IR initiatives. They further recommended that librarians and IR promoters explore other effective communication and promotional channels and strategies. Similarly, Pickton and McKnight (2006) asserted that postgraduate students' participation in IRs would increase when they recognise the potential benefits of IR publishing, such as greater visibility, exposure, and the possibility of receiving feedback from peers. Also, Nolan

and Costanza (2006) assert that students are motivated to deposit into IRs because of a desire to share their research findings with wider audiences and the possibility of receiving feedback and commentary. Tella et al. (2016) examined the use and perception of Open Access electronic theses and dissertations by undergraduate students of the University of Ilorin, Nigeria. A total of 375 students were drawn from the 15 faculties of the university as the sample for the study. The results showed that the use of Open Access electronic theses and dissertations is very low and most of the respondents demonstrate limited awareness of the availability of the theses and dissertations for research, which negatively affected the usage of the university's IR.

In a study conducted by Abdelrahman (2017) on the accessibility of IRs by graduate students in Khartoum, the results showed that the IRs are accessible from the university's webpage. The results also showed that graduate students exhibited a positive attitude towards the digital repository and its contents. This could be as a result of the non-availability of traditional library services and information resources needed to meet the graduate students' information needs. However, the graduate students' information needs are only partially satisfied with the contents of the repository. This means that a large component of the repository's collections is impertinent to the graduate students' information needs.

Almobarraz (2007) examined Saudi students' perception of digital repositories that archive works produced by students who were awarded scholarships. The study revealed that the majority of students have a positive perception about the quality of the contents of digital repositories and had desired to archive in a digital repository. However, the fear of copyright infringements and a lack of awareness of the existence of the digital repository were identified as major factors that prevented students from depositing their work in such repositories. Adedimeji and Adekoya (2019) investigated the attitudes of university students towards the use of IRs using a descriptive survey design. A total of 500 undergraduate and postgraduate students at the Federal University of Technology Akure were randomly sampled for the study. The study revealed that university students generally had a positive attitude towards the use of IRs and recommended that the contents of IRs be constantly updated in order to stimulate usage. From the above literature review, it is clear that students

generally have a positive attitude towards the use of IRs. This is largely influenced by their desire to ensure that their works reach as many audiences as possible and the possibility of receiving feedback or commentary.

The next section takes a critical look at the impact of institutional policies on the sustainability of IRs.

3.6 INSTITUTIONAL POLICIES AND THE SUSTAINABILITY OF IRs

Institutional policies play a crucial role in ensuring the successful implementation of an IR project. According to Callicott et al. (2016), once an institution has set up a repository, practitioners must turn their attention to setting up policies geared toward cultivating success. A carefully drafted IR policy can provide valuable learning and research opportunities for the benefit of all IR participants. However, many institutional repositories operate under policies that does not take into consideration the diverse and complex needs of the various stakeholder groups (Riddle 2015). This clearly threatens the sustainability of IRs, as these policies are supposed to guide usage, metadata control, content generation and administering, access, awareness, and preservation efforts. Therefore, IR policies must reflect the thinking and resolve reservations of the various stakeholder groups about the repository (Riddle 2015).

An important consideration for the development of organisational policies is the identification of the specific needs of an organisation and its key drivers (Digital Preservation Coalition 2020). Alignment with organisational drivers ensures that strategies employed by librarians and IR managers are aligned with organisational needs. Existing institutional Open Access policies are vital to the success of an IR initiative, especially at the initial implementation phase (Callicott et al. 2016:51). Most institutional Open Access policies are persuasive in nature. That is, they simply ‘encourage’ submission to Open Access and authors can often choose whether to comply or not. This is largely because there are no strong incentives or mandates for authors (Prabhakar & Rani 2018) and the institutions themselves lack the resources and expertise to enforce such mandates (Khalife 2018). According to Prabhakar and

Rani (2018), in the absence of an inducement package many faculty members are hesitant to provide even bibliographic details of their publications to OAIRs, particularly when they are aware that such packages exist elsewhere. In view of this, many institutional policies seek to strike a balance between the rights of individual researchers and those of their institutions (Gilman 2016). Public universities, like all other public educational institutions, are state funded and are therefore obligated to make their research findings freely accessible for the public good. However, these institutions are made up of individual researchers whose right to their publications must be respected in order to avoid creating apprehension regarding the repository (Fruin & Sutton 2016; Xia, Gilchrist, Smith, Kingery, Radecki, Wilhelm & Mahn 2012). Bergin and Roh (2016) examined the electronic thesis and digitisation policies of the University of Massachusetts. They opine that a carefully drafted policy that seeks to address copyright and accessibility issues is key to ensuring the population of IRs.

According to Riddle (2015:3), any successful IR policy must be aimed at addressing concerns around content generation, as well as the library's role in ensuring access to and the management and preservation of contents. Many have suggested a mandatory deposit policy as a panacea to the low participation of researchers in IR projects (Prabhakar & Rani 2018; Xia 2007). However, many researchers, particularly faculty members, have reacted negatively to any suggestion of compulsion and have viewed it as an affront to the author's right of choice of publication outlet, academic freedom, and publisher relations (Fruin & Sutton 2016:447). Xia et al. (2012) suggest that the enactment of mandatory IR or Open Access policies is not a panacea to obtaining content from faculty members and recommend reward systems for faculty members who deposit into the OAIR as part of the tenure process. It must therefore be noted that whether an institution opts for a mandatory or voluntary deposit policy, the sustainability of IRs cannot be guaranteed without faculty participation (Burris 2009). Since the primary aim of any IR policy is to enhance organisational image and prestige, it is imperative that IR policies outline flexible measures that would increase and ensure deposits of the research output of an institution's "highly skilled" workforce (Kodua-Ntim & Fombad 2020; Omeluzor 2014; Burris 2009). However, it must be noted that content generation is not the only issue that must be addressed by a policy (Callicott et al. 2016). Therefore, to ensure

the successful implementation and sustainability of an IR project, the IR policy must address the technical, operational, and managerial issues that surround an IR project.

3.7 COMPETENCIES OF IR PERSONNEL

Information communication technologies are increasingly shaping library services and repository services is no exception. The successful implementation, operation and management of institutional repositories therefore requires personnel with the requisite skills and competencies. Igun and Adogbeji (2007) observed that librarian competency is critical to the successful implementation and usage of ICT related services in libraries. Elaiess (2016) posits that the emergence of information communication technologies has changed the way librarians and other information workers provide information to their users or customers. According to Atanda, Owolabi and Ugbala (2021) librarians and information professionals today require new skills and technical know-how in computer and library activities to enable them to cope with the challenges of the digital era. However, ICT related skills seems to be lacking among library professionals particularly in Africa (Emezie & Ngozi, 2013; Okoye & Ejikeme 2011; Gbaje, 2007). Ferdinand (2011) reports that the huge difference in technological infrastructure and systems between advanced and developing countries as resulted in a situation where librarians in advanced countries are more ICT competent as compare to their counterpart in developing economies. There is therefore the need to bridge this yawning gap as libraries in Africa are increasingly adopting ICT in the preservation, management and dissemination of library collections and services.

There are a myriad of skills and competencies required of the modern day librarian or IR personnel. Kim, Warga and Meon (2013) conducted an analysis of the competencies required for digital curation in 173 job advertisements. They concluded that digital curation jobs are characterized by a complex interplay of various skills and knowledge. They further categorised competencies for digital curation into seven areas; communication and interpersonal, curating and preserving content, curation technologies, environmental scanning, management, planning and evaluation, services and systems, models and modeling competencies. Similarly, Marshall, Fisher, Moulton and Piccoli (2003) identified seven areas of competencies required

of special librarians. These included; foundational knowledge, interpersonal skills, leadership and management, collection development, information literacy, research and information technology skills. Bin Hashim and Mokhtar, (2012) highlighted the various qualifications and skills that are needed for a digital librarian position in academic libraries to include technological related experience, institution management, collection development and knowledge organization. Tammaro and Madrid (2013) effective digital curation entails a wide range of managerial and operating skills, including domain or subject expertise and good IT skills. Oyedokun, Oyewumi, Laro and Akanbi (2018) noted that competencies of special librarians entail adequate knowledge of all forms of information resources in the management of information products and services that meet the needs of their clientele. From the literature review, it is clear that new skill sets and competencies are required for the successful implementation of digital curation systems such institutional repositories. This study therefore examined the competencies expected of IR personnel in public universities in Ghana.

IRs, like all ICTs, comprise hardware and software components. The following section highlights some of the common hardware and software used for setting up IRs.

3.8 HARDWARE AND SOFTWARE REQUIREMENTS FOR SETTING UP AN INSTITUTIONAL REPOSITORY

The setting up of IRs, like all ICT projects, requires a careful consideration of a myriad of factors. These include the choice of software, hardware, power supply, internet connectivity, and personnel. These factors, however, are dependent on the kind of deployment strategy that management will adapt. The following subsections will take a critical look at the commonly used hardware and software, particularly in the African context.

3.8.1 Software

Software for IRs can either be open source or proprietary (Adewumi & Ikhu-Omoregbe 2010). The open source platforms are the most commonly used IR software. Many LIS studies on the adoption and use of library software and platforms

in Africa have recommended the adoption of Open Access automation systems and software (Komolafe-Opadeji & Ojo 2019; Chigwada 2018; Njoku & Ravichandran 2017; Ukachi 2017; Maua & Mwiti 2013; Karume & Mbugua 2012; Namuye & Kamau 2012). This is because open source platforms offer unlimited flexibility for developers to build custom features and collections (Bankier & Gleason 2014). Over the past decade, many open source IR platforms have been developed (Corbett et al. 2016; Pyrounakis 2014; Bankier & Gleason 2014). Common among these open source platforms are DSpace, Fedora, Greenstone, WEKO, Bepress, EPrints and Invenio. Statistics from the OpenDOAR indicate that as at February 2020, there were 77 known IR software platforms used by 5,320 repositories (OpenDOAR 2020). Of all the platforms, DSpace (40%), EPrints (12%), WEKO (8%), and Bepress (5%) were the most widely used IR software platforms. These software platforms were developed as a result of the global agenda for interoperable systems and a universal initiative for open archives (Tzoc 2016). Most IR software is issued either under a Berkeley Source Distribution (BSD) Open Source License or a GNU General Public License and is freely available for download from its own site or open sources directories. Each of the software programmes has a host of unique features and capabilities which the users could explore and experiment with.

In addition to Open Access software, there are also hosted or subscription-based IR platforms. Hosted or subscription-based IR platforms are increasingly gaining prominence in the IR space because of their potential to reduce total ownership cost and construction time (Upasani 2016; Bankier & Gleason 2014). However, many proponents of Open Access library systems tend to disagree with these assertions. Dalle, Normale, Cachan and Jullien (2002) examined the technological rivalry between open source and proprietary software and contended that the organisational structure of Open Source Software (OSS), free access to source codes, and the subsequent development of dedicated online communities or user groups are key features which, together with compatibility, make OSS cost-effective as compared to proprietary software. According to Payne and Singh (2010), OSS and systems are increasingly becoming an attractive option for libraries globally because of their flexibility and cost reduction implications. Sreekumar (2007) asserts that most libraries, especially smaller libraries, opt for OSS rather than proprietary

software, because of its potential to be configured to conform to their needs, which may be of benefit to other libraries.

According to Ray and Ramesh (2017), libraries are increasingly using OSS to provide effective and innovative services to their valued patrons because of its limited impact on library budgets. However, most libraries, especially those in developing countries, do not have the requisite IT personnel with the needed technical sophistication to install and maintain OSS (Kumar & Abraham n.d.; Upasani 2016; Chaudhari & Patel 2019), making proprietary software their only option. A qualitative study by Pruett and Choi (2013) aimed at offering a comparison between selected open source and proprietary software for integrated library systems concluded that there is no significant difference in usability between open source and proprietary integrated library systems. Corbett et al. (2016) posit that the distinction between open source and proprietary library systems has started to blur due to the increased dominance of commercial support services by software vendors and consulting firms. Since libraries today have a host of software solutions or platforms to choose from, they focus on choosing software with features and capabilities to address the needs of their clients in order to make their repositories globally competitive.

According to Tzoc (2016), the choice of IR software largely depends on the requirements and expectations of the repository. The choice of an IR software must be based on an internal and external needs assessments guided by the principles of usability, interoperability, cost, preservation, and migration of materials (DeRidder 2007). Fay (2010) investigated the choice of repository software for building digital libraries and identified customisation, extensibility, flexibility, and interoperability as key factors libraries consider in the choice of IR platform. Corbett et al. (2016) analysed the choice of open source repository platforms as against hosted solutions and emphasise that the choice and implementation of an IR platform must be based on its ability to best serve local needs. They concluded that locally hosted open-source IR system are flexible and provides easy customisation options, whereas a proprietary system offers turnkey entry and support. However, according to Samuels and Griffy (2012), the most overriding factor for libraries looking for online archiving

and publishing solutions is the total cost of ownership. Burns et al. (2013) explored the cost and value of IRs and identified software choice (open source vs. proprietary), staffing needs, start-up costs, and ongoing costs as major questions lR administrators and planners must answer to ensure the success of any IR project. Salo (2013) discusses the choice of online platform or systems for improving scholarly communication and identified factors such as usability, testing, and consultation with current or former users of the systems as important considerations for libraries seeking to acquire new information systems. Indeed, the success of any IR project is based on the choice of software platform. Even though there are many IR software programmes available today, the subsection below will highlight the two most widely used IR software programmes (OpenDOAR 2020; ROAR 2020).

3.8.1.1 DSpace

DSpace is an open-source electronic archival management software originally created by developers from MIT and HP Labs in 2002 for the collection and preservation of digitised research material (MacKenzie 2002). The platform allows libraries to capture information resources in a variety of formats (text, video, audio, and data) and distributes those resources over the Internet or the World Wide Web. It is the most used open source IR platform globally (Corbett et al. 2016; Pyrounakis 2014; Tzoc 2016; Tansley, Smith & Walker 2005). Statistics from the OpenDOAR indicates that as at February 2020, 2,128 repositories out of the 5,320 registered repositories use the DSpace platform. Similarly, data from the ROAR showed that 1,944 repositories use DSpace (ROAR 2020), making it by far the most commonly used and widely tested digital archiving solution available to most libraries. Verma and Kumar (2018:363) itemise the following as the benefits of using DSpace:

- Provides capabilities for storing a wide range of digital assets such as articles, technical reports, conference papers, books, theses, multimedia publications, administrative records, images, audio-video files, webpages, etc.
- Captures and ingests the digital content along with metadata.
- Lists the content systematically and helps in searching based on keywords and metadata.

- Enhanced indexing for searches through exposure to search engines such as Google.
- Supports preservation of the digital data for a long period of time.
- Easily customised.
- Has an active community of developers, readers, and users.
- Provides support for additional methods of authentication.
- Provides a constant persistent network identifier for stored assets that never changes or breaks.

DSpace is typically used in an IR to facilitate the capture and ingestion of digitised materials, including metadata about the materials, as well as to ensure easy access and retrieval by listing and searching (Pyrounakis 2014). According to Tzoc (2016), there are numerous benefits for using the DSpace platform. However, prominent among these are its built-in workflows for submitting data in any file format, international standards for metadata, an active community of developers, availability of the extensible markup language user interface framework for creating customisable front ends, and a growing list of service providers (Tzoc 2016). The collections are grouped according to existing institutional practices. The submission of content onto the DSpace platform follows a hierarchical workflow model or process that reflects institutional polices, practices, and procedures (Naik & Naik 2019; Bass et al. 2003; MacKenzie 2002). The workflow model defines the levels or steps a submitted item would have to undergo before it is finally archived. There are four basic end user roles within the workflow model, namely, submitters, approvers, reviewers, and editors. Submitters are persons authorised to submit content to the DSpace platform. Approvers have the authorisation to approve a submission after checking that the basic metadata entries and file format of submissions are correct. The reviewer goes over the metadata entries and file formats as provided by the submitter and cleared by the reviewer. The editor is the user authorised to give the final approval for a submission. These workflow processes are geared to ensuring that accepted submissions are free from errors and have undergone the standard editorial review.

The DSpace system deploys an information model that allows libraries to organise their digital assets into “communities” which reflect the institution’s organisational structure (MacKenzie 2002). An example of a community might be a college, such as the College of Education. The communities can be subdivided into “sub-communities” (e.g., the Department of Information Science). The content of each community is referred to as collections and may be in the form of theses, technical reports, preprints, data sets, white papers, images, etc. The DSpace system uses a Dublin Core metadata description system that allows for the customisation and editing of data fields. The Dublin Core metadata capturing system is used to improve interoperability and the discovery of content on the platform (Naik & Naik 2019).

The DSpace repository platform is based on a three-layer architecture model, which consists of the service or presentation layer, the business logic or repository management layer, and the data or storage interface layer (Naik & Naik 2019; Gao & Krogstie 2010) as shown in Figure 3.2. The service layer is the highest layer in the three-level hierarchy system. The service layer consists of the web service interface, the web user interface, and the federation and metadata harvesting protocol services. The service layer is a very important feature of the DSpace platform, as it has an impact on users’ experiences and interactions. The aim of a good user interface is to provide a smooth and easy connection between the user and the machine which provides valuable information (Das & Krishnamurty 2014). The business logic layer contains the modules or algorithms that perform all the logical operations or functionalities of the system, such as browsing, authentication, retrieval, searching, etc. The storage interface layer consists of a relational database for storing metadata and a bitstream storage module for storing content data.

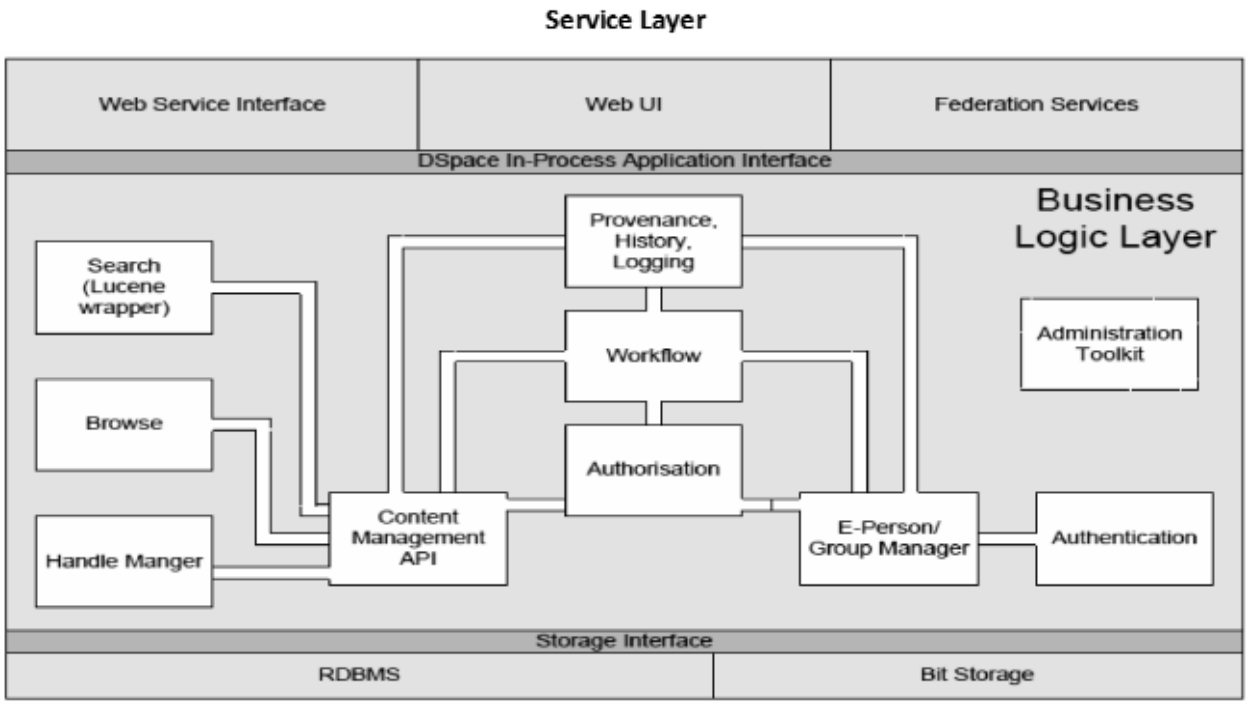

Figure 3.2: Three-layer DSpace architecture model

*Source***:** Naik and Naik (2019:3)

3.8.1.2 EPrints

EPrints is an Open Source repository platform developed by the University of Southampton and realised under the GNU General Public License in 2000 (Tansley & Harnad 2000). The project was originally sponsored by CogPrints, but is now supported by the Joint Information Systems Committee and the National Science Foundation. EPrints runs under the Linux operating system and creates online archives of electronic prints. It is the first professional software platform for building high quality repositories that are compliant with the open archives initiative protocol for metadata harvesting (Beazley 2011; Electronic Information for Libraries 2011). EPrints, like all repository platforms, is basically used to open archived scholarly and scientific literature. According to Electronic Information for Libraries (2011), EPrints is widely identified as the most convenient and fastest repository option available for archiving Open Access scientific or scholarly literature. This is largely due to its ability to archive individual documents in multiple formats.

EPrints uses a web-based command line that operates on the LAMP (**L**inux, **A**pache, **M**ySQL, **P**HP/**P**erl/**P**ython) architecture (Thiagarajan 2013). Its configuration files are written in Perl/XML, making it possible to run successfully on common operating systems such as Linux, Mac, and Windows. This makes EPrints an easy choice for many institutions seeking to set up a repository within a limited time period (Beazley 2011). Once the setup is completed, users can upload documents with the requisite metadata by filling out a simple web form. The default file formats accepted by the EPrints software are Postscript, portable document format (PDF), ASCII, and HTML. However, it offers IR managers the opportunity to incorporate specialised or customised file formats (Nixon 2002).

Despite its numerous benefits, such as improved metadata quality, reduced deposit time, high Google Scholar optimisation, RSS feeds, and email alerts (Tansley & Harnad 2000), EPrints is not without its challenges. One major challenge is the inadequate literature on the installation and management of an EPrints repository. As per the feedback provided by many experts and other technical reviewers, the installation, configuration, and management of an EPrints repository is not difficult (Verma & Kumar 2018; Thiagarajan 2013). However, the scarcity of literature and online support forums makes the installation and management of EPrints repositories a daunting task for novice users. A similar study by Leng, Ali and Hoo (2016), which investigated the feasibility of academic libraries in Japan adopting Open Access software for their repositories, asserted that the Wawasan Open University had to look for other alternatives after two years of implementing EPrints because of configuration and enhancement challenges. This was largely attributed to technical support and the lack of programming expertise. This therefore would require that libraries have in-house programmers or experienced IT support staff, which can be herculean task for most libraries in Africa, especially in this era of dwindling library budgets.

3.8.2 Hardware

Hardware continues to be one of the critical choices for the establishment of any IT infrastructure. This is because without the hardware, the system will simply not work. The software selection that is made would eventually have to run by or be installed

on hardware. The decision on the choice of hardware depends largely on the kind of repository an institution would like to build, as well their software choices. For example, if an institution selects a hosted service, then a desk computer or laptop, a scanning device and an internet connection might be the only hardware required (Okumu 2015:28). However, the majority of the OAIRs in Africa are developed in-house using Open Access software and would therefore require local servers to host them (OpenDOAR 2016). The specification of such local server(s) is determined by the quantum of data intended to be archived in the repository (Okumu 2015:28), as well as its intended functions or services. These local servers must be operated under controlled temperatures in order to avoid overheating and subsequent disruption of service. This therefore requires that servers are kept in a spacious, air-conditioned room and protected against power fluctuations, virus attacks, and hackers. This means purchasing of an uninterruptible power supply and voltage regulator and antivirus software, as well as building firewalls.

Another critical thing to consider when building IRs in-house is backups for disaster management (Okumu 2015:28). This contingency plan allows IR managers to transfer or mirror valuable IR data onto remote servers. These servers are usually kept secured on offsite locations and therefore can be a valuable reference point in times of disaster, such as fire outbreaks, floods, or simply a server crash. Although the ideal situation is to have a backup server, a simple external hard disk with a high capacity could be used to back up repository records.

While the majority of the IRs run on local servers, there seems to be a strong preference for cloud-based hosted services (Smith & Bishoff 2015; Younglove 2013; NdukweIfeanyi & Chukwudi 2013). An assessment by the Digital Preservation Team at the Rochester Institute of Technology on the feasibility of an all-in-one repository platform recommended a move from the OSS DSpace to the full-service hosted software Bepress from Digital Commons (Younglove 2013). Similarly, Smith and Bishoff (2015) investigated the digital collection management practices of non-members of the Association of Research Libraries in the USA. Out of the 102 respondents sampled for the study, 73 (72%) respondents indicated that their IR was a hosted service. According to Lumpa and Hussein (2019), many organisations are

opting for cloud-based IR solutions because of the ease of setting them up, with little or no investments in hardware, software and staff training or education. Similarly, NdukweIfeanyi and Chukwudi (2013) conducted a cost-benefits analysis of the adoption of cloud-based as against in-house IT products in higher education. Their study recommended cloud solutions as an excellent alternative for higher education institutions, particularly in times where library budgets are increasingly being reduced. However, it must be noted that whatever service option an institution chooses will require some level of investment in hardware. For many institutions in African, servers, scanners, computers, and a backup generator may be the basic hardware investments needed (Okumu 2015:28).

In view of this, the next section addresses some of the challenges facing the sustainability and development of IRs globally, with particular emphasis on developing countries.

3.9 CHALLENGES IN THE DEVELOPMENT OF INSTITUTIONAL REPOSITORIES

In today's competitive academic and scholarly environment, IRs have become an essential tool for academic institutions seeking to fulfil their mandate of knowledge generation and ensuring that the knowledge generated is disseminated for the benefit of the wider society. Despite its numerous benefits, IRs globally are confronted with numerous challenges that threaten their long-term survival and sustainability, but especially those in Africa (Wu 2015; Livingston & Nastasie 2009). The subsections below highlight some of these challenges.

3.9.1 Finance

The initial financial commitments for establishing repositories are moderately affordable for most academic institutions, especially in an era of a plethora of open source IR software platforms (Prabhakar & Rani 2018). However, for most institutions the cost of recurrent expenditure poses a significant challenge (Joo et al. 2018; Prabhakar & Rani 2018; Dlamini & Snyman 2017; Li & Banach 2011). A study by Joo et al. (2018) aimed at providing an in-depth analysis of the constraints facing

IRs from the perspectives of academic librarians identified budgetary constraints as a major factor that threatens the sustainability of IRs. Dlamini and Snyman (2017), investigating the challenges and obstacles that militate against the successful implementation of IRs in Africa, identified inadequate finance, lack of institutional support, and lack of promotional activities or initiatives. Uwa and Okoro (2009) believe that limited finances could be a major hindrance to the utilisation of IT-based information services.

Joo et al. (2019) examined the constraints facing IRs from the perspectives of academic librarians in the USA and identified budgetary constraints as one of the major hindrances to the development, deployment, and longevity of IRs. Studies by Li and Banach (2011) identified the lack of reliable funding sources as an important obstacle to the sustainability of IRs in academic and research institutions. Anyaoku et al. (2019) investigated the digital preservation practices of university libraries in sub-Saharan Africa. They revealed that university libraries in Africa lacked funding and the technical expertise required to effectively and efficiently manage their IRs. Similarly, Agyen-Gyasi et al. (2012) identified inadequate funding as a threat to the sustainability of IRs in Ghana.

However, it must be emphasised that most academic libraries in African are publicly funded and therefore are affected by the government's inability to adequately fund tertiary education. The inadequate funding by the government has led many academic institutions to halt their IR projects, particularly those in their infancy. This is largely due to the general lack of understanding of the significance or inherent value of IRs at both individual and institutional level (Burns et al. 2013). However, the majority of the proponents of IRs believe that the financial challenges that most IRs face can only be overcome when institutions realise the enduring value of IRs (Prabhakar & Rani 2018; Kaur 2017; Nkiko et al. 2014) and make the necessary financial commitments needed to ensure their growth and survival (Burns et al. 2013). It is therefore imperative that IR managers seek external sources of funding and ensure that the significance of IRs resonates with all segments of their institutions and the wider scholarly community.

3.9.2 Content generation

The success of any IR project is largely dependent on the quality of its contents and willingness of potential depositors to voluntarily deposit their works. According to Gibbons (2004), one of the best ways to ensure the long-term survival of IRs is to quickly populate it. In view of this, content generation has been identified as a major avenue for demonstrating the value of IRs. However, for most academic libraries the quest to generate content for their repositories is met with localised and publisher-related hurdles, particularly at the initial stages (Prabhakar & Rani 2018). The primary depositors of IRs in many academic institutions are students and faculty members and their contributions are critical to the success of an IR (Abrizah 2009). For most academic institutions, there are mandatory depositing policies for students. This has resulted in a situation where most of the contents of IRs is made up of students' theses and dissertations (Sale 2006; Pickton & McKnight 2006; Palmer et al. 2008).

However, securing faculty deposits appears to be one of the biggest headaches facing IR managers (Tillman 2017; Burris 2009). Several studies have found low rates of faculty submission (Tillman 2017; Chan 2004; Foster & Gibbons 2005; Pelizzari 2005; Davis & Connolly 2007). This has largely been attributed to the reluctance of many faculty members to submit content or their lack of understanding on the benefits authors can gain from submitting content to a repository (Moore 2011), as well as contractual arrangements between authors and publishers (Lee, Burnett, Vandegrift, Baeg & Morris 2015). Therefore, to increase deposits, academic and research institutions must effect the cultural and organisational changes necessary to make IRs an integral part of the institution's scholarly communication practices or activities (Abrizah 2009). However, it must be noted that many publishing outlets have begun modifying their author and licensing agreements to allow for submissions into non-commercial repositories, usually after a probation period (Björk 2013; Stanton & Liew 2012). Also, some journal publishers and funding agencies allow and/or encourage authors to host preprints of their publications in IRs or on preprint servers (Bjork, Cummings-Sauls & Otto 2019; National Information Standards Organization 2019; Luther, Anderson, Bradford & Inglis 2017). It must, however, be noted that while some journal publishers only permit preprints that do

not contain the revisions, comments, or suggestions made by the journal reviewers, others allow authors to deposit preprints that reflect such comments or revisions (Bjork et al. 2019).

While many faculty members may be aware of the prominence of Open Access publishing, the majority still prefer the traditional publishing practices (Peekhaus & Proferes 2015; Waller, Revelle & Shrimplin 2013). This has largely been attributed to individual and institutional factors such as tenure and promotional practices, ingrained behaviours, inertia, and resistance to change (Odell et al. 2016; Ware 2004). According to Odell et al. (2016), faculty promotional requirements in most institutions appear to force faculty members to prioritise publishing with conventional publishing outlets other than Open Access outlets. Odell et al. (2016) posit that despite the numerous benefits of Open Access, many faculty members still remain sceptical due to the fear that the choice of publishing Open Access outlets might affect their case for promotion and tenure. Similarly, Wical and Kocken (2017) observed that faculty members are generally anxious about the quality of Open Access publications and that this anxiety has been exacerbated by the proliferation of predatory journals. This invariably affects their contributions to or participation in IRs.

Also, faculty deposits seem to be hindered by the time-consuming processes involved in depositing content and time is something which academics often lack (Prabhakar & Rani 2018; Manjunatha & Thandavamoorthy 2011). As such they may be willing to contribute content, but are reluctant to do it themselves (Zhang, Boock & Wirth 2015). Therefore, there is a need for librarians and IR managers to put in place innovative services targeted at addressing this challenge.

3.9.3 Lack of awareness

Awareness creation is key to the development of community support for changing attitudes and perceptions about self-archiving in IRs. The benefit of self-archiving in IRs has been demonstrated by many researchers. Despite its numerous benefits, a scan of the literature suggests that several researchers, particularly faculty members, are either unaware of the benefits they stand to gain by contributing

content to IRs or are not motivated enough to do so (Yang & Li 2015). A study conducted by the Scholarly Communication Office of the University of California in 2007 revealed that 82% of faculty members were either “unaware” of or “had little knowledge” about IRs (University of California Office of Scholarly Communication and the California Digital Library eScholarship Program 2007). Similarly, studies by Kim (2011a) revealed that 60% of faculty members from 17 Carnegie doctorate-granting universities in the USA were unaware of their universities’ IRs. Dlamini and Snyman (2017) investigated the challenges and obstacles that militate against the successful implementation of IRs in Africa and identified lack of awareness or promotional activities as some of the major obstacles. Okoroma (2018b), aiming to address lecturers’ knowledge about, attitudes towards, and awareness of IRs in Nigeria, found out that the majority of the lecturers in Nigeria were either unaware of or not familiar with the concept of IRs or the purpose of their university’s IR.

In a case study to analyse the attitudes of researchers towards IRs, Alemayehu (2010) found a low level of awareness of IRs among faculty members in the University of Oslo. Nevertheless, faculty willingness to contribute content to their university’s IR was generally high. Dutta and Paul (2014) examined the perception, attitudes and willingness of selected science and technology faculty members of the University of Calcutta to participate in IRs. They reported that the faculty members’ attitudes regarding IRs were generally positive. However, their awareness was less than satisfactory. Similarly, Manchu and Vasudevan (2018) in examining the IRs and Open Access publishing awareness of researchers at the University of Calicut in India identified the lack of awareness of IRs as a major delimitating factor to faculty deposits. They recommended that in order to increase faculty deposits, librarians should design and provide awareness and training programs targeted at educating academics on the benefits of using IRs and Open Access publishing.

Manjunatha (2011) conducted a study on academic scholars’ attitude towards depositing their work into IRs of universities in Karnataka. The study revealed that most academics are unaware of the IR, are interested in contributing their work to their university's IR, and have a very favourable attitude toward making their work publicly accessible through IRs.

However, other studies have shown a high level of awareness and keenness to use IRs among researchers and faculty members (Manchu & Vasudevan 2018; Dhanavandan & Tamizhchelvan 2013; Manjunatha 2011). Dulle and Minishi-Majanja (2009) examined the awareness and usage of Open Access scholarly publications among Tanzanian researchers. According to the study findings, majority of researchers in Tanzanian public institutions are aware of Open Access scholarly communication and utilize it to access scholarly content rather than disseminate their research findings.

Similarly, Dhanavandan and Tamizhchelvan (2013) examined attitudes and awareness of IRs and Open Access publishing among 200 professors. They revealed that the majority (93.75%) of the professors in Annamalai University in India were aware of IR and Open Access publishing. Salo (2013) opines that the idea that "if you build it, they will come" can fail when faculty members do not show an interest in or recognize the value of submitting their work to a digital repository. This only echoes the need for librarians and IR managers to take a critical look at their IR advocacy and campaign strategies.

3.9.4 Publisher copyright restrictions

IRs and Open Access publishing are increasingly becoming common features of the scholarly communication process in most academic and research institutions. With the primary objective of not just changing the scholarly communication publication process, IRs provide institutions with a tangible indicator to access the institution's outlook and impact on the academic community (Nath, Joshi & Kumar 2008). However, one critical piece of the repository puzzle is to determine the impact of copyright law on content generation (Prabhakar & Rani 2018; Courtney 2016). Over the years, the copyright law has played an instrumental role in ensuring the protection of the rights of knowledge producers or authors. Despite the increasing awareness of the benefits that Open Access publishing brings to the scholarly communication process, many scholars seem hesitant to contribute content to IRs (Prabhakar & Rani 2018; Peekhaus & Proferes 2015; Waller et al. 2013). This uneasiness is largely attributed to their apprehension about infringing on contractual

agreements with publishers and a lack of adequate awareness about their own intellectual property rights (Dutta & Paul 2014; Abrizah 2009). Even though the copyright law gives autonomy to authors on how their works are to be disseminated, academic publishers have traditionally required authors to transfer all their copyrights to the publisher as a prerequisite to having their works published. Unfortunately, in the quest to have their works published, many authors have signed these publisher agreements with little or no scrutiny and with little appreciation of the implications thereof (Baker & Kunda 2019; Macklin 2013:103; Creaser, Fry, Greenwood, Oppenheim, Probets, Spezi & White 2010). Most of these publisher-author copyright agreements seem to be at loggerheads with the idea of self-archiving in OAIRs and the removal of monetary and legal barriers to the dissemination of scholarly information (Heller et al. 2013). This is a huge setback to ensuring the sustainability of IRs.

Kaur (2017) identified intellectual property rights as a militating factor against the creation and management of IRs in India. A study by Joo et al. (2018) aimed at providing an in-depth analysis of the constraints facing IRs from the perspectives of academic librarians identified copyright restrictions as a hindrance to faculty deposits in IRs. Aliyu et al. (2014) examined the challenges and prospects of IRs in Nigeria. They identified copyright issues as one of the major challenges facing IRs in Nigeria. Kim (2011b) identified time, effort, and copyright concerns as the three most statistically significant limitations to faculty participation in IRs. However, copyright concerns stood out as the greatest concern. Kim recommended the improvement of copyright management practices in IRs as a panacea to the low participation rate among faculty members in the quest to build sustainable IRs. Nath et al. (2008) examined intellectual property rights issues with regard to IRs. They concluded that one of the biggest obstacles to self-archiving is the copyright policies of publishers, which prevent authors from self-archiving with third parties. They further reiterated that copyright and licensing agreements continue to be a major policy issue for the sustainability of IRs.

In view of the above, many institutions have relied on librarians to provide guidance on how to overcome publishers' copyright restrictions. However, very few studies

have outlined how librarians have dealt with copyright limitations imposed by publishers in order to exhibit repository contents and give open access (Dawson & Yang 2016). Some librarians and IR managers have sought to address the problem by encouraging authors to renegotiate or amend their publisher copyright agreements to include the right to self-archive (Macklin 2013:105), while others have sought to encourage authors to deposit preprints or galley proofs (Kim 2011b). However, the challenge with the latter is that preprints might have a considerable number of errors. This invariably impacts negatively on the image and prestige of the parent institution. Also, some institutions have integrated into their repository database a listing of publishers and publishers' copyright policies that support self-archiving. By doing so, they hope that researchers interested in self-archiving will publish with these publishers and invariably self-archive with the IR. However, the available evidence shows that most of these institutions are still struggling with generating content for their repositories as a result of copyright uncertainties. It is, therefore, imperative that librarians and IR managers take a critical looked at addressing this challenge, as it is crucial to the building of a robust, respected, and highly sustainable repositories.

3.9.5 Academic social networking sites

Academic social networking sites are online networking sites that enable researchers and academics to easily connect, collaborate, and communicate with their peers. These websites aim to bring the benefits of online networking to the doorsteps of academics by providing services and products suited to their specific requirements (Jordan 2019). In recent times, professional social networking sites, such as Academia, LinkedIn, Mendeley, and ResearchGate, are growing in popularity among academics, researchers, and scholars (Jordan 2019; Eva & Wiebe 2019; Lovett, Rathemacher, Boukari & Lang 2017). These sites provide the platform on which researchers and funding agencies communicate for the purposes of working relations and career management and to search for employment opportunities (Skeels & Grudin 2009). On these platforms researchers can upload full versions or abstracts of their academic articles, track downloads and the demand for published articles, link up with other researchers with similar interests, share the same articles

across profiles, and monitor the impact of their research (Meishar-Tal & Pieterse 2017; Laakso, Lindman, Shen, Nyman & Björk 2017).

In contrast to these services most IRs, particularly those found in Sub-Saharan Africa, provide only long-term preservation services. The absence or nonexistence of such interactive and bibliometric services clearly underpins the reasons behind the low participation rates in IRs among academics as compared with academic social networking sites (Eva & Wiebe 2019; Okiki & Odunlade 2018; Borrego 2017). Studies on the motivation of participants engaged in the use of social networking sites affirm this point; they repeatedly stress the ability of these sites to allow researchers to communicate, establish new networks, and share ideas with peers as key to the widespread adoption of these sites (Okiki & Odunlade 2018; Meishar-Tal & Pieterse 2017; Laakso et al. 2017; Dunne, Lawlor & Rowley 2010; Urista, Dong & Day 2009). Meishar-Tal and Pieterse (2017) investigated the adoption and perceived utility of academic social networking sites among academics and affirmed this point when their study revealed that academics use academic social networking sites for the purposes of projecting themselves, acquiring professional knowledge, belonging to a peer community, and interacting with peers. Similarly, Okiki and Odunlade (2018) explored the scholarly communication practices of faculty members across IRs, social networking sites, and bibliographic databases. The study revealed that faculty members had largely self-archived on academic social network platforms and not on IRs. According to Laakso et al. (2017), academic social networking sites are increasingly becoming the first point of call for many researchers seeking to make their research output available to wider audiences, surpassing all other forms of internet sites such as personal webpages and repositories.

Even though academics and researchers who are active participants in academic social networking sites are more likely to share their publications in Open Access mediums such as IRs, many researchers still shy away from IRs because of a lack of understanding or a misunderstanding about IRs, Open Access publishing, and copyright (Lovett et al. 2017). It must be emphasised that with the exception of fully Open Access publishers, most publisher-author agreements prohibit authors or researchers from sharing or archiving copies of their publications on commercial

sites and may only allow some level of sharing on non-commercial sites after an embargo period (Björk 2013; Stanton & Liew 2012). This clearly offers an opportunity for librarians and IR managers to conduct outreaches to faculty members focused on their options for legally sharing published articles and to intensify faculty education in this regard. Also, many government and funding agencies recognise IRs as an official medium for depositing published research, whereas academic social networking sites are not (Ozkan 2019). Therefore, unlike academic social networking sites, depositing publications in IRs promotes authors' eligibility or access to research funds or grants. Clearly, this can be capitalised on by librarians and IR managers seeking to sell their IRs to faculty members.

3.9.6 Lack of personnel

The increased reliance on ICT tools by students and faculty members for teaching and learning has greatly influenced the academic landscape. In response, libraries have expanded the services they provide through the use of technology (Tait et al. 2016). Over the years, the role of academic libraries has evolved beyond being primarily about the collection, storage, and dissemination of information to becoming institutions where knowledge is created and shared (Paulus 2011) with the aid of technology. IRs have been identified as one such technological change. The implementation and management of an IR requires personnel with the needed managerial and technological expertise. However, such technological expertise is either non-existent in most academic libraries in Africa or inadequate (Oguche 2018). Emezie and Ngozi (2013) assert that the lack of technological competencies among librarians is a tremendous challenge to the effective delivery of library services. This affirms a previous study by Gbaje (2007) that identified the lack of technologically skilled librarians as a major obstacle to the provision of online library services. Despite the numerous benefits of IRs, very few libraries are able to set up IRs because the librarians lack the skill sets required to implement or manage such repositories (Okoye & Ejikeme 2011). Sawant (2012) opines that though universities in India have made great strides when it comes in establishing IRs, many of these university libraries are faced with the challenges of funding and a lack of requisite staff.

Fadehan and Ali (2010) examined the training and education needs of academic librarians in Nigeria within the electronic space. The study revealed that knowledge and competencies in ICT among librarians were generally low. This they indicated was as a result of inadequate emphasis on the inclusion of ICT education in most professional library training. Similarly, Dzandza (2019) studied the digital archiving practices of nine libraries in Ghana. She identified the lack of trained personnel as a common challenge for all of the libraries surveyed.

Many researchers seeking solutions for the lack of ICT skilled personnel within libraries have recommended that in addition to the core professional education, librarians must have training in networking, database management, and internet and web-based resource management (Fadehan & Ali 2010; Chiware 2007; Igun 2006; Oduwole 2005; Adedoyin 2005). This is because these skills have been identified as essential for a 21st century librarian. The acquisition of these skills has become even more relevant due to an increased preference or taste for online library services. However, it must be noted that such solutions would require adequate financial and personal investments, particularly for practicing librarians. It is, therefore, imperative that management of academic libraries takes a holistic approach to solving this problem through policy and budget allocations.

3.9.7 Erratic power supply

The poor quality of electricity supply has been identified as having a significant impact on the successful deployment of IT systems in Africa and IRs are not immune to this problem. One key feature of IRs is that they have to be openly accessible irrespective of the time and day, but this is dependent on the availability of a reliable and uninterrupted power supply. Unfortunately, most countries in sub-Saharan Africa experience a power disruption or outage at least once every four days (Scott, Darko, Lemma & Rud 2014:3). This invariably increases the operational costs of IRs, as additional expenditure is incurred for backup generators and fuel, making repository management a very difficult and expensive venture (Ridwan 2015; Agyen-Gyasi et al. 2012; Fatunde 2008). This problem, if not properly addressed, has the potential to bring any IR project to its knees irrespective of the initial investments. This is

because ICT devices used in setting up IRs require an uninterruptible power supply to optimise their functionality, availability, and usability.

Fatunde (2008) studied the impact of electricity supply on the operation and growth of ICTs in Nigerian universities. The study revealed that the erratic nature of power supply in Nigeria rendered ICT systems in Nigerian universities dysfunctional. Similarly, Ridwan (2015) opines that the unstable electricity supply in Nigeria is inimical to the development of ICT projects like IRs, as it makes their operation and management much more difficult and expensive. Also, Oguche (2018) examined the state of IRs and scholarly communication in Nigeria. He concluded that erratic power supply limits the potential of IRs as a useful vehicle for effective scholarly communication. This affirms an earlier study by Mohammed (2013) which asserts that most academic libraries in sub-Sharan Africa are confronted with an unstable power supply in their quest to make their resources easily and widely accessible through the Internet.

Fasae et al. (2017) examined the role of IRs in improving access to heritage materials. Study participants were conveniently sampled from selected academic libraries in Nigeria, Ghana, and Uganda. The study identified an unstable power supply as a major challenge that confronts the successful implementation and use of IRs. They also suggested that, management of academic institutions ensure that adequate finances be given for the implementation of IRs (Fasae et al. 2017).

Similarly, Siyao et al. (2017) examined the role of academic libraries in Ghana, Nigeria, Tanzania, and Uganda in promoting open science. Using the multiple case study research design approach, the study showed that OAIRs have not been adopted in most academic libraries. This was largely attributed to power supply, bandwidth, and advocacy challenges. Siyao et al. (2017) further recommended need for the management of academic institutions to ensure the stability of their power supply, as well as the reliability of their internet connection. Agyen-Gyasi et al. (2012) examined the prospects and challenges of setting up IRs within the context of the KNUST. They observed that electricity supply is a major problem in Ghana, as in other African countries, and that frequent power outages threaten the sustainability

of IRs in Ghana. Qualitatively, Dzandza (2019) explored the IR initiatives of nine members of the CARLIGH. The study revealed that five out of the nine libraries were confronted with electricity and bandwidth challenges. This finding is affirmed by a previous study conducted by Bossaller and Atiso in 2015 which recommended that IR managers look for alternative sources of power to supplement the existing supply in order to ensure the smooth running of IRs in Ghana.

3.9.8 Bandwidth

According to Jensen (2004), the world's knowledge economy depends on bandwidth. This is because it is seen as the catalyst needed to drive the transmission of information across any ICT infrastructure. Agyen-Gyasi et al. (2012) opine that while not much investments in infrastructure is required to set up a repository, much more is required to access its full benefits. Ensuring access is key to the sustainability of IRs. The high cost or unavailability of internet bandwidth required to host or access the contents of OAIRs remains a major challenge for many individuals and institutions in Africa seeking to enjoy the full benefits of these IRs (Bhardwaj & Banks 2019:166; Christian 2009). IRs and other ICT tools can serve as effective tools for the dissemination of developmental information only if individuals can afford them. In Ghana and many other African countries internet access is still a luxury for many people. The cost of internet bandwidth is a hindrance to many, particularly students seeking access to online educational resources. The high cost of internet bandwidth has resulted in many academic institutions in Africa subscribing to very low bandwidth packages (Muwanga, n.d.). This translates into very slow and frustrating attempts or experiences when accessing IRs.

Damaris, Kalunge and Duncan (2017) investigated the role of an IR in increasing access to and usage of institutional research outputs by faculty members at the Kenyatta University. A total of 91 faculty members were sampled for the study. The study revealed that faculty members faced numerous challenges when accessing the university's IR. Low internet bandwidth was identified as being a principal limiting factor. Okoroma (2018a) examined the technological and infrastructural challenges limiting the adoption and usage of IRs in university libraries in Nigeria. Through a multistage sampling procedure, a total of 844 academic staff members and eight

digital librarians were sampled from eight universities in Nigeria. The study identified low bandwidth, among others, as a major technological and infrastructural challenge confronting IRs in Nigerian university libraries. Similarly, Ukwoma and Ngulube (2019) descriptively surveyed 491 faculty members from five Nigerian universities. The study aimed at identifying challenges to the utilisation of IRs by Nigerian academics in order to recommend some practical solutions. The results identified inadequate infrastructure and bandwidth as some of the major barriers to the utilisation of IRs by faculty members.

Ibrahim (2019) assessed the impact of the UDS IR (UDSspace) on teaching, learning, and research activities at the university. A total of 988 respondents comprising faculty members, graduate students, and the IR manager were sampled. The study revealed that even though the level of awareness about UDSspace was high, poor internet connectivity and ICT infrastructure hindered its utilisation. Similarly, in an explorative study aimed at assessing the IR initiatives of CARLIGH member institutions, Dzandza (2019) identified low bandwidth as major challenge. These findings affirm the results of previous studies conducted by Thompson et al. (2016), Agyen-Gyasi et al. (2012), Corletey (2011), and Tiwari and Gandotra (2018).

It is clear from the literature review that many challenges confront the operation, management, and sustainability of IRs. Prominent among these are: financial constraints, lack of personnel, copyright, and lack of institutional support (Joo et al. 2018; Dlamini & Snyman 2017; Macklin 2013). In spite of the prevalent use and acknowledgement of the benefits of IRs among institutions and researchers worldwide, the sustainability of IRs can only be assured when these challenges are tackled head-on. This study therefore provides some solutions to these challenges in Chapter Six.

The next section highlights literature related to the sustainability of IRs.

3.10 RELATED STUDIES ON THE SUSTAINABILITY OF IRs

IRs present academic institutions globally with the opportunity to showcase their rich intellectual and scholarly outputs. It is a distinguishing feature of a world-class academic institution, conferring institutional prestige, global outlook and visibility (Nkiko, Bolu & Michael-Onuoha 2014). In view of this, IRs have piqued the interest of scholars all across the globe. This section presents an overview of related studies on the sustainability of IRs and categorises the studies based on geographical locations. This was to enable the researcher to avoid duplication, identify inconstancies, and establish the relevance of the research problem (Maggio, Sewell & Artino 2016). The intention was to learn as much as possible from researchers who had previously studied the phenomenon under study. The next section reviews studies on institutional repositories conducted outside of the African continent.

3.10.1 Eastern and Western studies

This section presents a synthesis of research done on institutional repositories outside the African continent.

Chenying, Mingjie, Chongyang, Yan, Yanqing and Chunning (2011) examined the essential factors for building a sustainable IR using the China Agricultural University as case study. They revealed that the increasing utilisation of IR content is key to building sustainable IRs and that IR managers and builders are needed to ensure that IR content is designed or organised to be responsive to user requests.

Drawing experiences from the repository team of the University of Southampton in the United Kingdom, White (2008) highlighted the need to integrate IRs into the cultural, financial, and technical structures of institutions to promote healthy repository growth. She further emphasised that there is a need to link repository deployment to other institutional scholarly communication initiatives, and the development of value-added services and policies.

Francke et al. (2017) examined the conditions for ensuring the longevity of the contents of IRs of Swedish higher education institutions. They examined how

repository content was managed with regard to file format. The study revealed that respondents generally considered visibility and access as the most important functions of the repositories and that ensuring that file formats are in accordance with Open Access standards have consequences for the long-term sustainability and access of the content deposited into the repositories. Similarly, Bradley (n.d.), in examining the digital sustainability of IRs in Australian universities, opined that the real measure of the success of a sustainable digital repository is access to valid and appropriate content by its user community.

At Kansas State University and Portland State University, Bjork, Otto, and Cummings-Sauls (2018) undertook a research to investigate the feasibility of incorporating metadata only (non-full-text) entries in the IR as a means to ensure greater visibility and representation of the intellectual and scholarly outputs. They emphasised the importance of staffing, collection development policies, and faculty outreach as critical to showcasing scholarship on campus and ensuring the sustainability of IRs.

Joo et al. (2019) identified 37 challenges related to data, metadata, technological requirements, user needs, ethical concerns, and administrative procedures that militates against the management of sustainable IRs in the USA from the perspective of academic librarians involved in the operation and management of IRs. They asserted that obtaining a more comprehensive understanding of the challenges and limitations confronting IRs is critical if those repositories are to be sustainable.

All of these studies emphasised the importance of IRs in ensuring greater visibility of the intellectual and scholarly outputs of institutions in their respective countries. A critical look at the above studies identifies content generation as a key factor in ensuring the visibility and sustainability of IRs. In view of this, the literature recommends different approaches, such as the development of institutional policies that support Open Access, education opportunities for repository staff, faculty outreach, lobbying, and collaboration, as measures to overcome this challenge. These studies and the time period in which they were conducted demonstrate that there is still plenty to explore, discover, and learn when it comes to the sustainability

of IRs, particularly within the African context. The next subsection explores studies done within the African context.

3.10.2 African studies

This section discusses studies conducted on institutional repositories on the African continent.

According to Van Wyk (2012), the planning and execution of an IR does not ensure long-term sustainability when exploring the challenges and possible indicators of sustainability for IRs in Africa. He further averred that the advent of ICTs, Open Access, and digital IRs has changed the way intellectual and scholarly outputs of universities and research institutions are stored, archived, accessed, and generally managed. Like Van Wyk (2012), Dlamini and Snyman (2017) explored the challenges and prospects of IRs in Africa and are of the view that IRs have the potential to enhance access to and sharing of research-based information generated in Africa.

Nkiko et al. (2014) examined the technical details involved in the development and sustenance of Covenant University's IR in Nigeria. They posit that the development of an IR is a capital-intensive project that requires continuous budget support and funding. The study further stated that in ensuring a sustainable repository, universities must mount intensive sensitisation and education on the dynamics of copyright law in relation to depositing content in IRs.

Okoro and Okogwu (2017), in analysing the issues, prospects, and challenges that threaten the sustainability of IRs in Nigerian libraries, posited that the concept of IRs has gained roots due the advancement of in ICTs in Nigeria. However, challenges such as the non-existence of comprehensive IR policies, copyright issues, inadequate ICT facilities, insufficient funding, lack of skilled personnel, and absence of quality control systems threaten the sustainability of IRs in Nigeria. Similarly Christian (2009), in his quest to identify the issues and challenges that militated against the development of OAIRs in academic and research institutions in Nigeria, highlighted the need for increased awareness, advocacy for IRs, budgetary support,

investment in information and communication infrastructure, and the retainment of author copyright.

Moseti (2016) used the survey research design to examine the state of digital preservation and IRs in six Kenyan universities. The study revealed that even though Kenyan scholars at the selected universities were personally archiving their information or scholarly outputs, they barely used IRs. Moseti (2016) attributes this to a lack of awareness and recommends intensive awareness creation efforts in order increase participation in and acceptance of digital repositories. Similarly, Ukwoma and Ngulube (2019), in analysing the obstacles and challenges related to the usage of IRs faced by academics in Nigeria, observed that academics are sometimes not aware of the availability and content of IRs, which leads to poor utilisation of IRs.

The next section explores studies conducted in Ghana.

3.10.3 Ghana

The studies under this section were categorised as research that was conducted in Ghana. Martin-Yeboah, Filson and Boohene (2020) examined the level of awareness, usage, and patronage of and content deposits into the UCC's IR (UCCSpace) by lecturers. They revealed that, generally, lecturers were oblivious of the existence of UCCSpace and that the majority of lecturers still preferred traditional scholarly communication options as compared with Open Access. This, they opined, greatly threatens the sustainability of UCCSpace. They further recommended that the university library and management invest more effort, time, and resources into educating and informing all stakeholders about the benefits of having an IR, while soliciting suggestions for improvement and addressing copyright concerns.

Using a qualitative research design, Adjei, Mensah and Amoaful (2019) purposively interviewed respondents from eight academic libraries in Ghana in their quest to paint a picture of the current state of digital preservation in academic libraries in Ghana. The study discovered that, while academic libraries had operational directions for digital preservation activities, available standards and practices for ensuring long-term preservation appear to be unsuitable, and thus recommended the

development of comprehensive digital preservation policies to provide a mandate and direction for the long term preservation of digital collections, develop disaster plans and ensure adequate funding.

The scope of literature sources on IRs indicated a significant number of research studies have been done on IRs in Ghana. However, with the exception of the above studies by Martin-Yeboah et al. (2020) and Adjei et al. (2019), all these studies have focused on the benefits, usage, marketing, and promotion of IRs (Corletey 2011; Agyen-Gyasi et al. 2012; Thompson et al. 2016;Martin-Yeboah et al. 2018; Kodua-Ntim & Fombad 2020) with little or no emphasis on the issue of the sustainability of IRs. This notwithstanding, these studies identified several challenges that confront the smooth operation of IRs and have recommended or provided suggestions on how these challenges may be curtailed if not eliminated. This study therefore sought to add to the existing literature on the sustainability of IRs in Ghana by providing an examination of the factors that account for the technical and managerial challenges faced by IR managers of public universities in Ghana.

3.10.3 Paradigms and methods used in previous studies

In a quantitative study aimed at investigating the development of institutional repositories in selected public universities in Kenya. Chilimo (2016) adopted the survey research design and used a questionnaire to collect data from the respondents who participated in the study. Dlamini and Snyman (2017) adopted purely quantitative methods (i.e. webometric and questionnaire) to explore the challenges to the establishment and operation of institutional repositories by academic institutions in Africa. Martin-Yeboah et al. (2020) adopted the descriptive survey design in examining the level of awareness, usage, and patronage of the institutional repositories by faculty members at the university of cape coast. An online questionnaire designed with google forms was the main instrument used for data collection. Thompson et al (2016) adopted quantitative methods in examining the experiences of the University for Development Studies in communicating the value of UDSspace to faculty members. A questionnaire was the instrument used to elicit data from the respondents who participated in the study. Okoroma (2018a)

adopted the descriptive survey research design in investigating the technological and infrastructural challenges of institutional repositories in university libraries in Nigeria. Using a qualitative research design, Adjei, Mensah, and Amoaful (2019) purposively interviewed respondents from eight academic libraries in Ghana in their quest to paint a picture of the current state of digital preservation in academic libraries in Ghana. Dzandza (2020) adopted a qualitative approach in the quest to investigate the extent of digitization of the intellectual output of Ghanaian universities. Data was collected from the head librarians who participated in the study through interviews. Underpinned by the pragmatic research philosophy, a study by Ibrahim (2019) integrated both qualitative and quantitative research approaches in assessing the role of institutional repositories in the teaching, learning, and research lifecycle of faculty members and students of the University for Development Studies. Similarly, a study by Kodua-Ntim (2020) ascribed to the pragmatic research paradigm and adopted the convergent parallel mixed methods design in examining the usage of open access institutional repositories in university libraries in Ghana. Data was collected using a questionnaire and an interview guide.

From the literature review, it is clear that the majority of the studies on IRs in Africa adopted quantitative methods with very few studies adopting qualitative and mixed methods approaches. This study, therefore, sought to add to the literature by viewing the phenomenon from a pragmatic viewpoint, which allowed the researcher to paint a holistic picture of the nature of IRs in Ghana. Most likely the information generated from this study will contribute to the literature by highlighting what might have been missed by previous authors.

The section that follows presents an outline of the important discoveries that were uncovered during the review of related literature.

3.11 THE SYNTHESIS OF THE LITERATURE REVIEW

Key findings in the literature indicate the following:

- Institutional repositories are online archives that are used to formally organised and managed collections of digital content generated by the faculty,

staff, and students of an institution. The content of institutional repositories in Africa comprise mainly of postgraduate thesis and dissertation, pre-print/post print of research articles, conference proceedings, faculty/departmental journals, administrative papers, newsletters and bulletins, teaching notes, committee reports, inaugural lectures and past examination questions

- Institutional policies are key to ensuring the sustainability of IRs. Although institutional policies on Open Access and content deposits in IRs are a common feature in most academic institutions, most of these policies are not mandatory (Prabhakar & Rani 2018; Callicott et al. 2016; Bergin & Roh 2016; Fruin & Sutton 2016; Xia 2007) and therefore inhibit efforts to use IRs to showcase the entire scholarly and intellectual output of most institutions.
- There seems to be a growing perception among faculty member, students, and librarians of the need to make scholarly literature public, free of charge, and free of most copyright and licensing restrictions (Oguz & Assefa 2014; Keeffe 2012; Van Noorden 2009). However, there are variations or differences in perception among faculty members, students, and librarians. It is therefore important that these variations or differences are harmonised in order to ensure the sustainability or continuous use of IRs.
- Librarian competency is critical to the successful implementation and usage of ICT related library services. However, there are a myriad of skills and competencies required of IR personnel. Prominent among these arecommunication and interpersonal, curating and preserving content, curation technologies, environmental scanning, management, planning and evaluation, services and systems, models and modeling competencies.
- The sustainability of IRs is dependent upon staff and the technical and managerial competencies of these staff members. However, many academic libraries lack personnel with the requisite IT skills, expertise, and competencies to effectively manage them (Dzandza 2019; Okiki & Odunlade 2018; Meishar-Tal & Pieterse 2017; Laakso et al. 2017; Tait et al. 2016; Dunne et al. 2010).
- While some features of emerging technologies, such as academic social networking sites, can be used in various ways to stimulate interest and participation in IRs, particularly among faculty members, it still remains a fairly

new concept that requires further research (Okiki & Odunlade 2018; Meishar-Tal & Pieterse 2017; Laakso et al. 2017; Dunne et al. 2010; Urista et al. 2009).

- Although financial constraints, copyright issues, lack of awareness, erratic power supply, low bandwidth, lack of expertise or staff, and lack of institutional support have been identified as major challenges that threaten the sustainability of IRs, not much is reported in this regard from Ghana (Martin-Yeboah et al. 2020; Kodua-Ntim & Fombad 2020; Dzandza 2019; Ibrahim 2019; Thompson et al. 2016; Agyen-Gyasi et al. 2012).

3.12 SUMMARY

The aim of this chapter was to review studies similar to the objectives set out in this study in order to provide the benchmarks against which the researcher can compare and contrast the results that emerged from the current study. The chapter also identified some of the gaps in the current literature on IRs, which the current study sought to address. The review showed the existence of numerous publications (journal articles, conference papers, theses, and dissertations) on the awareness, adoption, and usage of OAIRs. The majority of the studies reviewed adopted the quantitative research design and used questionnaires as their main instrument for data collection. A few adopted the mixed methods research design using questionnaires and (face-to-face) interviews as the main instruments for data collection. However, a significant minority of the studies reviewed adopted pure qualitative methodologies through face-to-face and remote interviews. Most of the studies reviewed focused attention on the promotion of IRs and addressed some of the factors militating against the sustainability of IRs. However, very few were conducted in Africa, much less in public universities in Ghana. Due to this, it is therefore imperative that a country-specific study be conducted in order to prescribe country-specific solutions.

The current study therefore examined the issues that threaten the longevity of IRs in public universities in Ghana and suggests measures to curb these threats. It is believed that the recommended measures will form part of a framework that might

enable libraries and other stakeholders gain adequate insights into the factors that threaten the longevity of IRs and counteractions which will contribute to the sustainability of IRs in public universities in Ghana. The next chapter outlines the methodological and procedural techniques that were adopted for the study.

CHAPTER FOUR:
RESEARCH METHODOLOGY

4.1 INTRODUCTION

The research methodology provides a description of the entire research process, from the theoretical underpinnings of the study to the data collection, analyses, and interpretation (Creswell 2014). It encapsulates all the procedures adopted by researchers to describe, explain, and predict their object of study (Rajasekar, Philominathan & Chinnathambi 2006:5). The methodology therefore forms the central focus of any research process, because it has an impact on the quality of the knowledge generated (Fielden 2008:7). In a nutshell, the research methodology refers to the methods and processes adopted by researchers in their quest to obtain the requisite data needed to provide answers their research questions and address the study objectives.

Chapter One outlined the objectives of the study as well as research questions. In order to obtain the data needed to provide answers the research questions, the study applied the mixed methods methodology, which is underpinned by pragmatism (Allmark & Machaczak 2018; Bergman 2011; Biesta 2010). Chapter Two provided a review of the Dynamics of IR Innovation Model and DOI Theory. Variables from these theories constituted the proposed framework that guided the study. The conceptual framework is based on the assumption that there are both quantifiable and subjective factors that influence the sustainability of IRs. Therefore, methods that elicited both objective and subjective responses were adopted. Hence, the mixed methods approach enabled the researcher to provide a comprehensive picture of the factors that confront the sustainability of IRs. Chapter Three provided an exploration of the literature related to the sustainability of IRs. It also explored the literature and addressed the study objectives as outlined in Chapter One.

Similarly, this chapter discusses the research methods that were adopted for this study in the quest to answer the research question and address study objectives. The chapter first introduces the world view to which the study subscribes. This is

followed by an outline of the approach and design of the study. The chapter also provide justifications for the choice of study population, sampling methods, data collection instruments, procedures, and analytical tools adopted for the study. It also provides an overview of the ethical stands ascribed to in executing the study.

The next section highlights the research paradigm adapted for the study.

4.2 RESEARCH PARADIGM

The research paradigm is the broad group of philosophical values and ideas that informs actions taken by researchers regarding how problems should be understood and addressed (Creswell 2014). Babbie (2010:33) views paradigms as “the fundamental models or frames of reference researchers use to organize their observations and reasoning”. The research paradigm provides the basic assumptions and reasoning upon which the discovery and advancement of knowledge within a particular field of inquiry is based. It is used to describe the ‘worldview’ that the researcher subscribes to (Mackenzie & Knipe 2006). In other words, the researcher’s views about the world, perspectives, school of thought, and shared beliefs that influence or inform what he/she considers as knowledge and how that knowledge is obtained and interpreted. According to Babbie (2010:33), “paradigms are often difficult to recognize because they are so implicit, assumed and taken for granted”. However, Creswell (2014) argues that although these philosophical ideas and beliefs are largely submerged in research, they form the basis for conducting any scientific enquiry.

A research paradigm is basically made up of four elements, namely; epistemology, ontology, methodology and axiology (Khatri, 2020; Creswell & Creswell, 2018; Kivunja & Kuyini, 2017). These elements serve as the foundation on which paradigms are formed as they constitute the basic assumptions, beliefs, norms and values that holds each paradigm (Kivunja & Kuyini, 2017). The epistemology of a research paradigm basically is the inquiry into what constitute valid knowledge or truth. It is the philosophy of knowledge or how we come to know (Trochim, 2000; 758). According (Kivunja & Kuyini, 2017; 27) epistemology is ‘concerned with the

very bases of knowledge, its nature, and forms and how it can be acquired, and communicated'. Its involves an examination of the relationship between the researcher and what is being studied. This is very crucial as affects what observations the researcher considers important in the quest to understanding the phenomenon or object understudy.

Ontology relates to the researcher's belief of what constitute reality. According to Patton (2002) it is the believe of a single verifiable reality or the believe that reality is socially constructed and can only be understood by examining the perception of the human actors. It examines the researchers believes about nature of reality and therefore shapes what the he/she believes can be known about that reality (Khatri, 2020).

The axiology of research paradigm deals with the values or ethical issues that needs to be addressed when conducting research. According to Kivunja and Kuyini (2017; 28) 'It involves defining, evaluating and understanding concepts of right and wrong behavior relating to the research'. It considers the value that researchers attach to the different aspects of the research, respondents, the data and the audience to which the research findings is to be communicated.

The methodology forms an important part of the research paradigm as provides a description of the entire research process, from the theoretical underpinnings of the study to the data collection, analyses, and interpretation (Creswell 2014). Khatri (2020) states that methodological considerations in a paradigm basically include the respondents, study instruments, data collection procedures and data analysis methods adopted in the quest to gain knowledge about the research problem. Therefore, the methodology is key to the obtaining the desired data, knowledge, observation and understandings of the phenomenon understudy.

Kivunja and Kuyini (2017) noticed that even though various paradigms have been proposed by many researchers, they can be categorised into four main taxonomies, namely: positivism, interpretive, critical theories, and pragmatic paradigms. As a philosophy, positivism states that knowledge is only factual and trustworthy when it is

observable or quantifiable. The positivist is of the view that nature is stable and can be studied and expressed from a neutral standpoint without having an impact on the phenomenon under study (Cohen, Manion & Morrison 2007). In positivist studies, researchers are required to objectively collect, analyse and interpret research data. Therefore, positivism relies on observations can be quantified and analysed statistically. A positivist study may be an inductive or deductive inquiry (Crowther & Lancaster 2008). Despite its proven success and wide acceptance, positivism has been highly criticised for its reliance on quantifiable experiences as valid sources of knowledge, since not all human experiences are quantifiable (Creswell 2014; Cohen et al. 2007; Hjørland 2005; Tribe 2001). Also, positivistic studies have been criticised for their reliance on the status quo. In other words, positivistic studies basically provide a description of the phenomenon under study and therefore lacks insight into in-depth issues.

Unlike the positivist paradigm, the critical paradigm holds the view that the study of the human environment can never be truly objective or free from the values of the researcher (DeCarlo 2018; Mittwede 2012). Thus, researchers are interactively linked to their objects of investigation. The main goal of the critical research perspective is to address social inequities and power differentials in order to foster social change (Wang 2014; Paynton, Lippert & Hahn 2014; Asghar 2013). Critical theories therefore seek to expose and challenge the status quo with the express goal of eliciting social change (DeCarlo 2018). Critical theories identify or point out what is wrong with existing social systems, identify actions needed to address them, and provide clear norms for criticism and transformation (Bohman 2005). The main strength of the critical theories paradigm is its ability to combine theory and practice. Rather than seeking prediction and control, or explanation and understanding, critical theories seek positive social change (Paynton et al. 2014).

The interpretive paradigm rejects the existence of a universal standard for conducting research. Max Weber, Alfred Schutz, Albion Small, George Herbert Mead, and Franklin Frazier, the pioneers of interpretivism, believed that there is no particular right or correct method to acquire knowledge (Goldkuhl 2012; Smith 1993). The fundamental belief of interpretive research paradigm is that there cannot be a

singular or independent view of the social environment as social reality is formed based on individual experiences and social context (Bhattacherjee 2012). The Interpretive paradigm is hinged on the theoretical belief that reality is shaped by one's social associations and is therefore best studied within its social and cultural context (Willis 2007; Angen 2000). Creswell and Clark (2007) posit that the goal of interpretive research is to rely on the views and experiences of the participants as much as possible. Therefore, to ensure the integrity of the phenomenon being studied, the researcher must make efforts to place himself/herself within the phenomenon to understand it from within. However, like positivism, interpretivism is not without its shortcomings. One of the greatest criticisms of interpretivism is its subjective nature (Creswell 2014; Goldkuhl 2012; Creswell & Clark 2007). Also, data obtained from interpretive studies is heavily impregnated with personal views and values which negatively impact the reliability and representativeness of the data (Cohen et al. 2007).

It can clearly be concluded that the above-mentioned paradigms have their inherent strengths and limitations. However, to overcome the limitations, researchers resort to the pragmatic philosophical position. According to Revez and Borges (2018:583), pragmatism is a philosophical position that avoids the one-size-fits-all approach to research and focuses on what is workable or practicable. Instead of focusing on methods, the researcher emphasised the research problem and used all approaches available to understand the issue under investigation (Creswell 2014:19). Even though pragmatism can serve as a philosophical underpinning for social research, regardless of whether that research uses qualitative, quantitative, or mixed methods (Morgan 2014:1045), it has been used extensively as the philosophical underpinning for mixed methods studies in LIS. Kankam (2019), in a study investigating the use of paradigms in the discipline of LIS, observed that pragmatism was one of the four most commonly used paradigms in LIS literature. Goldkuhl (2012), examining the influence of pragmatism in the field of information systems, revealed that pragmatism has significantly influenced information systems research. However, in seeking to determine the presence of the pragmatic paradigm in information science literature, Revez and Borges (2018) concluded that the presence of pragmatism either as a philosophical or methodological position in information science literature is very

small, but this attests to its ability to enrich knowledge creation and acquisition in the field. Similarly, Ngulube (2013) explored the use of mixed methods approaches (blending of qualitative and quantitative methods) by LIS researchers in Sub-Saharan Africa and concluded that the blending of different research methods was limited. It was then recommended that LIS researchers in Sub-Saharan Africa blend methods in order to obtain a comprehensive picture of a phenomenon under investigation (Ngulube 2013).

According to Johnson (2009:452), “social science data or facts cannot be interpreted in the absence of human values. This is because human beings cannot fully reason on or about ‘facts’ without concurrently reasoning and relying on values.” This affirms Tashakkori and Teddlie's (2003) position that the complexities of social phenomena require different kinds of study approaches in order to understand them and accurately make inferences. The pragmatic research paradigm served as the philosophical foundation for the study. In terms of ontology and epistemology, this study is not committed to any single system of philosophy and reality (Weaver, 2018). This is because the researcher recognises that understanding the issues affecting the sustainability of IRs in public universities in Ghana is a complex problem that keeps changing based on the study participants’ experiences and interactions with IRs.

No rigid approach was adopted for this study. Instead, only methods that allowed the researcher to unearth the issues that confronted the sustainability of IRs in public universities in Ghana were employed. As rightly put by Romm and Ngulube (2015), the rationale behind a pragmatic paradigm is to generate research that offers enhanced practical insights and ethical solutions to local and societal problems. These methods were adopted based on the study objectives and research questions. The nature of the study objectives and research questions required that both quantitative and qualitative information be utilised to adequately answer or address them. The quantitative data was collected through a questionnaire, while the qualitative data was obtained through the use of an interview guide. Study objectives and research questions therefore influenced how data was obtained, analysed, and interpreted.

The research approach adopted for the study is discussed in the next section.

4.3 RESEARCH APPROACH

The research approach provides the overall plan and gives a detailed description of the procedures and method adopted for data collection, analysis, and interpretation (Creswell & Creswell 2018; Priya 2016). The mixed methods research approach is the research approach adopted for this study. The mixed methods research approach involves the collection, analyses, and integration of quantitative and qualitative methods, data, and "worldviews" (positivism and interpretive) in the context of a single study (Romm & Ngulube 2015; Creswell 2014; Tashakkori & Teddlie 2003). It involves the application of two methodologies and two worldviews throughout the entire research process (Romm & Ngulube 2015: Teddlie & Tashakkori 2009).

According to Pashaeizad (2010), due to the multidisciplinary nature and complexity of problems in LIS settings, researchers are increasingly adopting the mixed methods research approach. Similarly, Kankam (2020) asserts that the increase application of mixed method approaches in library and information science research is due to its ability to provide comprehensive and meaningful outcomes as compared to other research methodologies. Furthermore, Jogulu and Pansiri (2011) opine that by combining methods researchers are able to provide a stronger justification for their findings and the inferences drawn from them as compared to using a single method.

The study adopted the mixed methods research approach because of the multi-facetted nature of the phenomenon under study. Sustainability is a complex phenomenon that cannot be reduced to simple objectification. Therefore, employing a wholly quantitative or qualitative approach would not have helped the researcher to adequately address the research questions. Creswell (2014) posits that by adopting the mixed methods research approach, one gains a deeper understanding of the phenomenon under study, both in breadth and depth. In view of this, the researcher sought to provide a comprehensive understanding of the factors that confront the

sustainability of IRs and increase the validity of the study findings by leveraging on the strengths of both quantitative and qualitative research approaches (Crist & Berman 2016; Romm & Ngulube 2015; Johnson, Onwuegbuzie & Turner 2007).

Also, the conceptual framework, as outlined in Chapter Two, postulated that stakeholders' conceptualisation of the IR is influenced by the stakeholder's characteristics, such as socio-economic characteristics (i.e., academic status and social influence) and personality variables (i.e., age, gender, and academic level). This therefore required the adoption of an approach that had the ability to capture "soft" views and experiences of the various stakeholders, as well as verifiable quantitative data (Jogulu & Pansiri 2011). Hence, the mixed methods research approach was adopted for the current study.

Teague (2017) successfully used the mixed methods research approach to examine online course facilitators' perceptions of mobile technology, and technological pedagogical content knowledge (TPaCK) affordances for the award of the Doctor of Education Degree in Learning Technologies at the Pepperdine University, USA. Bullock (2017), as part of the requirement for obtaining a PhD in Curriculum and Instruction, examined the role of school leadership in promoting students' achievements in mathematics using the mixed methods research approach. Kommey (2020) adopted the mixed methods approach when exploring knowledge sharing practices among rice farmers in the Eastern Region of Ghana as part of the requirement for the degree of Doctor of Philosophy and Literature in Information Science at Unisa. Similarly, Kodua-Ntim (2020), as part of the requirement for the degree of Doctor of Philosophy and Literature in Information Science at Unisa, successfully employed the mixed methods research approach in investigating the usage of OAIRs in university libraries in Ghana.

According to Stockman (2015:74), "mixed-methods research is growing in popularity across academic domains and levels and that achieving a doctorate through a mixed methods study can be a very fruitful endeavour." However, conducting a successful mixed methods study is not without its challenges. Mixed methods research has been criticised for its design complexities and time, resource, and expertise

constraints (McKim 2017; Stockman 2015; Creswell 2014). This is because additional time, resources, and expertise are needed to for the collection and analyses of two different types of data (Creswell & Plano Clark 2011). Despite these challenges, the researcher deemed the mixed methods approach appropriate for this study.

The next section outlines the overall strategy adopted by the researcher to address the research problem.

4.4 RESEARCH DESIGN

The research design is the overall strategy adopted by researchers to systematically connect the various aspects of a study (De Vaus 2001). Various types of typologies or taxonomies have been used to identify or classify the different types of mixed methods strategies or designs. However, common among these are convergent parallel design, explanatory sequential design, exploratory sequential design, and embedded and multi-phase design (Schoonenboom & Johnson 2017; Creswell 2014; DePoy & Gitlin 1998).

This study adopted the convergent parallel mixed methods design. This is because the researcher seeks to develop a holistic or more complete understanding of the factors that confront the sustainability of IRs in Ghana by obtaining different but complementary data. According to Creswell (2014:238), the aim of the convergent parallel mixed methods design is to compare data obtained from studying, analysing, and examining a phenomenon drawn from different perspectives in order to identify points of convergence, divergence, contradictions, or relations. In view of this, the study compared the views of IR managers and participants (authors, researchers, and librarians) to provide a holistic picture of the factors that confront the sustainability of IRs in Ghana. By obtaining complementary data, the researcher examined the IR conceptualisation, usage intension, and promotional strategies of the various stakeholder groups (IR managers, authors, researchers, and librarians). This is important, because it is only through the establishment of a connection between IR conceptualisation, usage intension, and promotional strategies across

the various stakeholder groups that sustainability or continuous use behaviour can be achieved as outlined in the conceptual framework.

In accordance with the adopted research design, quantitative and qualitative data sets were collected concurrently. Both quantitative and qualitative data were collected at the same time, analysed, and presented separately. However, they were integrated at the discussion or analytical stage of the study (Schoonenboom & Johnson 2017). This offered the researcher the opportunity to deal with convergent and divergent views that emerged from analysing both data sets under one heading and to completely address the research questions (Schoonenboom & Johnson 2017; Plano Clark & Ivankova 2016; Creswell 2014). Each set of data was given equal importance in addressing the research questions.

The study was guided by a conceptual framework. The Institutional Theory, Stakeholder Theory, Dynamics of IR Innovation Model, SST Theory, and DOI Theory were the main theories that informed the proposed conceptual framework. A detailed discussion on the proposed conceptual framework was outlined in Chapter Two.

The next section outlines the processes and procedures adopted by the researcher in identifying the study sites selected for the study.

4.5 SELECTION OF STUDY AREAS

The study areas were clustered into three zones based on their geographical locations. Zone one was made up of universities that are located in the Northern, Upper East, Upper West, North East, and Savannah regions; zone two comprised universities that are located in Eastern, Ashanti, Ahafo, Bono East, Brong Ahafo, and Oti regions; and zone three consisted of public universities that are located in the Western, Western North, Central, Greater Accra, and Volta regions.

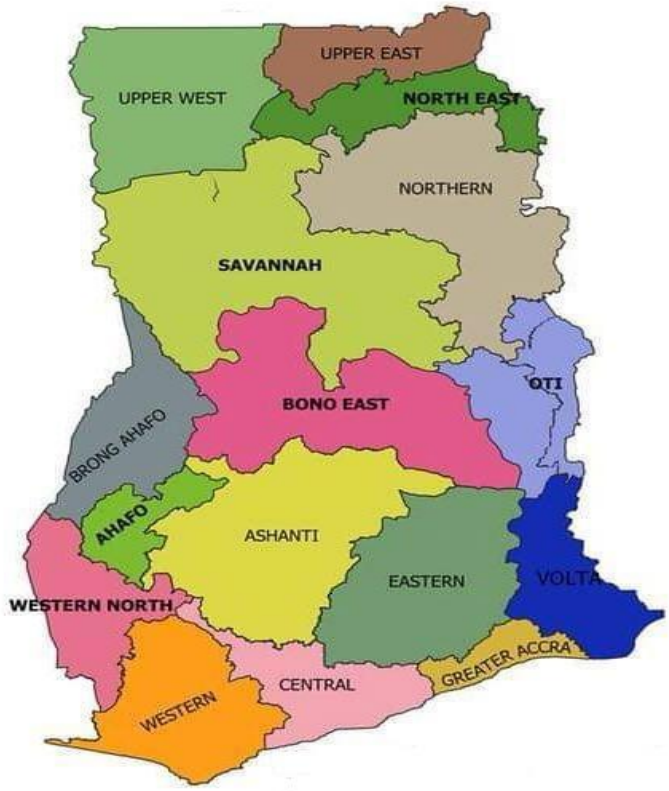

Figure 4.1: Map of Ghana

Source: Pulse Ghana (2018)

Table 4.1: Geographical zones

Zone	Institutions
One	UDS
Two	KNUST, UENR
Three	UMaT, UPSA, UHAS, UEW, UCC, UG

The UDS was purposively sampled from zone one, because it is the only public university in that zone. The UDS has four campuses, namely, Nyankpala, Wa, Navrongo, and Tamale campuses. The Nyankpala campus was purposively sampled, because that is the campus where the main university library is located. It houses the digitalisation and e-resources unit. Also, the office of the IR manager and the university librarian are located in the Nyankpala campus.

Universities in zone two and three were further grouped into universities whose IRs are listed on the OpenDOAR and those whose IRS that are not listed on

OpenDOAR. The OpenDOAR is a global Open Access repository directory noted for listing high quality functional IRs. In view of this, the KNUST, UCC, UG, and the UEW were purposively sampled because they are the only public universities in zone two and three that are listed on OpenDOAR.

In view of the above, the study setting comprised the UG, the UCC, the KNUST, the UDS, and the UEW.

The next section describes the study population and justifies the selection of this population.

4.6 POPULATION

The study population refers to the larger pool of units from which study samples are drawn (Bryman 2012). Lavrakas (2008:876) describes the study population as the entire set of units from which survey data is to be obtained to make inferences. That is, the group from which the researcher seeks to gain insights in order to draw conclusions.

In this study, the target population comprised IR managers, library staff (Digitization and E-Resources Units), postgraduate students, lecturers, and university librarians from public universities in Ghana. IR managers were targeted because they are the professionals responsible for managing the technical and intellectual contents of IRs. Library staff (Digitization and E-Resources Unit) were targeted because they are the major stakeholders responsible for uploading**,** marketing, and disseminating the e-resources of the library. University librarians were targeted because they have oversight responsibility for the management and operation of IRs within their respective institutions. Table 4.2 shows the breakdown of the study population.

Table 4.2: Population

Institution	Library staff (Digitization and E-Resources Unit)	IR managers	University librarians	Graduate students	Lecturers	Total
UG	14	1	1	4,820	1,400	6,236
KNUST	12	1	1	3,403	1,179	4,596
UCC	9	1	1	5,000	750	5,761
UEW	10	1	1	2,453	635	3,100
UDS	8	1	1	720	450	1,180
Total	**53**	**5**	**5**	**16,396**	**4,414**	**20,873**

Source: Preliminary survey 2020

4.7 SAMPLING METHOD

Sampling involves the selection of a group from the study population which the researcher intends to observe and make inferences that can be generalised to the wider population (Ary, Jacobs, Sorenson & Razavieh 2010:149). It involves the selection of units of analysis from a given population (Jupp 2006:271). The aim of sampling, therefore, is to ensure the representativeness and validity of the research findings. Due to the specialised and varying characteristics of the study population, the researcher adopted both purposive and convenience sampling techniques. This was to ensure that the various segments of the study population are adequately represented to further the objectives of the study (Emmel 2013). The following subsections provide a detailed explanation of the sampling methods adopted for the study.

4.7.1 Purposive sampling

The purposive sampling technique is a non-probability sampling technique that relies solely on the judgement of the researcher when selecting a study sample (Saunders, Lewis & Thornhill 2012). The main objective of a purposive sample is to produce a sample that can be logically assumed to be representative of the population. This is often accomplished by applying expert knowledge of the population to select in a non-random manner a sample of elements that represents a cross-section of the population (Saunders et al. 2012; Black 2010).

According to Black (2010), purposive sampling can be categorised as follows:

- **Critical case:** this is where samples are selected based on their likelihood to give you the most information about the phenomenon under study.
- **Extreme or deviant case:** this focuses on the selection of respondents with particular or unique characteristics.
- **Heterogeneous sampling:** relies on the judgement of the researcher in the selection of survey respondents with varying characteristics. The main goal of heterogeneous sampling is to achieve a high level of variability within the primary data.
- **Homogeneous sampling**: focuses on a specific subunit within the study population with similar characteristics. For example, a specific age group, gender, educational level, etc.
- **Typical case:** this involves the selection of respondents based on a profile developed by the researcher about what is normal or average for the phenomenon under study.

The study used the purposive heterogeneous sampling technique to sample library staff, IR managers, and university librarians because of their professional roles and technical competencies with regard to the management of the scholarly and intellectual contents of IRs. The aim of adopting the purposive sampling procedure is to ensure that respondents selected from the target population have the ability to help the researcher achieve the study objectives (Emmel 2013:88) within time and cost constraints (Black 2010).

4.7.2 Convenience sampling

The convenience sampling technique is a nonprobability sampling technique that allows researchers to select samples based on their availability. These samples are selected because they are the most “convenient" sources of data for the researcher (Lavrakas 2008:149). Even though samples are non-randomly selected, selection is usually based on some practical criteria, namely; accessibility to respondents, geographical proximity, availability at a given time, and the willingness of respondents to participate in the study (Dörnyei 2007; Lavrakas 2008). Although

convenience sampling has a lot of limitations, such as high vulnerability to selection bias and high level of sampling error (Saunders et al. 2012; Mackey & Gass 2005), it is useful, especially when randomisation is impossible, such as when the population is very large. Also, due to the subjective nature of the convenience sampling technique the effect of outliers can be devastating, as neither biases nor their probabilities can be quantified (Etikan, Musa & Alkassim 2016).

However, like all non-probability sampling techniques, the convenience sampling technique is cost- and time-effective. The convenience sampling technique was used to sample postgraduate students and lecturers because of cost implications, geographical distribution of the respondents, and the difficulty of locating these categories of respondents.

The next section addresses the procedures and methods used in determining the sample size for the study.

4.8 SAMPLING SIZE

The sample size is the number of observations used for calculating estimates of a given population (Smith 2010). It is the number of respondents or subjects included in a study. Fowler (2009) attests that the adequacy of the sample size is the most frequent question posed to survey methodologists. According to Taherdoost (2016), the diversity and complexity of the study population, the objectives of the study, and the kind of statistical analyses required to adequately provide answers to the research questions are key factors for the determination of the adequacy of the sample size.

There are several strategies or approaches for determining sample size. However, common among these are the use of formulas and published tables (Taherdoost 2017; Singh & Masuku 2014; Gill, Johnson & Clark 2010; Ary et al. 2010). The literature abounds with formulas for estimating the required sample size for a given population based on given combinations of precision, confidence level, and variability. However, many of these formulas require information that a researcher

might not be able to provide until the study has been conducted (Vogt 2005:284). In view of this, published tables seem to be the most convenient choice for most researchers.

Like formulas, there are several tables published in literature for estimating the appropriate sample size. These tables enable researchers to estimate the required sample size of a given population based on the design of the study, estimated effect size, desired statistical power (precision or error margins and confidence level), and significance thresholds (Salkind 2010:1301). The sample size used for the study was determined using the sample size estimation table suggested by Gill et al. (2010). According to Gill et al. (2010) sample size determination table at the confidence level of 95% and an error margin of 0.05%, the recommended sample size for a population of 20,873 at the confidence level of 95% and an error margin of 0.05% will be 514. Therefore, the researcher deemed a sample size of 830 appropriate for the study. Similarly, the Gill et al. (2010) sample size determination table at the confidence level of 95% and an error margin of 0.05% was used to determine the number of respondents sampled from each university. The choice of sample size was also influenced by the sample size used in previous IR studies conducted by Okoroma (2018a) and Ibrahim (2019). Using the Gill et al. (2010) sample size determination table at the confidence level of 95% and an error margin of 0.05% and with the population figure provided in Table 4.2, Table 4.3 shows the sampling distribution of respondents.

Table 4.3: Sampling distribution of respondents

Institution	**Library staff** (Digitization and E-Resources Unit)	**IR managers**	**University librarians**	**Graduate students**	**Lecturers**	**Total**
UG	14	1	1	185	36	237
KNUST	12	1	1	132	30	176
UCC	12	1	1	192	20	226
UEW	10	1	1	100	16	128
UDS	9	1	1	40	12	63
Total	**57**	**5**	**5**	**649**	**114**	**830**

A total of 820 respondents, comprising library staff, lecturers, and students, were sampled for the quantitative aspect of the study. Ten respondents comprising five university librarians and five IR managers were selected for the qualitative part of the study. University librarians and IR managers were selected for the qualitative phase of the study, because they are uniquely positioned to give further clarification on or insights into patterns or profiles that may emerge from the quantitative data.

4.9 INSTRUMENTATION

A research instrument is measurement tool used by researchers to collect data or information on a topic of interest from study participants (Suter 2012:252). According to Salkind (2010:608), research instruments provide researchers with an opportunity to attempt to measure variables or items of interest. It is important because it is the main means through which a researcher can gain insight into the phenomenon under study. As such, the researcher developed a questionnaire and an interview guide for the factual collection of data for the study. This section will provide a detailed description of the research instruments.

4.9.1 Questionnaire

Questionnaires consist of a series of questions and other prompts for the purpose of gathering insights into a phenomenon from respondents. According to Popper (2004), the questionnaire is the most commonly used research instrument because it is practical; less time consuming and relatively cheaper to administer; data collected through questionnaires can easily be analysed by either a researcher or through the use of a software package; and, above all, the results can be analysed more 'scientifically' and objectively than with other research instruments. Questionnaires, like many evaluation tools, have some disadvantages. With questionnaires, there is no way the researchers can tell how truthful or thoughtful the respondent is being. Questionnaires are standardised, so it is not possible to explain any points in the questions that participants might find misleading or ambiguous (Wilkinson & Birmingham 2003; Milne 1999). However, despite the above-stated disadvantages, the questionnaire was one of the main instruments adopted for the study. The questionnaires were analysed using the SPSS software.

The questionnaire was divided into seven sections based on the study objectives: demographic information, stakeholders' (faculty members, IR personnel, and students) perception of IRs, the role of institutional policies in the sustainability of IRs, competencies of IR personnel, technical specifications of IRs, content and set procedures for depositing content into IRs, and challenges related to the sustainability of IRs. The items under each of the above sections were adapted from previous studies. Items measuring the stakeholders' perceptions of IRs were adapted from studies by Tella et al. (2016), Oguz and Assefa (2014), Nunda and Elia (2019), Pickton and McKnight (2006), Ugwuanyi et al. (2013), Anenene et al. (2017), Gunasekera (2017) and Okoroma (2018b). Items that examined the role of institutional policies on the sustainability of IRs were developed from studies by Prabhakar and Rani (2018), Khalife (2018), Gilman (2016), and Bergin and Roh (2016). Items that focused on the competencies of personnel assigned to IR work were influenced by studies by Cassella and Morando (2012), Simons and Richardson (2012), Emezie and Ngozi (2013), Fadehan and Ali (2010), and Oguche (2018). Items on the technical requirements for setting up IRs were inspired by studies by Tzoc (2016), Corbett et al. (2016), and Beazley (2011). Items that focused on contents and set procedures for depositing content were adapted from studies by Tillman (2017), Lee et al. (2015), and Björk (2013). Finally, items on challenges to the management of IRs were inspired by studies by Dlamini and Snyman (2017), Kaur (2017), Kodua-Ntim and Fombad (2020), and Martin-Yeboah et al. (2020).

Two sets of questionnaires were developed for faculty members, IR personnel, and students (see Appendix A and B). Each questionnaire was designed bearing in mind the unique characteristics of each group of respondents. The questionnaire for faculty members and students (see Appendix A) had six main sections (A-F). Section A had seven items (questions 1-7) that measured respondents' socio-demographic characteristics, namely, gender, age, institutional affiliation, rank, study level, years of service, and subject specialisation. The items were mostly multiple choice questions. Respondents responded by placing a mark in the boxes provided for the multiple choice items and wrote in the space supplied when it was required. Section B of the questionnaire contained a combination of open-ended and five-point Likert

scale questions. The section had 23 items (8-30) aimed that measuring respondents' perceptions of IRs. Section C of the questionnaire consisted of 10 items (31-40). These items measured the impact of institutional policies on the sustainability of IRs. Section D of the instrument comprised 30 items (41-70) that measured the technical, managerial, and communication competencies of IR personnel. Section E of the instrument comprised six multiple choice items (71-76). These items measured the contents and set procedures for depositing content into IRs. Section F comprised 16 items (77-93) that measured the challenges to the operation, management, and usage of IRs.

The questionnaire for IR personnel (see Appendix B) had seven main sections (A-G). Section A had six items (questions 1-6) that measured respondents' socio-demographic characteristics, namely, gender, age, institutional affiliation, rank, employment status, and years of service at the IR department. The items were mostly multiple choice questions. Respondents responded by placing a mark in the boxes provided for the multiple choice items and wrote in the space supplied when it was required. Section B of the questionnaire contained a combination of open-ended and five-point Likert scale questions. The section had 23 items (7-29) aimed at measuring respondents' views of IRs. Section C of the questionnaire consisted of 10 items (30-39). These items measured the impact of institutional policies on the sustainability of IRs. Section D of the instrument comprised 30 items (40-69) that measured the technical, managerial, and communication competencies of IR personnel. Section E of the instrument comprised six open-ended and multiple choice items (70-75). These items measured the hardware and software requirements for setting up an IR. Section F comprised of five items (76-80) that measured the contents and set procedures for depositing content into IRs. Finally, Section G constituted 16 items (81-96) and measured the challenges to the management of IRs.

4.9.2 Interview guide

According to Bird (2016:125), an interview guide is simply a listing of questions based on the research topic which the researcher seeks to cover in an interview. Interview guides are useful for research because they usually yield the richest data,

details, and new insights; allows for physical contact with study participants; and provides the opportunity for the in-depth exploration of research topics (Frechtling & Sharp 1997). In view of this, an interview guide was developed for the purpose of gathering the qualitative data from the university (head) librarians and IR managers of the universities sampled for the study (see Appendix C). The development of the interview guide was informed by the research questions and extant literature on IRs.

The interview guide (see Appendix C) had seven main sections (A-G). Section A had five items (1-5) that measured respondents' socio-demographic characteristics, namely, age, institutional affiliation, position, employment status, and years of service at the current position. Section B of the interview guide solicited the respondents' opinions, perceptions, and understanding of the concept of IRs. The section had four (6-9) items. Section C of the interview guide had 10 items (10-19). These items sought respondents' views on the impact of institutional policies on the sustainability of IRs. Section D of the instrument sought their views and opinions on the technical, managerial, and communication competencies required of IR personnel (questions 20-22). Section E of the instrument covered the hardware and software requirements for setting up an IR and had eight (23-30) items. Section F comprised five items (31-35) that sought the view of respondents on the contents and set procedures for depositing content into IRs. Finally, Section G sought the views of respondents on the challenges to the management of IRs (36-37).

Trustworthiness of the qualitative phase

To ensure trustworthiness, the researcher ensured that the principles of credibility, dependability, conformability, and transferability were upheld. These principles have been identified as the most widely used trustworthiness evaluation criteria (Stahl & King 2020; Connelly 2016; Elo et al. 2014). In this study, the credibility of the interview qualitative phase of the study was achieved through member checking and triangulation. According to Creswell (2012: 259) member checking 'is the process in which the researcher asks one or more participants in the study to check the accuracy of the account'. In view of this, the researcher sent the findings of the study back to participants for feedback on how accurately their views and opinions have

been captured and interpreted. Also, data and methodological triangulations were used to ensure the credibility of the qualitative phase of the study. Stahl and King (2020:26) posit that ‘one method of promoting credibility is through the various processes of triangulation’. Therefore, in this study, the researcher used more than one data collection and analysis method. Specifically, the study collected both qualitative and quantitative data through the use of a questionnaire, interview guide, and content analysis. Both set of data were compared and checked for consistency and variations in the data.

Dependability was the second criterion that was used to ensure trustworthiness. This was achieved through peer debriefing. Specifically, interview transcripts and the interpretations drawn from the data analysis were given to a colleague researcher for his objective assessment of the theme drawn from the interview transcripts and the analytical techniques used. This helped ensure that key findings that were missed or overemphasized were addressed (Janesick, 2015).

The third criterion that was used by the researcher to ensure trustworthiness was confirmability. According to Connelly (2016), confirmability is the degree of neutrality and is analogous to objectivity in quantitative research. In this study, the researcher reflected on his own personal biases and opinions. Throughout the study, the researcher made a conscious effort at ensuring that his personal opinions and biases did not influence the analysis of the data collected and the interpretations drawn. This help in addressing any biases that may have been developed from personal experiences and the literature.

The fourth criterion was transferability. Transferability in this study was achieved through the provision of rich, thick, and detailed descriptions to convey the study findings. Also, the study provided a detailed description of the study sites as outlined in section 1.2.1. This was done to ensure the applicability of the study results within other contexts, circumstances, and settings (DeVault, 2019; Connelly, 2016; Janesick, 2015).

4.10 PRE-TESTING OF INSTRUMENTS

According to Hu (2014:14), pretesting is the stage in the research process where the research instruments are tested on a section of a study population to ascertain the reliability and validity of the research instruments before they are finally administered. This is done to ensure that the final research instrument is free from ambiguities, is properly worded, and measures accurately what the researcher seeks to measure (Creswell 2008; Frankel & Wallen 1996).

The research instruments (questionnaire and interview) were pre-tested with faculty members, librarians, and students from the UCC using the convenience sampling method between the 26 January 2020 and 1 February 2020. Two sets of questionnaires were developed for the study. The questionnaire for faculty members and students (FSQ) had six main sections (A-F) whiles the questionnaire for IR personnel (IPQ) had seven main sections (A-G). A total of five faculty members, five librarians, and 20 (PhD and MPhil) graduate students responded to the questions. Respondents were thoroughly briefed on the purpose and essence of the pilot study. Respondents were given a week to fill in the questionnaire, write down any ambiguities or errors they encountered, and indicate any misunderstandings they had with any of the items on the questionnaire.

With regard to the interview guide, a date was set for the interview upon discussions with the selected librarians. However, only three out of the five selected librarians were available on the set dates. The interviews were conducted from 8 to 11 February 2020. To ensure the trustworthiness of the interview guide, the results of the pre-test was shared with participants. This was done to ensure that the interpretation of study finding reflected the views of study participants.

At the end of the pilot exercise, it was clear that the instruments needed some improvement before final administration. Therefore, some items were deleted, others refined and new ones were introduced.

Specifically, before pretesting the instruments, section B of both sets of questionnaires (see Appendix A and B) for faculty members and students had 27 items. Four of the items were deleted whiles two items were merged because respondents' found them ambiguous and repeatitive. Section C of the questionnaire initially consisted of 8 items, however, two items were introduced to improve the section. Section D of the instrument comprised 25 items, 5 new item on the technical, managerial, and communication competencies of IR personnel were added to the instrument. To ensure the content and face validity of the instruments, the researcher sought expert advice from his supervisor and a specialist in measurement and evaluation.

The internal consistency reliability of sections of the research instruments was tested using the Cronbach alpha. The reliability co-efficient of the questionnaire items ranged between 0.70 and 0.97. This the researcher considered acceptable for the administration of the study instruments to the study population (Pallant, 2016; Taber 2008; Lavrakas 2008). Table 4.4 shows the reliability co-efficient of the sections of both set of questionnaires.

Table 4.4 Reliability of research instruments

Section	Cronbach alpha (α)		No. of items	
	FSQ	IPQ	QIP	FSQ
A	0.70	0.81	7	6
B	0.77	0.73	23	23
C	0.84	0.77	10	10
D	0.97	0.97	30	30
E	0.82	0.82	7	6
F	0.80	0.70	16	5
G	-	0.80	-	16

FSQ: Questionnaire for faculty members and students
IPQ: Questionnaire for IR personnel

4.11 DATA COLLECTION

The collection of data is an essential part of any research endeavour. According to Bryman (2012:14), “data collection involves the process of gathering information from study participants with the view to find answers to the research questions or test the hypothesis”. Creswell (2014:210) posits that the procedure for collecting data involves the setting of boundaries for the study, the collection of information, and the establishment of protocols for recording information. Flick (2018:8) notes that the major aim of data collection is to provide adequate information about a phenomenon for an in-depth empirical analysis.

The researcher administered the research instruments with the support of five research assistants (one from each university). The research assistants were given training on research ethics and procedures for administering questionnaires. The researcher and his research assistants ensured strict adherence to the COVID-19 protocols by washing their hands, wearing face masks, sanitising their hands, and observing a metre distance between the researcher and study participants. The researcher received ethical clearance from the College of Human Sciences Research Ethics Committee and obtained an introductory letter from the Information Science Department, Unisa, in order to facilitate data collection. The researcher sought study site permission and approval from all five public universities selected for this study. This helped establish a good rapport with all the selected respondents, legitimised the research findings, and ensured the protection of study participants' rights, dignity, and safety. All the study participants were informed on the objectives and design of the study. They were also informed that the findings of the study would be used purely for academic purposes.

The research assistants were given two days of training on the administration of the questionnaire. On the first day, the researcher visited the selected universities and their librarians to discuss the purpose of the study. The researcher took the opportunity to visit the Digitization and E-Resources Units of the selected universities to familiarise himself with the staff there and state the purpose of the visit. The researcher also visited the graduate hostels and the offices of lecturers from the

selected universities to familiarise himself with them. The researcher discussed the purpose and objectives of the study with them.

The researcher visited the selected universities upon institutional approval and ethical clearance. The research assistants stationed at the selected universities helped the researcher hand over the questionnaire to students at graduate hostel, lecturers, and staff members of the Digitization and E-Resources Units who had previously agreed to participate the study. The research assistants collected the questionnaires at their respective universities within three days after administering them. A total of 57 questionnaires that were distributed to staff of the Digitization and E-Resources Units who had previously agreed to take part in the study, 56 questionnaires were duly completed and returned, yielding a 98.2% response rate. Six hundred and forty-nine (649) and 114 questionnaires were handed out to graduate students and lecturers, respectively. Out of the 649 questionnaires that were handed out to graduate students, 631 were returned, yielding a 97.2% response rate. Out of the 114 questionnaires handed out to lecturers, 80 were returned, constituting a response rate of 70.2%.

The researcher also scheduled face-to-face or telephonic interviews with the university librarians and IR managers of the selected universities. Each interview lasted between 25 and 40 minutes. The interviews were recorded using a digital voice recorder and Tecno Spark 4 cell phone, respectively. The researcher obtained copies of institutional IR policies from the selected IR managers and university librarians.

4.12 DATA ANALYSIS

Data analysis is described as a systematic way of grouping, classifying, or coding collected data (Marshall & Rossman 2006:150). This usually involves subjecting data to statistical or logical techniques with the sole aim of discovering useful patterns or information. A mixed methods design involves the analysis of quantitative and qualitative data (Creswell 2014; Onwuegbuzie & Combs 2011).

The quantitative data that was collected through a questionnaire was analysed using the SPSS software. The SPSS softaware was used to perform both descriptive and inferential analysis. This allowed the researcher to logically report, interpret and summarise patterns and relationships that emerged from the data (Ary et al. 2010). Descriptive and inferential analysis have been used extensively in information science research (Togia & Malliari 2017; Ezema & Okafor 2015; Aharony 2012; Zaidan, Ismail, Yusof & Kashefi 2012; Grover, Cheon & Teng 1994).

The results of the descriptive and inferential analysis are illustrated with bar graphs, pie charts, and tables. In the case of open-ended responses, the researcher undertook a thematic content analysis and generated frequency distribution tables, which were subsequently used to look out for any patterns within these responses that might yield additional information. This was achieved by grouping similar responses under one heading.

The qualitative data was analysed using Nvivo software. The recorded interviews were transcribed into an MS Word document. The interview transcripts were imported into Nvivo software. Nvivo was used to categorise participants' responses into nodes or themes and categories based on the research questions. Both the qualitative data and quantitative data were integrated at the discussion stage of the study. In Chapter Five, the quantitative data is presented before the qualitative data as outlined in previous studies (Nunda & Elia 2019; Tapfuma & Hoskins 2019; Vogl 2018). The next paragraphs outline how specific research questions and hypothesis were analysed.

Research Question 1: How do the various stakeholders (faculty members, students and IR staff) perceive institutional repositories? Frequencies and percentages were generated to describe the knowledge and attitudes of faculty members, students, and librarians about IRs.

Research Question 2: What is the role of institutional policies in ensuring the sustainability of institutional repositories in Ghana? In addressing this research

question, the data collected was analysed using narratives, content analysis, frequencies, percentage counts, and mean and standard deviations.

Research Question 3: What are the competencies or skill sets required of institutional repository professionals? To address this research question, narratives, frequencies, percentages, means, and standard deviations were generated to describe the competencies required of IR personnel. Means were calculated using the following scale: 1 = No level of competence, 2 = low level of competence, 3 = average level of competence, 4 = moderately high level of competence, and 5 = high level of competence.

Research Question 4: What are the technical specifications of institutional repositories in Ghana? Tables were used to show the hardware specifications and IR software used by IRs in Ghana. Also, narratives were used to explain the reasons for the choice of software.

Research Question 5: What type of documents are archived in the institutional repositories in Ghana? To address this research question, frequencies, and percentages were used to show the type of documents and file formats of document archived in IRs in Ghana.

Research Question 6: What are the procedures for submitting content to institutional repositories in Ghana? To address this research question, narratives, frequencies and percentages were generated to describe the content depositing procedures adopted by IRs in Ghana.

Research Question 7: What challenges confront the sustainability of institutional repositories according to the participants and administrators of institutional repositories at the selected public universities in Ghana? Thematic analysis was used to categorise the responses into six major themes. Each major theme was divided into sub-themes.

H_1: There is statistically significant relationship between IR conceptualisation and use intentions. A simple linear regression test was used to analyse the relationship between IR conceptualistaion (independent variable) and IR use intentions (dependent variable).

H_2: There is statistically significant relationship between promotional strategies and use intentions. A simple linear regression test was used to analyse the relationship between promotional strategies (independent variable) and IR use intentions (dependent variable).

H_3: There is statistically significant relationship between personality variables (age, gender and academic status) and conceptualisation of IRs. To analyse this hypothesis, a partial correlation test was conducted to analyse the relationship between personaility variables such as age, gender and academic status and IR conceptualistaion.

H_4: There is statistically significant relationship between IR characteristics and use intension. A multivariate linear regression test was conducted to analyse this hypothesis. This was used to analyse the relationship between IR characteristics such as relative advantage, compatibility, complexity and observability (independent variables) and IR use intentions (dependent variable).

H_5: There is statistically significant relationship between IR policies and use intension. A simple linear regression test was used to analyse the relationship between IR policies (independent variable) and IR use intentions (dependent variable).

H_6: There is statistically significant relationship between IT infrastructure and IR use intension. A simple linear regression test was used to analyse the relationship between IT infrastructure (independent variable) and and IR use intentions (dependent variable).

4.13 ETHICAL CONSIDERATIONS

According to Bryman and Bell (2007), ethical consideration forms the fundamental and yet most crucial part of any research endeavour. This is because they provide the standards by which the conduct of researchers can be regulated (Byrne 2017). Bryman and Bell (2007) identified the elements of ethical considerations as the protection of the dignity of research participants, informed consent, anonymity, confidentiality, honesty, transparency, and objectivity.

With these issues in mind, the researcher took steps to ensure that the above-stated considerations were adhered to in this study. Firstly, upon completion of his research instruments, the researcher sought ethical clearance for the study as indicated in Unisa's (2016) Policy on Research and Ethics. Secondly, the researcher sought the consent of the research participants through a consent form. The consent form clearly stated the nature and purpose of the study. The respondents were given two days to indicate whether or not they consent to participate in the study. Study participants were informed on the purpose of the study and were assured of the anonymity and confidentiality of the responses they would provide. Only participants who agreed to take part in the study were sampled for the study.

Thirdly, the researcher ensured that the study was conducted in accordance with Unisa's (2016) Policy on Research and Ethics. In view of this, the research results are presented strictly in accordance with the ethical principles of honesty, transparency, and objectivity. Objectivity in research reporting was given an important consideration in the study. This was done by ensuring that the personal opinions and biases of the researcher did not get in the way survey results and interview response were reported.

The next section provides an evaluation of the research methods adopted for the study.

4.14 EVALUATION OF THE RESEARCH METHODOLOGY

The evaluation of the research methodology is critical for any research project, as it offers researchers the opportunity to explain what happened and what could have been done differently for different outcomes to be achieved (Stern 2004).

The study employed the mixed methods research approach because of the multi-facetted nature of the phenomenon under study. Sustainability is a complex phenomenon that cannot be reduced to simple objectification. In view of this, the researcher adopted the mixed method approach with the view of providing a comprehensive understanding of the factors that confront the sustainability of IRs by leveraging on the strengths of both quantitative and qualitative research approaches (Crist & Berman 2016; Romm & Ngulube 2015; Johnson et al. 2007).

The main instrument used in the study included a questionnaire and an interview guide. Data collection was conducted on site at the campuses of the selected public universities. This gave the researcher the opportunity to visit the IRs of the selected universities to observe the universities' IR infrastructure. The majority of the interviews were conducted via telephone due to COVID-19 restrictions. The COVID-19 pandemic led to the closure of schools in Ghana. This lengthened the data collection period (eight months instead of three months as anticipated). To fast-track data collection, an online questionnaire was developed, but it did not receive the anticipated response. A total of 820 questionnaires were distributed to faculty members, graduate students and IR personnel. Seven hundred and six seven questionnaires were fully completed, yielding a response rate of 93.5%. Though the the questionnaires achieved a response rate of 93.5%, the issue of the non-response rate cannot be ignored.

A total of 35 questionnaires distributed to graduate students, faculty members, and IR personnel were either partially completed or did not complete at all. Out of the 35 questionnaires, 28 were partially completed. The partially completed questionnaires were rejected and not included in the data analysis. Perhaps if these questionnaires had been fully completed, they would have helped improve the study results and

strengthened the validity of the findings. To help improve response rates, particularly among university librarians and faculty members, the researcher followed up through emails, telephone calls, WhatsApp messages, and office visits. These follow ups were conducted based on the advice and recommendations given by Bryman (2012:236) and greatly improved the response rate and the validity of the study findings. This is because respondents who initially couldn't find the time to complete the questionnaire because of their busy schedules had made time to complete the questionnaire after the periodic reminders through emails, telephone calls, WhatsApp messages, and office visits.

4.15 SUMMARY

The study employed the convergent parallel mixed methods approach in gathering data or information from participants. Despite being criticised for its design complexities and time, resource, and expertise constraints, the mixed methods design was adopted because it offered the researcher the opportunity to collect and analyse both qualitative and quantitative data. The distribution of the self-administered questionnaires was done with the support of five research assistants. The face to face and telephone interviews were conducted by the researcher. A pilot testing of research instruments was conducted, to evaluate their reliability and validity prior to final administration. The steps taken to ensure the reliability and validity of the research instruments were discussed in this chapter. Quantitative data was collected through a questionnaire and analysed descriptively using the SPSS software. The data was illustrated with bar graphs, pie charts, and frequency distribution tables. The qualitative data collected with the aid of the interview guide was analysed using Nvivo software. Nvivo was used to categorise participants' responses into nodes or themes and categories based on the research questions. Both the qualitative data and quantitative data were integrated at the discussion stage of the study. The study was conducted in accordance with Unisa's (2016) Policy on Research and Ethics, as approved by council on 15 September 2016.

The next chapter presents the findings of the study in accordance with the study objectives and research questions.

CHAPTER FIVE:
RESEARCH FINDINGS

5.1 INTRODUCTION

This chapter organises and reports the main research findings obtained through the processes outlined in Chapter Four. Burton (2000:427) posits that "the results chapter forms the main body of a thesis and should take the various aspects of the research findings and integrate them with current theoretical debates and previous research findings." Swaen (2020) opines that the results chapter should objectively present observations (qualitative and quantitative) made in relation to each research question. Similarly, Marshall and Rossman (2006:150) describe data analysis as the "systematic way of grouping, classifying or coding of collected data". This usually involves subjecting data to statistical or logical techniques with the sole aim of discovering useful patterns and addressing research questions.

According to Creswell (2014:225), the data presentation must inform the reader of the type of statistical analysis or tools that were used in analysing the data. Likewise, Bryman (2012:13-14) and Creswell (2009:152) opine that the main purpose of data analysis is to enable researchers make logical deductions from the gathered data with the aim of making meaningful conclusions targeted at addressing the research questions or study objectives.

Chapter Four of this study outlined a convergent parallel mixed methods approach that offered the researcher the opportunity to obtain both qualitative and quantitative data sets for analyses. A self-administered questionnaire and face-to-face and telephone interviews were the main methods used for data collection. Both the face-to-face and telephone interviews were recorded and transcribed. The transcribed data was analysed using Nvivo software. Nvivo was used to categorise interview responses into themes. The quantitative data obtained with the aid of the self-administered questionnaire was analysed using the SPSS software and illustrated with the aid of figures and frequency distribution tables. The themes that emerged

from the qualitative data are presented as narrative text to substantiate the quantitative data.

The next section outlines how the findings of the study will be presented.

5.2 DATA PRESENTATION

The result section of any research is aimed at informing the audience about the outcome or findings of the research (Fah & Aziz 2006). However, the findings of a typical doctoral research study are often huge and must be presented in an organised manner in order to avoid confusion. In view of this, the representation of the study finding is in two parts. The quantitative data is presented in part A whiles the qualitative data is presented in part B. As recommended by Bryman (2012:689) data in both parts (A and B) is presented in accordance with the research questions as outlined in section 1.4.3.

5.3 RESPONSE RATE AND BACKGROUND OF PARTICIPANTS

Response rates have been identified by several authors as the most commonly used indicator of data quality and validity (Frey 2018; Creswell & Creswell 2018; Lavrakas 2008; Baruch 1999). However, there are varying opinions on the minimum response rate threshold. Baruch (1999) examined 175 different studies and concluded that a 55.6% response rate is a reasonable response rate in academic studies. Similarly, Creswell (2012:390) observed that majority of the studies published in leading educational journals reported a fifty percent response rate or better. Babbie and Mouton (2009:261) state that a fifty to seventy percent response rate is adequate for data analysis and reporting.

Studies on IRs in Africa have reported a wide range of response rates: 46.2% (Anyaoku et al. 2019), 65.8% (Thompson et al. 2016), 87.1% (Ibrahim 2019), 87.5% (Fasae et al. 2017), 87.6% (Kumah et al. 2018), to 91.8% (Ntim & Fombad 2020).

Study participants were sample from all five universities (UG, UCC, UEW, KNUST, and UDS) and grouped into five categories (library staff, IR managers, university librarians, graduate students, and lecturers).

Library staff working in the Digitization and E-Resources Units of the five selected public universities were approached to participate in the study. From a total of 57 questionnaires that was given out to study participants, 56 questionnaires were duly completed and returned, yielding a 98.2% response rate. This was achieved through reminders via telephone calls, WhatsApp and text messages.

After a visit to the graduate hostels and offices of lecturers at the selected universities, 649 and 114 questionnaires were handed out to graduate students and lecturers respectively. Out of the 649 questionnaires that were handed out to graduate students, 631 were returned, yielding a 97.2% response rate. Out of the 114 questionnaires handed out to lecturers, 80 were returned, constituting a response rate of 70.2%. This was achieved through reminders via bulk SMS and personal visits.

University librarians from the five selected universities were approached for interviews; three out of the five scheduled interview appointments were successfully completed. This yielded a 60.0% response rate. Interview appointments were also scheduled with IR managers from the five selected universities. All five scheduled interview appointments were honoured, yielding a 100% response rate. In order to improve the response rates among all study participants, reminders were sent out to participants through telephone calls, WhatsApp messages, text messages, and personal visits. Bryman (2012:236), recommends the sending out of reminders as one of the ways to improve survey response rates. Therefore, through WhatsApp, text, and telephonic reminders, the researcher was able to significantly improve upon the response rate, particularly among the faculty members. The overall response rate across all study participants was 93.4%. This the researcher considered adequate to facilitate data analysis (Creswell 2012:390; Babbie & Mouton 2009:261; Fincham 2008).

Table 5.1: Summary of the composition of study participants

Institution	Completed questionnaire			Interviews conducted	
	Library staff (Digitization and E-Resources Unit)	**Graduate students**	**Faculty Members**	**IR managers**	**University librarians**
UG	14	180	21	1	-
KNUST	12	132	20	1	-
UCC	12	185	15	1	1
UEW	10	100	12	1	1
UDS	8	34	12	1	1
Total	**56(**7.23%**)**	**631(**81.4%**)**	**80(**10.3%**)**	**5(**0.65%**)**	**3(**0.39%**)**

(*Source:* Field Data 2021), n=775 **(**100.0%**)**

Table 5.1 provides details of the study participants. The university librarian of KNUST could not participate in the study due to his busy schedule. The university librarian of the UG was about to retire and was thus very busy handing over notes and attending to other engagements. However, she referred the researcher to the IR manager. Nevertheless, the researcher believes that insights provided by IR librarians, lecturers, and graduate students, together with information obtained from the IR policies of the selected universities, would suffice in portraying a holistic view of the sustainability issues confronting IRs in these universities. Notably, 10.3% of the study participants were faculty members, 81.4% were graduate students, 7.23% were IR staff, 0.65 were IR librarians while university librarians constituted 0.39% of the study participants.

5.4 PROFILE OF RESPONDENTS

The first section of the of the research instruments (questionnaire and interview guide) required the research participants to provide information about their gender, age, and the different professional capacities the respondents served in. This section provides the profiles of the various categories of respondents who participated in the study.

5.4.1 University librarians' profiles

Three university librarians participated in the study. They were all males. On the average, the university librarians had served for 5.6 years and were an average age of 55.3 years old.

5.4.2 IR managers' profiles

The IR managers surveyed for the study were all at the rank of Junior Assistant Librarian. Four were males, while the remaining one was a female. On the average, the IR managers had served for 3.5 years and were an average age of 38.4 years old.

5.4.3 Faculty members' profiles

Gender, rank, subject specialisation, and age were the indicators used in building or exploring the profiles of faculty members. The contents of Table 5.2 show that the majority (81.2%) of the respondents (lecturers) surveyed were males, while 18.8% were females. Two (2.50%) of the respondents were professors, 2 (2.50%) of the respondents were associate professors, 20 (25.0%) of the respondents were senior lecturers, 24 (30.0%) of the respondents were lecturers, while 32 (40.0%) of the respondents were assistant lecturers.

With regard to subject specialisation, 30 (37.5%) of the respondents were in the humanities, 18 (22.5%) of the respondents in the natural sciences (i.e., physics, chemistry, and biology), and 3 (3.75%) of the respondents were in the medical sciences.

Fifteen (18.8%) of the respondents were between 51 and 60 years old, 36 (44.9%) of the respondents were between 41 and 50 years old, 25 (31.3%) of the respondents were between 31 and 40 years old, while 4 (5.0%) of the respondents were between 21 and 30 years old.

Table 5.2: Profile of faculty members

Rank	Gender		Age (years)				Academic specialisation							Total (%)
	Male (%)	**Female** (%)	**21 – 30** (%)	**31- 40** (%)	**41 – 50** (%)	**51 – 60** (%)	**Ag.** (%)	**A** (%)	**B** (%)	**H** (%)	**N** (%)	**M** (%)	**ICT** (%)	
Professor	1.25	1.25	0.0	0.0	0.0	2.50	0.0	0.0	0.0	2.50	0.0	0.0	0.0	**2.50**
Associate Professor	0.0	2.50	0.0	0.0	1.25	1.25	0.0	0.0	1.25	0.0	1.25	0.0	0.0	**2.50**
Senior Lecturer	22.5	2.50	0.0	0.0	20.0	5.00	0.0	0.0	10.0	7.50	5.00	0.0	2.50	**25.0**
Lecturer	28.8	1.25	2.50	12.5	6.25	8.75	3.75	2.50	1.25	12.5	5.00	2.50	2.50	**30.0**
Assistant Lecturer	28.8	11.3	2.50	20.0	17.5	0.0	3.75	6.25	1.25	15.0	11.3	1.25	1.25	**40.0**
Sub-total	**81.2**	**18.8**	**5.0**	**31.3**	**44.9**	**18.8**	**7.50**	**8.75**	**13.8**	**37.5**	**22.5**	**3.75**	**6.25**	**100.0**

(*Source:* Field Data 2021), N=80

Ag – Agricultural Science, A – Arts, B – Business, H – Humanities, N – Natural Sciences, M – Medical Sciences, ICT – Information and Communication Technology

5.4.4 IR staff members' profiles

Data in Table 5.3 indicate that the majority (82.1%) of the study participants (library staff working the Digitization and E-Resources Units) surveyed were males, while 17.9% were females. Three point six percent of the respondents were Senior Assistant Librarians, 14.3% of the respondents were Junior Assistant Librarians, 7.1% of the respondents were Chief Library Assistants, 21.4% of the respondents were Principal Library Assistants, 32.1% of the respondents were Senior Library Assistants, 10.7% of the respondents were Library Assistants, and 10.7% of the respondents were Junior Library Assistants.

Thirty-two point one percent of the respondents had served for 1-5 years, 17.9% of the respondents had served for 6-10 years, 25.0% of the respondents had served for 11-15 years, and 17.9% of the respondents had served for 16-20 years, while 7.1% of the respondents had served for more than 20 years.

Table 5.3: Profile of IR staff

Rank	Gender		Age (years)				Years of service				
	Male (%)	**Female** (%)	**21- 30** (%)	**31-40** (%)	**41- 50** (%)	**51-60** (%)	**1-5** (%)	**6-10** (%)	**11-15** (%)	**16-20** (%)	**Above 20** (%)
Senior Assistant Librarian	3.6	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	3.6	0.0
Junior Assistant Librarian	10.7	3.6	0.0	7.1	7.1	0.0	10.7	0.0	0.0	0.0	3.6
Chief Library Assistant	7.1	0.0	0.0	3.6	3.6	0.0	0.0	3.6	3.6	0.0	0.0
Principal Library Assistant	21.4	0.0	0.0	10.7	7.1	3.6	0.0	3.6	10.7	3.6	3.6
Senior Library Assistant	25.0	7.1	10.7	14.3	7.1	0.0	14.3	3.6	7.1	7.1	0.0
Library Assistant	7.1	3.6	3.6	7.1	0.0	0.0	0.0	7.1	3.6	0.0	0.0
Junior Library Assistant	7.1	3.6	3.6	3.6	3.6	0.0	7.1	0.0	0.0	3.6	0.0
Total	**82.1**	**17.9**	**17.9**	**46.4**	**28.6**	**7.1**	**32.1**	**17.9**	**25.0**	**17.9**	**7.1**

(*Source:* Field Data 2021), N=56

5.4.5 Profile of graduate students

The data as shown Table 5.4 indicates that 67.7% of the participants of the study (graduate students) surveyed were males, while 32.3% were females. Regarding their current studies, 46.4% of the respondents were pursuing Master of Arts (MA) degrees, 39.0% of the respondents were pursuing Master of Philosophy (Mphil) degrees, and 14.7% of the study participants were pursuing doctoral degrees.

The majority (55.6%) of the study participants were between 21 and 30 years of age, 33.5% of the study participants were between 31 and 40 years of age, 9.35% of the study participants were between 41 and 50 years of age, while 1.59% of the study participants were above 50 years of age.

Table 5.4: Profile of graduate students

Level of Study	**Gender**		**Age (years)**			
	Male (%)	**Female** (%)	**21-30** (%)	**31-40** (%)	**41-50** (%)	**51 and Above** (%)
PhD	9.98	4.75	3.33	4.28	5.55	1.59
Mphil	30.7	8.08	25.5	10.5	2.85	0.00
MA	26.9	19.5	26.8	18.7	0.95	0.00
Sub-total	**67.7**	**32.3**	**55.6**	**33.5**	**9.35**	**1.59**

(*Source:* Field Data 2021), N=631

5.5 PART A: QUANTITATIVE DATA ANALYSIS

5.5.1 Stakeholders' perceptions of IRs in public universities in Ghana

The global support and acceptance of the concept of free and open access to knowledge has propelled many universities and research centres to set up IRs. According to Serrano-Vicente et al. (2016), many of these universities and research centres have adopted their own institutional Open Access policies. However, this has proven not adequate enough to bring about the needed attitudinal change required to make IRs an integral part of institutional scholarly communication architecture. It is therefore important to determine how the various stakeholders perceive IRs. In this

regard, the objective was set to examine how the various stakeholder groups (faculty members, students, and librarians) in public universities in Ghana perceive IRs. In addressing this research question, the collected data was analysed using frequencies and percent counts. The next subsections present the results under the various stakeholder groups.

5.5.1.1 Faculty members' perception of IRs

There is growing demand among scholars to make both scientific and academic information easily accessible to the public, at little or no cost, and with no or minimum publisher restrictions (Oguz & Assefa 2014; Keeffe 2012; Van Noorden 2009). Institutional repositories present faculty members the opportunity to desemminate their research findings at little or no cost. However, perception has been identified as key to encouraging faculty members' deposits into IRs. Table 5.5 presents faculty members' perception of IRs. The results show that out of the 80 faculty members surveyed, 45.0% of the respondents agreed that IRs make it easy for other people to search for and locate their publications, 37.5% of the respondents agreed that IRs provided long-term preservation of their digital research materials, 58.7% of the respondents agreed that IRs preserve the university's intellectual capital in a central place, 11.3% of the respondents disagreed that few people would access their work when deposited in an IR, 37.5% of the respondents disagreed that OAIRs are not prestigious, while 15.0% of the respondents strongly disagreed that publishers would not let them deposit their work in an IR.

Table 5.5: Faculty members' perception of institutional repositories

Item	SDA	DA	MA	A	SA
Prefer to make my work available only on an academic social networking site than an IR	0.00	15.0	45.0	31.3	8.2
Open Access IRs are not prestigious	11.3	37.5	8.74	27.5	15.0
Others might copy my work without my permission	6.24	36.3	36.3	16.2	5.0
Difficult and time-consuming to deposit my work in IRs	8.75	22.5	27.5	22.5	18.7
Do not know how and what to deposit in IRs	8.74	31.2	37.4	11.3	11.3
Concerned that if I deposit my work in an IR, I may not be able to publish it elsewhere	11.2	46.3	18.7	15.0	8.8
Publishers would not let me put my work in an IR	15.0	36.3	15.0	22.5	11.3
Few people would access my work when deposited in an IR	3.74	11.3	35.0	35.0	15.0
Make preprint or post-print versions of my research publications available to a worldwide audience	11.3	26.3	26.2	26.2	10.0
Disseminate my research findings faster than the traditional publishing process	0.00	8.75	31.2	48.7	11.3
Make freely available types of materials that could otherwise attract subscription fees	0.00	3.74	32.5	45.0	18.7
Make my research visible with very little effort	0.00	8.75	31.3	37.5	22.5
Provide long-term preservation of my digital research materials	0.00	11.3	31.2	37.5	20.0
Make it easy for other people to search for and locate my work	0.00	8.75	18.75	45.0	27.5
Preserve university's intellectual capital in a central place	0.00	3.74	15.0	58.7	22.5
Average Responses	**5.08**	**20.5**	**27.3**	**32.0**	**15.2**

(*Source:* Field Data 2021) N=80

SDA= Strongly Disagree**, DA=** Disagree, **MA**= Moderately Agree, **A**= Agree, **SA**=Strongly Disagree

Knowledge of repository services is key to its usage. Therefore, the researcher sought to examine faculty members' knowledge of IRs as one of the avenues for the dissemination of scholarly or scientific outputs. Figure 5.1 presents faculty members' knowledge of IRs. The results show that out of the 80 faculty members surveyed, 73 (91.3%) of the respondents either agreed or strongly agreed that IRs contain intellectual outputs produced by members of particular institutions, 40 (50.0%) either agreed or strongly agreed that IRs provide unrestricted worldwide access to their contents, 22 (27.5%) moderately agreed that IRs are electronic archives, while 29 (36.3%) either disagreed or strongly disagreed that IRs are web-based. The data in Figure 5.1 shows that faculty members' knowledge of IRs is generally high.

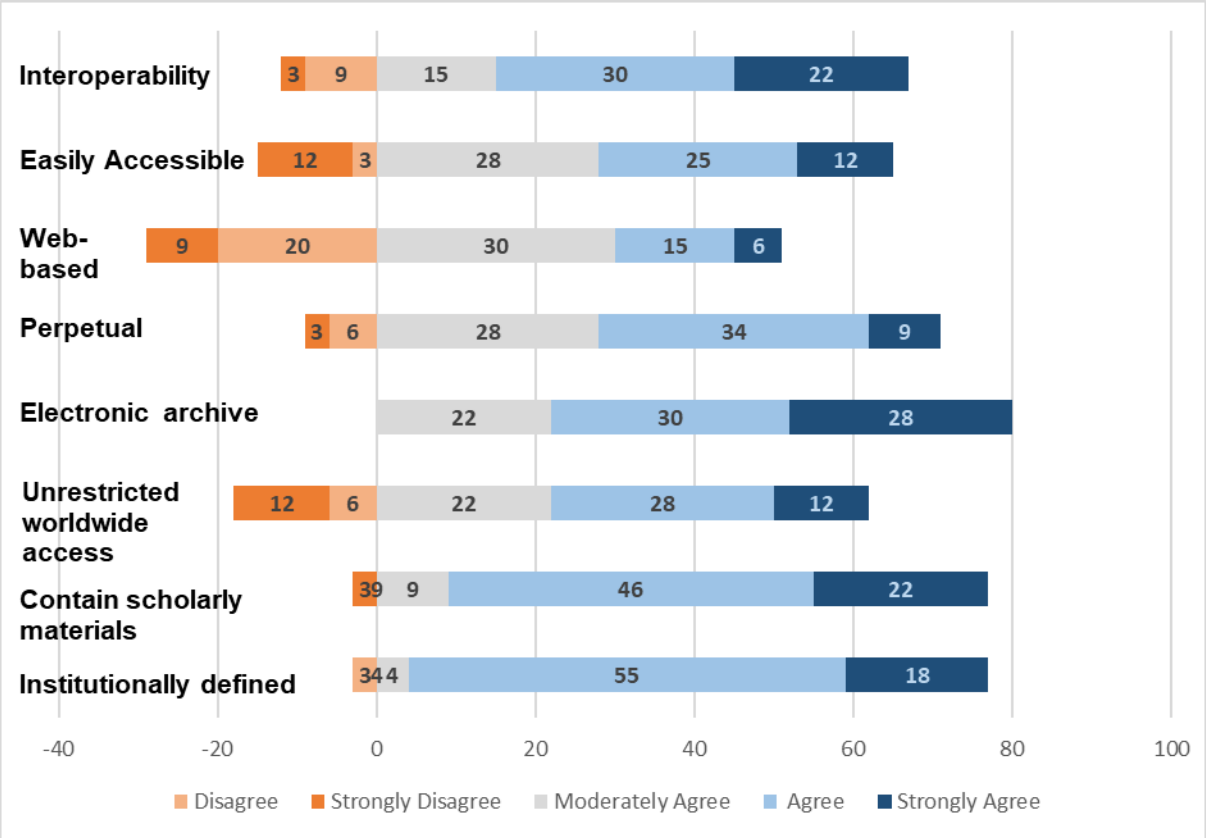

Figure 5.1: Faculty members' knowledge of IRs

(*Source:* Field Data 2021), N=80

Perception has been identified as key to encouraging faculty members' deposits into IRs. Table 5.5 presents faculty members' perception of IRs. The results show that out of the 80 faculty members surveyed, 45.0% of the respondents agreed that IRs make it easy for other people to search for and locate their publications, 37.5% of the

respondents agreed that IRs provided long-term preservation of their digital research materials, 58.7% of the respondents agreed that IRs preserve the university's intellectual capital in a central place, 11.3% of the respondents disagreed that few people would access their work when deposited in an IR, 37.5% of the respondents disagreed that OAIRs are not prestigious, while 15.0% of the respondents strongly disagreed that publishers would not let them deposit their work in an IR.

5.5.1. 2 Students' perception of IRs

Table 5.6 presents postgraduate students' perception of IRs. The results show that out of the 631 faculty members surveyed, 29.0% of the respondents strongly agreed that IRs make it easy for them to search and locate literature; 44.8% of the respondents agreed that IRs provided long-term preservation of their digital research materials; 37.4% of the respondents agreed that few people would access their work when deposited in an IR; 19.7% of the respondents moderately agreed that others might copy their work without their permission when archived in IRs; 33.4% of the respondents moderately agreed that OAIRs are not prestigious; 31.1% of the respondents moderately agreed that they were concerned that if they deposited works in an IR, they may not be able to publish it elsewhere; 18.2% of the respondents disagreed that it was difficult and time-consuming to deposit content into IRs; and 1.43% of the respondents strongly disagreed that IRs provide long-term preservation of their digital research materials. The overall responses show that 79.6% of graduate students have a positively high perception of IRs.

Table 5.6: Students' perception of institutional repositories

Item	SDA	DA	MA	A	SA
Prefer to make my work available only on an academic social networking site than an IR	6.81	17.9	21.7	32.0	21.6
Open Access IRs are not prestigious	8.87	18.7	33.4	28.1	10.9
Others might copy my work without my permission	8.87	16.3	19.7	37.4	17.7
Difficult and time-consuming to deposit my work in IRs	6.97	18.2	43.4	24.6	6.81
Do not know how and what to deposit in IRs	10.8	16.8	35	24.1	13.3
Concerned that if I deposit my work in an IR, I may not be able to publish it elsewhere	11.9	24	31.1	23.6	9.35
Publishers would not let me put my work in an IR	8.87	15.7	43.9	18.7	12.8
Concerned that my work might not be preserved in the long term	7.92	28.0	21.7	28.1	14.3
Few people would access my work when deposited in an IR	1.9	11.4	33.4	37.4	15.9
Make preprint or post-print versions of my research publications available to a worldwide audience	2.54	16.8	22.2	42.3	16.2
Disseminate my research findings faster than the traditional publishing process	1.9	10.8	34.5	37.4	15.4
Make freely available types of materials that could otherwise attract subscription fees	1.9	5.39	29	40.4	23.3
Make my research visible with very little effort	3.01	9.83	23.1	45.4	18.7
Provide long-term preservation of my digital research materials	1.43	4.91	19.7	44.8	29.2
Make it easy for me to search for and locate literature	0.95	7.45	22.7	39.9	29.0
Preserve university's intellectual capital in a central place	6.81	17.9	21.7	32.0	21.6
Average Responses	**5.63**	**14.8**	**29.0**	**33.6**	**17.0**

(*Source:* Field Data 2021), N=631
SDA= Strongly Disagree**, DA=** Disagree, **MA**= Moderately Agree, **A**= Agree, **SA**=Strongly Disagree

Figure 5.2 shows postgraduate students' knowledge of IRs. The results show that out of the 631 students surveyed, 397 (62.9%) of the respondents either agreed or strongly agreed that IRs contain intellectual outputs produced by members of particular institutions, 279 (44.2%) either agreed or strongly agreed that IRs provide unrestricted worldwide access to their contents, and 170 (26.9%) moderately agreed that IRs are electronic archives, while 100 (15.8%) either disagreed or strongly disagreed that IRs are web based. The data as presented in Figure 5.2 shows a positively high knowledge of IRs among postgraduate students surveyed for the study.

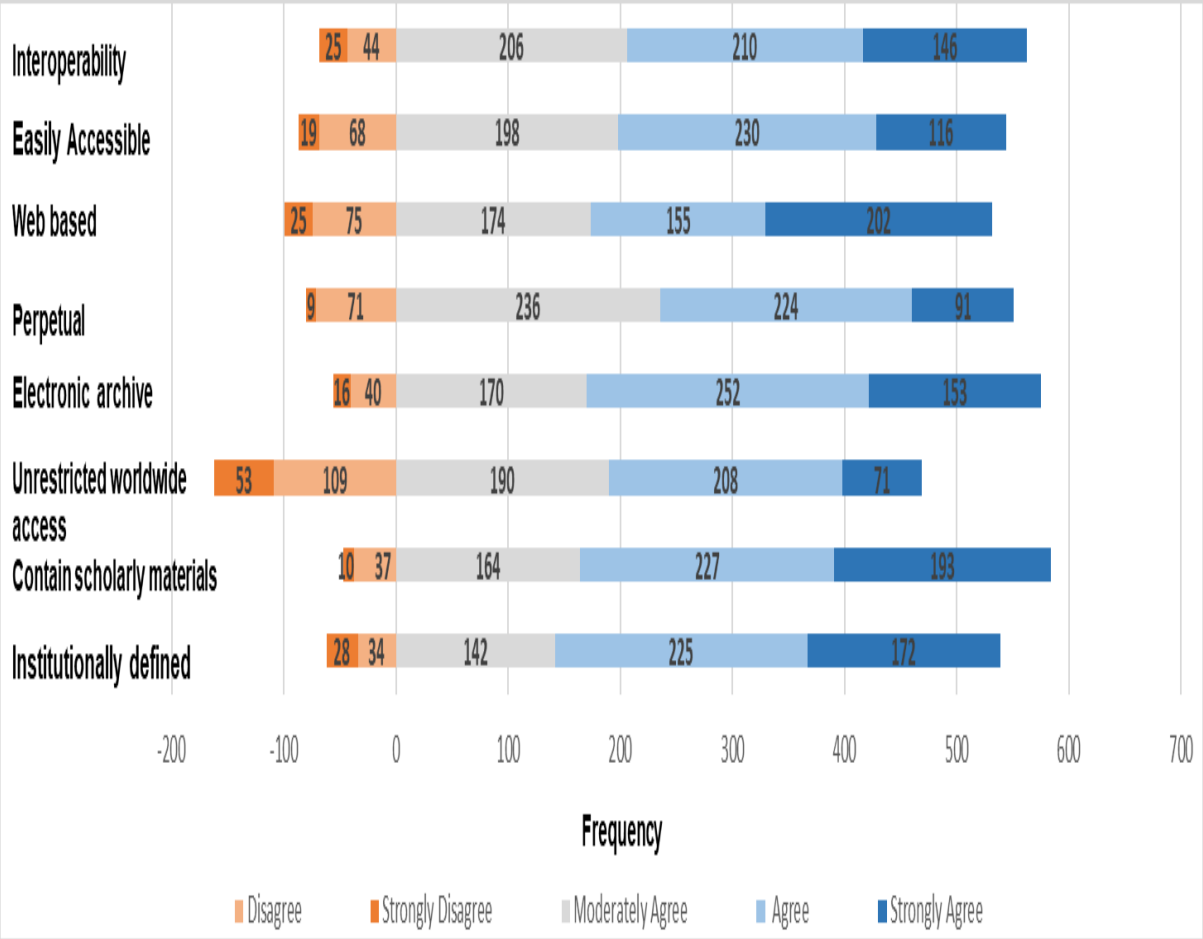

Figure 5.2: Students' knowledge of institutional repositories

(*Source:* Field Data 2021), n=631

5.5.1.3 Library staff's perception of IRs

Table 5.7 presents IR staff members' perceptions of IRs. The results showed that out of the 56 IR staff members surveyed, 75.0% strongly agreed that IRs make it easy for others to search and locate the university's intellectual outputs. Similarly, 75.0% of the respondents strongly agreed that IRs enabled researchers to search for the most current research findings, 80.4% agreed that IRs are relevant to the changing demands of academia, 14.3% of the respondents moderately agreed that IRs make preprint or post-print versions of research works available to a worldwide audience, 28.6% of the respondents disagreed that clients prefer to archive on academic social networking sites rather than on an IR, 39.3% of the respondents disagreed that publishers do not permit researchers to deposit publications in an IR, while 39.3% of the respondents strongly disagreed that the contents of IRs are accessed by only a few people. The overall responses show that 77.2% of library staff at the Digitization and E-Resources Units of the libraries surveyed for the study have a positive high perception of IRs.

Table 5.7: IR personnel's perception of institutional repositories

Item	SDA	DA	MA	A	SA
Clients prefer to make my work available only on ASN platform than on an institutional repository	5.36	28.6	25	35.7	5.36
Enhances visibility and public value of the university	35.7	39.3	14.3	5.36	5.36
Relevant to the changing demands of academia	0.0	0.0	0.0	80.4	19.6
Researchers who deposit their work in the University's IR may not be able to publish it elsewhere	0.0	39.3	28.6	19.6	12.5
Publishers do not permit researchers to deposit their published work in an IR	0.0	39.3	28.6	19.6	12.5
Contents of IRs are accessed by a few people	39.3	35.7	14.3	5.36	5.36
Preserve university's intellectual capital in a central place	0.0	12.5	5.36	25.0	57.1
IRs make preprint or post-print versions of research works available to a worldwide audience	0.0	5.36	14.3	25.0	55.3
Disseminate research findings faster than the traditional publishing process	0.0	5.36	14.3	25.0	55.3
Make research visible with very little effort and without having to maintain a website of my own	0.0	5.36	5.36	30.4	58.9
Provide long-term preservation of digitized research materials	0.0	0.0	5.35	30.4	64.2
Make it easy for other people to search for and locate the university's intellectual outputs	0.0	0.0	0.0	25.0	75.0
Allow researchers or patrons to search the IR for the most current research findings	0.0	5.36	0.0	19.6	75.0
Average responses	**6.18**	**16.6**	**12.0**	**26.6**	**38.6**

(*Source:* Field Data 2021), N=56

SDA= Strongly Disagree**, DA=** Disagree, **MA**= Moderately Agree, **A**= Agree, **SA**=Strongly Disagree

Figure 5.3 presents library staff members' knowledge of IRs. The study surveyed only library staff who worked directly with IRs, specifically at the Digitization and E-Resources Unit. The results show that out of the 56 library staff surveyed, 48 (85.7%) of the respondents strongly agreed that IRs contain intellectual outputs produced by members of particular institutions, 39 (69.6%) of the respondents strongly agreed that IRs are online archives, 11 (19.6%) of the respondents agreed that IRs are web-based, while 3 (5.36%) of the respondents disagreed that IRs

provided perpetual (permanent) archiving services. The data as presented in Figure 5.3 shows that, generally, IR personnel's knowledge of IRs is extremely high.

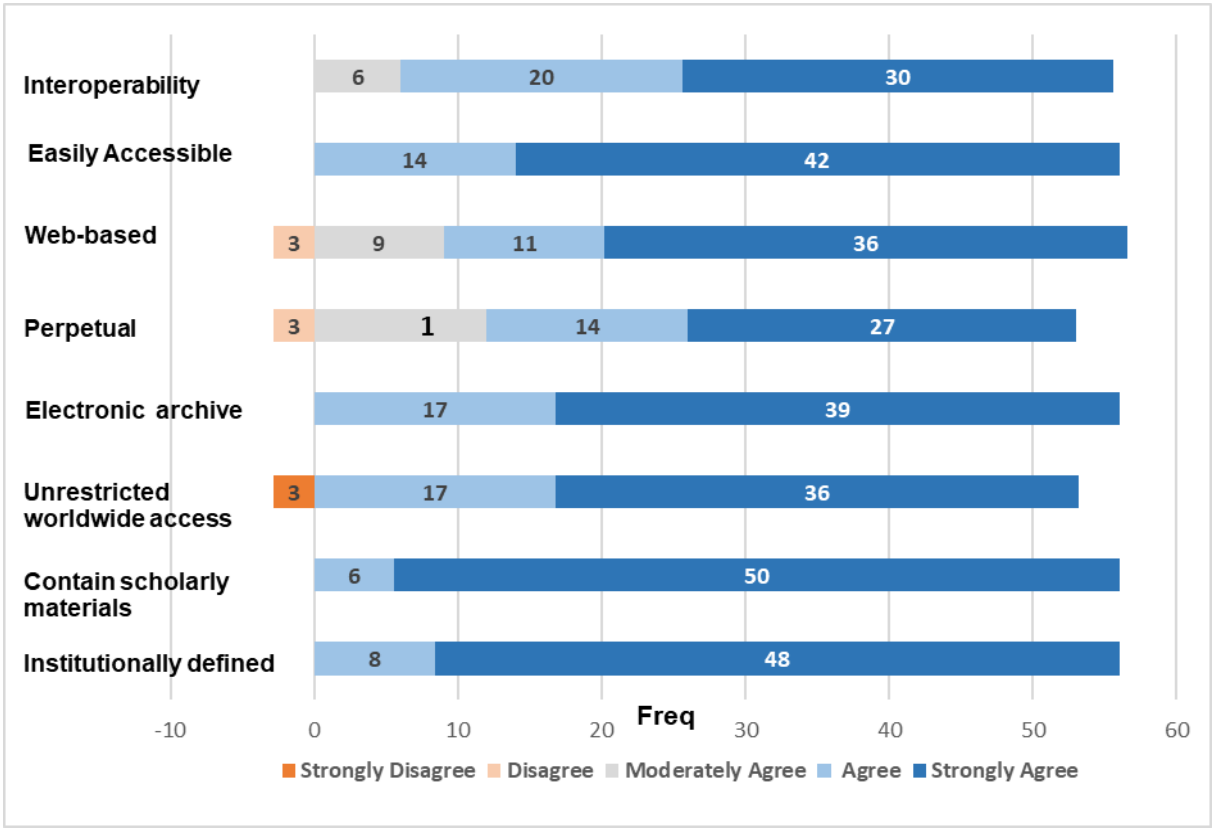

Figure 5.3: IR personnel's knowledge of institutional repositories

(*Source:* Field Data 2021), N=56

Further ANOVA analysis was conducted to determine wheather there are differences in perception among the various stakeholders (IR personnel, Faculty members and Students). Table 5.8 shows the results of the one-way ANOVA along with the Scheffe post-hoc multiple comparisons.

Table 5.8 – ANOVA and Post Hoc Analysis for Stakeholders' perception of IRs

ANOVA

Perception of IRs

	Sum of Squares	***df***	***Mean Square***	***F***	***Sig.***
Between Groups	5.843	2	2.921	14.565	.000
Within Groups	153.237	764	.201		
Total	159.079	766			

Multiple Comparisons

Dependent Variable: Perception of IRs

Scheffe

					95% Confidence Interval	
(I) Category of Respondent	(J) Category of Respondent	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Lower Bound
IR personnel	Faculty members	.40836*	.07803	.000	.2170	.5997
	Students	.29610*	.06245	.000	.1429	.4493
Faculty members	IR personnel	-.40836*	.07803	.000	-.5997	-.2170
	Students	-.11226	.05315	.108	-.2426	.0181
Students	IR personnel	-.29610*	.06245	.000	-.4493	-.1429
	Faculty members	.11226	.05315	.108	-.0181	.2426

** The mean difference is significant at the 0.05 level*

(*Source:* Field Data, 2021)

The results of the ANOVA as indicated in Table 5.8 shows a significant difference in perception of IRs between the stakeholder groups; $F(2,764) = 14.57$, $p < 0.001$. The Scheffe post-hoc analysis revealed that IR personnel ($n = 56$, $M = 3.78$, $SD = 0.28$) had significantly higher perception of IRs than both students ($n = 631$, $M = 3.47$, $SD = 0.47$) and faculty members ($n = 80$, $M = 3.36$, $SD = 0.29$). There was no significant difference in perception of IRs among students and faculty members (p=0.108)

Further bivariate regression analysis was conducted to determine the relationship between IR knowledge and IR perception. From the regression analysis, there is a significant relationship between IR knowledge and IR perception. IR knowledge significantly influenced IR perception (F= 49.66, p < 0.001). This indicate that IR knowledge has a significant role in shaping IR perception (b=0.617, p < 0.001). The data also, showed that IR knowledge is capable of explaining about 38.0% (R^2=0.38) of the variations in IR perception. The result is presented in Table 5.9

Table 5.9 Effect of IR knowledge on IR perception

Statistical Parameter	Value
Regression weight	IRK ⟶ IRP
Beta Co-efficient	0.617
R^2	0.38
F	49.663
P-value	0.000

* The mean difference is significant at the 0.05 level
Note: **IRK**: IR Knowledge, **IRP:** IR perception
(*Source:* Field Data, 2021)

5.5.2 Role of institutional policies on the sustainability of IRs in public universities in Ghana

A well drafted IR policy is the backbone of a sustainable IR project, as it provides valuable framework within which an IR operates and thereby provides learning and research opportunities for the benefit of all IR participants. According to Callicott et al. (2016), once an institution has set up a repository, practitioners must turn their attention to setting up policies geared toward cultivating success. In light of this, the second research objective was to examine the role of institutional policies on the sustainability of IRs in public universities in Ghana. This research research question was set to find out how institutional policies influence the day-to-day operation and management and usage of IRs. In addressing this research question, data collected was analysed using frequencies, percentage counts, mean, standard deviations and ANOVA analysis.

5.5.2.1 Awareness of the existence of an IRs policy

The reason for this analysis was to find out whether respondents were aware of a that universities in Ghana had IR polices that guided the operation, management, and usage of the IR. The results, as exhibited in Figure 5.4, showed the existence of an IR policy in all selected public universities in Ghana. A total of 702 (91.5%) respondents agreed to some extent to the existence of an IR policy within their respective institutions. Specifically, 247 (32.2%) of the respondents strongly agreed to the existence of an institutional IR policy, 275 (35.8%) of respondents agreed to the existence of an institutional IR policy, 180 (23.5%) of the respondents neither agreed nor disagreed to the existence of an IR policy, while 31 (4.04%) respondents strongly disagreed to the existence of an institutional IR policy.

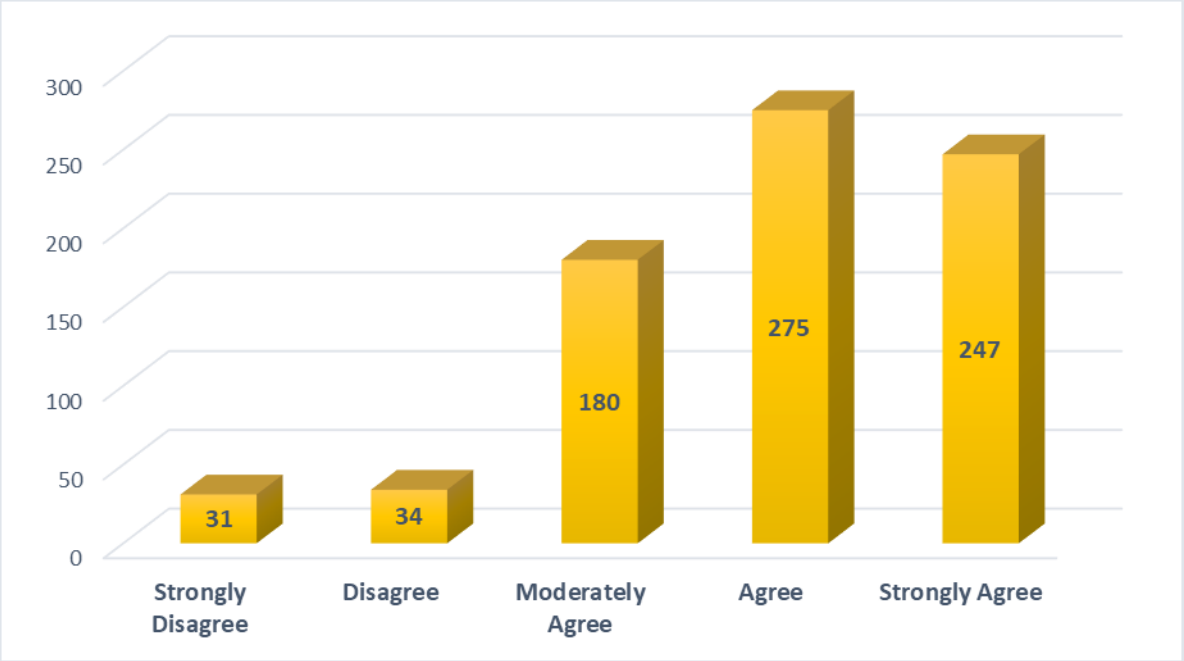

Figure 5.4: Awareness of the existence of IR policy

(*Source:* Field Data 2021), N=767

Further ANOVA analysis was conducted to determine the level of awareness of the existence of an IR policies between the various stakeholder groups. The result of the ANOVA analysis along with the Scheffe post-hoc multiple comparisons is presented in Table 5.10

Table 5.10 – ANOVA and Post Hoc Analysis of Stakeholders' Awareness of IR policy

ANOVA **Awareness of IR policy**					
	Sum of Squares	***Df***	***Mean Square***	***F***	***Sig.***
Between Groups	14.935	2	7.467	7.500	.001
Within Groups	760.721	764	.996		
Total	775.656	766			

Multiple Comparisons

Dependent Variable: Awareness of IR policy

Scheffe

					95% Confidence Interval	
(I) Category of Respondent	(J) Category of Respondent	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Lower Bound
IR personnel	Faculty members	.53036*	.17386	.010	.1040	.9568
	Students	.53707*	.13913	.001	.1958	.8783
Faculty members	IR personnel	-.53036*	.17386	.010	-.9568	-.1040
	Students	.00672	.11842	.998	-.2837	.2972
Students	IR personnel	-.53707*	.13913	.001	-.8783	-.1958
	Faculty members	-.00672	.11842	.998	-.2972	.2837

** The mean difference is significant at the 0.05 level*

Data in Table 5.10 shows a significant difference in the level of awareness of the existence of IR policy between stakeholder groups; $F(2,764) = 7.50$, $p = 0.001$. The Scheffe post-hoc analysis revealed that IR personnel ($n = 56$, $M = 4.39$, $SD = 1.00$) had significantly higher awareness level of the existence of IR policy than both students ($n = 631$, $M = 3.85$, $SD = 0.40$) and faculty members ($n = 80$, $M = 3.86$, $SD = 0.95$) there was no significant difference in awareness of the existence of an IR policy among students and faculty members (p=0.998)

Further analysis was conducted with the aim of finding out whether IR policies addressed sustainability issues, such as content submission or generation, and copyright concerns. The results, as presented in Table 5.11, showed that IR policies had a positive impact on the sustainability of IRs. A total of 503 respondents agree (mean=3.76, SD=0.93) that the existing IR policies address copyright and accessibility concerns. Similarly, 66.4% of the respondents agree (mean=3.76, SD=0.93) that the Institutional IR policy is key to ensuring the sustainability of IRs.

Table 5.11: Role of IR policy on the sustainability of IRs

Item	F	%	Means	SD
IR policy guides and addresses copyright and accessibility concerns.	503	65.5	3.76	0.93
IR policy mandates members of the university community to deposit their research output	463	60.4	3.48	1.10
IR policy allows members of the university community to voluntary deposit their research output	477	62.1	3.63	1.00
IR policy rewards faculty members for depositing contents into the institution's IR.	366	47.7	3.06	1.03
Institutional IR policy is key to ensuring the sustainability of IRs	509	66.4	3.76	0.93
IR policy guides its operation and usage	525	68.5	3.98	0.99
IR policy guides how content is generated	516	67.2	3.85	0.91
IR policy guides the management and preservation of content	512	66.8	3.87	0.94
My institution's IR policy enhances organisational image and prestige	424	55.3	3.66	0.98
Overall Means			**3.67**	**0.98**

(*Source:* Field Data 2021), N=767

Means were calculated on a scale of **5** = Strongly Agree, **4** = Agree, **3** = Moderately Agree, **2** = Disagree, and **1** = Strongly Disagree

The purpose of an IR policy is to guide the operation, usage, and management of the IR. A total of 68.5% of the respondents agreed (mean=3.98, SD=0.99) that the IR policy guides its operation and usage, 67.2% of the respondents agreed (mean=3.85, SD=0.91) that it guides content generation, 66.8% of the respondents agreed (mean=3.87, SD=0.94) that it guides the management and preservation of IR content, while 55.3% of the respondents agreed (mean=3.66, SD=0.98) that the IR policy enhances organisational image and prestige. The overall mean of 3.88 (SD=0.97) indicates that respondents agreed that institutional policies govern the management and operation of their respective IRs.

However, 47.7% of the respondents moderately agreed (mean=3.06, SD=1.03) with the assertion that the IR policy rewards faculty members for depositing content, 60.4% of the respondents moderately agreed (mean=3.48, SD=1.10) that the IR policy mandates the members of the university community to deposit content, while 62.1% of the respondents agreed (mean=3.60, SD=1.00) that content submission into IRs is voluntary.

5.5.3 Competencies of IR personnel in public universities in Ghana

The increase in the adoption of IRs as a strategy to facilitate the spread and promotion of the intellectual outputs of academic institutions implies that an additional set of skills and competencies are required for librarians and repository managers. In view of this, the third research question was to assess the competencies of personnel assigned to work on the IRs in public universities in Ghana. This research question was set to find out the communicative, managerial, and technical skill sets and competencies required of IR staff and managers. In addressing this research question, questionnaires were sent out to faculty members, graduate students, and IR staff to indicate which skill sets they think IR personnel should possess. The data collected was analysed using frequencies, percentage counts, and mean and standard deviations. Means were calculated on the following scale: 1 = No level of competence, 2 = low level of competence, 3 = average level of competence, 4 = moderately high level of competence, and 5 = high level of

competence. The subsections below present the findings that emanated from the data analysis.

5.5.3.1 Managerial competencies expected of IR professionals

This study sought to analyse the managerial competencies of IR personnel using a questionnaire and a semi-structured interview guide. The results of the analysis of the data collected from the questionnaires are shown in Table 5.12. Table 5.12 presents data on the managerial competencies expected of IR Managers. A total of 689 (89.8%) of the respondents were of the view that IR personnel should have a moderately high competence (mean=3.87, SD=0.99) in planning repository workflow, 85.5% of the respondents indicated IR personnel must have a moderately high competence (mean=3.61, SD=1.05) in planning budgets, while 59.9% of the respondents indicated that an IR manager must have a moderately high competence (mean=3.89, SD=1.05) in planning and executing advocacy and awareness programmes.

Table 5.12: Managerial competencies

Managerial Skills	**F**	**%**	**Means**	**SD**
Plan repository activity workflow	689	89.8	3.87	0.99
Coordinate and manage human resources for teamwork	682	88.9	3.79	1.01
Plan a budget	656	85.5	3.61	1.05
Plan fund-raising campaigns, activities, and strategies	633	82.6	3.54	1.19
Collect, harmonise, and validate data and statistics about repository activities	672	87.7	3.82	1.08
Plan, carry out surveys, and evaluate findings	554	72.3	3.58	1.21
Identify and manage copyright issues	582	75.9	3.77	1.05
Plan and develop the repository collection	591	77.0	3.94	0.99
Ensure digital rights management issues are resolved	599	78.1	3.97	0.99
Assess and evaluate repository performance as a service	577	75.2	3.87	1.04
Plan and execute advocacy and awareness programmes	459	59.9	3.89	1.05
Overall Means			**3.79**	**1.06**

(*Source:* Field Data 2021), N=767

5.5.3.2 Communicative competencies expected of IR professionals

Librarianship is a service-oriented discipline that thrives on effective communication. The study therefore sought to examine the communicative skill set and competencies required of IR personnel to ensure efficient and effective IR service delivery. A questionnaire and a semi-structured interview guide were the main tools used for data collection. The results of the analysis of the data collected from questionnaires are shown in Table 5.13. Also, data from the qualitative interviews with the IR managers and university librarians was used to support the quantitative results.

Table 5.13 presents data on the communicative competencies expected of IR personnel. A total of 689 (89.8%) of the respondents were of the view that IR personnel should possess a moderately high level of competence (mean=3.96, SD=1.06) in communicating and promoting IR to faculty members, students, and other stakeholders, 90.2% of the respondents indicated that IR personnel should possess a moderately high level of competence (mean=3.90, SD=1.04) in communicating technical issues to management and team members, while 574 (74.8%) of the respondents indicated that IR personnel should possess a moderately high level of competence (mean=3.92, SD=1.14) in activating help desk services to support IR management and self-archiving practices. The overall mean of 3.92 (SD= 1.05) indicates that respondents expected IR personnel to possess a moderately high communicative skill set and competencies.

Table 5.13: Communicative competencies

Communicative skills	F	%	Means	SD
Communicate and promote the IR to faculty members, students, and other stakeholders	689	89.8	3.96	1.06
Manage, liaise, and communicate with institutional leadership (VC, provosts, deans, department heads, etc.)	698	91.1	3.96	1.02
Communicate with and promote IR to external stakeholders (policy makers, enterprises, professional communities, funding agencies)	679	88.5	3.89	1.05
Organise and handle promotional workshops, training sessions, and conferences	676	88.1	3.84	1.04
Communicate technical issues to management and team members	692	90.2	3.90	1.04
Liaise with clients regarding technical problems	577	75.2	3.82	1.11
Liaise with IT support staff	616	80.3	4.09	0.95
Activate help desk services to support IR management and self-archiving practices	574	74.8	3.92	1.14
Overall Means			**3.92**	**1.05**

(*Source:* Field Data 2021), n=767

5.5.3.3 Technical competencies expected of IR professionals

Table 5.14 presents the results on the expected technical competencies of IR professionals. The result identified 10 technical competencies for an IR professional: deploy and manage IR software, implement interoperability standards and protocols (OAI-PMH, OAI-ORE, CERIF), customise IR webpages (layout, design), develop value-added services and facilities, develop web 2.0 functionalities and tools, analyse and solve problems related to repository software, possess knowledge in intellectual property rights issues in the digital environment, implement digital preservation procedures, possess knowledge of metadata standards, and monitor metadata quality.

On knowledge in intellectual property rights issues, 692 (90.2%) of the respondents indicated that IR personnel should have a moderately high competence (mean= 3.91, SD=1.01) in copyright and licensing issues in the digital environment. A total of 685 (89.4%) of the respondents indicated that IR personnel should have a moderately high competence (mean= 3.99, SD=1.03) in IR webpage customisation and 663 (86.4%) of the respondents indicated that IR personnel should have a moderately high competence (mean=3.75, SD=1.16) in metadata standards (Dublin

Core, MARC, METS, LOM, PREMIS). Similarly, the results show that 84.3% of respondents indicated that IR personnel should have a moderately high competence (mean= 3.75, SD=1.16) in monitoring metadata quality.

Table 5.14: Technical competencies

Technical Skills	F	%	Means	SD
Deploy and manage IR software	659	86.0	3.82	1.08
Implement interoperability standards and protocols (OAI-PMH, OAI-ORE, CERIF)	672	87.7	3.82	1.12
Customise IR webpages (layout, design)	685	89.4	3.99	1.03
Develop value-added services and facilities (download statistics, citation index, rankings, bibliographies, and so on)	656	85.5	3.72	1.14
Develop web 2.0 functionalities and tools (alerts, RSS, wikis, blogs, and so on)	682	88.9	3.67	1.11
Analyse and solve problems related to repository software	672	87.7	3.85	1.04
Knowledge in intellectual property rights issues (e.g., copyright, licensing, etc.) in the digital environment	692	90.2	3.91	1.01
Implement digital preservation procedures	676	88.1	3.84	1.06
Knowledge of metadata standards (Dublin Core, MARC, METS, LOM, PREMIS)	663	86.4	3.75	1.16
Monitor metadata quality	646	84.3	3.71	1.16
Overall Means			**3.81**	**1.09**

(*Source:* Field Data 2021), n=767

5.5.4 Technical specifications of IRs in Ghana

Setting up IRs, as with all ICT projects, requires a careful consideration of hardware and software specifications. Thus, the fourth research question was to examine the technical specifications of IRs in Ghana. Table 5.15 presents the specifications of existing IRs in Ghana.

Table 5.15: IR specifications

Institution	IR server specification						IR software
	Brand	Type	Memory size	Processor speed	Processor type	Hard disk space	
UG	Dell	Power Edge T40	8 GB	3.5 GHz	Intel Xeon E-2224G	1 TB	Dspace 6.3
KNUST	HP	ProLiant DL360-G9	128 GB	2.1 GHz	Intel Xeon E305.3965	4.8 TB	Dspace 5.8
UCC	Dell	ProLiant DL380-G9	15 GB	1.90 GHz	Intel Xeon E5-2609	260 GB	Dspace 5.8
UEW	HP	ProLiant DL360-G9	128 GB	2.1 GHz	Intel Xeon E305.3965	4.8 TB	Dspace 6.2
UDS	HP	ProLiant DL360-G9	32 GB	2.3 GHz	Intel Xeon E5-2650	1.8 TB	Dspace 5.8

(*Source:* Field Data 2021)

The data in Table 5.15 shows that all the IRs surveyed were using Dspace. The results also showed that all IRs surveyed are using 9th generation servers with a processor speed ranging from 1.90 to 3.5GHz. Specifically, three of the repository servers surveyed were HP ProLiant Gen9 servers, while two were Dell PowerEdge Gen9 servers.

5.5.5 Contents of IRs in Ghana

Many academic and research institutions in Ghana have created IRs in an attempt to use the power of the Internet to provide an alternative and cheaper form of access to their research outputs. Therefore, content seems to the most important factor for the successful implementation of an IR. To this end, the fifth research question sought to examine the contents of IRs of the selected public universities in Ghana. In addressing this research research, data from the qualitative interviews with the IR

managers and university librarians, as well as content analysis of the IR policies of public universities in Ghana, were used to support the quantitative results. Also, the researcher visited the IR platforms of the selected universities to observe their contents. The next paragraphs present the results under the research questions that addresses the above research objective.

5.5.5.1 Document types archived in IRs in Ghana

Content is critical to the successful implementation and survival of an IR. This is because content is what is going to drive traffic to the IR, thereby giving the institution the mileage and attraction it seeks for its research outputs. This research question aimed at finding out the kinds of documents that are archived in IRs in public universities in Ghana. To answer this research question, the researcher visited the IR websites of the selected public universities. The results of the analysis of content analysis of the documents archived in the selected repositories. A detailed breakdown is provided in Table 5.16.

Table 5.16: Documents archived in IRs in Ghana

Document Type	F	%
Theses & Dissertations	21,293	46.7
Journals	1,980	4.3
Research Articles	19,971	43.8
Book Reviews	84	0.2
Conference/Seminar Proceedings	480	1.1
Work in Progress	6	0.0
Heritage Materials/Special Collections	521	1.1
Lectures and Speeches	654	1.4
Newsletters & Newspapers	70	0.2
Institutional Policies	226	0.5
Committee Reports	116	0.3
United Nation's Reports	229	0.5
Teaching Notes	1	0.0
Total	**45631**	**100.0**

(*Source:* Field Data 2021)

An analysis of the contents of the individual IRs as shown in Table 5.16 revealed that thesis and dissertations were the most (46.7%, n=21,293) archived document by

public universities in Ghana; research articles constituted 43.8% (n=19,971) of the contents of IRs; book reviews, newsletters and newspapers, works in progress, and teaching notes were the least archived documents constituting 0.2%(n=84), 0.2%(n=70), 0.0% (n=6), and 0.0% (n=1) respectively.

5.5.5.2 Document types and file formats stakeholders prefer to be archived in IRs in Ghana

The study sought to find out what document types and file formats respondents preferred to archive in their university's IR. Respondents were given a list of document and file types and asked to select the ones they would prefer archived in an IR.

Table 5.17 presents the results of the preferred document type as indicated by the respondents. The majority (81.3%) of the respondents indicated they prefer full-text theses and dissertations, 326 (42.6%) of the respondents preferred technical and research reports, 271 (35.3%) of the respondents preferred peer-reviewed research papers, 261 (34.0%) of the respondents preferred conference proceedings, and 166 (21.7%) of the respondents preferred data sets.

Table 5.17: Preferred document type

Document Type	F	%
Theses and dissertations (full text)	623	81.3
Theses and dissertations (abstract)	320	41.7
Preprint (research articles before peer review)	235	30.6
Post-print (peer-reviewed research papers)	271	35.3
Books and book chapters	297	38.7
Reports (technical, research)	326	42.6
Images, audio files, and videos	193	25.1
Conference proceedings	261	34.0
Seminar papers	313	40.9
Data sets	166	21.7

(*Source:* Field Data 2021), n=767

Table 5.18 shows the file format that respondents preferred to be archived in an IR. The majority (87.7%) of the respondents preferred documents in PDF, 212 (27.7%) of the respondents preferred MS Word processed documents, 196 (25.5%) of the

respondents preferred MS PowerPoint documents, while 98 (12.8%) of the respondents preferred audio files.

Table 5.18: Preferred file format

Document Type	F	%
PDF	672	87.7
Word processed document (MS Word)	212	27.7
Postscript (peer-reviewed paper format)	104	13.6
Presentation (MS PowerPoint)	196	25.5
Spreadsheet (MS Excel)	160	20.9
Database (MS Access)	111	14.5
Image (GIF, JPG, PNG, TIFF)	150	19.6
Audio (WAV, MP3, AIFF)	98	12.8
Video (MP4)	144	18.7

(*Source:* Field Data 2021), n=767

5.5.6 Procedures submitting content to institutional repositories in Ghana

The quality of the content of IRs is critical to its continuous use and survival. To attract content there must be laid down process for depositing content as well as the willingness of stakeholders to archive in institutional repositories. The results in response to the above research question is presented in tables 5.19, 5.20 and figure 5.5.

The results, as presented in Table 5.19, showed that content submission among faculty members and students was very low, as 53.6% and 64.5% respectively had never archived content in an IR.

Table 5.19: Respondents' previous content deposit

	Faculty members		Students	
Response	**F**	**%**	**F**	**%**
Yes	26	46.4	224	35.5
No	30	53.6	497	64.5
Sub-total	**56**	**100.00**	**631**	**100.0**

(*Source:* Field Data 2021), n=687

However, the results, as presented in Table 5.20, is very encouraging as it showed that 92.9% and 88.3% of faculty members and students surveyed, respectively, indicated their willingness to archive content in an IR in the future.

Table 5.20: Respondents' willingness to deposit content

Response	Faculty members		Students	
	F	%	F	%
Yes	52	92.9	557	88.3
No	4	7.1	74	11.7
Total	**56**	**100.0**	**631**	**100.0**

(*Source:* Field Data 2021), n=687

To ensure the successful participation of all stakeholders in an IR project, there must be set procedures for depositing content. Figure 5.5 shows that mediated deposit is the mode of content deposit used by most (84.0%) respondents.

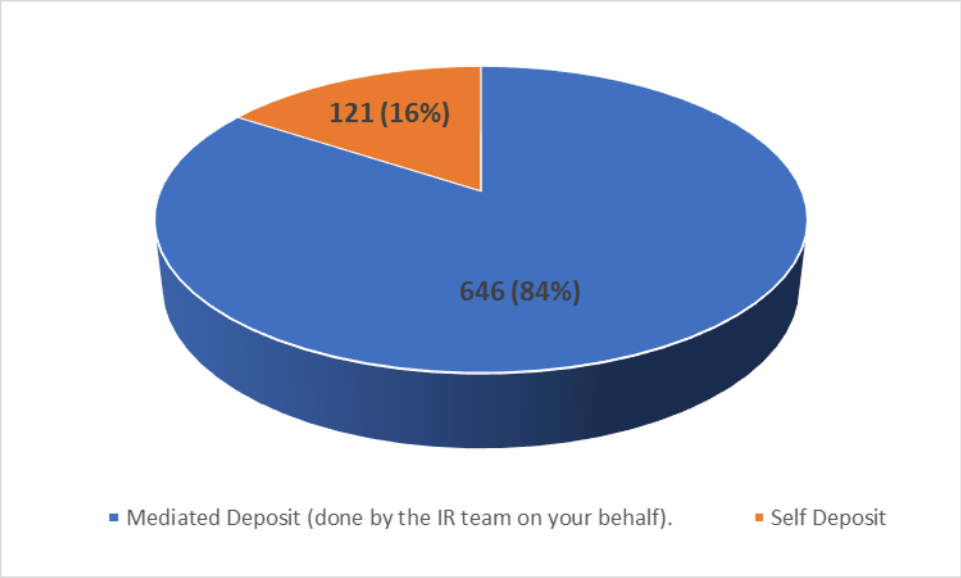

Figure 5.5: Content submission modes
(*Source:* Field Data 2021), n=767

5.5.7 Challenges to the Sustainability of IRs in Ghana

IRs have been adopted by many academic institutions due to their ability to enhance access and sharing of research-based information generated within respective institutions, as well their potential to increase visibility and reach a wider audience. Despite their varied benefits, IRs globally are confronted with numerous challenges that threaten their long-term survival and sustainability, especially those in Africa (Wu 2015; Livingston & Nastasie 2009). The final research question was set to identify challenges related to the management of the IRs and their sustainability. In addressing this research question, questionnaires were sent out to faculty members,

graduate students, and IR staff to indicate challenges that hinder their participation in IRs. The data collected was analysed using frequencies, percentage counts, and mean and standard deviations.

Table 5.21 presents the identified challenges that confront the sustainability of IRs in public universities in Ghana. The results have been categorised under the following themes: funding, infrastructure, staffing, policy, management support, and awareness creation.

The results show that to a high extent, funding (mean=4.08, SD=1.18), management support (mean=3.65, SD=1.21), infrastructure (mean=3.56, SD=1.25), and awareness (mean=3.57, SD=1.25) are key constraints to the sustainability of IRs in public universities in Ghana. Specifically, the majority of the respondents indicated that a limited budget for purchasing equipment (85.0%, mean=4.05, SD=1.19), lack of technical staff for system development and management (65.1%, mean=3.85, SD=1.14), lack of support from top management (65.1%, mean=3.85, SD=1.31), lack of awareness of IRs among top management (60.0%, mean=3.80, SD= 1.28), and unreliable internet connectivity (57.9%, mean=3.84, SD= 1.15) to a high extent constrained the sustainability of IRs in Ghana.

Also, respondents indicated that unreliable power supply (46.4%, mean=3.45, SD=1.15), inadequate ICT infrastructure (50.1%, mean=3.40, SD=1.14), difficulty in communicating challenges to ICT/IR staff (50.1%, mean=3.32, SD=1.31), lack of awareness among researchers (75.0%, mean=3.22, SD=1.23), and publisher copyright restrictions (48.5%, mean=3.43, SD=1.13) to a moderate extent constraint the sustainability of IRs in Ghana.

Table 5.21: Challenges to the sustainability of IRs in Ghana

Challenges	F	%	Mean	SD
Funding				
Inadequate funding for marketing and advocacy	575	75.0	4.10	1.17
Limited budget for purchasing equipment	652	85.0	4.05	1.19
Sub-mean			**4.08**	**1.18**
Infrastructure				
Unreliable internet connectivity	444	57.9	3.84	1.15
Unreliable power supply	356	46.4	3.45	1.20
Inadequate ICT infrastructure	384	50.1	3.40	1.14
Sub-mean			**3.56**	**1.25**
Staffing				
Lack of technical staff for system development and management	499	65.1	3.85	1.14
Difficult communication challenges to IR/technical staff	384	50.1	3.32	1.31
Difficulty in backing up data	460	60.0	2.85	0.93
Sub-mean			**3.34**	**1.13**
Awareness				
Lack of awareness of IRs among researchers	575	75.0	3.22	1.23
Lack of awareness of IRs among top management	460	60.0	3.80	1.28
Inadequate advocacy for marketing of IR	418	54.5	3.70	1.24
Sub-mean			**3.57**	**1.25**
Management Support				
Lack of support from top management	499	65.1	3.85	1.31
The lack of motivations for researchers to share their research work	343	44.7	3.45	1.11
Sub-mean			**3.65**	**1.21**
Policy				
Publisher copyright restrictions	372	48.5	3.43	1.13
Data protection concerns	369	48.1	3.45	1.10
Lack of explicit IR policy	350	45.6	3.16	1.21
Sub-mean			**3.35**	**1.15**

(*Source:* Field Data 2021), n=767

1= very least extent, **2**= least extent, **3**= moderate extent, **4**= large extent, and **5**= to a very large extent.

5.5.8 Conceptual Model

There are several factors that could be integrated to predict the sustainability of IRs in public universities in Ghana. These factors were identified in the conceptual framework and was adapted from the Dynamics of IR Innovation Model and Diffusion

of Innovation Theory as explained in section 2.8. The conceptual framework was made up of seven variables (factors), which was consistent with the literature. The first variable representing IR conceptualisation is composed of nine items. The second variable representing IR use intention is composed of eight items. The third variable representing personality variables is composed of four items. The fourth variable representing promotional strategies is composed of three items. The fifth variable IR policy is composed of seven items. The sixth variable IR characteristics is made of three sub-variables (relative advantage, compatibility, complexity and observability). Relative advantage is composed of three items, compatibility is composed four items, complexity is composed of two items and observability is composed of four items. The seventh variable representing IT infrastructure is composed of six items. Based on the conceptual framework six hypothesis were proposed as outlined in section 2.8. The next section presents an analysis of the hypothesis.

H_1: There is statistically significant relationship between IR conceptualisation and use intentions.

Simple linear regression was used to analysis hypothesis one (H_1). According to Sandilands (2014) linear regression analysis is the analysis of two variables to determine whether there is a statistically significant association between two variables, the degree of association and the extent to which one variable can be predicted from another. In view of this, simple linear regression was used to analysis the relationship between IR conceptualistaion (independent variable) and IR use intentions (dependent variable). To ensure that the regression results are reliable, the data was checked if the assumptions for normality and linearity are met. In SPSS, the standard normal probability plots (Normal P-P Plot) provide standard basis for testing normality and linearity (Pallant 2016). The Normal P-P plot or graph is generated concurrent when the regression output is produced. According to Pallant (2016), an observation of reasonable straight normal probability plot is an indication of normality and linearity. Where these assumptions are not met, the standard linear regression will not give reliable results. The result of The Normal P-P plot is reported in Figure 5.6.

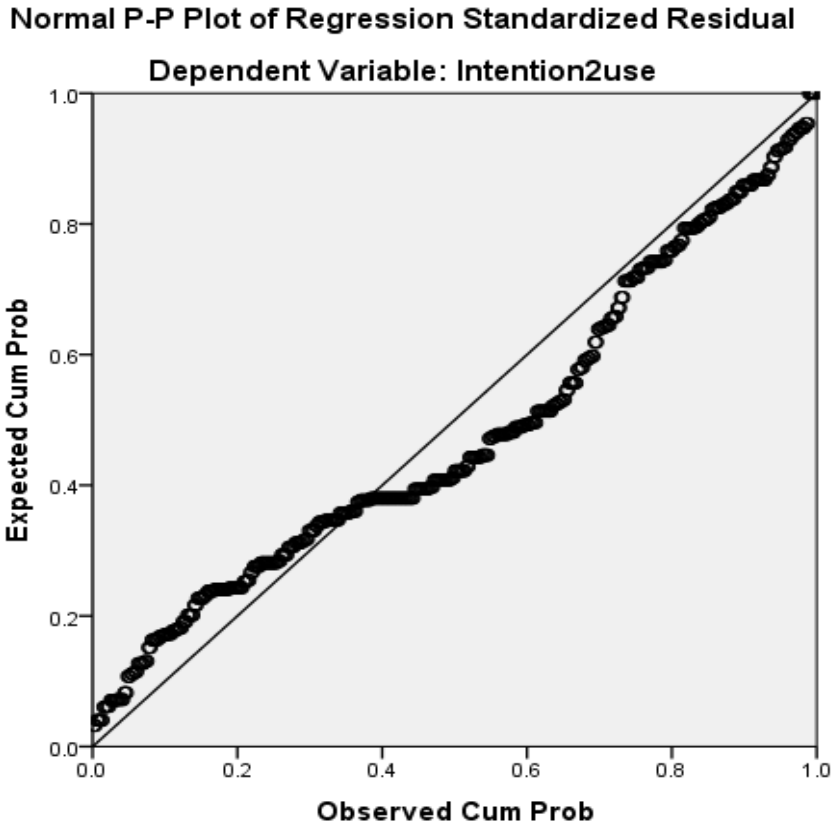

Figure 5.6: Normal P-P plot of Regression Standardised Residual (H_1)
(*Source:* Field Data 2021)

It can be observed from Figure 5.6 that the line passes through a number of points suggesting a reasonable straight line. This demonstrates that the normality and linearity in the study variables as assumed by regression have been met. The pre-diagnostic test as indicated above showed that the data met the assumption for normality and linearity. Therefore, it was appropriate to run the regression test. The summary of the results of the regression analysis is presented in Table 5.22.

From the regression analysis, there is a significant relationship between IR conceptualistaion and use intention. IR conceptualistaion significantly influenced use intention ($F(1,764) = 32.205$, $p < 0.001$). This indicate that IR conceptualistaion impact in shaping use intentions ($\beta=0.221$, $p < 0.001$). These results clearly direct the positive effect of IR conceptualisation on use intension. The data also, show that

IR conceptualisation is capable of explaining about 64.5% (R^2=0.645) of the variations of the level of respondents' intension to use IRs.

Table 5.22: Relationship between IR knowledge and IR perception

Statistical Parameter	Value
Regression weight	IRC ⟶ IU
Beta Co-efficient (β)	0.221
R^2	0.645
F	32.205
P-value	0.000

* The mean difference is significant at the 0.05 level
Note: **IRC**: IR Conceptualisation, **UI:** Use Intention
(*Source:* Field Data, 2021)

H_2: There is statistically significant relationship between promotional strategies and use intentions.

Linear regression was used to analysis hypothesis two (H_2). The simple linear regression analysis was conducted to test the relationship between promotional strategies (independent variable) and IR use intentions (dependent variable). Normality and linearity diagnostic test was conducted to determine whether the dependent variable and independent variable have normal distribution or not. The result of The Normal P-P plot is reported in Figure 5.7.

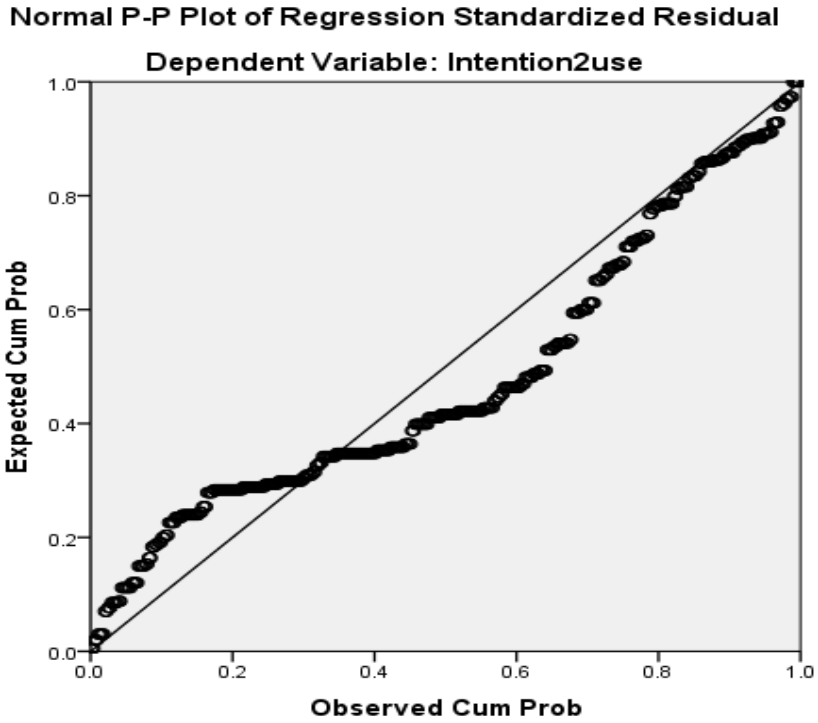

Figure 5.7: Normal P-P plot of Regression Standardised Residual (H_2)

It can be observed from Figure 5.7 that the line passes through a number of points suggesting a reasonable straight line. This demonstrates that the normality and linearity in the study variables as assumed by regression have been met. Therefore, the researcher proceeded to conduct the regression analysis.

From the regression analysis, there is a significant relationship between promotional strategies and use intentions. Promotional strategies significantly influenced use intention (F = 40.93, p = 0.001). This indicate that promotional strategies significantly shaped use intentions (β=0.421, p =0.001). These results clearly show that promotional strategies are capable of explaining about 51.6% (R^2=0.516) of the variations in use intension. The summary of the results of the regression analysis is presented in Table 5.23.

Table 5.23: Relationship between promotional strategies and use intention

Statistical Parameter	Value
Regression weight	PS ⟶ IU
Beta Co-efficient (β)	0.421
R^2	0.516
F	40.93
P-value	0.001

* The mean difference is significant at the 0.05 level
Note: **PS**: IR Conceptualisation, **UI:** Use Intention
(*Source:* Field Data, 2021)

H_3: There is statistically significant relationship between personality variables and conceptualisation of IRs.

Multiple linear regression was used to analysis hypothesis three (H_3) The multiple linear regression analysis was conducted to examine the relationship between personality variables (age, gender, academic level and subject area) and IR conceptualisation. According to Pallant (2016) to ensure the reliable of the results of multiple linear regression, the data must be screened to check if the data satisfies the assumptions for multicollinearity, outliers, normality, linearity, homoscedasticity and independence of residuals.

Multicollinearity Diagnostic Analysis

Multicollinearity is the measure of the degree of correlation among the independent variables. Multicollinearity occurs when there is a high inter-correlation among two or more independent variables in a multivariate regression model (Hayes & Scot 2022; Pallant 2016; Klein 2013). The assumption is that for a standard multiple regression there must be no multicollinearity. If this assumption is violated the results may be unreliable. It is generally accepted that correlation coefficient of 0.7 or more between two independent variables demonstrate evidence of multicollinearity (Pallant 2016;

Tabachnick & Fidell, 2001). Table 5.24 presents the results for correlation between the study variables.

Table 5.24: Correlation between study variables (H_3)

Study Variable	IRC	G	A	SA	AQ
IRC	1.000	-.113	-.016	-.229	.197
G	-.113	1.000	-.081	.016	-.157
A	-.016	-.081	1.000	-.015	.270
SA	-.229	.016	-.015	1.000	-.173
AQ	.197	-.157	.270	-.173	1.000

IRC: IR Conceptualisation; **G:** Gender; **A:** Age; **SA:** Subject Area; **AQ:** Academic Qualification
(*Source:* Field Data, 2021)

Further Tolerance and Variance Inflation Factor (VF) analysis was conducted to check for problems with multicollinearity that may not be evident in the correlation matrix (Table 5.24). The model as could be observed from Table 5.25 gives emphatic proves that there was no multicollinearity problem. All the variables had Tolerance values of more than 0.01. Similarly, the VIF values are less than 10. Thus, no VIF value was equal or above the 10 threshold. It is therefore safe to conclude that there was no multicollinearity between the study variables.

Table 5.25: Collinearity Analysis of Personality Variable and its Constructs

Constant (1)	Tolerance	VIF
G	.974	1.027
A	.924	1.082
SA	.969	1.032
AQ	.881	1.135

G: Gender; **A:** Age; **SA:** Subject Area; **AQ:** Academic Qualification
(*Source:* Field Data, 2021)

Outliers, Normality, Linearity and Homoscedasticity

According to Pallant (2016) one of the ways for checking these assumptions in SPSS is by inspecting the Normal Probability Plot (P-P) of the Regression

Standardised Residual and the Scatter-plot. The result of the Normal P-P plot is reported in Figure 5.8

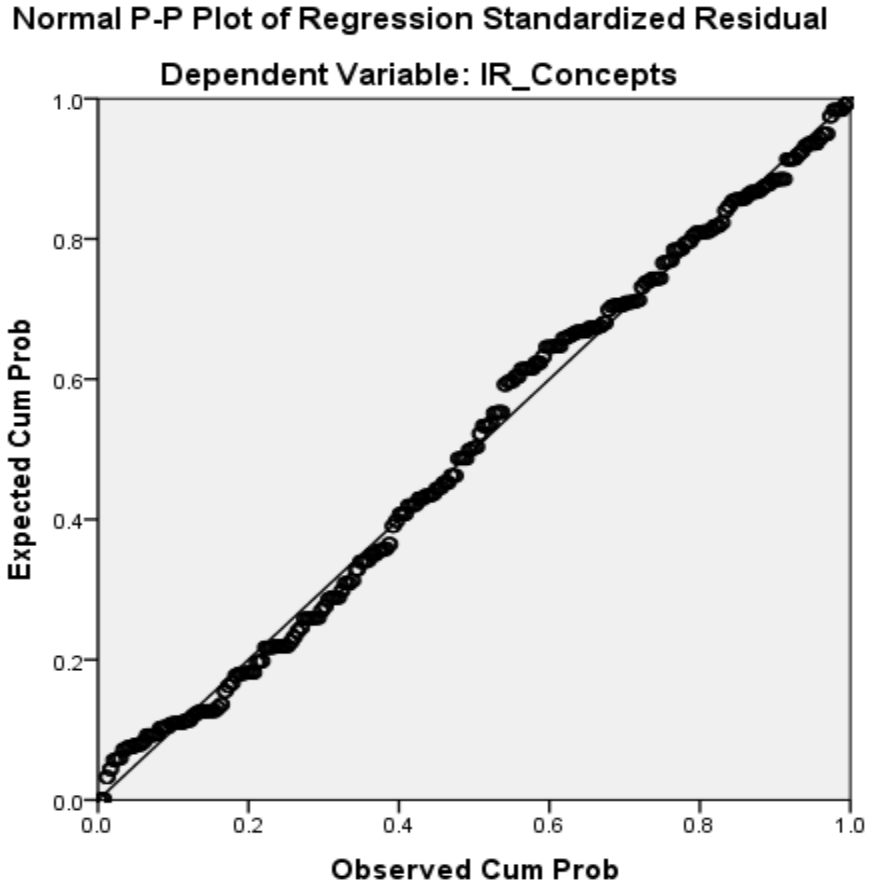

Figure 5.8: Normal P-P plot of Regression Standardised Residual (H_3)
(*Source:* Field Data, 2021)

It can be observed from Figure 5.8 that the points lie in a reasonably straight diagonal line from bottom left to top right. This suggests that there are no major deviations from normality. This demonstrates that the normality and linearity in the study variables as assumed by regression have been met.

Further analysis for outlier was conducted using a scatterplot of the standardised residuals. According to Tabachnick and Fidell (2013; 125) the presence of outliers can be detected from scatter plots. It can be observed from figure 5.9 that the residuals are roughly distributed, with most of the scores concentrated in the centre (along the 0 point). Tabachnick and Fidell (2013) defines outliers as cases that have a standardised residual plot of more than 3.3 or less than –3.3. From Figure 5.9 it can be observed that the standardised residual of the study variables approximately

lies between 2.8 and -3.0. Therefore, it safe to conclude that there were no outliers in the study variables.

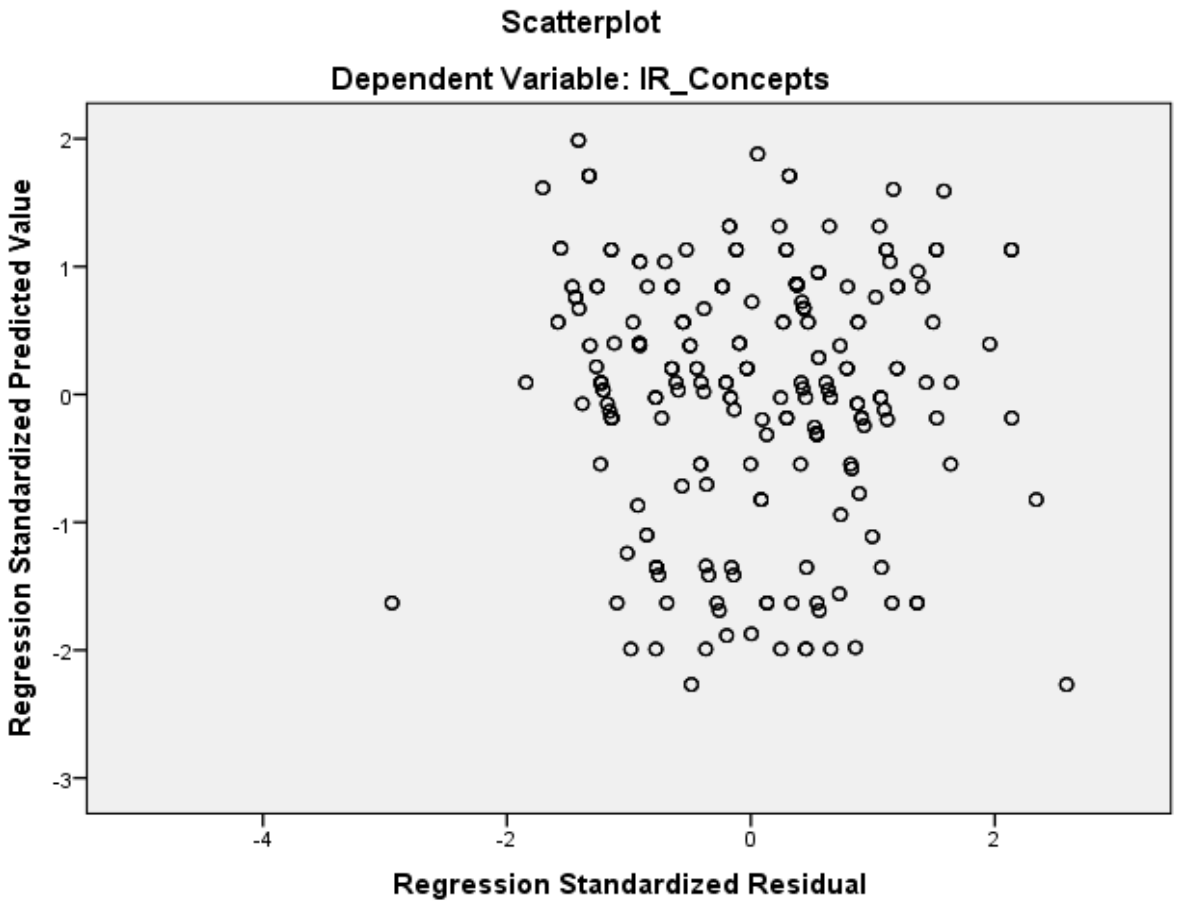

Figure 5.9: Scatterplot of Standardised Residual (H_3)
(*Source:* Field Data, 2021)

Regression Results

The pre-diagnostic test as showed shown above indicated that the data met all the assumption for multiple regression analysis. Therefore, the researcher proceeded to conduct the multiple regression analysis to examine hypothesis three (H_3). The result as captured in Table 5.26 showed that ggender, age, subject area and academic qualification significantly influenced IR conceptualisation (F (4,762) = 15.51 p = 0.001). This indicate that these personality variables significantly shaped IR conceptualisation (β=0.381, p =0.001). These results show that personality variables (age, gender, academic qualification and subject area) are capable of explaining about 9.0% (R^2=0.090) of the variations in IR conceptualisation (knowledge and understanding of benefits of IRs). The study proceeds further to examine the effect of each of these variables on IR conceptualisation.

Table 5.26: Effect of Age, Gender, Academic Qualification and Subject Area on IR Conceptualisation.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.300[a]	.090	.084	.54191

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	18.220	4	4.555	15.510	.000[b]
	Residual	183.838	762	.294		
	Total	202.058	766			

Coeffficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		Sig.
Model		B	Std. Error	Beta (β)	t	
1	(Constant)	3.810	.133		28.595	.000
	G	-.108	.047	-.089	-2.315	.021
	A	-.047	.026	-.072	-1.816	.070
	SA	-.049	.010	-.200	-5.164	.000
	AQ	.127	.031	.168	4.127	.000

a. Dependent Variable: IRC

b. Predictors: (Constant), G, AQ, SA, A

G: Gender; **A:** Age; **SA:** Subject Area; **AQ:** Academic Qualification
(*Source:* Field Data, 2021)

It can be seen from the Table 5.26 that there two betas (standardised and unstandardized). These two betas are used in examining the causal relationship between the dependent variable and independent variables. According to Pallant (2016) the standardised beta (B) is used when the aim of the study is to construct a regression equation while the unstandardized beta (β) is used when the interest is to compare the contribution of each independent variable. In this study, since the interest is to examine the respective contributions of age, gender, academic

qualification and subject areas to IR conceptualisation, the unstandardized beta values are used in analysing the data.

From Table 2.26 it can be observed that academic qualification is the variable that made the strongest unique impact on IR conceptualisation (β=0.127, p=0.001) when other variables in the model are controlled for. This was followed by gender (β= -0.108, p=0.021) and study area (β=-0.049, p=0.001). This meant that academic qualification, study area and gender made statistically significant unique contributions to shaping respondents' IR conceptualisation. The data in table 2.26 also show that age had no statistically significant unique contribution to IR conceptualisation (β=-0.047, p=0.70).

H_4: There is statistically significant relationship between IR characteristics and use intension.

Hypothesis four (H_4) was analysed using multiple linear regression. From the conceptual framework as explained in section 2.8, IR characteristics is composed of four variables (i.e relative advantage, compatibility, complexity and observability). The multiple regression analysis was therefore conducted to analyse the relationship between relative advantage, compatibility, complexity and observability (independent variables) and IR use intentions (dependent variable). To ensure that the regression results are reliable, the data was checked if it met the assumptions for multicollinearity, outliers, normality, linearity, homoscedasticity and independence of residuals.

Multicollinearity

From Table 5.27, the correlation between relative advantage as against compatibility, complexity and observability was 0.104, 0.115 and 0.549 respectively. The correlation between compatibility as against complexity and observability was 0.188 and 0.191 respectively whiles the correlation between complexity and observability was found to be 0.127. The highest correlation coefficient between the independent variables (relative advantage, compatibility, complexity and

observability) was 0.549 which is less than the threshold of 0.7. This indicate that the assumptions for multicollinearity have been met.

Table 5.27: Correlation between study variables (H_4)

Study Variable	IU	RA	CP	CX	OB
IU	1.000	.396	.728	.626	.389
RA	.396	1.000	.104	.115	.549
CP	.728	.104	1.000	.188	.191
CX	.626	.115	.188	1.000	.127
OB	.389	.549	.191	.127	1.000

IU: Use intention; **RA:** Relative Advantage; CP**:** Compatibility; **CX:** Complexity; OB**:** Observability
(*Source:* Field Data, 2021)

Further Tolerance and Variance inflation factor (VF) analysis was conducted to check for problems with multicollinearity that may not be evident in the correlation matrix (Table 5.27). The model as could be observed from Table 5.28 gives emphatic proves that there was no multicollinearity problem. All the variables had Tolerance values of more than 0.01. Similarly, the VIF values are less than 10. Thus, no VIF value was equal or above the 10 threshold. It is therefore safe to conclude that the assumptions for multicollinearity had been met.

Table 5.28: Collinearity Analysis of IR Characteristics Variable and its Constructs

Constant (1)	Tolerance	VIF
RA	.697	1.435
CP	.936	1.068
CX	.953	1.049
OB	.679	1.472

IU: Use intention; **RA:** Relative Advantage; CP**:** Compatibility; **CX:** Complexity; **OB:** Observability
(*Source:* Field Data, 2021)

Outliers, normality, linearity, homoscedasticity and independence of residuals

The normal probability plot (P-P) of the Regression Standardised Residual and the Scatter-plot was used to check for outliers, normality, linearity, homoscedasticity and independence of residuals. The results are presented in Figures 5.10 and 5.11 respectively. It can be observed from Figure 5.9 that the points lie in a reasonably straight diagonal line from bottom left to top right. The line passes through a number of points suggesting a reasonable straight line. This clearly demonstrates that the normality and linearity in the study variables as assumed by regression have been met.

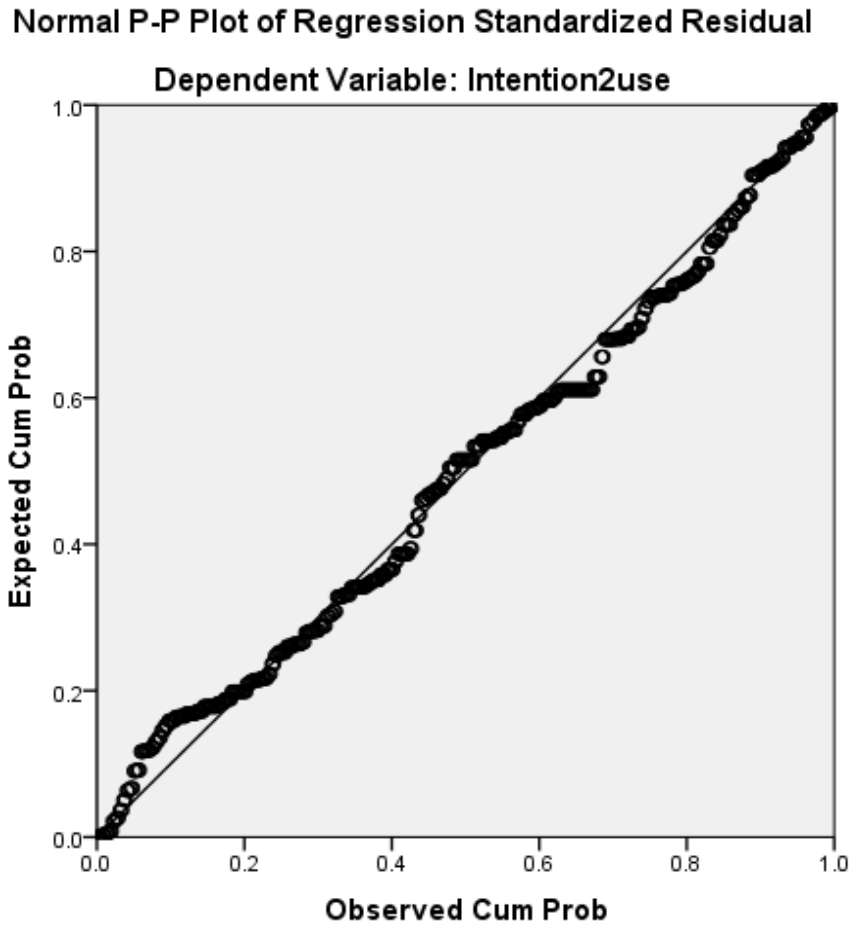

Figure 5.10: Normal P-P plot of Regression Standardised Residual (H_4)
(*Source:* Field Data, 2021)

Further analysis for outlier was conducted using a scatterplot of the standardised residuals. It can be observed from figure 5.11 that the residuals are roughly distributed, with most of the scores concentrated in the centre (along the 0 point). Figure 5.10 can be observed that the standardised residual of the study variables

lies approximately between 2.5 and -2.5 which is less than 3.3. Tabachnick and Fidell (2013) classifies outliers as cases that have a standardised residual plot of more than 3.3 or less than –3.3. Therefore, it safe to conclude that there are no outliers in the study variables.

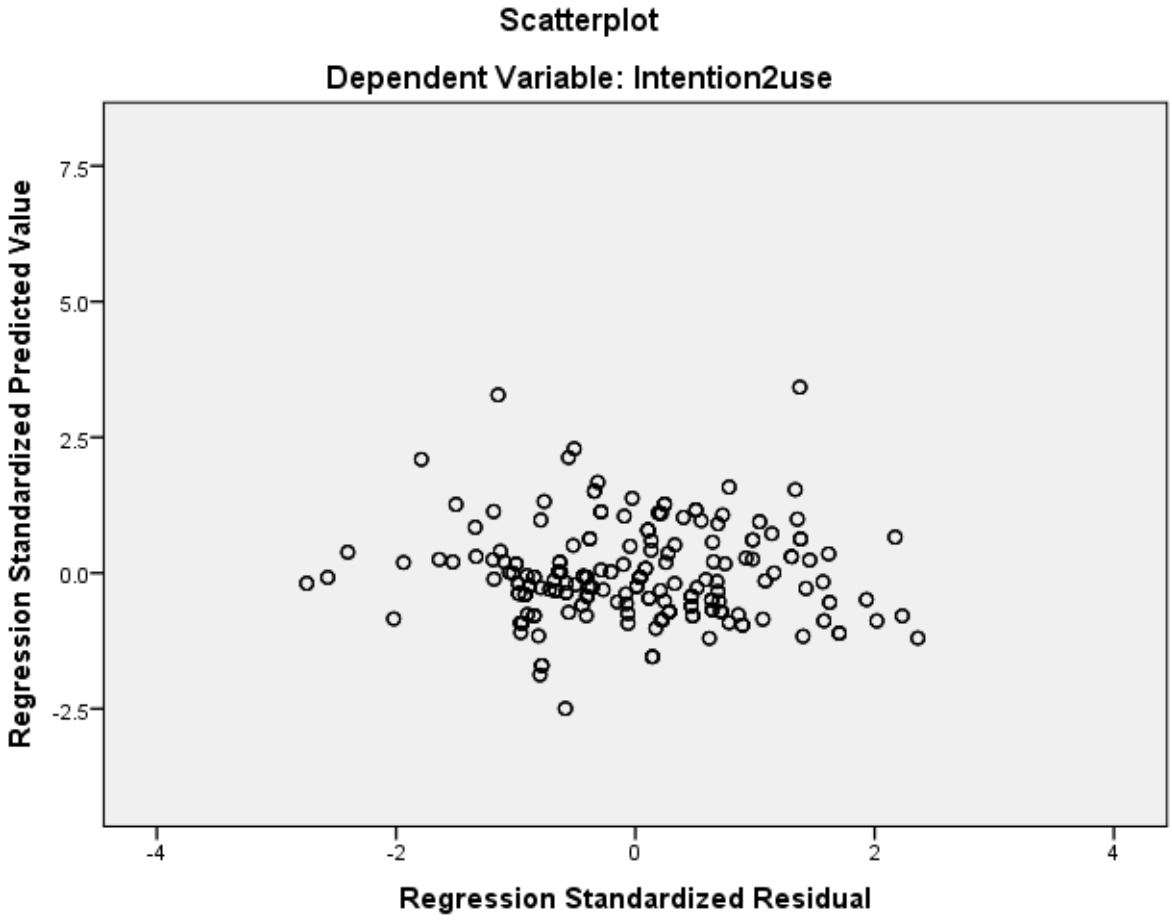

Figure 5.11: Scatterplot of Standardised Residual (H_4)
(*Source:* Field Data, 2021)

Regression Results

The pre-diagnostic test performed above showed that the data met all the assumptions for multiple regression analysis. Therefore, it is appropriate to conduct the regression analysis. The study proceeded to conduct multiple regression analysis to examine hypothesis four (H_4). The result as captured in Table 5.29 show that relative advantage, compatibility, complexity and observability significantly influenced use intentions (F (4,762) = 950.96, p = 0.001). This indicate that these variables that constituted the IR characteristics construct significantly shaped respondents' intention to use institutional repositories (β=0.381, p=0.001). These

results show that IR characteristics (relative advantage, compatibility, complexity and observability) is capable of explaining about 85.9% (R^2=0.859) of the variations in use intention. The study proceeded further to examine the effect of each of these independent variables on use intention.

Table 5.29: Effect of IR characteristics on use intention

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.927[a]	.859	.858	.28535

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	309.723	4	77.431	950.958	.000[b]
	Residual	50.971	762	.081		
	Total	360.694	766			

Coeffficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		Sig.
Model		B	Std. Error	Beta (β)	t	
1	(Constant)	-.233	.074		-3.148	.002
	RA	.248	.019	.231	12.822	.000
	CP	.447	.012	.598	38.489	.000
	CX	.271	.009	.476	30.960	.000
	OB	.085	.018	.087	4.775	.000

a. Dependent Variable: IU

b. Predictors: (Constant), IU, RA, CP, CX, AQ

IU: Use intention; **RA:** Relative Advantage; CP**:** Compatibility; **CX:** Complexity; **OB:** Observability

(*Source:* Field Data, 2021)

From Table 2.29 it can be observed that compatibility is the variable that made the strongest unique impact on use intention (β=0. .598, p=0.001) when other variables in the model are controlled for. Complexity made the second strongest unique impact on use intention (β= -0.476, p=0.001) when other variables in the model are

controlled for. Relative advantage (β= -0.231, p=0.001) and observability (β= -0.087, p=0.001) made the third and fourth strongest unique impact on use intention.

H_5: There is statistically significant relationship between IR policies and use intension.

Hypothesis five (H_5) was examined using simple linear regression analysis. The simple linear regression was used to analysis the relationship between IR policies (independent variable) and IR use intentions (dependent variable). Assumptions for normality and linearity was tested using standard normal probability (Normal P-P) plot. This was done to determine whether the dependent variable and independent variable have normal distribution or not. The result of The Normal P-P plot is reported in Figure 5.12.

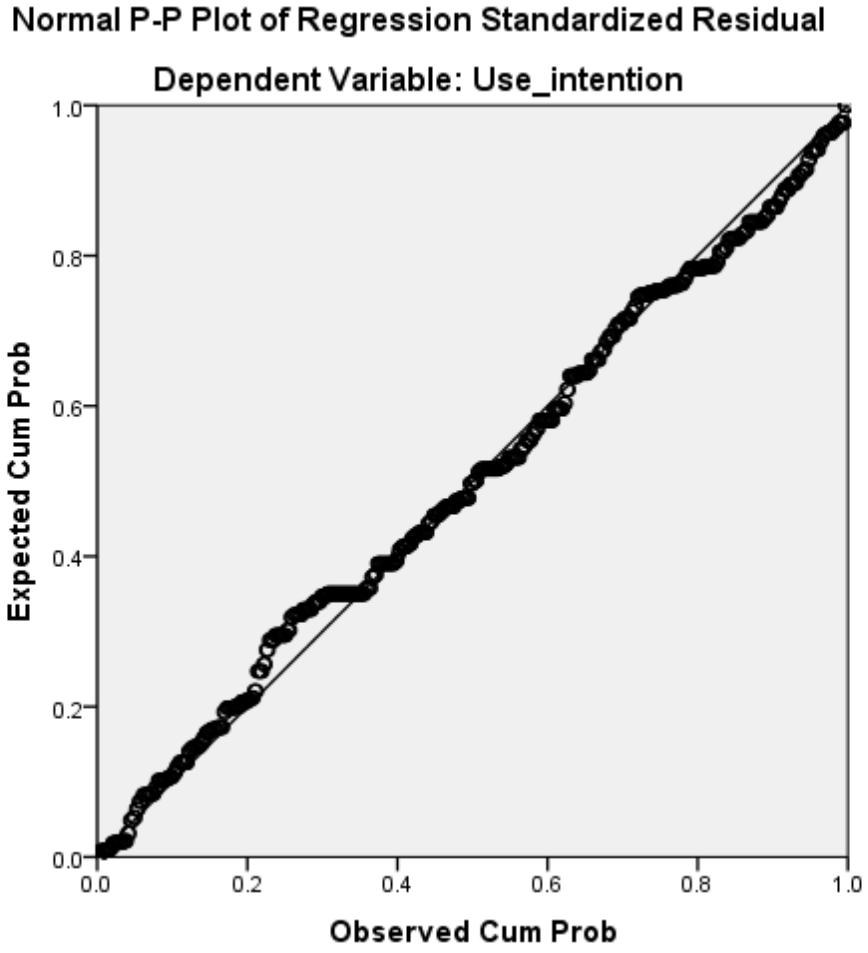

Figure 5.12: Normal P-P plot of Regression Standardised Residual (H_5)
(*Source:* Field Data 2021)

It can be observed from Figure 5.12 that the line passes through a number of points suggesting a reasonable straight line. This demonstrates that the normality and linearity in the study variables as assumed by regression have been met. Therefore, the researcher proceeded to conduct the regression analysis. The summary of the results of the regression analysis is presented in Table 5.30.

From the regression analysis, there is a significant relationship between IR policies and use intention ($F(1,760) = 71.039$, $p < 0.001$). This indicate that IR policies significantly shaped use intentions ($\beta=0.292$, $p < 0.001$). These results clearly direct the positive effect of IR policies on use intension. The data also, show that IR policies is capable of explaining about 8.5% ($R^2=0.085$) of the variations of the level of use intension.

Table 5.30: Relationship between IR policies and use intention

Statistical Parameter	Value
Regression weight	IRP ⟶ IU
Beta Co-efficient (β)	0.292
R^2	0.085
F	71.039
P-value	0.000

* The mean difference is significant at the 0.05 level
Note: IRP: IR Policies, **UI:** Use Intention
(*Source:* Field Data, 2021)

H_6: There is statistically significant relationship between IT infrastructure and IR use intention.

A simple linear regression analysis was to analyse the relationship between IT infrastructure (independent variable) and IR use intentions (dependent variable) as stated in hypothesis six (H_6). Normality and linearity diagnostic tests was conducted using standard normal probability (Normal P-P) plot. This was done to determine whether the dependent variable and independent variable have normal distribution or not. The result of The Normal P-P plot is reported in Figure 5.13.

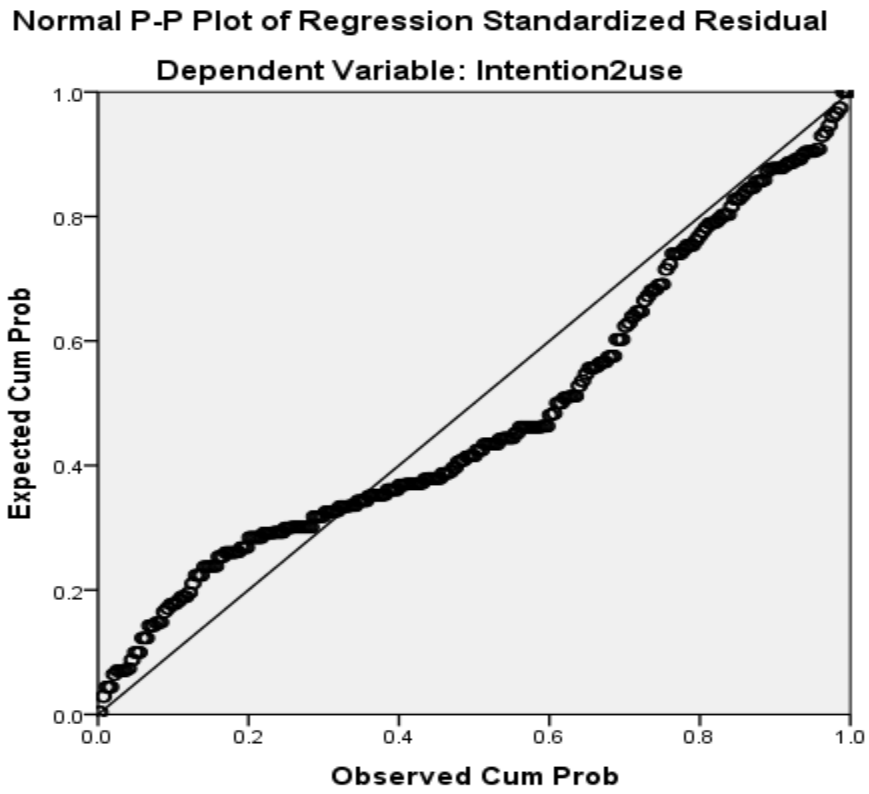

Figure 5.13: Normal P-P plot of Regression Standardised Residual (H_6)
(*Source:* Field Data 2021)

It can be observed from Figure 5.13 that the line passes through a number of points suggesting a reasonable straight line. This demonstrates that the normality and linearity in the study variables as assumed by regression have been met. Therefore, the researcher proceeded to conduct the regression analysis.

From the regression analysis, there is a significant relationship between IT infrastructure and use intention ($F(1,760) = 7.808$, $p = 0.006$). This indicate that IT infrastructure significantly shaped use intentions ($\beta=0.73$, $p = 0.006$). These results clearly direct the positive effect of IT infrastructure on use intension. The data also, show that IT infrastructure is capable of explaining about 7.3% ($R^2=0.073$) of the variations in respondents' intension to use IRs. The summary of the results of the regression analysis is presented in Table 5.31.

Table 5.31: Relationship between impact of IT infrastructure and use intention

Statistical Parameter	Value
Regression weight	ITF ⟶ IU
Beta Co-efficient (β)	0.073
R^2	0.12
F	7.708
P-value	0.006

* The mean difference is significant at the 0.05 level
Note: ITF: IT Infrastructure, **UI:** Use Intention
(*Source:* Field Data, 2021)

Results of Hypothesis Testing

Hypothesis testing is the process where statistical inferences are used to decide whether the data collected significantly support a particular assumption or hypothesis. According to Davis and Mukamal (2006: 1078) the main aim of hypothesis testing to 'evaluate the strength of evidence from the sample and provides a framework for making determinations related to the population'. Therefore, in the study, six hypotheses were proposed and tested. A summary of the results is presented in Table 5.32.

Table 5.32 Result of Hypotheses Testing

Hypothesis	Path	P-Value	Decision
H_1	IRC ⟶ IU	0.000	ACCEPTED
H_2	PS ⟶ IU	0.001	ACCEPTED
H_3	PV ⟶ IRC	0.001	ACCEPTED
H_4	IRH ⟶ IU	0.001	ACCEPTED
H_5	IRP ⟶ IU	0.001	ACCEPTED
H_6	ITF ⟶ IU	0.006	ACCEPTED

IRC: IR Conceptualisation; **IU:** Use Intention; **PS:** Promotional Strategies; **PV:** Personality Variables; **IRH:** IR Characteristics; **IRP:** IR Policies; **ITF:** IT infrastructure
(*Source:* Field Data 2021)

The results as presented in Table 5.32 showed that IR conceptualisation ($p < 0.001$), IR characteristics (p=0.001), promotional strategies (p=0.001), IR policies (p <0.001) and IT infrastructure ($p = 0.006$) have significant effect on respondents' intention to use IRs. Therefore, the hypotheses H_1, H_2, H_4, H_5 and H_6 were accepted. Further, the study findings showed that personality variables specifically gender, age, subject area and academic qualification significantly influenced IR conceptualisation ($p = 0.001$). Therefore, the hypothesis H_3 was also accepted.

5.6 PART B: QUALITATIVE DATA ANALYSIS

5.6.1 Introduction

The section presents the result of data collected, using the semi-structured interview guide. The interview guide (see Appendix C) had seven main sections. A total number of ten respondents comprising of five university librarians and five IR managers from the five selected universities were targeted for the interviews. Three out of five scheduled interview appointments were successfully completed. This yielded a 60.0% response rate. All five scheduled interview appointments were honoured, yielding a 100% response rate. Interviews were conducted either face to face or via telephone at the convenience of the participants. Each interview lasted between 25 and 40 minutes. The interviews were recorded using a digital voice recorder and Tecno Spark 4 cell phone respectively. The researcher observed all ethical issues related to the conduct of interviews. The qualitative data was grouped into themes based on the research objectives as outlined in section 1.4.2.

5.6.2 Stakeholders' (IR Staff, faculty members and students) perception of institutional repositories.

One of the items on the interview guide revealed how IR staff, faculty members and students perceive IRs. Analysis of the interview responses indicate that perception of IRs among faculty members, students and IR staff has seen positive improvement over the period. This was largely attributed the period marketing and sentization campaigns organised over the period.

Extract

> *Generally, perception of the IR is good because when the IR started there were a series of seminars, flyers, workshops and trainings organized to sensitize members of the University community. And it is an on-going activity, it not something we just did it once. So people have come to appreciate what the IR does. So the reception is OK but there still room for improvement since there still people who think the IR alone is not enough.* **(IR Manager 5)**.

This was affirmed by IR manager 1:

> *About four to five years ago the perception of the IR wasn't good at all. The reception was poor not because they do not appreciate the idea but because the were not to familiar or aware of the benefit that comes with depositing your content in the IR. But as time goes on and we engage in a lot of promotion and advocacy through the various presentation to the HODs and graduate school. They came to appreciate the fact that it was one of the criteria for ranking universities and could give them global visibility. So, I can say that in terms of acceptance that has really improved* **(IR Manager 1)**.

However, in some universities perception of IR was found to be low. This was mainly attributed to inadequate marketing and promotional activities.

Extract

> *I say to a large extend we are still struggling for faculty members and students to embrace this concept of IR because most faculty members struggle to publish their articles in IR because it is not so much popular and not enough marketing has been done by the library. In my opinion not so much embraced* **(IR Manager 3)**.

5.6. 3 Role of institutional policies in ensuring the sustainability of institutional repositories in Ghana

The responses from the interviews conducted with IR managers and university librarians confirmed the existence of an IR policy as observed in the quantitative analysis. The interview data indicated that the IR policies largely guided usage, metadata control, submission, administering, access, and preservation.

Extracts:

> *You know now universities globally are trying to develop IRs and we are bench marking from other earlier universities. So, we understand clearly that the way these things are, they have to be guided by a policy, so we have a policy for the operation and usage of our IR* **(University Librarian 3)**.

> *Yes, there is a policy the forms the framework of the work we do* **(IR Manager 5)**.

The researcher also sought to find out how policies addresses content submission and copyright concerns. Responses from the interviews conducted with IR managers and university librarians showed that IR staff and managers do further checks on the documents to check for copyright restrictions before archiving them.

Extracts:

> *Because we are specialised and trained in digital archiving. We do not just deposit, we try as much as possible to access the publisher's information as to whether their final copy, i.e. preprint or post-print, can be deposited before we finally deposit them. Those that we are not allowed to deposit, all we do is that we just put the bibliographic details of the original sources and any who goes to access the item is the redirected to the original source* **(IR Manager 1).**

First of all, we check the credibility of the journal that published the journal. Previously, we were not doing this, but now with the advent of predatory journals we verify to check if the journal that published the research is not predatory. After we verify that the journal is not predatory, the next is to check for copyright encumbrances, you could have Open Access journal that have copyright challenges, if there are not challenges then you upload **(IR Manager 2).**

Similarly, a content analysis of the various IR policies showed that the policies address copyright concerns.

Extracts:

The author(s) have to seek copyright clearance, if necessary, from a Publisher that requires that before submitting the item to KNUSTSpace **(KNUST 2008: Section 12.2).**

The author shall search for the publisher's self-archiving policy or "OA policy". Online in the SHERPA/RoMEO database at http://www.sherpa.ac.uk/romeo.php or in the Australian OAKList database at http://www.oaklist.qutedu.au. If a publisher cannot be found on this site, the publisher shall be contacted directly **(UEW n.d.: Section 13.2.8 -9).**

When an item is submitted to UCCSpace the author(s) grant(s) a non-exclusive dissemination right to the university. This does not prevent the author(s) from publishing it as a journal article or in any other place because s/he still holders partial copyright of the item. The author has to seek copyright clearance, if necessary, from a publisher that requires that before submitting the item **(UCC 2012: Section 2.3, bullet 1 and 2; UEW n.d.: Section 13.2.8-9)**.

5.6.4 Competencies or skill sets required of institutional repository professionals

The managerial, Technical and communication competencies of persons assigned IR work is critical to the adoption, acceptance and usage of IRs as a strategic platform for the desemination and promotion institutional scholary and research outputs. Analysis of the interview responses from IR managers and University librarains indicated the kinds of communicative, managerial, and technical skill sets and competencies required of persons assigned IR work.

5.6.4.1 Managerial competencies expected of IR professionals

An analysis of the interview responses revealed that IR managers must also have the skill to manage the emotions and attitudes of their staff, as well as be able to resolve interpersonal conflicts among staff.

Extracts:

> *In terms of management, you know that management has to do with you managing your own staff, and so your level of understanding of the IR software and system is important so that you can transfer knowledge to your staff as well as putting standard practice into place so that your IR team can adherer to them* **(IR Manager 1)**.

> *When it comes managerial, yeah you are working with staff and attitude, temperament; you should be able to know how to manage them. One of challenges is that sometimes when we go for the thesis from graduate school there is a deadline that we have to meet, I find it a bit difficult to push them. One of the things is being emotional intelligent. Being able to manage their emotions to get results* **(IR Manager 3).**

> *She/he should be able to manage people, deal with issues maturely and be firm* **(University Librarian 5).**

5.6.4.2 Communicative competencies expected of IR professionals

Analysis of the interview responses affirmed the quantitative results as shown in Table 5.10 was affirmed by the interviews conducted with IR managers and university librarians. The analysis of the interview responses showed that IR personnel needed moderately high competencies in communicating and promoting the IR to all stakeholders.

Extracts:

> *An IR manager needs promotional and advocacy skills, this is because the IR manager interacts with many stakeholders and must be able to communicate effectively with all these stakeholders* (**IR Manager 1).**

> *I like that part you talked about communication. I mean that is very important, because getting content into IR is dependent on other stakeholders and if there is no communication between us and them, then we may have all the skills but may not be able to populate the IR* **(IR Manager 4).**

6.6.4.3 Technical competencies expected of IR professionals

Information communication technology skills form the basic technical skills required of an IR professional. This was largely attributed to the fact IRs are IT systems and therefore required some level of IT skills to trace, analyse and resolve challenges that might arise during the operation and use of the system. These are typified by the comments below, as expressed by some IR librarians during the interviews.

Extracts:

> *So, well my thought is that managing the IR should be a librarian with same level of IT competencies. Because an IT or systems librarian is not a librarian. This is because an IR manager will be dealing with metadata and cataloguing records* **(IR Manager 3)**.

IR personnel must have training in terms of metadata and be able to use the Dublin core to process physical materials. You also need some technical skills relating [to] *the Dspace software or IR software you* [are] *using* **(IR Manager 1)**.

I think a professional IR manager should be someone with an IT background, particularly database management should have website development skills, cataloguing skills, referring skills, public relation skills. This [is] *because you are an embodiment of the system, so you need to have IT background. You also need to have information studies background to augment your work* **(IR Manager 4)**.

Further to probe on how libraries seek to have personnel with the requiste IT skills revealed some of the librarieshave resorted to recruiting system librarians instead of relying on staff from the universities's IT directorate

Extracts:

So due to difficulties in getting personnel from the ICT directorate to work within the library. We now recruiting systems librarians. That is persons with IT backgrounds but who have the requiste experience and appreciation of library IT sysytems.
(University Librarian 3).

6.6.5 Technical specifications of institutional repositories in Ghana

Analysis of the interview responses showed that Dspace is the only IR software used by public universities in 201alla. The researcher therefore sought to examine the reasons behind the choice of Dspace, since there are other IR softwares available. During the semi-structured interviews, the IR managers and university librarians were asked why Dspace was chosen. Cost, availability, community of support, and ease of use were stated as major reasons the informed the choice of Dspace.

Extracts:

> *We choose Dspace because* [it] *is the most commonly used* **(IR manager 1)**.
>
> *The truth of the matter is that is cost and at the time IR was introduced in the university, that was the software available. Also, when setting up our IR we had support from the African Library and Information Associations and Institutions and they recommended Dspace. And so, the university also used Dspace. Currently I do not know of any university in the country that is using any other software apart from Dspace* **(IR Manager 2).**
>
> *Dspace, because it has proper maintenance cost saving, good information security, cost-effectiveness, and it is very common in our parts of the world. It offers speed and is user friendly and, lastly, it is flexible and offers multiple ways for solving problems* **(IR Manager 3).**
>
> *Dspace is quite friendly to use. When you look at the matrix involved, it is very easy to use compared to other software* **(IR Manager 4).**
>
> *We chose Dspace, primarily because it's cost-effective and user friendly* **(IR Manager 5).**

5.6.7 Documents archived in the institutional repositories in Ghana

From the analysis of the interview transcripts obtained from the interviews with IR managers and university librarians, it was revealed that documents archived in the IRs in public universities in Ghana included theses and dissertations (Mphil and PhD), research papers or articles, books, conference proceedings, and other publications of the universities (e.g., speeches, inaugural lectures, committee reports, etc.). This was affirmed by the content analysis of IR policies of the selected repositories.

***Extracts*:**

> *The acceptable document format for archive in KNUSTspace shall include; Journal Articles, Working Papers, Technical Reports, Pre-Prints, Post-Prints, Manuscripts, Conference Papers, Newspaper Clippings, Speeches, Theses and Dissertations Inaugural /Professorial/ Occasional Lectures, E-resources, Data Sets, Multimedia Publications, Digital Images, Lecture notes, Grey literature, Presentations and Courseware* ***(KNUST 2008: Section 4.4, p7)***

> *The University of Education, Winneba Repository shall hold the following types of material; Theses/Dissertation/Project Works etc. of postgraduate students of UEW, Refereed research articles and contributions at the pre-print and post-print stage of publication and Grey literature* **(UEW n.d.: Section 7.0)**

5.6.8 Procedures for submitting content to institutional repositories in Ghana

An analysis of the interview transcripts of IR managers showed that content submission into IRs in public universities in Ghana is mediated by IR staff. Authors would have to submitted documents to the IR team, who then takes the submitted documents through file formatting, water marking, entry of bibliographic details (meta data) and check for copyright restrictions before they are finally archived.

Extracts:

> *Because we want to ensure that standards are met, we don't allow for self-archive. We collect the content and deposit it on their behalf* **(IR Manager 2).**

> *So, there is a workflow, when we received materials. So first of all, when we receive content either by mail or physical contact, the document goes straight to the IR workroom. The IR staff then determines the nature of the document. For example, if it is a thesis*

in Word, it is then converted into PDF with the university's logo watermarked on it. It is submitted with the needed metadata. The materials then goes to the final archiver, usually the IR manager, for approval before the materials are finally archived in the institutional repository **(IR Manager 5)**.

Because we are specialised and trained in digital archiving, we don't allow members to self-archive; we do it on their behalf. We do not just deposit; we try as much as possible to access the publisher's information as to whether their final copy, i.e. preprint or post-print, can be deposited before we finally deposit them. Those that we are not allowed to deposit, all we do is that we just put the bibliographic details of the original sources and any who goes to access the item is the redirected to the original source **(IR Manager 1).**

However, a content analysis of the IR policies of the UCC and the KNUST showed that the IR staff should make provisions for self-archiving.

Extract:

Submissions can either be self-archived (by researchers/authors) or mediated archived (by IR staff). Quality assurance will be carried out by the IR staff to ensure that only original work is deposited. (UCC 2012: Section 2.2.4, p6; KNUST 2008: Section 4.1.2)

5.6.8.1 Level of compliance to IR deposit policies

An analysis of the interviews conducted with university librarians and IR managers showed low compliance with deposit policies. The interviews reponses generally indicated that it was difficult to obtain content, particularly from faculty members.

Extracts:

> *You see the issue is about the debate on university laws, statutes, and policies. Naturally, university policies are not laws, so you may have a policy, but people may not comply with them. Yes, the policy mandates members of the university to deposit their research outputs into the IR, but they don't. And it* [is] *sometimes difficult to enforce this mandate, since it's not in the status* **(University Librarian 3)**.

> *It is stated clearly in the policy that everyone must archive, but I think that putting in place measures to ensure that people willingly deposit by making it part and parcel of the system is what is lacking* **(IR Manager 5)**.

> *Ok so the policy that is in existence now is a bit passive. In the sense that most of the things that is required of faculty members is not being done. That is why in my earlier submission I stated that it is important to have management support in pushing them to do the right thing as far as deposit is concern* **(IR Manager 3)**.

However, one of the universities had sought to address this challenge of getting faculty members to deposit content by making it a promotion requirement.

Extract:

> *The IR policy has a general statement that entreats people to deposit. The IR policy does not make depositions mandatory, so it was the case that librarians were chasing them to bring their publications, but seeing depositions was becoming a problem the university incorporated the mandatory deposits into the promotional requirement. For instance, before your promotional documents are submitted there must be proof that the faculty member has archived his publications into the IR. The university took this step because of*

the benefits it gives individual faculty members and the university as a whole **(IR Manager 2)**.

5.6.9 Challenges to the Sustainability of IRs in Ghana

The analysis of the qualitative interviews with the IR managers and university librarians revealed response that affirmed the quantitative results as shown in Table 5.17. Respondents identified policies, staffing, and awareness creation or education as hindrances to the sustainability of IRs in Ghana. These are typified by the following comments by some IR managers and university librarians captured during the interview sections.

Extracts:

I think that is a major thing for the library to be out there in terms of visibility. I think the library should devote some time or budget to the IR. Whereby more forum and programmes are organised to educate the university on IRs. I believe there is the need for a deliberate attempt to improve people's appetite on the need to use and contribute content to IRs **(IR Manager 3).**

We also have challenges with staffing required to we deal with the database management aspect of the system. The core IT people who are supposed to deal with the system are outside the domain of the library. Since they are not library staff, they do not understand the language of the library and that is a huge problem **(IR Manager 4).**

Similarly, respondents identified top management support as vital to the sustainability of IRs in public universities in Ghana. This was aptly expressed by University Librarian 3 during the face-to-face interview.

***Extract*:**

> *I think sustainability goes beyond policy, but policy complements other efforts of management to ensure that the necessary infrastructure, human resources, funding, and institutional commitment need to sustain IRs are provided* **(University Librarian 3)**.

The findings seemingly suggest that knowledge of the concept of IRs within public universities in Ghana is moderately high across all the stakeholder groups (students, faculty members, and IR staff) surveyed. However, it is apparent there are certain factors that inhibit the full participation of stakeholders in the IR initiative and this threatens the sustainability of IRs in Ghana. In Chapter Six, the researcher provides a detailed interpretation of these findings.

5.7 CHAPTER SUMMARY

The outcome of the analyses of the data collected through the research instruments (questionnaires and interview guide) was presented in this chapter. The chapter also presented the findings after a thorough examination of the various institutional IR policies. The following represents the key issues that was identified from the study findings:

- There is variation in knowledge and perception levels of IRs among stakeholders in public universities in Ghana. IR personnel had significantly higher perception of IRs than both students and faculty members. Also, IR knowledge was found to significantly shape IR perception.
- It is expected that IR managers and administrators effectively communicate and promote IRs to faculty, students, and other stakeholders; communicate technical issues to management, IT staff, and team members; and activate help desk services to support IR management and self-archiving practices.

- Repository managers and administrators are expected to competently operate repository software, as well as communicate technical issues to management, team members, and clients.
- IRs in Ghana run on 9th generation servers with processor speeds ranging from 1.90 to 3.5GHz.
- Dspace is the only repository software used by public universities in Ghana.
- Research articles, theses, and dissertations constituted the seventy-seven percent of the contents of IRs in Ghana.
- Mediated deposit is the most commonly used mode of content submission adopted by repository managers in public universities in Ghana.
- Inadequate funding, ICT Infrastructure, and bandwidth; publisher copyright restrictions; and the lack of technical staff for system development and management of IRs are the major challenges that confront IR participation and threaten their long-term survival and sustainability in Ghana.

The findings seem to suggest that the concept of IRs is not new to public universities in Ghana. However, it is apparent that certain issues seem to threaten the sustainability of these repositories. A detailed interpretation of these findings is provided in Chapter Six.

CHAPTER SIX:
DISCUSSION OF THE RESEARCH FINDINGS

6.1 INTRODUCTION

This chapter provides an in-depth discussion of the study's findings as presented in Chapter Five and relates the current findings with the conclusions of previous studies as outlined in Chapter Three. The discussion is presented in accordance with the study objectives. According to Creswell (2014:226), the interpretation section of a thesis offers the researcher the opportunity to establish whether the results support or refute the research questions and establishes a relationship with previous studies. Similarly, McGregor (2018) asserts that in writing a good discussion, the researcher must relate their work back to the original research question. Annesley (2010) opines that the goal of the discussion section is to make logical deductions and provide a description of the significance of the study findings as they relate to previous studies, as well as to provide an explanation for any new understanding or insights that emerged out of the current study. In view of McGregor (2018) and Annesley's (2010) explanations, it is important that the researcher revisits the study objectives, research questions, and the reviewed literature on the sustainability of IRs in Ghana. Revisiting these points is crucial, as it offers the researcher the opportunity to connect the various aspects of the thesis from the beginning to the end (Blum 2006). McGregor (2018), Allen (2017), and Docherty and Smith (1999) assert that the purpose of the discussion is to:

1. interpret and summarise important results or findings;
2. examine the implication and significance of the results or findings;
3. compare study results or findings to other published works;
4. acknowledge the constraints of the current study; and
5. suggest areas for further studies based on the current findings.

In Chapter One, IRs were identified as being increasingly deployed in academic and research institutions for the management of institutional intellectual resources in digital or non-print formats (Mohammed 2013). This was largely due to the potential of IRs to improve on the preservation, access and dissemination of organisational

intellectual and scholarly resources (Agyen-Gyasi et al. 2012; Shampa 2012; Mohammed 2013; Bhardwaj 2014). However, it was also noted that IRs, particularly those in developing countries like Ghana, face numerous challenges that threaten their sustainability (Corletey 2011; Thompson et al. 2016; Martin-Yeboah et al. 2018; Anyaoku et al. 2019). Therefore, this study aimed at investigating these challenges in order to recommend measures that will form part of a framework that might enable libraries and other stakeholders to gain adequate insights into the factors that threaten the longevity of IRs and counteractions which will contribute to the sustainability of IRs in public universities in Ghana.

A researcher-developed questionnaire and interview guide were the main instruments used for data collection. The analysis of the data collected using the above stated research instruments is presented in Chapter Five. To ensure consistency in the presentation of the study findings and discussions, the chapter is presented under the same sectional headings as outlined in Chapter Five.

At the beginning of this study, the researcher outlined a set of factors he believed are critical to the sustainability of IRs. These factors formed the bases upon which the study objectives were developed. Notably, Chapters Two, Three, Four, and Five were organised in accordance with these factors. This practice is adhered to in Chapter Six. These factors served as the conduit through which all the chapters of this thesis were connected. These factors are:

1. Stakeholder views or perceptions of IRs.
2. Institutional policies and the sustainability of IRs.
3. Competencies of IR personnel.
4. Hardware and software specifications of IRs.
5. Content and deposit procedures of IRs.
6. Factors that threaten the sustainability of IRs.

The review of existing literature on the above-stated factors led to the identification of some key issues. First and foremost, most university libraries in Africa in an effort to preserve their digital and digitised scholarly outputs in the face of budget cuts, the increased cost of journal subscriptions, and advocacy for Open Access, have

adopted IRs as a way of promoting, preserving, and distributing their institutional scholarly output (Kodua-Ntim & Fombad 2020; Savova & Price 2019; Shu et al. 2018; Sanjeeva & Powdwal 2017). Generally, there is a positive perception of the benefits of IRs among students, faculty members, and library staff. However, there is variations in the level of awareness, usage, and willingness to deposit content (Okoroma 2018a; Anenene et al. 2017; Abdelrahman 2017; Tella et al. 2016; Stanton & Liew 2012; Manjunatha & Thandavamoorthy 2011).

Institutional policies are identified as critical to content generation (Digital Preservation Coalition 2020; Callicott et al. 2016; Gilman 2016). Generally, students are willing to comply with mandatory deposit policies (Sale 2006; Pickton & McKnight 2006; Palmer et al. 2008), while faculty members have reacted negatively to any suggestion of compulsion and have viewed it as an affront to the author's right of choice of publication outlet, academic freedom, and publisher relations (Fruin & Sutton 2016; Xia et al. 2012). It is, however, worthy to note that the majority of the contents of IRs is deposited by students (Barandiaran et al. 2014; Swan 2005). Most libraries in Africa use Open Access automation systems and software (Komolafe-Opadeji & Ojo 2019; Chigwada 2018; Njoku & Ravichandran 2017; Ukachi 2017; Maua & Mwiti 2013; Karume & Mbugua 2012; Namuye & Kamau 2012) because of cost and their ability to allow users to build customised features and collections (Bankier & Gleason 2014). Dspace is the most commonly used IR software in Africa (OpenDOAR 2020; Tzoc 2016). Financial constraints, content generation, lack of awareness, copyright restrictions, personnel, erratic power supply, and inadequate bandwidth are the major challenges that threaten the sustainability of IRs in Africa (Dzandza 2019; Anyaoku et al. 2019; Okoroma 2018b; Oguche 2018; Aliyu et al. 2014).

This chapter will endeavour to connect the disclosures identified during the literature review with the findings of the study as presented in Chapter Five. This will be done by highlighting similarities and contradictions as well as new concepts that emerged out of the study findings.

The next section discusses the stakeholders' perceptions of IRs in the public universities in Ghana.

6.2 STAKEHOLDERS' PERCEPTIONS OF IRs IN PUBLIC UNIVERSITIES IN GHANA

According to Elnaga (2012:59), "perception is not only passive, it is shaped by our knowledge, experiences and education". The concept of an IR is not new in Ghana, as confirmed by several studies conducted on the subject (Dzandza 2020; Kodua-Ntim & Fombad 2020; Martin-Yeboah et al. 2018; Kumah et al. 2018; Malekani & Kavishe 2018; Thompson et al. 2016; Corletey 2011). All the public universities surveyed for the study had established IRs. This is largely attributed to the numerous benefits (e.g., prestige, wider readership, increased acceptance of Open Access, etc.) IRs bring to depositors and the institution as a whole. The perception and knowledge level of all stakeholders is therefore paramount in ensuring the sustainability of IRs in Ghana. The proposed conceptual framework for the study opined that for IRs to be sustainable, it is paramount that all stakeholders have a positive conceptualisation of IRs. The study showed a generally high conceptualisation of IRs across all the stakeholder groups (IR personnel, faculty members, and students) despite the variations. These variations in perception can be attributed largely to the different IR knowledge levels among the stakeholder groups as IR knowledge is capable of explaining about 38.0% (R^2=0.38) of the variations in IR perception (see Table 5.9).

6.2.1 Faculty members' perception and knowledge of IRs

The literature reviewed and findings from this study indicate a generally high acceptance and knowledge level of the concept of OAIRs by of faculty members. Figure 5.1 summarises the definitions of an IR as outlined in the literature (Kaladhar et al. 2018; Kakai 2018; Anenene et al. 2017; Gibbons 2004; Genoni 2004). It is clear from the literature that an IR contains scholarly and intellectual documents produced by members of particular institution (Kaladhar et al. 2018; Genoni 2004; Crow 2002). Forty-six (57.5%) faculty members agreed to the statement that an "institutional repository contains scholarly and intellectual documents produced by

members of a particular institution", while 22 (27.5%) faculty members strongly agreed. Also, the literature defines IRs as online archives capable of exchanging or making use of information with other computer systems (Tsunoda et al. 2016; Foster & Gibbons 2005; Crow 2002). Similarly, 22 (27.5%) faculty members moderately agreed to the statement that "institutional repositories are electronic archives" and 30 (37.5%) faculty members agreed, while 28 (35.0%) faculty members strongly agreed. This clearly shows that faculty members understand what IRs are. This finding is in agreement with previous studies that had reported high levels of awareness of the concept of Open Access among faculty members (Sheikh 2019; Pelizari 2005). Contrarily, studies by Gunasekera (2017) and Alemayehu (2010) showed low knowledge or awareness of OAIRs among faculty members.

The study conceptualised that for an IR to be adopted by stakeholders, it must present stakeholders with visible, tangible, and intangible benefits, as well as offering advantages over similar systems. To this end, the study examined the critical role of perception in ensuring the participation of faculty members in IRs (Gunasekera 2017; Alemayehu 2010). In view of this, faculty members were asked to indicate their level of agreement or disagreement to 15 statements aimed at gauging their perception of OAIRs. Generally, the findings as shown Table 5.5 show that faculty members' perception of OAIRs was moderately high (Mean=2.83, SD=1.00). However, it is interesting to note that 51.4% of faculty members surveyed did not find OAIRs to be prestigious, while 68.7% found it difficult and time consuming to contribute content. This affirms the findings by Anderson et al. (2012) that music faculty members are not in the habit of self-archiving and making their work openly available in IRs. Keeffe (2012), with the objective to examine the factors that facilitate or impede faculty members' willingness to deposit into repositories, revealed that even though a substantial majority of faculty members agreed that there are personal benefits associated with IR contribution, they hardly deposited their work into IRs. Similarly, Okoroma (2018b) examined the utilisation of IRs by faculty members in five Nigerian universities and revealed that faculty members are hesitant to contribute content IRs. This therefore calls for an increase in awareness and training of faculty members regarding the benefits of archiving content in IRs. Also, IR managers must look at the

possibility of shortening and simplifying submission processes (Ammarukleart 2017) without compromising on quality or due diligence.

6.2.2 Students' perception and knowledge of IRs

Students constitute the largest stakeholder group of content providers for IRs in Ghana. The knowledge and perceptions of students about IRs are therefore important to ensure its sustainability. According to Swan (2005), the preservation of students' research works continues to be one of the major reasons why universities set up repositories. The results on students' knowledge and perception of IRs are shown in Figure 5.2 and Table 5.6 respectively.

The results in Figure 5.2 indicate that students' knowledge of IRs is generally high. Specifically, 397 (62.9%) of the respondents either agreed or strongly agreed that IRs contain intellectual outputs produced by members of particular institutions, 252 (39.9%) of the respondents agreed that IRs are electronic archives, 174 (27.6%) of the respondents moderately agreed that IRs are web-based, 109 (17.3%) of the respondents disagreed that IRs provide unrestricted worldwide access to their contents, and 10 (1.58%) of the respondents strongly disagreed that IRs contain scholarly materials. These findings are contrary to studies by Tella et al. (2016), Stanton and Liew (2012), and Pickton and McKnight (2006) which determined that students have low or limited awareness and knowledge of OAIRs. However, Nunda and Elia (2019) and Nolan and Costanza (2006) have also determined a high awareness and usage rate of IRs among students.

Similarly, Table 5.6 also showed that the majority (79.6%) of graduate students have a positively high perception of IRs. This is in line with studies by Adedimeji and Adekoya (2019) and Almobarraz (2007) which revealed that the majority of students have a positive perception about the quality of the contents of digital repositories and had desired to use or archive in a digital repository. The high perception and knowledge of IRs can be attributed to the accessibility of IRs from the library's website or the university's webpage and the general acceptance of the concept of Open Access. According to Abdelrahman (2017), students generally exhibit a positive attitude towards digital repositories and their contents due to their increased

reliance on ICT tools and the non-availability of traditional library services and information resources needed to meet the graduate students' information needs. Even though all the university libraries surveyed for this study provided both electronic and traditional services, the increase in knowledge and a positive perception of IRs can largely be attributed to the increased adoption of ICT systems for service delivery, marketing, and promotion by the libraries surveyed for the study. As conceptualised in the framework that guided the study, the sustainability of IRs can only be ensured when it is consistent with existing institutional scholarly communication procedures and practices. This therefore calls for librarians and IR managers to explore other effective communication and promotional channels and strategies aimed at making IRs an integral component of the institutional scholarly communication and dissemination process.

6.2.3 IR staff's perception and knowledge of IRs

IR staff form the most critical stakeholders in any IR initiative. This is because they are the main promoters of IRs and are responsible for communicating the benefits of IRs to other stakeholders. Therefore, their knowledge and perceptions of IRs inform the kinds of marketing and promotional strategies they would deploy. A total of 56 library staff members working at the Digitization and E-Resources Units were purposively surveyed. Figure 5.3 in Chapter Five shows that out of the 56 library staff members surveyed, 50 (89.3%) of the respondents strongly agreed that repositories contain scholarly materials, while 48 (85.7%) of the respondents strongly agreed that IRs contain intellectual outputs produced by members of particular institutions. Crow (2002:16) defined an IR as a "digital archive of intellectual product created by faculty, research staff, and students of an institution and accessible to end users both within and outside the institution, with few, if any barriers to access". Similarly, other authors such as Kaladhar et al. (2018) and Genoni (2004) viewed IRs as containing scholarly and intellectual documents produced by members of particular institutions.

Similarly, findings in Table 5.7 showed at that 77.2% of library staff at the Digitization and E-Resources Units had a positive perception of IRs. These findings are accordance with previous studies that had reported that professional librarians generally had a positive perception and knowledge of Open Access scholarly

publishing and viewed IRs as a very useful tool for the preservation and dissemination of scholarly information (Anenene et al. 2017; Ugwuanyi et al. 2013; Rieh et al. 2008). The high knowledge and perception level of librarians is a positive step towards the sustainability of IRs in Ghana. This is because as librarians, they form the fulcrum around which IR promotional or awareness strategies revolve. However, librarians must make conscious efforts to keep themselves abreast with current repository marketing and promotional trends in order to be able educate and effectively communicate the benefits of IRs across all stakeholder groups (Dandawate & Dhanamjaya 2019; Sanjeeva & Powdwal 2017; Dang 2017) to ensure sustainability.

It is worthy to note that the findings in Tables 5.5, 5.6, and 5.7 show that stakeholders (librarians, faculty members, and students) have a positive perception of IRs. However, there significant difference in perception of IRs between the stakeholder groups. IR personnel were found to have significantly higher perception of IRs than both students and faculty members. This variation in perception is largely due to the differences in IR knowledge levels among the stakeholder groups (Table 5.8). Therefore, to ensure sustainability or continuous use behaviour it is important IR managers and administrators design educational and sensitization programmes targeting the specific needs of students and faculty members. This is because IR knowledge was found to have a significant role in shaping IR perception and accounted for about 38.0% (R^2=0.38) of the variations in IR perception (Table 5.9). It is therefore paramount that librarians who are at the forefront of any IR initiative take up a more proactive role in promoting the benefits of OAIRs in order to create a standardised conceptualisation of IRs among all stakeholder groups.

The next section discusses the role of institutional polices in ensuring the sustainability of IRs in Ghana.

6.3 THE ROLE OF INSTITUTIONAL POLICIES ON THE SUSTAINABILITY OF INSTITUTIONAL REPOSITORIES IN PUBLIC UNIVERSITIES IN GHANA

Institutional policies form the basis for formulating, directing, and shaping major organisational decisions, as well as ensuring that organisational members work and act within a set of established boundaries. Therefore, examining the impact of institutional policies on the operation and management of IRs is key to its sustainability. According to Callicott et al. (2016:51), institutional Open Access policies are critical to the successful deployment of institutional repositories, particularly at the elementary or initial stages of deployment. The study conceptualised that for IRs to be sustainable, they must conform to existing institutional values and norms. For public universities in Ghana, most of these institutional norms and values are enshrined in institutional policies and regulations. In view of this, respondents' knowledge of the existence of an IR policy, compliance levels, and the impact of IR policy on use the sustainability of IRs in Ghana were elicited and presented in Figure 5.4 and Table 5.10.

Generally, 702 (91.5%) of the respondents agreed to some extent to the existence of an IR policy that guided the operation, usage, and management of IRs in their respective institutions. Specifically, 247 (32.2%) of the respondents strongly agreed to the existence of an institutional IR policy, while 31 (4.04%) respondents strongly disagreed to the existence of an institutional IR policy. This meant that the majority of the respondents are aware of the existing rules and guidelines for all IR participants and that these rules were formulated to ensure that all participants enjoy the benefits of their participation in the IR initiative. However, there were significant differences in the level of awareness of the existence of IR policy between stakeholder groups. IR personnel were found to have significantly higher awareness level of the existence of IR policy than both students and faculty members. This finding was not surprising as the work of IR personnel from the processing of documents to the final archive of documents is guided by the IR policy.

The results as shown in Table 5.11 also indicate that 67.2% of the respondents agreed (mean=3.85, SD=0.91) that the IR policy guided content generation. This shows that the policy drafters recognise the critical role policy plays in the sustainability of IRs in Ghana. However, an analysis of the interview response from IR managers and librarians clearly shows that these policies are persuasive in nature, particularly for faculty members. That is, they generally entreat people to deposit. The IR policies do not make depositions mandatory, particularly for faculty members. This can largely be attributed to the non-existence of "incentives" or "motivators" for faculty members (Prabhakar & Rani 2018) to deposit. So, even though these policies exist, policy compliance among faculty members is very low. It is instructive to note that, as shown in Table 5.19, 53.6% of faculty members had never contributed any content to their institution's IR. This previous studies have attributed to the reluctance of many faculty members to submit content to a repository (Moore 2011) and copyright or contractual arrangements between authors and funders (Lee et al. 2015). It is interesting to note that the findings of this study revealed that IR policies in Ghanaian public universities addressed these challenges. However, despite the high awareness level of the existence of IR policies among faculty members (n = 80, M = 3.86, SD = 0.95) compliance with the policy still is not encouraging.

This is a situation that needs the attention of all stakeholders, as the primary aim of an IR initiative is to enhance organisational image and prestige. Therefore, there is the need for strict institutional frameworks and support for ensuring that IRs form an integral part of the institution's scholarly communication practices or activities (Abrizah 2009). One of the ways ensure compliance is for public universities in Ghana to formulate policies that will mandate their most "highly skilled" workforce to deposit content into their institution's IR (Prabhakar & Rani 2018; Xia 2007). Even though others have expressed contrary opinions and have viewed such mandates as an affront to the *author's right of choice of publishing outlet, academic freedom, and publisher relations* (Fruin & Sutton 2016:447; Xia et al. 2012), it seems that mandates are the only option available to IR managers and librarians, since constant efforts aimed at persuading faculty members to deposit content, such as awareness creation and promotion, have not yielded the desired results. This position is aptly

supported by views expressed by IR Manager 2 during the interview session: "…*so it was the case that librarians were chasing them* [faculty members] *to bring their publications but seeing depositions was becoming a problem, the university incorporated the mandatory deposits into the promotional requirement. This really increased faculty deposits."*

However, it must be noted that content generation is not the only issue that must be addressed by a policy (Callicott et al. 2016). The literature reviewed and findings from this study indicate that one critical policy issue that affects faculty members' decision to participate in contributing content to IRs is the issue of copyright. As presented in Table 5.20, 92.9% of faculty members surveyed had indicated a willingness to archive content in an IR in the future. However, data in Table 5.21 shows that 48.5% of respondents agreed to a moderate extent (Mean=3.43, SD=1.13) that copyright concerns hinder IR participation. Even though a content analysis of the IR policies shows that the policies addressed copyright concerns, these policies place the burden on authors to seek copyright clearance from publishers when necessary before submitting content. This makes the submission process cumbersome and tedious for faculty members, perhaps discouraging deposits. Even though an analysis of the interview transcripts revealed that librarians (IR personnel) check for copyright restrictions on deposited material before the final archive, this is not stated in the policies. This therefore requires librarians to be more proactive in letting authors (faculty members and students) know that they are available to perform copyright restriction checks on their behalf.

It was also instructive to note that these policies are silent on funding, despite the fact that previous studies have increasingly identified funding (Anyaoku et al. 2019; Agyen-Gyasi et al. 2012; Uwa & Okoro 2009) as posing a significant threat to the sustainability of IRs. It was therefore imperative that these policies identify funding sources for IR activities, particularly due to the rapid changing nature of IR systems and technologies. This notwithstanding, the IR policies of public universities clearly provide the needed guidelines and operational framework for the successful implementation and sustainability of IRs in Ghana.

The next section discusses the competencies expected of personnel assigned to work in the IRs in public universities in Ghana.

6.4 COMPETENCIES OF PERSONNEL ASSIGNED TO WORK ON INSTITUTIONAL REPOSITORIES IN PUBLIC UNIVERSITIES IN GHANA

Skills and competencies of IR professionals are critical to the successful implementation and sustainability any IR initiative. This is because the constantly evolving scientific communication and knowledge management landscape has brought about great changes in the services offered by repositories. This therefore calls for repository managers and administrators to acquire new skills and competencies that would enable them effectively and efficiently manage their repositories (Adam & Kaur 2021:1). This position is affirmed by Simons and Richardson (2012:3), who asserted that modern day repository management requires staff with specific skill sets and competencies different from the traditional skill sets excepted of the average librarian.

The conceptual framework for the study postulated that sustainability or continuous use behaviour will be achieved when the IR conceptualisation, intension, and promotional strategies of the various stakeholders are harmonised. However, it must be noted that the kind of promotional or advocacy strategies deployed by IR personnel depends largely on their competencies. The literature reviewed, questionnaires analysed, and librarians and IR managers interviewed concurred that there are critical skill sets and competencies required for planning and establishing an IR in an academic institution. These skill sets were broadly categorised into three groups, namely, managerial, technical, and communicative skill sets.

Data in Table 5.13 shows that communicative skills and competencies were the highest ranked (mean=3.92, SD=1.05) skill set respondents expected of IR professionals. This was in line with studies by Wickham (2010) and Cassella and Morando (2012) that identified communication as an important skill for repository staff. This means that respondents expect IR professionals to effectively communicate and promote IR to faculty, students, and other stakeholders;

communicate technical issues to management, IT staff, and team members; and activate help desk services to support IR management and self-archiving practices. It is also interesting to note that 91.1% (mean=3.96, SD=1.02) of the respondents expected IR professionals to be able to effectively liaise and communicate with institutional leadership (vice chancellors, provosts, deans, department heads, etc.). Through constant communication with top management, IR professionals would have the institutional support needed to ensure the sustainability of these repositories.

It is however worthy to note that technical skills were ranked as the second highest (mean=3.81, SD=1.09) skill set expected of an IR professional. It is particularly interesting, considering that IRs are technical systems that require some level of technical expertise to be effectively managed. According to Simons and Richardson (2012), technical knowledge and competencies are an essential skill set for repository managers and administrators. This is because they are expected to be proficient in operating repository systems (hardware and software) and be able to timely communicate technical challenges to management, team members and patrons. Knowledge in intellectual property rights issues in the digital environment, IR webpage customisation, and metadata standards (Dublin Core, MARC, METS, LOM, PREMIS), as well as the ability to analyse and solve problems related to repository software, were identified by respondents as the core technical skills expected of IR professionals. Hakopov (2016) opines that modern digital repositories are complex systems that combine expert classification systems and modern semantic technology to assist users in much broader ways. Similarly, Clobridge (2010) identified technical competencies as a vital skill needed for the successful execution of the roles and responsibilities of a digital repository programme coordinator. Even though an analysis of the interview transcripts shows that the majority of the libraries had IT support staff (system librarians), IR professionals are expected to be able to effectively diagnose and communicate technical challenges to IT support staff. Simons and Richardson (2012:12), in discussing why technical skills are vital for a repository manager, aptly make the point that “where IT support is overstretched, the repository team is likely to attempt to resolve the problem themselves”. Therefore, it is important that IR professionals have full understanding

of and control over the IR systems (hardware and software), as well as staying abreast with emerging IR technologies.

Data in Table 5.12 indicates that managerial or administrative competency was the lowest (mean=3.79, SD=1.06) ranked competency respondents expected of IR professionals. This can be attributed to the fact that the majority (88.6%) of the respondents were students and faculty members whose participation in IRs is based on the functionality and availability of the IR platform (Manchu & Vasudevan 2018; Dhanavandan & Tamizhchelvan 2013; Manjunatha 2011) and they might not necessarily know what happens backstage. Specifically, the coordination and management of human resources for teamwork, budget planning, and repository activity workflow were rated as moderately high competencies expected of IR professionals by 88.9% and 89.8% of the respondents respectively. However, it is interesting to observe that only 59.9% of the respondents indicated that an IR manager must have a moderately high competence (mean=3.89, SD=1.05) in planning and executing advocacy and awareness programmes. These results seem to suggest that even though respondents view advocacy and awareness programmes as important, they do not classify them as having the same importance as the ability to draft a budget or human resource management. However, it is important to emphasise that advocacy skills are as vital as all other skill sets, particularly in sub-Saharan Africa where resource constraints seem to be a headache for all managers. Repository managers must therefore possess the skill not only to draw up budgets, but also to make a compelling argument to justify the need for the items expressed in the budget, as well as elicit institutional support.

6.5 TECHNICAL SPECIFICATIONS OF INSTITUTIONAL REPOSITORIES IN GHANA

IRs, like all ICT projects, require a careful selection of computer hardware and software. The selection of hardware and software components is based on system specifications. These specifications provide a technical description of the complexity and trialability of the of the intended system. As identified in the conceptual framework and the reviewed literature, the ease of use or simplicity of an innovation

has been identified to have a positive impact on use intension and behaviour (Mndzebele 2013; Ntemana & Olatokun 2012; Murillo 2004; Rogers 2003). Therefore, through the establishment of user friendly repository systems, it is expected to have significant influence on use intention and behaviour of IRs by students and faculty members. The following subsections outline the hardware specifications and software used by existing IRs in Ghanaian public universities.

6.5.1 Hardware

Data in Table 5.15 shows that all IRs surveyed are using 9th generation servers with a processor speed ranging from 1.90 to 3.5GHz. Specifically, three of the repositories' servers were HP ProLiant Gen9 servers, while two were Dell PowerEdge Gen9 servers. These 9th generation servers use the Intel Core microarchitecture that is designed to optimise the performance, energy efficiency, and scalability of multi-core processors (HP 2016; Riwzan, Baris, Ramesh & Vishvesh 2006), thereby providing a cost-efficient solution for diverse repository workloads (HP 2016). These features offer libraries the opportunity to host other library systems and applications. Ninth generation servers also provide flexible choices for storage, networking, and power options that repository managers and administrators can capitalise on to cut down on costs and improve efficiency. According of Xani (2016), generation nine servers perform at three times the computing power per watt, which translates to up to 62% cost savings over the life of the server, including the initial acquisition cost.

An analysis of the interview transcripts revealed that the IRs run on local servers at a Network Operation Centre with backup servers in the library. By running repositories on local servers, libraries are able to have greater control and access over their repository infrastructure and are able to customise them as the repository grows. This finding was in line with studies by Smith and Bishoff (2015) and Younglove (2013) which revealed that the majority (72%) of repositories in the USA are hosted locally. However, a study by NdukweIfeanyi and Chukwudi (2013) found a strong preference for cloud-based services among libraries. This notwithstanding, it is clear that the current IR hardware infrastructure of public universities in Ghana is robust and has the capacity to expand when the need arises. Library management must

collaborate with central administration and the main IT department to ensure continuous investment into current IT systems in order to sustain the gains and ensure the longevity or sustainability of IRs in Ghana.

6.5.2 Software

Software forms a critical component of information systems and repositories are no exception. From Table 5.15, it is clear that Dspace is the only repository software used by public universities in Ghana. This is in line with studies by Komolafe-Opadeji and Ojo (2019), Chigwada (2018), Njoku and Ravichandran (2017), Ukachi (2017), Maua and Mwiti (2013), Karume and Mbugua (2012), and Namuye and Kamau (2012) which recommended that libraries and information centres adopt Open Access automation systems and software.

A probe on the reasons why public universities chose Dspace revealed cost, availability, community of support, and user friendliness as the major reasons. It is clear that cost was a major deciding factor for libraries in Ghana, considering the strict budget and financial conundrum that most libraries in Ghana are usually faced with.

Dspace has a robust organisational structure and dedicated online communities or user groups, allows open access to source codes, and is compatible with other systems. These features make it a more cost-effective option as compared to proprietary software. Also, since all the repositories are using Dspace, it will help in building local expertise which can be tapped into by new institutions looking to set up repositories in Ghana. This is particularly vital, as most libraries in Ghana lack the requisite IT personnel with the needed technical sophistication to install and maintain OSS (Kumar & Abraham n.d.; Upasani 2016; Chaudhari & Patel 2019).

The next section discusses the contents of IRs and the content submission procedures adopted by IRs in Ghana.

6.6 CONTENTS AND SET PROCEDURES FOR DEPOSITING CONTENT INTO INSTITUTIONAL REPOSITORIES IN GHANA

The conceptual framework for the study opined that the continuous usage of an IR can be ensured when stakeholders are aware of its tangible and intangible benefits. The continuous usage of an IR, as with any informational source, greatly depends on the quality of its contents. Gibbons (2004) posits that content quality and population is one of the best ways to ensure the long-term survival of IRs. Table 5.16 shows that research articles and theses and dissertations constituted 77.0% of the documents archived IRs in Ghana. This is clearly due to the fact that students and faculty members are the main producers of knowledge within public universities in Ghana. The knowledge produced through research activities carried out by faculty members and students is usually packaged as theses, dissertations, and research articles. This is not surprising, as the primary mandate of public universities in Ghana revolves around teaching, learning, research, and community services. This finding affirms views expressed by Abrizah (2009) that students and faculty members' contributions are vital to the successful deployment of IRs in academic institution, since they are the primary depositors of IRs in many academic institutions.

Data in Table 5.16 also shows that theses and dissertations were the most (46.7%, n=21,2935) archived document by public universities in Ghana. This finding is in agreement with the results of previous studies (Sale 2006; Pickton & McKnight 2006; Palmer et al. 2008) which posited that most of the contents of IRs are students' theses and dissertations. However, it was interesting to observed that 43.8% (n=19,971) of the items archived in IRs in Ghana were research articles. This can be attributed to the fact that most public universities are increasingly positioning themselves to be ranked by university ranking agencies and are thus putting in place internal research grants and award schemes. These grants and award schemes usually require awardees to publish in Open Access journals and either archive preprints or post-prints of the research publication in the university's repository. Interestingly, analysis of interview transcripts shows a general reluctance by faculty members to submit content to their university's IR. This is largely because most faculty members are unsure whether the author-publisher agreement or contracts

they signed with the publisher allow them to archive in the university's repository. Dutta and Paul (2014) and Abrizah (2009) posit that the unwillingness of faculty members to archive their published works in an IRs can largely be attributed to their fear of infringing on contractual agreements with publishers and a lack of adequate awareness about their own intellectual property rights. This calls for greater education and awareness creation on intellectual property rights and copyright restrictions by repository managers and administrators. Faculty members must be entreated to carefully read every sentence in the author-publisher licencing agreement before signing, as in most cases faculty members underestimate the kind of rights they are signing away to the publisher.

The results as shown in Table 5.17 show that the majority (81.3%) of the respondents preferred that their university's repository archive full-text theses and dissertations. This could be attributed to the fact that the majority (81.4%) of the study respondents, as shown in Table 5.1, were graduate students who were writing their thesis or dissertation. The thesis content of repositories therefore offered a valuable reference source for postgraduate students embarking on their thesis or dissertation, as it provides them with the opportunity to peruse what others have done and acts as a guide for their thesis research.

6.6.1 Submission procedures

To ensure the successful participation of all stakeholders in an IR project, there must be procedures for submitting content. These procedures must be user friendly and ensure that final archived documents are of the highest standards. This is very important, as repositories should showcase the institution's standards and help improve its visibility, recognition or rewards, prestige, and public value (Kim 2007:3). Figure 5.5 shows that mediated deposit is the most (84.0%) commonly used mode of content submission adopted by repository managers in public universities in Ghana. This means that depositors submit content to the IR team, who in turn archive the documents after going through procedures such as copyright restriction checks with Sherpa Romeo, PDF conversion, watermarking, and entering of metadata. The item is finally accepted for archive upon approval by the final archiver, who is usually the IR manager.

It is believed that these procedures ensure that only content that meets the highest standards are archived. This is because IR staff specialise in digital archiving and will ensure that the right documents are archived and that the institution does not become liable to being sued by publishers. However, the results show that 27.5% of faculty members (Table 5.5) and 43.4% of graduate students (Table 5.6) to a moderate extent found the submission procedures to be difficult and time consuming when contributing content. This therefore calls for an increase in education training on submission procedures in a repository environment. Also, IR managers must take a second look at the submission procedures (Ammarukleart 2017) and allow for remote submission or self-archiving. This would offer authors the opportunity to submit content irrespective of the time of the day or location. After all, the decision to have a document finally archived would still be the responsibility of the IR manager.

IRs, like all technological innovations, are confronted by challenges that threaten their sustainability. The next section discusses some of these challenges within the Ghanaian context.

6.7 CHALLENGES TO THE SUSTAINABILITY OF INSTITUTIONAL REPOSITORIES IN GHANA

Despite the numerous benefits of IRs to authors and their institutions, there are challenges that confront IR participation and threaten the long-term survival and sustainability of IRs in Ghana. These challenges are presented in Table 5.21 and shall be discussed under the following subheadings: funding, infrastructure, staffing, publisher copyright restrictions, lack of advocacy and awareness, and top management support.

6.7.1 Funding

The results in Table 5.21 indicate that 80.0% of the respondents agreed to a high extent (means=4.08, SD=1.18) that funding for the purchase of new equipment and IR promotional activities is a challenge to the sustainability of IRs in public universities in Ghana. This finding is in line with previous studies that suggested that

the cost of recurrent expenditure poses a significant challenge for most academic institutions (Joo et al. 2018; Prabhakar & Rani 2018; Dlamini & Snyman 2017; Li & Banach 2011) in Africa. This may be due to the fact that the institutions surveyed for the study are all publicly funded and therefore are affected by government subventions and other cash inflows. However, funding tertiary education has always been a challenge for the Government of Ghana. The payments of government subventions to tertiary institutions are mostly insufficient to adequately fund tertiary education and are often in arrears. The inadequate funding from the government has led many academic institutions to rely mainly on school fees and revenue from other economic activities to finance goods and services, capital expenditure, and compensation for employees not covered by the government (Adam 2021). This is a situation that has halted many IR projects, particularly those in their infancy. Therefore, to ensure the sustainability of IRs in public universities in Ghana, IR managers and administrators must seek external funding sources to ensure the smooth operation and management of their IRs. Adequate funding will also ensure that the significance of IRs as the most effective and efficient means for universities to offer digital information services to the global academic community resonates with all stakeholders.

6.7.2 Infrastructure

Data in Table 5.21 shows that 51.5% of the respondents agreed to a high extent (means=3.56, SD=1.25) that infrastructural challenges threaten the sustainability of IRs in Ghana. Specifically, 57.9% of the respondents stated that unreliable internet connectivity to a high extent (means=3.56, SD=1.25) hindered their access to and use of IRs. This is largely due to the high cost of internet data in Ghana. According to the Alliance for Affordable Internet (2014), the cost of internet data remains too high for the average Ghanaian. Even though Ghana was ranked as having one of the lowest internet data prices in Africa (Faria 2021; Sasu 2021), the cost for 1GB of data ranged between 0.66 and 3.47 US Dollars (USD) in 2021. This is exceedingly high for many Ghanaians, considering the minimum daily wage is 2.07 USD (Norden 2021), making internet access a luxury for many people. This finding is in line with previous studies conducted in Africa that also identified the high cost of internet connectivity and adequate bandwidth as major challenges for many individuals,

particularly students, and institutions on the continent (Bhardwaj & Banks 2019:166; Christian 2009) seeking to provide or have access to online educational resources. The high cost of internet bandwidth has resulted in many academic institutions in Ghana subscribing to very low bandwidth packages, resulting into very slow and frustrating attempts or experiences when accessing IRs.

Although most of the institutions surveyed had made significant investments into IT infrastructure by creating wireless internet access points on their campuses, 50.1% of the respondents stated that to a moderate extent (means=3.40, SD=1.14) inadequate ICT infrastructure hindered their access to and use of their institution's repository. This can be attributed to the fact that these wireless internet access points do not spread across the whole campus and students have to converge in a specific area, usually the library, to have a signal strength adequate enough to access content from the repository. This greatly affects usage, as IRs are supposed to be openly accessible irrespective of the time and place.

The poor quality of electricity supply was also identified by 46.4% of the respondents to have challenged their usage of IRs to a moderate extent. This finding was in line with studies by Oguche (2018), *Fasae et al. (2017), Siyao* et al. (2017), and Mohammed (2013), which identified unstable *power supply as a major challenge that confronts successful implementation and uses of IRs. However, it was observed that most of the libraries surveyed had procured standby generators as a backup to keep library systems running in case of power outages in order to ensure continuous access. However, this adds up to the* operational costs of IRs due to the additional expenditure for backup generators and fuel. This is makes repository management a very difficult and expensive venture and has the potential of bringing the IR project in Ghana to its knees, irrespective of tremendous gains.

6.7.3 Staffing

The results in Table 5.21 indicate that 65.1% of the respondents agreed to a high extent (means=3.85, SD=1.14) that the lack of technical staff for system development and management of IRs poses a great challenge to the sustainability of IRs in public universities in Ghana. This is line with findings by previous studies that

found that the technological expertise to effectively manage repositories or other IT systems is either non-existent in most academic libraries in Africa or inadequate (Dzandza 2019; Oguche 2018; Emezie & Ngozi 2013; Gbaje 2007; Fadehan & Ali 2010). This is a conundrum, as it seems that the library profession keeps evolving, but its professionals do not seem to be abreast with the needed skills and competencies to keep pace with changes within their own profession. These changes, which are spearheaded by technology, have brought about an ever-broadening array of innovative devices and applications that have become associated with libraries (Yu 2011). Therefore, there is a need for libraries to have staff with the necessary training, competencies, and skills to effectively and efficiently manage these systems.

Academic libraries in Ghana seem to be tackling this problem through the recruitment of system librarians. The idea behind the recruitment of system librarians is to have personnel with the requisite training and experience in librarianship and library systems to solve strong technical problems that confront the deployment of IT systems in libraries. The recruitment of such personnel has become critical, as many academic libraries in Ghana, apart from establishing IRs, are increasingly expanding the services they provide through the use of technology. Also, there is the need for library schools to integrate core IT courses, such as networking, database management, and internet and web-based resource management into the training and education of librarians, as these skills have been become an essential skill set for the 21st century librarian. However, it must be noted that such solutions would require adequate financial and personal investments, particularly for practicing librarians. It is therefore imperative that the management of academic libraries takes a holistic approach to solving this problem through policy and budget allocations.

6.7.4 Publisher copyright restrictions

Data in Table 5.21 shows that 48.5% of the respondents stated that to a moderate extent (means= 3.43, SD= 1.13) publisher restrictions had the potential of threatening the sustainability of their institution's repository. This finding is in agreement with previous studies that have revealed that although there is a general positive attitude towards OAIRs, many scholars seem uncomfortable when

contributing content to IRs (Prabhakar & Rani 2018; Peekhaus & Proferes 2015; Waller et al. 2013) due to the fear of infringing on contractual agreements with publishers (Dutta & Paul 2014; Abrizah 2009). This is due to the fact that most of these publisher-author copyright agreements seem to be at loggerheads with the idea of self-archiving (Heller et al. 2013) and authors in the quest to have their publications published sign these with little or no scrutiny and with little appreciation of their own intellectual property rights. This results in a huge setback for content generation and the sustainability of IRs. To combat this, repository managers and administrators need to provide guidance to authors on publishers' copyright restrictions and how to overcome them.

Repository managers and administrators have sought to overcome these restrictions by archiving preprints or galley proofs (Kim 2011b). However, although preprints may not have significant content variations when compared with the final published paper, they might have a considerable amount of grammatical or syntax errors. This invariably impacts negatively on the image and prestige of the repository.

An analysis of interview transcripts revealed that public universities had IR policies that explicitly show the chain of responsibilities, scope of the IR, submission procedures, metadata standards, and content generation. However, 45.6% of the respondents stated that the lack of explicit policy to a moderate extent (means=3.16, SD=1.21) hindered the usage and submission of content to their university's IR. This is because the current IR policies place the burden of checking for copyright restrictions or seeking publisher permission to archive in the university's repository on authors. This makes potential authors reluctant to submit content to repositories. It is therefore important that repository managers and administrators take steps to increase awareness and education on submission procedures. This is particularly important, as the survey revealed that the IR team checks for copyright restrictions before archiving. The IR policies place this responsibility on the IR team and it forms an integral part of their work procedures as personnel clothed with the responsibility of archiving and disseminating the intellectual output of the university.

6.7.5 Lack of advocacy and awareness

The results in Table 5.21 indicate that 63.2% of the respondents agreed to a high extent (means= 3.57, SD= 1.25) that the lack of advocacy for and awareness about their university's IRs greatly influenced their participation. This is in agreement with studies by Yang and Li (2015), Dlamini and Snyman (2017), Okoroma (2018), Alemayehu (2010), and Manchu and Vasudevan (2018) that showed that despite its numerous benefits for authors who archived in repositories many authors, particularly faculty members, are either unaware of the benefits they stand to gain by contributing content to IRs or are not motivated enough to do so. This is largely due to the fact that even though the libraries surveyed are increasingly embarking formal and informal user promotional strategies such as workshops, flyers, personal visits to faculty, presentations at academic board meetings, and notifications through the university's e-mailing system, newsletters, and notice boards (Martin-Yeboah et al. 2018; Hayibor 2017; Thompson et al. 2016; Bossaller & Atiso 2015), these have not had the needed impact, especially among faculty members (Lambaria 2020; Okoroma 2018b; Ammarukleart 2017; Hall 2014).

This calls for repository managers and administrators to have comprehensive policies that strategically address marketing and promotion issues targeted at ensuring continuous awareness creation among the university community. Repository managers and administrators must also take a look at exploring the digital media space and making the contents of their IRs more discoverable by search engines, such as Google and Ask.com, through which more traffic would be directed to the IR website, thereby increasing awareness and patronage.

6.7.6 Top management support

Despite the numerous benefits IRs offer to authors, data in Table 5.21 shows that 44.7% of the respondents stated that to a moderate extent (means= 3.45, SD= 1.11) they are not motivated to share their research work through their university's IR. According to Abrizah (2009), there is a need for academic institutions to effect the cultural changes necessary to make IRs an integral part of the institution's scholarly communication practices or activities. But to effect such changes top management support is vital. The literature shows that while many faculty members may be aware

of the prominence of Open Access publishing, the majority still prefer traditional publishing practices (Peekhaus & Proferes 2015; Waller et al. 2013). This means that there is a need for top management to put in place policies, guidelines, and procedures that place the same or similar value on both open and closed access publications. According to Odell et al. (2016), faculty promotional requirements in most institutions appear to force faculty members to prioritise publishing with conventional publishing outlets rather than Open Access outlets.

Through support from top management, faculty members' scepticism about Open Access publishing due to the fear that it might negatively affect their chances for promotion and tenure may be alleviated. This will invariably help increase content submission to and usage of IRs. Also, through top management support, challenges associated with funding and personnel can be easily solved.

6.8 SUMMARY

This chapter provided in-depth explanation for the study findings as presented in Chapter Five and related the study findings to the findings of previous studies as outlined in Chapter Three. It appears the literature reviewed and findings from this study concur that there are certain factors that threaten the sustainability of IRs. The interpretations can be summarised as follows:

a) Stakeholders' views or perceptions of IRs
   - Knowledge and perceptions of IRs among stakeholders (students, faculty members, and IR personnel) in public universities in Ghana are positively high, however, there are differences across the stakeholder groups. This variation is largely because of the differences in IR knowledge.

b) Competencies of IR personnel
   - Communicative skill and competency was ranked as the skill set most respondents expected IR professionals to have. IR managers and administrators were expected to effectively communicate and promote IRs to faculty, students, and other stakeholders; communicate technical issues to

management, IT staff, and team members; and activate help desk services to support IR management and self-archiving practices.

- The technical skill set was the second-highest ranked skill set expected of an IR professional. This was particularly interesting, as IRs are technical systems that require some level of technical expertise to effectively manage. Repository managers and administrators were expected to be able to operate repository software, as well as communicate technical issues to management, team members, and clients; have knowledge of intellectual property rights issues in the digital environment, IR webpage customisation, and metadata standards (Dublin Core, MARC, METS, LOM, PREMIS); and be able to analyse and solve problems related to repository software.
- Managerial or administrative competency was the skill set that was least expected of IR professionals by the respondents. This can be attributed to the fact that the majority (88.6%) of the respondents were students and faculty members whose participation in IRs is based on the functionality and availability of the IR platform, and they might not necessarily know what happens backstage.

c) Hardware and software specifications of IRs

- IRs surveyed use 9th generation servers with processor speeds ranging from 1.90 to 3.5GHz. These are HP ProLiant Gen9 and Dell PowerEdge Gen9 servers. The repositories use 9th generation servers because they are cost-effective and provide flexible choices for storage, networking, and power options that repository managers and administrators can capitalise on to improve efficiency.
- Despite the current investments into state-of-the-art servers that have the capacity to run several library systems, library management must collaborate with central administration and the main IT department to ensure continuous investment into current IT systems in order to sustain the gains and ensure the longevity or sustainability of IRs in Ghana.
- Dspace is the only repository software used by public universities in Ghana. Cost, availability, community of support, and ease of use were the major reasons that informed the choice of Dspace.

- It is clear that cost was a major deciding factor for the choice of Dspace by libraries in Ghana, considering the strict budget and financial conundrum that most libraries in Ghana are usually faced with.

d) Contents and deposit procedures of IRs
    - Majority (77.0%) of the documents archived in IRs in Ghana were research articles, theses, and dissertations. This is largely because students and faculty members are the main producers of knowledge within public universities in Ghana.
    - Research articles were the most (49.9%, n=15215) archived document by public universities in Ghana. This finding was in agreement with previous studies that posited that most of the contents of IRs is made up of students' theses and dissertations.
    - Most public universities have put in place internal research grants and award schemes that reward students and faculty members who publish in Open Access journals and either archive preprints or post-prints of the research publication in the university's repository.
    - Respondents preferred that their university's repository archived full-text theses and dissertations. This could be attributed to the fact that the majority (81.4%) of the study respondents were graduate students who were writing their own thesis or dissertation.
    - Mediated deposit is the most commonly used mode of content submission adopted by repository managers in public universities in Ghana.
    - Depositors submit content to the IR team, who in turn archive the documents after going through procedures such as copyright restriction checks with Sherpa Romeo, PDF conversion, watermarking, and entering of metadata.
    - Items are finally accepted for archive upon approval by the final archiver, who is usually the IR manager.

e) Challenges to the sustainability of IRs in Ghana
    - There are challenges that confront IR participation and threaten its long-term survival and sustainability in Ghana. These challenges are:
        i. Inadequate funding.

ii. Inadequate ICT infrastructure.
iii. Bandwidth.
iv. Lack of technical staff for system development and management of IRs.
v. Publisher copyright restrictions.
vi. Lack of advocacy and awareness.

- IR managers and administrators need the support of top management in order reduce the effect of these challenges and ensure the sustainability of IRs in Ghana.

Based on the discussions and interpretations made in Chapter Six, Chapter Seven outlines the conclusions drawn out of the study findings and provides some recommendations that may contribute to ensuring the sustainability of IRs in public universities in Ghana.

CHAPTER SEVEN:
SUMMARY OF RESEARCH FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

7.1 INTRODUCTION

The purpose of this study was to research the factors that confront the sustainability of IRs in public universities in Ghana. The study covered areas such as stakeholders' views or perceptions of IRs, competencies of IR personnel, institutional policies and sustainability of IRs, hardware and software specifications of IRs, contents and deposit procedures of IRs, and factors that threaten IR participation. The research findings are presented in Chapter Five, with Chapter Six providing an interpretation and discussion of the findings. Bunton (2005) explained that a well written conclusion offers researchers the chance to demonstrate to their audience their appreciation of the problem under investigation. According to Sharpling (2012), many authors have expressed varied opinions on the best way to compose the conclusion of a thesis or dissertation. Nonetheless, there are some common considerations:

1. A summary of the main text or main points of the study.
2. A concluding statement.
3. The researcher's personal opinion on what has been discussed.
4. A statement about the limitations of the work.
5. The implications of the work for future research.

Assan (2006:2) asserts that "a conclusion must have a clear structure that is able to hold the attention of the examiner and provides a convincing sequence of the how the project is able to unequivocally and rigorously identify sound knowledge that can inform theory and or policy." In view of this, this chapter presents a summary of the research findings, conclusions, recommendations, and theoretical implications, as well as the study's contribution to the body of knowledge.

7.2 SUMMARY OF THE RESEARCH FINDINGS

The study aimed at investigating the managerial and technical issues that threaten the sustainability of IRs in public universities in Ghana in order to make recommendations that will help ensure the sustainability of IRs at these universities. A review of the literature showed that Ghanaian universities are increasingly adopting IRs as a medium for preserving and disseminating intellectual content (Corletey 2011; Thompson et al. 2016; Martin-Yeboah et al. 2018; Dzandza 2019; Kodua-Ntim & Fombad 2020). However, little is known about the technical and managerial issues, such as content quality, institutional policies, copyright, and personnel competencies, that confront the sustainability of these repositories.

The next subsections present a summary of the findings in accordance with the study objectives outlined in section 1.4.2.

7.2.1 Stakeholders' perceptions of institutional repositories

Students, faculty members, and IR personnel (Digitization and E-Resources Units) of public universities in Ghana had a high level of understanding and positive attitude towards the concept of IRs. They understood what an IRs is and its benefits for depositors and the university at large. However, there were differences in the conceptualisation of IRs across the stakeholder groups. This was large due differences in IR knowledge since IR knowledge was found to significantly shape IR perception. IR knowledge was capable of explaining about 38.0% (R^2=0.38) of the variations in IR perception.

Although faculty members' attitudes towards OAIRs were generally positive, 51.2% of faculty members surveyed did not consider OAIRs as prestigious and felt that it was difficult and time consuming to contribute content. This shows that although faculty members are aware of the personal and institutional benefits associated with IR contribution, faculty members are reluctant to submit work to their university's IR. This

An analysis of the interview transcripts revealed that authors had to physically visit the Digitization and E-Resources Unit or the graduate school of their university to submit content to the IR team. Although some of the IRs have instituted online submission platforms for theses and dissertations, the submission procedures are often cumbersome and students generally find it difficult to make submissions.

7.2.2 Role of institutional policies on the sustainability of institutional repositories in public universities in Ghana

Institutional IR policies and promotional polices guide the operation, management, and submission of content to IRs in public universities in Ghana. This means that there are existing rules and guidelines that ensure that individuals and the universities enjoy the benefits of their participation in the IR initiative. This shows that the policy drafters recognised the critical role of policy in the sustainability of IRs in Ghana. However, these policies are persuasive in nature, particularly in addressing content submission by faculty members.

Due to the passive nature of the IR submission policies, compliance among faculty members is very low. It is instructive to note that 53.6% of faculty members had never contributed any content to their institution's IR.

The literature reviewed and findings showed that although there is a general willingness of faculty members to archive content in an IR in the future, critical policy issues concerning matters such as copyright, tenure, and promotion affected faculty members' decision to contribute content to IRs.

The IR policies of public universities in Ghana have provisions that address the issue of copyright. However, these provisions place the burden on authors to seek copyright clearance from publishers before submitting content, thereby making the submission process cumbersome and tedious for faculty members and perhaps discouraging deposits.

Institutional IR policies of public universities in Ghana are silent on sources of funding. This coming from the backdrop of previous studies that have identified

funding (Anyaoku et al. 2019; Agyen-Gyasi et al. 2012; Uwa & Okoro 2009) as posing a significant threat to the sustainability of IRs. It is therefore imperative that these policies identify funding sources for IR activities, particularly due to the rapid changing nature of IR systems and technologies.

7.2.3 Competencies of personnel assigned to work on the institutional repositories in public universities in Ghana

Communicative skills and competencies are the most important skill set IR managers and administrators of public universities in Ghana are expected to possess. IR managers and administrators in Ghana are expected to be able to effectively communicate and promote IRs to faculty, students, and other stakeholders; communicate technical issues to management, IT staff, and team members; and activate help desk services to support IR management and self-archiving practices.

Repository managers and administrators in public universities in Ghana are expected to able to operate and solve repository software related challenges, as well as understand intellectual property rights issues in the digital environment, IR webpage customisation, and metadata standards (Dublin Core, MARC, METS, LOM, PREMIS). This is because it is important that IR managers and administrators have a full understanding of and control over the IR systems (hardware and software), while staying abreast of emerging IR technologies. Public universities' libraries have sought to address the lack of personnel with core IT skills by recruiting system librarians.

Repository managers and administrators of public universities in Ghana were expected to have the competencies to plan and execute advocacy and awareness programmes. This is particularly important, as budgetary and resource constraints have been identified as a great challenge for repository managers in Ghana.

7.2.4 Technical specifications of institutional repositories in Ghana

IR servers used by public universities in Ghana are 9th generation servers. These servers were designed to operate at optimum performance, energy efficiency, and scalability of multi-core processors.

IRs in public universities run on local servers located at a Network Operation Centre with backup servers in the library. By running repositories on local servers, libraries are able to have greater control and access over their repository infrastructure and are able to customise them as the repository grows.

Dspace is the only repository software used by public universities in Ghana. Dspace is the preferred software because of its cost, availability, community of support, and user friendliness. Dspace has a robust organisational structure and dedicated online communities or user groups, allows open access to source codes, and is compatible with other systems.

7.2.5 Contents and deposit procedures of institutional repositories in Ghana

The continuous usage of an IR greatly depends on the quality of its contents and content submission rates. Research articles, theses, and dissertations were the most commonly archived documents in university IRs in Ghana.

Students and faculty members are the main producers of knowledge within public universities in Ghana. The knowledge produced through research activities in public universities in Ghana are packaged and archived in IRs as theses, dissertations, and research articles.

This is not surprising, as the primary mandate of public universities in Ghana revolves around teaching, learning, research, and community services. This finding affirms views expressed by Abrizah (2009) that students and faculty members' contributions are critical to the success of an IR, as they form the primary depositors of IRs in many academic institutions.

Faculty members are reluctant to submit content to the university's repositories. This is largely because of the fear of infringing on contractual agreements with publishers and lack of adequate awareness about their own intellectual property rights.

7.2.5.1 Submission procedures

Mediated deposit is the most common mode of content submission used by repository managers at public universities in Ghana. Content is submitted to the IR team, who in turn check for copyright restrictions, covert the files into PDFs, watermark them, and enter metadata. Items are finally accepted for archive upon approval by the final archiver, usually the IR manager.

7.2.6 Challenges related to the management of institutional repositories in Ghana

IRs in Ghana are confronted by numerous challenges that threaten their long-term survival and sustainability. These challenges are funding, infrastructure, staffing, publisher copyright restrictions, lack of advocacy and awareness.

7.2.6.1 Funding

Although, there have been significant investments into repositories in Ghana, the lack of funding for recurrent expenditure, such as the purchase of new equipment and IR promotional activities, still remains a challenge for many public university repositories.

7.2.6.2 Infrastructure

The majority of the respondents agreed to a high extent that infrastructural challenges, such as the unavailability and cost of internet bandwidth, threaten the sustainability of IRs in Ghana. Most public universities in Ghana had made investments into creating wireless internet access points. However, the range of most of these access points are often limited to certain parts of the campus and where there is coverage, signal strength is often inadequate to download content from the repository. This greatly affects usage, as IRs are supposed to be openly accessible, irrespective of time and place. For those seeking to use personal internet bundles, the cost of internet data was a great challenge to their usage of repositories.

Most public university libraries had procured standby generators in case of power outages in order to keep the library systems running and ensure continuous access.

However, this adds up to the operational costs of IRs due to the additional expenditure for backup generators and fuel. This makes repository management a very difficult and expensive venture and has the potential of bringing the IR project in Ghana to its knees, irrespective of tremendous gains.

7.2.6.3 Staffing

The lack of technical staff for system development and management of IRs poses a great challenge to the sustainability of IRs in public universities in Ghana. Academic libraries in Ghana seem to be tackling this problem through the recruitment of system librarians. The idea behind the recruitment of system librarians is to have personnel with the requisite training and experience in librarianship and library systems to solve major technical IT problems that confront the deployment of IT systems in libraries.

7.2.6.4 Publisher copyright restrictions

Although knowledge of and attitudes towards IRs are generally positive, the fear of infringing on publisher copyright agreements is a huge setback for content generation and the sustainability of IRs in Ghana. Repository managers and administrators have sought to overcome these copyright restrictions by archiving preprints or galley proofs. However, even though preprints may not have significant content variations when compared with the final published paper, they might have a considerable amount of grammatical or syntax errors. This invariably impacts negatively on the image and prestige of the repository.

7.2.6.5 Lack of advocacy and awareness

The majority (63.2%) of the respondents agreed to a high extent that the lack of advocacy for and awareness about their university's IRs greatly influenced their participation. Although the libraries surveyed are increasingly embarking on formal and informal user promotional strategies, such as workshops, flyers, personal visits to faculty, presentations at academic board meetings, and notifications through the university's e-mailing system, newsletters, and notice boards, these have not had the needed impact, especially among faculty members.

The next section highlights the conclusions drawn based on the research objectives.

7.3 CONCLUSIONS BASED ON THE RESEARCH OBJECTIVES

The conclusions drawn from the study findings will be discussed in this section.

7.3.1 Stakeholders' perceptions of institutional repositories

The study showed a generally high conceptualisation of IRs across all the stakeholder groups (IR personnel, faculty members, and students). The high perception levels can be attributed to the fact the concept of IRs is not new in Ghana. This was determined by the several studies (Dzandza 2020; Kodua-Ntim & Fombad 2020; Martin-Yeboah et al. 2018; Kumah et al. 2018; Malekani & Kavishe 2018; Thompson et al. 2016; Corletey 2011) conducted on the subject in Ghana.

Secondly, the knowledge of and positive attitude towards IRs can also be attributed to the numerous benefits (i.e., prestige, wider readership, increased acceptance of OA, etc.) IRs bring to depositors and the institution as a whole. The university libraries surveyed for this study provided both electronic and traditional services. The increase in knowledge of and positive attitudes towards IRs can largely be attributed to the increased adoption of ICT system for service delivery and marketing and promotion by the libraries surveyed for the study. However, there were differences in the conceptualisation of IRs across the stakeholder groups. This variation in perception and knowledge levels can be attributed largely to the differences in IR knowledge across the stakeholder groups as IR knowledge accounted for about 38.0% of the variations in IR perception. Although, the high perception levels hold prospects for the sustainability of IRs in Ghana. There is the need for IR manager and administrators to increase education on IRs as this would significantly improve perception and general acceptance of IRs as a reliable archival platform.

7.3.2 Role of institutional policies on the sustainability of institutional repositories in public universities in Ghana

Institutional repository policies in addresses copyright right infringement concerns of depositors or authors. However, these IR policies place the burden of proof on

authors to seek copyright clearance from publishers, when necessary, before submitting content. However, these checks are also done by the IR team before final archive. This, therefore, requires an increase in assurances and education by IR team members aimed at eliciting the confidence of authors who might be reluctant to deposit content due to copyright restrictions. It is therefore safe to conclude that IR policies of public universities in Ghana provide the needed guidelines and operational framework for the successful implementation and sustainability of IRs in Ghana.

7.3.3 Competencies of expected of personnel assigned to work on the IRs in public universities in Ghana

Communicative skills and competencies was the most ranked skill set respondents expected of IR professionals. This largely due to the fact that IRs in all the universities surveyed are managed by the library and since libraries are service oriented institution it was natural that respondents expected these skills set from IR personnel. However, the fact that respondents expected IR managers and administrators to continuously promote IRs and offer client support services meant that respondents are either unaware or do not receive such services from the IR team. This therefore to ensure the sustainability of IRs in Ghana there is the need for more stakeholder engagements and education.

Technical competencies was the second ranked competencies respondents expected of IR personnel. This was particularly interesting considering the fact that IRs are technical systems that required some level of IT skills to operate and manage. However, it was worthy to note that 90.2% of respondents expected IR be knowledgeable in intellectual property rights issues in the digital environment. Considering that fact intellectual right issues falls mainly in the domain of librarians and IRs in public universities in Ghana are managed by the library. It therefore important the IR personnel leverage on their competencies in intellectual property issues to endanger confidence and trust of all stakeholders, particularly those who are those of have challenges archiving in IRs because of intellectual property right issues.

7.3.4 Technical specifications of IRs

IRs of public universities are run on 9th generation servers with a processor speed ranging from 1.90 to 3.5GHz. These 9th generation servers are designed to operate at optimise the performance and energy efficiency. These servers have features offer libraries the opportunity to host other library systems and applications and increase storage space when the need arise. All the servers of the IRs surveyed are hosted local at Network Operation Centre with a backup server located in the library. This provides IR managers and administrators the opportunity to have greater control and access over their repository infrastructure and are able to customise them as the repository grows. It is therefore safe to conclude that the IR infrastructure of public universities in Ghana is robust and has the capacity to expand when the need arises. However, there is a need for continuous investment into current IR infrastructure in order to sustain the gains and ensure the longevity or sustainability of IRs in Ghana.

7.3.5 Contents and deposit procedures of IRs

mediated deposit is the most (84.0%) commonly used mode of content submission adopted by repository managers in public universities in Ghana. However, some faculty members and graduate students found the submission procedures to be difficult and time consuming. There is a need to increase education and training on submission processes and procedures.

7.3.6 Challenges related to the management of IRs and their sustainability

The day-to-day running and usage of IRs in public universities in Ghana are faced with some challenges. Prominent among these challenges are Inadequate funding, the cost of internet bandwidth, unreliable of internet connectivity, publisher copyright restrictions, and lack of technical staff for system development and management of IRs.

7.4 RECOMMENDATIONS

Based on the findings of the study, the following recommendations are made for consideration by various stakeholders of IRs in Ghana:

1. The study underscores the importance of policy in ensuring sustainable IR projects in Ghana, as it provides a valuable framework within which an IR operates. Although public universities in Ghana had IR policies, they did not have a policy implementation strategy. Therefore, IR managers and administrators must make efforts towards the drafting of an IR policy implementation strategy.
2. The majority of study participants revealed that advocacy and awareness about their university's IR was low and that this negatively influenced their participation. It is therefore recommended that repository managers and administrators implement a comprehensive strategy aimed at addressing marketing and promotion issues to ensure continuous awareness creation among the university community.
3. The study revealed that IR personnel, managers and administrators of public universities in Ghana were all librarians with some level of basic IT skills. However, the fact that IRs are technical systems that required some high level technical skills and competencies in troubleshooting, customisation and integration with other systems and software requires that public universities libraries to recruit system librarians to augment their workforce. These must be persons with requisite qualifications and practical experience to operate IT systems within the library environment.

4. The results of the study showed that 84.5% of faculty members and 75.3% of students indicated that they preferred archiving with academic networking sites that in institutional repositories. The growing popularity of professional social networking sites such as Academia, LinkedIn, Mendeley, and ResearchGate among academics, researchers, and scholars offers a great challenge to repository management. It is therefore recommended that IR managers and administrators must also look at the possibility of giving depositors periodic

bibliometric updates on their deposits (i.e., number of downloads, citations, etc.). This has become even more important, as researcher are increasingly interested in knowing the impact of their publications.

5. The success of any IR project depends largely on the quality of its contents and willingness of potential depositors to voluntarily deposit their works. However, the study findings showed that some respondents found the submission procedures to be cumbersome and a waste of time. Considering the fact that all the repositories were practicing mediated content deposits where submission is done on behalf of authors, it was surprising that the respondents found the submission process cumbersome. It is therefore recommended that IR teams increase education and awareness on submission processes within the repository environment, as well as taking a critical look at the possibility of shortening and simplifying submission processes without compromising on quality or due diligence.
6. An analysis of the IR policies showed that content *s*ubmission is generally voluntary, particularly for faculty members. This contributed to the low submission rate among faculty members. It is therefore recommended that the appointment and promotion board must make proof of submission of content to the university's IR a part of the appointment and promotion requirement for faculty members.
7. Funding for the purchase of new equipment and the cost of recurrent expenditure is still a challenge for IR management. This is a situation that has halted many IR projects, particularly those in their infancy. Therefore, to ensure the sustainability of IRs in public universities in Ghana, IR managers and administrators must seek external funding sources to ensure the smooth operation and management of their IRs.
8. Although knowledge of and attitudes towards IRs are generally positively high, the fear of infringing on publisher copyright agreements is a huge setback for content generation and the sustainability of IRs in Ghana. This calls for repository managers and administrators to provide guidance to authors on publishers' copyright restrictions and how to overcome them.

In light of the above recommendations, the next section proposes a framework that identifies certain factors that may contribute to ensuring the sustainability of the IRs in public universities in Ghana.

7.5 PROPOSED FRAMEWORK FOR THE SUSTAINABILITY OF INSTITUTIONAL REPOSITORIES IN PUBLIC UNIVERSITIES IN GHANA

A conceptual framework is basically a structured system of ideas that a researcher believes can best provide a comprehensive understanding of a phenomenon under study (Jabareen 2009; Camp 2001). According to Rogers (2012), a conceptual framework is an essential tool for research, because it allows the researcher to examine the sensitive experiences of the respondents related to the phenomenon being studied. In view of this, the conceptual framework was used to document the perspectives of various researchers on the factors that threaten the sustainability of IRs. Specifically, the conceptual framework served as a lens through which to examine stakeholders' perceptions of IRs in the quest to offer some remedies for the managerial and technical challenges confronting IRs in public universities in Ghana.

7.5.1 Proposed Framework

The conceptual framework is born out of the reviewed literature as reported in Chapter Three and the findings of this study as presented in Chapter Five and interpreted in Chapter Six. In order to conceptualise what IRs are, the study provided a working definition for IRs that defined them as online archives that showcase scholarly and intellectual outputs of members of an institution, with the aim of promoting institutional image and prestige through continuous usage.

The findings of this study revealed that knowledge of and attitudes towards IRs in public universities in Ghana were positively high. The literature showed that the concept of IRs is not new in Ghana (Dzandza 2020; Kodua-Ntim & Fombad 2020; Martin-Yeboah et al. 2018; Kumah et al. 2018; Malekani & Kavishe 2018; Thompson et al. 2016; Corletey 2011). The popularity of IRs in Ghana is largely attributed to the numerous benefits they bring to depositors and the institution as a whole (Lambaria 2020; Prabhakar & Rani 2018; Wu 2015; Bolu 2012; Jones 2007; Chan 2004;

Yeates 2003; Crow 2002). However, there are numerous challenges that threaten the sustainability of IRs (Anyaoku et al. 2019; Bhardwaj & Banks 2019; Prabhakar & Rani 2018; Okoroma 2018b; Oguche 2018; Dawson & Yang 2016). The research problem outlined in Chapter One highlighted the need to examine the issues that threaten the longevity of IRs in public universities in Ghana.

Also, the objectives of the study outlined key factors that may help to ensure the continuous usage of IRs. These factors were: IR conceptualisation, promotional strategies, and usage behaviour. The study employed the Dynamics of IR Innovation Model and DOI Theory to explain how IRs in Ghana can be sustainable. Furthermore, the study developed a conceptual framework that was adapted, validated and modified to fit the study. The proposed model attempts to establish the link between the research problem and the proposed solutions for this particular study, with the aim of ensuring the sustainability of IRs in Ghana.

7.5.2 Justification for the framework

Based on the findings presented in Chapter Five and the literature review in Chapter Three, the study established the following:

- Knowledge and understanding of the concept and benefit of IRs is high.
- Some faculty members did not consider OAIRs to be prestigious and found it difficult and time consuming to contribute content.
- Institutional IR policies are persuasive in nature and do not mandate content submission by faculty members.
- The content submission rate is low among faculty members.
- Policy issues such as copyright, tenure, and promotion affected faculty members' decision to contribute content to IRs.
- Institutional IR policies of public universities in Ghana are silent on sources of funding.
- The lack of technical staff for system development and management of the IRs poses a great challenge to the sustainability of IRs in public universities in Ghana. Academic libraries in Ghana seem to be tackling this problem through the recruitment of system librarians.

- Inadequate funding, IT infrastructure, and bandwidth; the cost of internet data; staffing issues; copyright restrictions; and lack of awareness are major challenges that threaten the sustainability of the IRs in public universities in Ghana.

Although the benefits of IRs for individual authors and institutions are well known, there are very few authors willingly archiving their research outputs in repositories (Tillman 2017; Chan 2004; Foster & Gibbons 2005; Pelizzari 2005; Davis & Connolly 2007). There are numerous challenges that prevent many people from either contributing content to or accessing the existing contents of IRs (Li & Banach 2011; Okoroma 2018a; Anyaoku et al. 2019). Based on what was described in the literature and the findings of this study, taking steps to address these challenges could lead to increased participation by all stakeholders and ensure the sustainability of IRs in Ghana.

The concepts expressed in the proposed conceptual framework were derived from the reviewed literature and objectives of the study. It is believed that a cautious examination of each concept could help in ensuring the sustainability of IRs. Nonetheless, it should be noticed that these concepts are not exhaustive and therefore further research could reveal additional concepts that may help ensure the sustainability of IRs in public universities in Ghana. This framework was developed taking into account the perspective of various researchers and the findings of this study. It is therefore recommended as a guide and not as a set of instructions on how to ensure the sustainability of IRs. A detailed explanation of the framework is provided in Chapter Two. In view of this, the next subsection provides a summarised explanation.

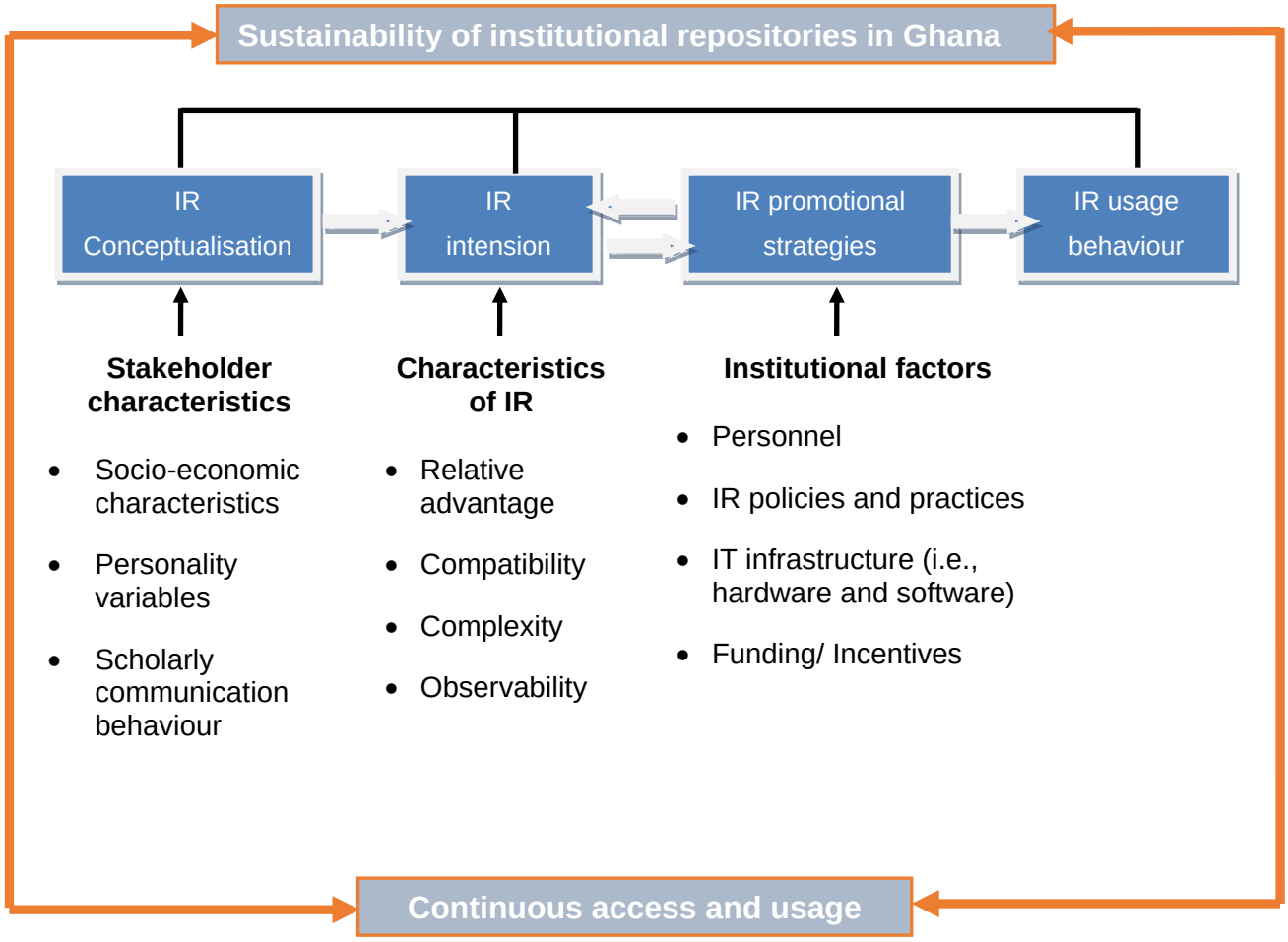

Figure 7.1: Framework for the sustainability of IRs

7.5.3 Explanation of the framework

The concepts expressed in the proposed conceptual framework were derived from the reviewed literature and objectives of the study. This framework attempted to show a connection between the factors that could lead to ensuring the sustainability of IRs. The explanations provided are based on information gathered from the literature review and the findings of the study.

The framework postulated that stakeholders' IR usage behaviour is influenced by their IR concepts and use intentions. Also, IR use intentions may subsequently be influenced by IR promotional strategies and the characteristics of the IR. Furthermore, it is postulated that sustainability or continuous use behaviour will be achieved when the IR conceptualisation, intension, and promotional strategies of the various stakeholders are harmonised. The proposed framework also postulates that

stakeholder conceptualisation of the IR is influenced by stakeholder characteristics such as socio-economic characteristics (i.e., academic status and social influence), personality variables (i.e., age, gender, and IT competencies), and scholarly communication behaviour. Furthermore, IR characteristics such as relative advantage, compatibility, complexity, and observability influence stakeholders' IR intensions. Lastly, IR promotional strategies are influenced by institutional factors such personnel, IR policies and practices, IT infrastructure (i.e., hardware and software), and funding/incentives. The following subsections provide a detailed justification for the selected constructs.

7.5.3.1 Relative advantage

According to Rogers (2003), an innovation that presents its users with superior benefits as compared to its predecessors is more likely to be adopted and implemented. Current empirical evidence shows that relative advantage significantly impacts use intension and behaviour (Kapoor et al. 2013; Scott et al. 2008; Hsu et al. 2007; Greenhalgh et al. 2004). Thus, the sustainability of an IR is assured when depositors and users find it more advantageous as compared to archiving or publishing platforms.

7.5.3.2 Compatibility

IRs cannot operate in isolation. They must be consistent with the predetermined values, experiences, and aspirations of potential adopters (Rogers 2003). That is, procedures for archiving and using the contents of IRs must be consistent with existing institutional scholarly communication procedures and practices. Thus, IRs will receive the necessary funding, personnel, and university commitment when they are consistent with existing norms of digital communication, storage, and preservation practices.

7.5.3.3 Complexity

The ease of use or simplicity of an innovation has been identified to have a positive impact on use intension and behaviour (Mndzebele 2013; Ntemana & Olatokun 2012; Murillo 2004; Rogers 2003). The positive impact of ease of use on the adoption and use of IT systems makes it imperative for IR administrators and

university authorities to deploy easy to use IR systems and submission procedures in order to enhance the adoption and usage of IRs by all stakeholders.

7.5.3.4 Observability

IRs must present existing users and potential adopters with visible, tangible, and intangible benefits. According to Ibrahim et al. (*2015), observability* is a very important construct to the adoption of an innovation, since it focuses on the benefits of an innovation as experienced by others. Thus, the sustainability of IRs is assured when students, librarians, faculty, and policy makers perceive IRs to have a positive impact on organisational image, prestige, and scholarship.

7.5.3.5 Socio-economic characteristics and personality variables

The impact of socio-economic and personality variables on perception of and attitude towards the adoption of IT innovations has been studied extensively across many disciplines (Sikundla et al. 2018; Sánchez-Torres et al. 2017; Aizstrauta et al. 2015; Tambotoh et al. 2015; Albert & Jonhson 2011). The findings of this study showed that knowledge and perceptions of IRs among stakeholders (students, faculty members, and IR personnel) in public universities in Ghana are positively high, however, there are differences across the stakeholder groups. This variation is largely because of the differences IR knowledge and personality variables, such as age, gender, academic level and subject area. This calls for IR managers and administrators to design promotional campaigns and strategies targeting specific stakeholder groups.

7.5.3.6 Scholarly communication behaviour

Scholarly communication is a critical component of the research process and therefore a key variable in analysing how researchers perceive or conceptualise a particular scholarly communication outlet or channel. Numerous studies have examined the impact of students and faculty members' scholarly communication practices on their perception or conceptualisation of OAIRs (Shukla & Ahmad 2018; Gunasekera 2017; Oguz & Assefa 2014). It is clear that faculty members' and students' conceptualisation of IT innovation is influenced by their communication behaviour and practices. Therefore, it is important that IR managers and

administrators identify and examine the scholarly communication behaviour and practices of their stakeholders in order to put in place interventions that will ensure the continuous patronage of IR products and services.

7.5.3.7 Promotional strategies

Promotional strategies are essential in ensuring that prospective users are aware of the existence of an innovation. This allows prospective users to know about the benefits of an innovation. The main aim of any promotional strategy is getting the word out about an innovation using an array of methods (Martin-Yeboah et al. 2018). According to Yang and Li (2015), the success of any IR innovation depends on its popularity across all stakeholder groups. This clearly depends upon the nature of the promotional strategies embarked upon by librarians and promoters of IRs. Promotional strategies consist of a series of activities, messages, and communication channels aimed at informing, reminding, and persuading prospective users (Akporhonor & Olise 2015; Holtzhausen 2010). However, IR promotional strategies are influenced by institutional factors such as personnel, institutional policies, IT infrastructure, and funding.

7.5.3.8 IR usage behaviour

The continuous usage of IR depends largely on user satisfaction. According to Jennex and Olfman (2006) user satisfaction is a key indicator for measuring the success of an IT innovation. Masrek et al (2010) posited that user contentment of the extent to which the benefits they anticipate to receive from using an IR has been fulfilled is a critical measure of their satisfaction with the system. Similarly, Dwivedi, Kapoor, Williams and Williams (2013) asserted that the most significant measures for assessing user satisfaction are the net benefits of the system and the desire of patrons to reuse the system in future. Therefore, the continuous use and sustainability of IRs is also dependent on user satisfaction.

7.6 THEORETICAL IMPLICATIONS AND CONTRIBUTION TO KNOWLEDGE

The findings of the study highlighted the role of theory in ensuring the sustainability of IRs. The study was guided by a conceptual framework which was underpinned by the Institutional Theory, Stakeholder Theory, DOI Theory, and the Dynamics of IR Innovation Model. According to Lester (2005), research findings are said to be relevant when they are used to modify, support, or build on existing theoretical assumptions. The successful implementation of IRs in the selected public universities in Ghana can be attributed to the participation of all the principal actors (library staff, faculty members, and students) and the existence of guidelines or rules that facilitate participation, which is in line with both the Stakeholder Theory and Institutional Theory. The Stakeholder Theory seeks to identify the principal actors and their relationship with a project and incorporate their views into creating a sustainable project (Lin 2018; Freeman et al. 2018; Phillips 2003).

The findings thus support the Stakeholder Theory, which requires that organisations should create the needed environment to ensure the full participation of stakeholders. It is therefore expected that public universities in Ghana and other tertiary and research institutions seeking to set up IRs identify and address the concerns of all stakeholders to ensure full participation.

From the findings it is clear that the enactment of IR policy is an important factor critical to the survival of IRs in public universities in Ghana. The IR policies of the selected public universities address content deposits and copyright concerns, and place the library as the focal point of all repository activities. Ultimately, these policies have helped govern the operation and management of these repositories. The theoretical implication, which is in line with the Institutional Theory, is that pre-existing rules, beliefs, and environmental factors such as regulatory, legal, and policy frameworks influence IR participation (Currie 2011; Lawrence et al. 2002; Scott 2004). This explains the continued existence of these repositories despite numerous challenges.

Perception was also identified as a key factor in the successful implementation of an IR project. It was found that the perception of the value and benefits of IRs was generally positive, even though there were some variations across the stakeholder groups (library staff, faculty members, and students). The variation in perceptions provides the platform for duty bearers to design policies and programmes to harmonise these perceptions to create an enduring value for their individual IRs. This is in line with principles enshrined in the SST and DOI theories. According to these theories, the 'success or adoption' or 'failure' of an innovation (such as IRs) depends how the innovation is communicated and how the relevant social groups perceive it (Mackenzie & Wajcman 1985; Pinch & Bijker 1984; Maull et al. n.d.). Thus, continued stakeholder engagement will ensure that IRs meet the needs and aspirations of all the various stakeholder groups.

Besides the findings, a major contribution of the study is the development of a framework for the participation and management of IRs within the Ghanaian context (see Figure 7.1). The framework is based on theories and frameworks expressed in previous studies. The new model emerged from efforts to establish a connection between the Dynamics of IR Innovation Model and DOI Theory. The model established a connection between stakeholders' perceptions and their usage of IRs. The model also established a relationship between IR usage behaviour and stakeholders' IR perceptions and use intentions. IR use intentions are subsequently influenced by IR promotional strategies and the characteristics of the IR.

7.7 AREAS FOR FURTHER RESEARCH

Previous studies (Dzandza 2020; Kodua-Ntim & Fombad 2020; Anyaoku et al. 2019; Martin-Yeboah et al. 2018; Kumah et al. 2018; Thompson et al. 2016; Bossaller & Atiso 2015) reviewed for this study showed that numerous challenges threaten the sustainability of IRs in Ghana. Recommendations offered mostly targeted repository managers and administrators. The study proposed a framework in Section 7.5.1 that could help public university libraries in Ghana to curtail, if not eliminate, some of these threats.

The study highlights the need to harmonise stakeholder conceptualisation, promotional strategies, and usage intentions and behaviour in order to ensure the sustainability of IRs in Ghana. However, like other research models, this model is not exhaustive as the current study could not study everything due to time and resource constraints. Therefore, the study recommends the following areas for further research:

1. The study focused only on internal stakeholders of IRs. However, considering the fact that IRs are open to members outside the hosting institution, it is recommended that further studies should focus on external users of IRs. This could help paint a holistic picture of the factors that threaten the sustainability of IRs in Ghana.
2. The study revealed that some respondents found IRs less prestigious than academic social networking platforms. However, the study did not examine the features of academic social networking platforms that made them more alluring to some respondents. It is therefore recommended that further research could be conducted on how IRs could offer services that are similar to or improved versions of those offered by academic social networking platforms in order to make them more attractive.
3. The study examined IRs in public universities in Ghana. However, considering the fact that repositories are gaining popularity in Ghana, it is recommended that further studies focus on the feasibility of the establishment of a national repository in Ghana. This is because IRs are a viable platform for preserving institutional research outputs, heritage, and rare collections that would enable the country to reap the advantages that these collections offer in terms of prestige, visibility, and intellectual development.

7.8 FINAL CONCLUSION

This study investigated the state of IRs in public universities in Ghana with the aim of addressing the challenges that threaten the sustainability of IRs in Ghana. The study established that the concept of IRs is not new to the stakeholders of IRs in public universities in Ghana. However, there are certain factors that prevent the effective

participation of all stakeholders in the IR project. This conclusion was arrived at after an analysis of the research findings, which revealed the following:

- There is a generally high understanding and perception of the concept of IRs across all the stakeholder groups.
- There are IR policies that govern the management, operation, and usage of IRs.
- Institutional policies on the submission of content to IRs in Ghana are passive or non-mandatory. Institution repository policies in Ghana place the burden of proof on authors to seek copyright clearance from publishers, when necessary, before submitting content.
- IR managers and administrators are expected to continuously promote IRs to all stakeholders, offer client support services, and communicate technical issues to management, IT staff, and team members.
- The current IR hardware infrastructure can be expanded to meet future usage and storage demands. However, due to the evolving nature of technology, there is the need for continuous investment into current IR infrastructure in order to sustain the gains and ensure the longevity of IRs in Ghana.
- Dspace is the most common IR software used by public universities in Ghana. This increasingly builds local expertise on the installation, customisation, and management of Dspace in Ghana.
- Inadequate funding, inadequate or unavailability of internet, publisher copyright restrictions, and a lack of technical staff for system development and management of IRs are the major challenges that threaten the sustainability of IRs in Ghana.

From the findings of the study which is largely supported by the reviewed literature, it safe to conclude that IRs in public universities in Ghana are sustainable. This conclusion is born mainly out of the fact that IR hardware and software used by public universities in Ghana have the capacity for future expansion. Dspace, which the only IR software used by Ghanaian public universities is open source and therefore undergoing constants upgrades to meet current and future needs. These coupled with the positive attitudes towards IRs really hold prospects for the future of

IRs in Ghana. However, despite the increase in the adoption and knowledge of IRs, as well as positive attitudes towards IRs, there are some challenges that confronts IRs in Ghana. For this reason, the study made recommendations and suggested areas of further research that might help improve participation and mitigate against some of these challenges. Public universities must realise that as public research and teaching institutions they are expected to communicate research findings to the wider society. IRs therefore present public universities with the opportunity to contribute effectively to the scholarly communication process, especially in this current information and knowledge economy where public access to quality information has been identified to be critical to the promotion of peace, prosperity, and human freedoms.

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APPENDICES

Appendix A

UNIVERSITY OF SOUTH AFRICA
COLLEGE OF HUMAN SCIENCES
DEPARTMENT OF INFORMATION STUDIES

QUESTIONNAIRE FOR FACULTY MEMBERS AND STUDENTS

Dear Respondent,

I am Osman Imoro, a PhD candidate at the Department of Information Science of the University of South Africa (UNISA). This instrument is being administered to selected respondents to gather their views on the research topic "Sustainability of Institutional Repositories in selected public universities in Ghana" as part of the fulfillment of the requirement for the award of a PhD.

I would be very grateful if you could spend part of your valuable time to respond to all the questions provided in as much detailed as required. Completing this questionnaire should take 30-40 minutes of your time. Your participation will make a valued contribution towards this study and recommendations on ensuring the sustainability of Institutional Repositories in Ghana. The responses you give will be used for academic purpose only and would be treated with strict adherence to the UNISA Research Ethics Policy. You are welcome to view the policy at: https://www.unisa.ac.za/static/corporate_web/Content/Colleges/CLAW/Research/Docs/Policy%20on%20Research%20Ethics%20-%20rev%20appr%20-%20Council%20-%2015.09.2016.pdf

Please do not hesitate to contact me on 0209165724 if you need clarification on any of the questions.

Consent: I have read and understood the above information, and I willingly consent to participate in this study. I understand that as a study participant I am free to withdraw at any time without giving reasons.

…… ……
Signature Date

Many thanks for your participation.

Section A: Demographic Information

Please tick as appropriate as possible.

Q1	**Please indicate your gender group.**				
1.	Male				
2.	Female				
Q2	**Please indicate your institutional affiliation.**				
1.	University of Ghana				
2.	Kwame Nkrumah University of Science and Technology				
3.	University of Cape Coast				
4.	University of Education, Winneba				
5.	University for Development Studies				
Q3	**Category of Respondent**				
	Faculty ☐ member		Student ☐		
Q4	**Rank**		**Study Level**		
1.	Professor		1.	Master of Arts (MA)	
2.	Associate Professor		2.	Master of Philosophy (MPHIL)	
3.	Senior Lecturer		3.	Doctor of Philosophy (PhD)	
4.	Lecturer		4	Other specify	
5.	Assistant Lecturer				
Q5	**Please indicate your age group**		**Please indicate your age group**		
1.	21 – 30 years		1.	21 – 30 years	
2.	31 – 40 years		2.	31 – 40 years	
3.	41 – 50 years		3.	41 – 50 years	
4.	51 – 60 years		4.	51 – 60 years	
5.	61 years and above		5.	61 years and above	
Q6	**Please indicate your subject area**		**Please indicate your subject area**		
1.	Agricultural Sciences		1.	Agricultural Sciences	
2.	Arts		2.	Arts	
3.	Business		3.	Business	
4.	Humanities		4.	Humanities	
5.	Legal studies		5.	Legal studies	

6.	Medical Sciences		6.	Medical Sciences	
7.	Natural Sciences (Physics, Chemistry, Biology, etc.)		7.	Natural Sciences (Physics, Chemistry, Biology, etc.)	
8.	Others specify		8.	Others specify	
Q7	**Please indicate the number of years you have served at your institution.**				
1.	1 – 5 years				
2.	6 – 10 years				
3.	11 – 15 years				
4.	16 – 20 years				
5.	Over 21 years				

Section B: Perception of Institutional Repositories (IR)

*Based on a five-point pre-coded scale described as: **1**= Strongly Disagree, **2**= Disagree, **3**= Moderately Agree, **4**= Agree, **5**=Strongly Disagree. Please tick the category of the column that best describes you're the following statements.*

Based on the five point Likert scale described above, please indicate your understanding of what an Institutional Repository is?		**1 SDA**	**2 A**	**3 MA**	**4 A**	**5 SA**
Q8	Institutionally defined (contains intellectual outputs produce by members of particular institution)					
Q9	Contain scholarly materials					
Q10	unrestricted worldwide access					
Q11	Online electronic archive					
Q12	Perpetual (permanent)					
Q13	Web based (cannot be accessible without internet)					
Q14	Easily Accessible					
Q15	Interoperability (able to exchange and make use of information with other computer systems)					

What do you think are some of the characteristics of open access Institutional Repositories?

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……

……

Based on the five-point Likert scale described above, how do the following statement reflect your perception of institutional Repositories.		**1 SDA**	**2 A**	**3 MA**	**4 A**	**5 SA**
Q16	Prefer to make my work available only on an academic social networking site (eg. Researchgate, linkedIn, etc) than an institutional repository					
Q17	Open access Institutional Repositories are not prestigious					
Q18	Others might copy my work without my permission					
Q19	Difficult and time-consuming to deposit my work in IRs					
Q20	Do not know how and what to deposit in IRs					
Q21	Concerned that if I deposit my work in an IR I may not be able to publish it elsewhere					
Q22	Publishers would not let me put my work in an IR					
Q23	Few people would access my work when deposited in an IR					
Q24	Make preprint or post print versions of my research publications available to a worldwide audience					
Q25	Disseminate my research findings faster than the traditional publishing process					
Q26	Make freely available types of materials that could otherwise attract subscription fees					
Q27	Make my research visible with very little effort					
Q28	Provide long-term preservation of my digital research materials					

Q29	Make it easy for other people to search for and locate my work					
Q30	Preserve university's intellectual capital in a central place					

In your opinion what are some of the perceptions of Institutional Repositories?

……

……

……

Section C: Institutional policies and the sustainability of IRs

Based on the five point likert scale described above, please indicate degree of agreement or disagreement with the following statements		**1 SDA**	**2 A**	**3 MA**	**4 A**	**5 SA**
Q31	My institution has an IR policy					
Q32	My institution's IR policy guides its operation and usage					
Q33	My institution's IR policy guides how content is generated.					
Q34	My institution's IR policy guides the management and preservation of content					
Q35	My institution's IR policy guides and addresses copyright and accessibility concerns.					
Q36	My institution's IR policy mandate faculty members to deposit their research output (research articles, conference proceedings, etc.) into the institution's IR.					
Q37	My institution's IR policy allows faculty members to voluntary deposit their research output (research articles, conference proceedings, etc.) into the institution's IR.					
Q38	My institution's IR policy rewards faculty members for depositing contents into the institution's IR.					
Q39	My institution's IR policy enhances organizational image					

	and prestige.					
Q40	Institutional IR policy is key to ensuring the sustainability of IRs					

Section D: Competencies of IR personnel

Based on a five-point pre-coded scale described as: High level of competence (extensive experience in the skill area) = ***5****, Moderately high level of competence (good experience in the skill area) =* ***4,*** *Average level of competence (some experience in the skill area) =* ***3****, Low level of competence (little experience in the skill area) =* ***2****, No level of competence (no experience in the skill area) =* ***1***

Based on the five-point Likert scale described above, please indicate degree of competencies needed of an IR personnel in the following skill areas.

Competencies		**1 NLC**	**2 LLC**	**3 ALC**	**4 MHC**	**5 HLC**
Communicative competencies						
Q41	Communicate and promote the IR to faculty, students and other stakeholders					
Q42	Manage, liaise and communicate with institutional leadership (VC, Provosts, Deans, HODs etc)					
Q43	Communicate with and promote IR to external stakeholders (policy makers, enterprises, professional communities, funding agencies)					
Q44	Plan and develop an institutional advocacy programme for IR					
Q45	Organize and handle promotional workshops, training sessions and conferences					
Q46	Communicate technical issues to management and team members					
Q47	Liaise with clients regarding technical problems					
Q48	Liaise with IT support staff					

Q49	Activate help-desk services to support IR management and self-archiving practices					
Managerial competencies						
Q50	Plan repository activity workflow					
Q51	Coordinate and manage human resources for team work					
Q52	Plan a budget					
Q53	Plan fund-raising campaigns, activities and strategies					
Q54	Collect, harmonize and validate data and statistics about repository activities					
Q55	Plan, carry out surveys and evaluate findings					
Q56	Identify and manage copyright issues					
Q57	Plan and develop the repository collection					
Q58	Ensure digital rights management issues are resolved					
Q59	Assess and evaluate repository performance as a service					
Q60	Plan and execute advocacy and awareness programmes					
Technical competencies						
Q61	Deploy and manage IR software					
Q62	Implement interoperability standards and protocols (OAI-PMH, OAI-ORE, CERIF)					
Q63	Customize IR web pages (layout, design)					
Q64	Develop value-added services and facilities (download statistics, citation index, rankings, bibliographies and so on)					
Q65	Develop web 2.0 functionalities and tools (alerts, RSS, wikis, blogs and so on)					
Q66	Analyze and solve problems related to repository software					
Q67	Knowledge in intellectual property rights issues (eg. Copyright, licensing etc.) in the digital environment					
Q68	Implement digital preservation procedures					
Q69	Knowledge of metadata standards (Dublin Core, MARC, METS, LOM, PREMIS and so on)					

Q70	Monitor metadata quality					

Section E: Content and set procedures for depositing content

Please tick as many as are appropriate.

Q71	**How are contents uploaded onto your institution's IR?**	
1.	Mediated- deposit (done by the IR team on your behalf).	
2.	Self-deposit	
Q72	**Have you deposited any of your work in an IR?**	
1.	Yes	
2.	No	
Q73	**Will you consider depositing your work into an IR?**	
1.	Yes	
2.	No	
Q74	**What types of materials have you/would you like to deposit in an IR? (Please tick as many as applicable)**	
1.	Thesis and Dissertations (Full Text)	
2.	Thesis and Dissertations (Abstract)	
3.	Preprint (research article before peer reviewed)	
4.	Postprint (peer-reviewed research paper)	
5.	Books and Book Chapters	
6.	Reports (technical, research)	
7.	Images, Audio and Video	
8.	Conference Proceedings	
9.	Seminar paper	
10.	Data sets	
11.	Others (**Please specify**)	
Q75	**Have you ever accessed content from an IR?**	
	Yes	
	No	
Q76	**Which file format will you prefer for the content of an IR?**	

1.	PDF	
2.	Word processed document (MS Word)	
3.	POSTSCRIPT (peer-reviewed paper format)	
4.	Presentation (MS PowerPoint)	
5.	Spreadsheet (MS Excel)	
6.	Database (MS Access)	
7.	IMAGE (GIF, JPG, PNG, TIFF)	
8.	AUDIO (WAV, MP3, AIFF)	
9.	VIDEO (MP4)	
10.	Others (**Please specify**)	

Section F: Challenges to the sustainability of IRs

*Based on a five-point pre- coded scale described as: **5**= Very high extent, **4**=High extent, **3**= Moderate extent, **2**= Least extent, **1**= Very least extent, please indicate the extent to which the following factors inhibits the operation, management and usage of IR in your institution.*

Challenges		1 VLE	2 LE	3 ME	4 HE	5 VHE
Q77	Inadequate funding for marketing and advocacy					
Q78	Limited budget for purchasing equipment					
Q79	Unreliable Internet connectivity					
Q80	Cost of Internet bandwidth					
Q81	Unreliable power supply					
Q82	Inadequate ICT infrastructure					
Q83	Lack of technical staff for system development and management					
Q84	Difficult communication challenges to IR/technical staff					

Q85	Difficulty in backing up data					
Q86	Lack of awareness of IRs among researchers					
Q87	Lack of awareness of IRs among top management					
Q88	Inadequate advocacy for marketing of IR					
Q89	Lack of support of top management support					
Q90	The lack of motivations for researchers to share their research work					
Q91	Publisher copyright restrictions					
Q92	Data protection concerns					
Q93	Lack of explicit IR policy					

In your opinion what are some other challenges prevents you from using or depositing content into your institutional repository

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Thank you

Appendix B

UNIVERSITY OF SOUTH AFRICA
COLLEGE OF HUMAN SCIENCES
DEPARTMENT OF INFORMATION STUDIES

QUESTIONNAIRE FOR IR PERSONNEL

Dear Respondent,

I am Osman Imoro, a PhD candidate at the Department of Information Science of the University of South Africa (UNISA). This instrument is being administered to selected respondents to gather their views on the research topic "Sustainability of Institutional Repositories in selected public universities in Ghana" as part of the fulfillment of the requirement for the award of a PhD.

I would be very grateful if you could spend part of your valuable time to respond to all the questions provided in as much detailed as required. Completing this questionnaire should take 30-40 minutes of your time. Your participation will make a valued contribution towards this study and recommendations on ensuring the sustainability of Institutional Repositories in Ghana.

The responses you give will be used for academic purpose only and would be treated with strict adherence to the UNISA Research Ethics Policy. You are welcome to view the policy at: https://www.unisa.ac.za/static/corporate_web/Content/Colleges/CLAW/Research/Docs/Policy%20on%20Research%20Ethics%20-%20rev%20appr%20-%20Council%20-%2015.09.2016.pdf

Please do not hesitate to contact me on 0209165724 if you need clarification on any of the questions.

Consent: I have read and understood the above information, and I willingly consent to participate in this study. I understand that as a study participant I am free to withdraw at any time without giving reasons.

…….. ……
Signature Date

Many thanks for your participation.

Section A: Demographic Information

Please tick as appropriate as possible.

Q1	**Please indicate your gender group.**	
1.	Male	
2.	Female	
Q2	**Please indicate your institutional affiliation.**	
1.	University of Ghana	
2.	Kwame Nkrumah University of Science and Technology	
3.	University of Cape Coast	
4.	University of Education, Winneba	
5.	University for Development Studies	
Q3	**Please indicate your rank.**	
1.	Senior Assistant Librarian	
2.	Assistant Librarian	
3.	Junior Assistant Librarian	
4.	Principal Library Assistant	
5.	Senior Library Assistant	
6.	Junior Library Assistant	
Q4	**Please indicate your employment status.**	
1	Part time	
2	Full time	
Q5	**Please indicate your age group.**	
1.	21- 30 years	
2.	31- 40 years	
3.	41- 50 years	
4.	51 - 60 years	
Q6	**Please indicate the number of years you have served at your institution.**	
1.	1 - 5 years	
2.	6 - 10 years	
3.	11- 15 years	
4.	16- 20 years	
5.	Over 21 years	

Section B: Perception of Institutional Repositories (IR)

Based on a five-point pre-coded scale described as: ***1****= Strongly Disagree,* ***2****= Disagree,* ***3****= Moderately Agree,* ***4****= Agree,* ***5****=Strongly Disagree. Please tick the category of the column that best describes you're the following statements.*

Based on the five point Likert scale described above, please indicate your understanding of what an Institutional Repository is?		**1 SDA**	**2 A**	**3 MA**	**4 A**	**5 SA**
Q7	Institutionally defined (contains intellectual outputs produce by members of particular institution)					
Q8	Contain scholarly materials					
Q9	unrestricted worldwide access					
Q10	Online electronic archive					
Q11	Perpetual (permanent)					
Q12	Web based (cannot be accessible without internet)					
Q13	Easily Accessible					
Q14	Interoperability (able to exchange and make use of information with other computer systems)					

What do you think are some of the characteristics of open access Institutional Repositories?

……

……

Based on the five-point Likert scale described above, how do the following statement reflect your perception of institutional repositories.		**1 SDA**	**2 A**	**3 MA**	**4 A**	**5 SA**
Q15	Prefer to make my work available only on an academic social networking site (eg. Researchgate, linkedIn, etc) than an institutional repository					

Q16	Open access Institutional Repositories are not prestigious					
Q17	Others might copy my work without my permission					
Q18	Difficult and time-consuming to deposit my work in IRs					
Q19	Do not know how and what to deposit in IRs					
Q20	Concerned that if I deposit my work in an IR I may not be able to publish it elsewhere					
Q21	Publishers would not let me put my work in an IR					
Q22	Few people would access my work when deposited in an IR					
Q23	Make preprint or post print versions of my research publications available to a worldwide audience					
Q24	Disseminate my research findings faster than the traditional publishing process					
Q25	Make freely available types of materials that could otherwise attract subscription fees					
Q26	Make my research visible with very little effort					
Q27	Provide long-term preservation of my digital research materials					
Q28	Make it easy for other people to search for and locate my work					
Q29	Preserve university's intellectual capital in a central place					

In your opinion what are some of the perceptions of Institutional Repositories?

……

……

Section C: Institutional policies and the sustainability of IRs

Based on the five point likert scale described above, please indicate degree of agreement or disagreement with the following statements	**1 SDA**	**2 A**	**3 MA**	**4 A**	**5 SA**

Q30	My institution has an IR policy					
Q31	My institution's IR policy guides its operation and usage					
Q32	My institution's IR policy guides how content is generated.					
Q33	My institution's IR policy guides the management and preservation of content					
Q34	My institution's IR policy guides and addresses copyright and accessibility concerns.					
Q35	My institution's IR policy mandate faculty members to deposit their research output (research articles, conference proceedings, etc.) into the institution's IR.					
Q36	My institution's IR policy allows faculty members to voluntary deposit their research output (research articles, conference proceedings, etc.) into the institution's IR.					
Q37	My institution's IR policy rewards faculty members for depositing contents into the institution's IR.					
Q38	My institution's IR policy enhances organizational image and prestige.					
Q39	Institutional IR policy is key to ensuring the sustainability of IRs					

Section D: Competencies of IR personnel

Based on a five-point pre-coded scale described as: High level of competence (extensive experience in the skill area) = ***5****, Moderately high level of competence (good experience in the skill area) =* ***4,*** *Average level of competence (some experience in the skill area) =* ***3****, Low level of competence (little experience in the skill area) =* ***2****, No level of competence (no experience in the skill area) =* ***1***

Based on the five-point Likert scale described above, please indicate degree of competencies needed of an IR personnel in the following skill areas.

Competencies		1 NLC	2 LLC	3 ALC	4 MHC	5 HLC
Communicative competencies						
Q40	Communicate and promote the IR to faculty, students and other stakeholders					
Q41	Manage, liaise and communicate with institutional leadership (VC, Provosts, Deans, HODs etc)					
Q42	Communicate with and promote IR to external stakeholders (policy makers, enterprises, professional communities, funding agencies)					
Q43	Plan and develop an institutional advocacy programme for IR					
Q44	Organize and handle promotional workshops, training sessions and conferences					
Q45	Communicate technical issues to management and team members					
Q46	Liaise with clients regarding technical problems					
Q47	Liaise with IT support staff					
Q48	Activate help-desk services to support IR management and self-archiving practices					
Managerial competencies						
Q49	Plan repository activity workflow					
Q50	Coordinate and manage human resources for team work					
Q51	Plan a budget					
Q52	Plan fund-raising campaigns, activities and strategies					
Q53	Collect, harmonize and validate data and statistics about repository activities					
Q54	Plan, carry out surveys and evaluate findings					
Q55	Identify and manage copyright issues					
Q56	Plan and develop the repository collection					

Q57	Ensure digital rights management issues are resolved					
Q58	Assess and evaluate repository performance as a service					
Q59	Plan and execute advocacy and awareness programmes					
Technical competencies						
Q60	Deploy and manage IR software					
Q61	Implement interoperability standards and protocols (OAI-PMH, OAI-ORE, CERIF)					
Q62	Customize IR web pages (layout, design)					
Q63	Develop value-added services and facilities (download statistics, citation index, rankings, bibliographies and so on)					
Q64	Develop web 2.0 functionalities and tools (alerts, RSS, wikis, blogs and so on)					
Q65	Analyze and solve problems related to repository software					
Q66	Knowledge in intellectual property rights issues (eg. copyright, licensing etc.) in the digital environment					
Q67	Implement digital preservation procedures					
Q68	Knowledge of metadata standards (Dublin Core, MARC, METS, LOM, PREMIS and so on)					
Q69	Monitor metadata quality					

Section E: Technical requirements for setting up Institutional Repositories (IR)

Please tick as many as are appropriate.

Q70	**Which of the following IR software is your institution currently using?** ***Please tick as many as are appropriate.***	
1.	Dspace	
2	Eprints	
3	WEKO	
4	Digital Commons	
5	Islandora	
6	Federo	
7	Other specify	
Q71	**Please what informed your choice of IR software?** ***Please tick as many as are appropriate.***	

1	Cost	
2	Interoperability (able to exchange and make use of information with other well-known software)	
3	Security (vulnerable to security attacks)	
4	search engine optimization	
5	Customisability (the ease to modify, add or delete the code)	
6	Flexibility (possibility of using whatever version or build of the software)	
7	Auditability (easy access to the source code)	
8	Availability of support options	

Please state what other factors influenced your institution's choice of IR software

……

……

……

Q72	**Please is your IR hosted on a local server?**	
1	Yes	
2	No	
Q73	**Please where is your local IR server kept? *Please tick as many as are appropriate.***	
1	Library	
2	Network Operation Centre (NOC)	
3	Other Specify	
Q74	**Please Does your IR have a backup or contingency plan?**	
1	Yes	
2	No	

If Yes, please indicate the nature of the backup or contingency plan?

……

……

……

Q75	**Please indicate any technical challenges are you currently facing? *Please tick as many as are appropriate.***	
1.	Overheating of local server	
2	Server Crushes	
3	Power fluctuations	

4.	Virus attacks	
5.	Hackers	
6.	Others (**Please specify**)	

Section F: Content and set procedures for capturing and disseminating the content

Please tick as many as are appropriate.

Q76	**How are contents uploaded onto your institution's Institutional Repository?**	
1.	Mediated- deposit (done by the IR team on your behalf).	
2.	Self-deposit (done by depositors themselves).	
Q77	**What type of recruitment strategy is adopted by the library?**	
1.	Promotional strategies	
2.	Depositing services	
3.	Content harvesting	
4.	Researcher bibliographies	
5.	Usage / citation information	
Q78	**Which of the following types of material is deposited in your Institutional Repository?**	
1.	Thesis and Dissertations (Full Text)	
2.	Thesis and Dissertations (Abstract)	
3.	Preprint (research article before peer reviewed)	
4.	Postprint (peer-reviewed research paper)	
5.	Books and Book Chapters	
6.	Reports (technical, research)	
7.	Images, Audio and Video	
8.	Conference Proceedings	
9.	Seminar paper	
10.	Data sets	
11.	Others (**Please specify**)	
Q79	**Which of the following file formats is accepted for deposit into you**	

	Institutional Repository?	
1.	PDF	
2.	Word processed document (MS Word)	
3.	POSTSCRIPT (peer-reviewed paper format)	
4.	Presentation (MS PowerPoint)	
5.	Spreadsheet (MS Excel)	
6.	Database (MS Access)	
7.	IMAGE (GIF, JPG, PNG, TIFF)	
8.	AUDIO (WAV, MP3, AIFF)	
9.	VIDEO (MP4)	
10.	Others (**Please specify**)	
Q80	**How is the content of your institutional repository disseminated?**	
1.	Academic Social Networking Sites	
2.	Social Media	
3.	Library Website	
4.	Staff meeting	
5	Conferences and works	
6.	Colleagues	
7.	Others (**Please specify**)	

Section G: Challenges to the sustainability of IRs.

*Based on a five-point pre- coded scale described as: **5**= Very high extent, **4**=High extent, **3**= Moderate extent, **2**= Least extent, **1**= Very least extent, please indicate the extent to which the following factors inhibits the operation, management and usage of IR in your institution.*

	Challenges	1 VLE	2 LE	3 ME	4 HE	5 VHE
Q81	Inadequate funding for marketing and advocacy					
Q82	Limited budget for purchasing equipment					
Q83	Unreliable Internet connectivity					

Q84	Unreliable power supply					
Q85	Inadequate ICT infrastructure					
Q86	Lack of technical staff for system development and management					
Q87	Difficult communication challenges to IR/technical staff					
Q88	Difficulty in backing up data					
Q89	Lack of awareness of IRs among researchers					
Q90	Lack of awareness of IRs among top management					
Q91	Inadequate advocacy for marketing of IR					
Q92	Lack of support of top management support					
Q93	The lack of motivations for researchers to share their research work					
Q94	Publisher copyright restrictions					
Q95	Data protection concerns					
Q96	Lack of explicit IR policy					

In your opinion what are some other challenges prevents you from using or depositing content into your institutional repository

……

……

……

…….....

Thank you

Appendix C

UNIVERSITY OF SOUTH AFRICA
COLLEGE OF HUMAN SCIENCES
DEPARTMENT OF INFORMATION STUDIES

INTERVIEW GUIDE FOR UNIVERSITY LIBRARIANS / REPOSITORY MANAGERS

Dear Respondent,

I am Osman Imoro, a PHD candidate at the Department of Information Science of the University of South Africa (UNISA). This instrument is being administered to selected respondents to gather their views on the research topic "Sustainability of Institutional Repositories in selected public universities in Ghana" as part of the fulfillment of the requirement of the award of my PHD. I would be very grateful if you could spend part of your valuable time to respond to all the questions provided in as much detailed as required.

The responses given will be used for academic purpose only. No individually identifiable information will be reported on. Please be assured that information provided will be treated with absolute confidentiality.

Instructions

- Please read each question carefully and prepare the appropriate answers before the interview date.
- Please note that the interview will be tape recorded and transcribed.
- Please do not hesitate to contact me on 0209165724 if you need clarification on any of the questions.

Many thanks for your cooperation.

Section A: Demographic Information

Q1. Please, how old are you?
Q2. What is the name of your institution?
Q3. Please what is your position?

Q4. Please are you acting or substantive?

Q5. Please, how many years have served at current position?

Section B: Perception of the concept of IRs.

Q6. Please what do you know about an institutional repository (IR)?

Q7. What are the characteristics of an institutional repository (IR)?

Q8. How the concept of institutional repository (IR) has being received member of your institution?

Q9. Can you give reasons for your answer above?

Section C: Institutional policies and the sustainability of IRs

Q10. Does your institution have an IR policy?

Q11. Does the IR policy guide the usage?

Q12. Does the IR policy guides how content is generated?

Q13. Does the IR policy guide the management and preservation of content?

Q14. Does the IR policy mandate faculty members and students to deposit their research output?

Q15. Does the IR policy guide awareness and preservation efforts?

Q16. Does the IR policy guide and address copyright and accessibility concerns?

Q17. Does the IR policy ensure the sustainability of IRs?

Q18. Does the IR policy rewards faculty members for depositing content?

Q19. Does your institution's appointment and promotion policies reward faculty members who publish with open access outlets?

Section D: Competencies of IR personnel

Q20. What communicative competencies should an IR manager posse?

Q21. What managerial competencies should an IR manager posse?

Q22. What technical competencies should an IR manager posse?

Section E: Technical requirements for setting up Institutional Repositories (IR)

Q23. Please are you using an open source or proprietary IR software?

Q24. Please can you mention the IR software you are currently using?

Q25. Please what informed you choice of IR software?

Q26. Please is your IR hosted on a local server?

Q27. If yes, what is the specification of the local server?

Q28. Please does your IR have a backup or contingency plan?

Q29. If yes, what is the nature of the plan?

Q30. Please indicate any technical challenges are you currently facing?

Section F: Content and set procedures for depositing content

Q31. How does the library recruit contents onto the institutional repository?

Q32. How are contents uploaded onto the institutional Repository?

Q33. What kinds of material are deposited in the institutional Repository?

Q34. Which file formats is accepted for deposit into the institutional Repository?

Q35. How is the content of the institutional repository promoted or marketed?

Section G: Challenges to the sustainability of IRs.

Q36. The challenges hinder the smooth operation and management of the institutional repository

Q37. Suggest ways/recommend how to address the identified challenges.

Appendix D

Study objectives, research questions, respondents, and possible sources of data

Research objectives	Research questions	Theory	Possible sources of data	Possible respondents
To examine how the various stakeholder groups (faculty members, students, and librarians) in public universities in Ghana perceive IRs.	How do the various stakeholder groups (faculty members, students and IR staff) perceive institutional repositories?	Dynamics of IR Innovation Model	• Interviews • Questionnaires	• Head librarians • IR managers • Postgraduate students • Faculty members
To examine the role of institutional policies on the sustainability of IRs in public universities in Ghana.	What is the role of IR policies in ensuring the sustainability of institutional repositories in Ghana?	DOI Theory	• Questionnaires • Content analysis • Interviews	• Library staff • IR managers • Head librarians • IR managers • Postgraduate students • Faculty members
To assess the competencies of personnel assigned to work on the IRs in public universities in Ghana.	What are the technical and managerial competencies or skill sets required of institutional repository professionals?	Dynamics of IR Innovation Model	• Questionnaires • Interviews	• Head librarians • IR managers
To examine the technical specifications	What are the technical specifications of	DOI Theory	• Questionnaires • Interviews	• Head librarians • IR managers

of IRs in Ghana.	institutional repositories in Ghana?			
To examine the contents of IRs in Ghana.	What type of documents are archived in the institutional repositories in Ghana?	DOI Theory	• Questionnaires • Interviews • IR website • IR policy	• Head librarians • IR managers
To examine the procedures for submitting content to institutional repositories in Ghana.	What are the procedures for submitting content to institutional repositories in Ghana?	DOI Theory	• Questionnaires • Interviews • IR policy	• Head librarians • IR managers • Postgraduate students • Faculty members
To identify challenges to the sustainability of institutional repositories in Ghana.	What challenges confront the sustainability of institutional repositories according to the participants and administrators of institutional repositories at the selected public universities in Ghana?	Dynamics of IR Innovation Model	• Questionnaires • Interviews	• Head librarians • IR managers • Postgraduate students • Faculty members

Appendix E

DEFINITION OF INSTITUTIONAL REPOSITORIES

Definition	Source
A digital archive of intellectual products created by faculty, research staff, and students of an institution and accessible to end users both within and outside the institution, with few, if any barrier to access	Crow (2002:16).
A formally organised and managed collections of digital content generated by the faculty, staff, and students of an institution.	McCord (2003)
An electronic system that captures, preserves and provides access to the digital work products of a community	Foster and Gibbons (2005:1)
A set of services that an institution offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members.	Lynch (2003:4
The primary purpose of an IR is to allow easy search and retrieval of an institution's scientific and scholarly publications by both local and foreign users	Alfa Network Babel Library [ANBL](2007).

Appendix F

UNISA ETHICAL APPROVAL

UNISA university of south africa

COLLEGE OF HUMAN SCIENCES RESEARCH ETHICS REVIEW COMMITTEE

23 February 2021

NHREC Registration # :
Rec-240816-052
CREC Reference # :
55772676_CREC_CHS_2021

Dear Mr O. IMORO

Decision:
Ethics Approval from 23 February 2021 to 23 February 2026

Principal Researcher: Mr.O. IMORO (**55772676@mylife.unisa.ac.za**)

Supervisor: Prof N. SAUROMBE (**mnkennp@unisa.ac.za**)

Title: *Sustainability of institutional repositories in selected public universities in Ghana*

Degree Purpose: PhD

Thank you for the application for research ethics clearance by the Unisa College of Human Science Ethics Committee. Ethics approval is granted for five years.

The ***Low risk application*** *was* ***reviewed*** by College of Human Sciences Research Ethics Committee, on **23 February 2021** in compliance with the Unisa Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the College Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data require additional ethics clearance.
7. No fieldwork activities may continue after the expiry date **(23 February 2026).** Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:

*The reference number **55772676_CREC_CHS_2021** should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Yours sincerely,

Signature :

Signature :pp

Prof. Ilse Ferns
CHS Ethics Chairperson
Email: fernsi@unisa.ac.za
Tel: (012) 429 8210

Prof K. Masemola
Exécutive Dean : CHS
E-mail: masemk@unisa.ac.za
Tel: (012) 429 2298

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Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

Appendix G

UNIVERSITY OF CAPE COAST ETHICAL APPROVAL

UNIVERSITY OF CAPE COAST

INSTITUTIONAL REVIEW BOARD SECRETARIAT

TEL: 0558093143 / 0508878309
E-MAIL: irb@ucc.edu.gh
OUR REF: UCC/IRB/A/2016/1103
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

16TH SEPTEMBER 2021

Mr. Osman Imoro
Department of Information Science
University of South Africa

Dear Mr. Imoro,

ETHICAL CLEARANCE – ID (UCCIRB/EXT/2021/20)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted Provisional Approval for the implementation of your research titled ***Sustainability of Institutional Repositories in Selected Public Universities in Ghana***. This approval is valid from 16th September 2021 to 15th September 2022. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD
UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST

Appendix H

STUDY SITE APPROVAL – KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Kwame Nkrumah
University of Science
and Technology, Kumasi

OFFICE OF THE REGISTRAR

RO/CEN/ADM **September 20, 2021**

Osman Imoro
College of Human Sciences
UNIVERSITY OF SOUTH AFRICA
SOUTH AFRICA

Dear Sir,

RE: PERMISSION TO CONDUCT A PHD RESEARCH WORK

THIS is to acknowledge receipt of yours on the above subject.

At the instance of the Registrar, I write to inform you that approval has been granted to enable you conduct research at the KNUST on "***Sustainability of institutional repositories (IRs) in selected public universities in Ghana***".

By copies of this letter, all officers concerned are being informed of the permission to enable you to collect the data. Any courtesies accorded him will be appreciated in this regard.

Sincerely Yours,

Efua Arku
SENIOR ASSISTANT REGISTRAR(RO)
for: **REGISTRAR**

cc: Vice-Chancellor
Pro Vice-Chancellor
Provosts
University Librarian
Dean, School of Graduate Studies
Deputy Registrar (HRD)
Deputy Registrar (Academic Affairs)

PMB UPO, KNUST, Kumasi, Ghana. **Tel:** +233-3220-60331 **Email:** registrar@knust.edu.gh **Website:** www.knust.edu.gh

Appendix I

STUDY SITE APPROVAL – UNIVERSITY OF EDUCATION, WINNEBA

UNIVERSITY OF EDUCATION, WINNEBA
OFFICE OF THE REGISTRAR
DIVISION OF ACADEMIC AFFAIRS
P. O. Box 25, Winneba, Ghana
academicaffairs@uew.edu.gh/ academicverification@uew.edu.gh
+233 (020) 2041115

Our Ref: DAA/P.1 /Vol./11
Your Ref:

27th August, 2021

Mr. Osman Imoro
University of South Africa
P. O. Box 392
UNISA 0003
South Africa

Dear Mr. Imoro,

RE: PERMISSION TO CONDUCT A PHD RESEARCH

Your letter on the above subject is referred.

We write to inform you that, your request to conduct research work at the University of Education, Winneba has been approved and will be offered the needed assistance.

Kindly report to the Deputy Registrar, Division of Academic Affairs for further directives.

Thank you.

Yours faithfully,

Kenneth Abban
***for*: Deputy Registrar, Academic Affairs**

cc: *The University Librarian, UEW*
Dean, School of Graduate Studies, UEW
Heads of Department, UEW

Appendix J

STUDY SITE APPROVAL – UNIVERSITY FOR DEVELOPMENT STUDIES

UNIVERSITY FOR DEVELOPMENT STUDIES

Tel: 03720-93382/26634/22078
Email: registrar@uds.edu.gh
Website: www.uds.edu.gh

P. O. Box TL 1350
Tamale, Ghana

Our Ref:.....

Your Ref:.....

OFFICE OF THE REGISTRAR

Date: **June 5, 2021**

Mr. Osman Imoro
C/O University of South Africa
College of Human Science
P. O. Box 392
South Africa
Tel: 0209165724

Dear Sir,

RE: PERMISSION TO CONDUCT PHD RESEARCH WORK

Please, I refer to your letter dated May 24, 2021, requesting for permission to conduct a PhD Research work on the title 'Sustainability of Institutional Repositories in Selected Public Universities in Ghana' and write to convey approval of your request to conduct your study in the University for Development Studies.

The University has put in place protocols to be observed to prevent the spread of COVID-19. It is our hope that these protocols would be observed during your study.

Also note that you are governed by the rules and regulations of the University pertaining to the conduct of research.

Yours faithfully,

Abdul-Mumin Alhassan
(Assistant Registrar)
For: Registrar

Cc: Librarian

Appendix K

STUDY SITE APPROVAL – BALME LIBRARY, UNIVERSITY OF GHANA

UNIVERSITY OF GHANA

THE BALME LIBRARY

P.O. BOX LG 24, LEGON, ACCRA, GHANA

Our Ref: BL/41

Your Ref:

Direct: 055-236-4745

http://library.ug.edu.gh
e-mail: blbalmelib@.ug.edu.gh

March 26, 2021

Mr. Osman Imoro
PhD Candidate
UNISA
South Africa

Dear Sir

RE: PERMISSION TO CONDUCT A PHD RESEARCH WORK

Your letter on the above mentioned subject refers.

We wish to inform you that permission has been granted for you to conduct your research work on the topic "*sustainability of institutional repositories in selected public universities in Ghana*".

Please contact the undersigned for further information.

Thank you.

Yours faithfully

Prof. Perpetua S. Dadzie
Ag. University Librarian

Appendix L

Turn-it-in Digital Receipt

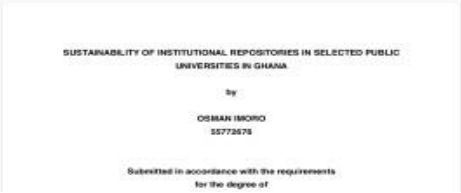
turnitin

Digital Receipt

This receipt acknowledges that Turnitin received your paper. Below you will find the receipt information regarding your submission.

The first page of your submissions is displayed below.

Submission author:	Osman Imoro
Assignment title:	Revision 1
Submission title:	Final thesis_reviewers comments
File name:	Final_thesis_corrections_310822.doc
File size:	7.38M
Page count:	370
Word count:	94,127
Character count:	547,894
Submission date:	31-Aug-2022 07:08PM (UTC+0200)
Submission ID:	1890109722



SUSTAINABILITY OF INSTITUTIONAL REPOSITORIES IN SELECTED PUBLIC UNIVERSITIES IN GHANA

by

OSMAN IMORO

Submitted in accordance with the requirements for the degree of

ORIGINALITY REPORT

30%	26%	12%	12%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	uir.unisa.ac.za Internet Source	3%
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3	ugspace.ug.edu.gh Internet Source	1%
4	researchspace.ukzn.ac.za Internet Source	1%
5	digitalcommons.unl.edu Internet Source	1%

Appendix M

EDITOR'S STATEMENT

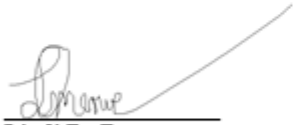
EDITOR'S STATEMENT

21 April 2022

I hereby declare that I have edited this thesis entitled *Sustainability of Institutional Repositories in Selected Public Universities in Ghana* by Osman Imoro (student number 55772676). The edit entailed correcting spelling and grammar where necessary and checking for consistencies in style and reference method used within the main body of the document according to guidelines provided by the student. I have not helped to write this document or altered the student's work in any significant way. I will not be held accountable for bad spelling or grammar or incorrect referencing where the student has rejected my editing, ignored my suggestions, or made changes after I had completed my edit.

I was not assigned to edit the introductory pages (Abstract, Dedication, Declaration, and Acknowledgements), the appendices, or the List of References, and thus will accept no responsibility for any errors in these sections.

It was also not my responsibility to check for any instances of plagiarism and I will not be held accountable should the student commit plagiarism. I did not check the validity or factual accuracy of the student's statements/research/arguments.



Lindi De Beer

Contact Details:
☎ **083 456 4358**
lindi@grammarsmith.co.za

GRAMMAR SMITH