Adoption of Linked Data Among the University Libraries in Uganda

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DECLARATION

I, Winny N. Akullo, declare that:

1) The research reported in this thesis, except where otherwise indicated, is my original research.
2) This thesis has not been submitted for any degree or examination at any other university.
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Candidate: Winny N. Akullo

Signed: 

Supervisor: Dr. Zawedde Nsibirwa

Signed 

DEDICATION

I dedicate this thesis to the glory of the Almighty God. I also dedicate it to my son and my beloved mother for her support.

ABSTRACT

Globally, libraries have experienced numerous innovation cycles due to technological developments and among these cycles is Linked Data. Linked Data is a set of practices used to represent and connect structured data on the Web. It requires that data is published on the Web in a readable, interpretable, and useable format by computers. This study aimed to explore the adoption of Linked Data among selected university libraries in Uganda. The objectives of the study were to: determine the level of awareness of Linked Data among professional librarians; establish the extent of Linked Data adoption; determine the potential benefits of adopting Linked Data; investigate the factors that influence the professional librarians' behaviour towards the adoption of Linked Data; and investigate the strategies to promote the use and adoption of Linked Data.

The Unified Theory of Acceptance and Use of Technology (UTAUT) and the Diffusion of Innovation (DOI) theory were adopted for the study. The study used a pragmatism paradigm. Mixed methods were employed to collect quantitative and qualitative data for the study. Fourteen university libraries were purposively selected and a target population of 187 participants from these selected university libraries was identified. A link to the online questionnaire was sent to the professional librarians and heads of library technical services and telephonic interviews conducted with the University librarians and heads of IT. Of these respondents, 160 responded, giving a response rate of 85.6%. The SPSS software was used to analyse quantitative data while qualitative data was analysed using thematic content analysis.

The results showed that 70.3% of the professional librarians were aware of the Linked Data concept; 82.8% were aware of the university library's need to use the Web of Data to enable access and sharing of data with users without barriers. The results further showed that 91.8% of the respondents prefer to first experience with how Linked Data works before adopting and implementing it; 93.4% of the respondents expressed willingness to learn about Linked Data technologies to improve data sharing and reuse in their institutional libraries. The results of the study further showed that over 90% of the respondents agreed that Linked Data shall

reduce unnecessary duplication; and improve users' overall search experiences; increased richness in overall data; increase the exposure of institutional repository collection to web search engines; benefit research, discovery, and enrich discovery and create a model other universities can use. The results also showed that over 70% of the respondents indicated that top management buy-in and support, prior knowledge of using Linked Data will influence the behaviour of professional librarians towards the adoption of Linked Data in university libraries, and; over 90% of the respondents agreed that benchmarking with other institutional libraries and support from the IT staff will influence the adoption of Linked Data. While 97.5% of the respondents proposed the need to encourage staff to keep themselves up-to-date and explore the potential of Linked Data technologies in libraries with a few indicated the need to include research assignments in some of the employees' workload for them to conduct research during the exploratory stages of innovation adoption.

The study, therefore, recommends that university libraries lobby for budget allocations or seek grants to facilitate the acquisition of infrastructure required for the adoption and implementation of Linked Data. Other recommendations include the training of professional librarians by professional associations with expertise in Linked Data technologies ; the development of courses on Linked Data by the various library and information training institutions; the establishment of a library technical team that will ensure data sharing and its reuse; the development of a legal framework that will mandate university libraries to share and link their data; collaboration with other university libraries through the Consortium of Uganda University Libraries (CUUL); the establishment a central data repository; and collaboration and the establishment of partnerships with other communities and organisations both in and out of the library and information field.

The originality and contribution of the study is derived from the methodology, theory, practice, and policy. The study explored the adoption of Linked Data and is the first to be carried out in multiple universities in Uganda.

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GOD BLESS YOU ALL

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AACR	Anglo-American Cataloguing Rules
AI	Artificial Intelligence
ALA	American Library Association
BBC	British Broadcasting Corporation
BIBFRAME	Bibliographic Framework
CPD	Continuous Professional Development
CUL	Cornell University Library
CUUL	Consortium of Uganda University Libraries
DOI	Diffusion of Innovation
EE	Effort Expectancy
EIFL	Electronic Information for Libraries
FCs	Facilitating Conditions
GLAM	Galleries, Libraries, Archives and Museums
GRDDL	Gleaning Resource Description from Dialects of Language
HIT	Head of Information Technology
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
IFLA	International Federation of Library Associations and Institutions
ILS	Integrated Library System
IPs	Information Professionals
IRs	Institutional Repositories
IS	Information System
IT	Information Technology
LAM	Libraries, Archives and Museums
LCSH	Library of Congress Subject Headings
LD4L	Linked Data for Libraries
LIC	Library and Information Centres
LIS	Library and Information Science
LMS	Learning Management System

LOD	Linked Open Data
LOD2	Linked Open Data2
MARC	Machine Readable Cataloguing
MLA	Mobile Library Applications
MUELE	Makerere University Elearning Environment
NDP	National Development Plan
NGOs	Non-Governmental Organisations
NLAI	National Library and Archives of Iran
OCLC	Online Computer Library Center
OER	Open Educational Resources
OPAC	Online Public Access Catalogue
PBC	Perceived Behavioural Control
PE	Performance Expectancy
RDA	Resource Description and Access
RDF	Resource Description Framework
RDMS	Research Data Management Services
RENU	Research and Education Network of Uganda
SI	Social Influence
SMEs	Small and Medium-sized Enterprises
SPSS	Statistical Package for Social Sciences
SRSIS	Scholarly Resource Semantic Information Store
TAM	Technology Acceptance Model
TCT	Trilingual Cultural Thesaurus
TOE	Technology Organisation Environment
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UKZN	University of KwaZulu-Natal
UL	University Librarian
UNLV	University of Nevada, Las Vegas
URIs	Uniform Resource Identifiers
UTAUT	Unified Theory of Acceptance and Use of Technology

VIAF	Virtual International Authority File
W3C	World Wide Web Consortium
XML	eXtensible Markup Language

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Introduction

This study explores the adoption of Linked Data among university libraries in Uganda. Chapter One provides the background to the study, its purpose, and the statement of the problem. The research objectives, research questions, and the theoretical framework underpinning the study are presented. The chapter also provides an overview of the research design and methods applied in the study. The definitions of the key operational terms and concepts used in the study are put forward, the study's ethical considerations are highlighted, and finally, the structure of the thesis is outlined.

1.2 Background to the study

Globally, libraries have experienced numerous innovation cycles due to technological developments (Niu, 2020a), and among these developments is Linked Data. Linked Data is a set of practices used to represent and connect structured data on the World Wide Web (or Web) (Bizer, 2009; Gonzales, 2014; Mitchell, 2016). Linked Data requires that data published on the Web be in a readable, interpretable, and useable format by computers (Guerrini and Possemato, 2013; Gonzales, 2014). This is because computers can better read, interpret and reuse this data compared to human beings doing so (Byrne and Goddard, 2010; Raza, Mahmood and Warraich, 2019:11)**.** For example, the computer better understands the meaning of content than matching a string of text (Byrne and Goddard, 2010:1; Rahaman, 2021). Linked Data, therefore, is a data publishing technique that uses standard Web technologies to connect related data and make it accessible on the Web; Zengenene, 2013; Zhang, 2013; LIBER Linked Open Data working group, 2021). Linked Data requires communities to agree on their data and how to share it in other information spaces (OCLC, 2022). When Linked Data is embedded into the Web, it enriches and makes data easily discoverable and utilisable (Hawkins, 2022:320).

The adoption of Linked Data encourages institutions to publish, share and interlink their data. Linked Data is built upon Semantic Web technologies, that allow data published on the Web to become part of a single data space (Saleem, Butt and Warriach, 2018; Rahaman, 2021; Hawkins, 2022). Linked Data has four principles that support access to data and facilitate its reuse on the Web (Berners-Lee et al., 2001; Berners-lee, Chen, Chilton, Connolly, Dhanaraj, Hollenbach, Lerer and Sheets, 2006; Mukhopadhyay, 2020; Meherehera, Mekideche, Zemmouchi-Ghomari and Ghomari, 2021). These four principles are:

i) Uniform Resource Identifiers (URIs) are used as names for things.
ii) Hypertext Transfer Protocol (HTTP) URIs are used so that people can look up those names.
iii) When someone looks up a URI, it provides valuable information using the standards Resource Description Framework (RDF), and the Simple Protocol and Resource Description Framework Query Language (SPARQL).
iv) URIs include links to other URIs so that people and intelligent Semantic Web agents can discover more things.

The Five-star Linked Open Data (LOD) model ranges from one star to five stars and should be co-opted to expose data on the Web (Berners-Lee, 2006; Mitchell, 2013; Saleem et al, 2018; Unterstraßer, 2023). These five-star principles describe the ascending order of publishing data on the Web using the five-star rating system for Linked Open Data (Unterstraßer, 2023). They are:

*One's data is available on the Web in whatever format.
**The material put on the Web is available as structured data in Excel instead of as a scanned image of a table.
***Available in non-proprietary formats like csw instead of Excel.
****Use URLs to identify the objects, so that users can point to these objects.
*****One's data is linked to data produced by others to define a context.

One of Linked Data's distinct concepts is that data published on the Web should connect all the related data for accessibility and discoverability. The relationships between the data are

expressed using the RDF (Gonzales, 2014; Ali and Warraich, 2018; Rahaman, 2021). The RDF, which was proposed by the World Wide Web Consortium (W3C), is a flexible standard language used to encode a collection of resources.

Libraries and Information centres (LICs)have shown significant interest in Linked Data because they share, collect, preserve and provide access to the various information resources and cultural heritage with Linked Data. However, most Linked Data initiatives in libraries and information centres (LICs) have taken place in developed countries (Ali and Warraich, 2018). As noted by Summers and Salo (2013) and Rahaman (2021), while a majority of libraries and cultural institutions do have vast amounts of rare and authentic information resources, unfortunately, these are kept in silos and MARC is not able to connect the relationships of its entities using the Web.

Libraries worldwide have begun to adopt the RDF for their data to be more discoverable on the Web, where the majority of their users are. The Library of Congress is among the organisations that are taking the lead in converting their authority records to Linked Data (Laurence, 2013:3; Chowdhury and Scholar, 2019). Linked Data has indeed changed how information is generated, transferred, shared, and consumed in libraries and other cultural institutions (Zengenene, 2013). For example, the UK National Infrastructure Commission and its data model were adopted and influenced by the national bibliography published by the British Library as LOD (Smith-Yoshimura, 2016). Other national libraries that have adopted Linked Data include the Library of Congress, the Bibliotheque National de France, National library of India and the German National Library Linked Data Service, among others (Smith-Yoshimura, 2016; Chowdhury and Scholar, 2019). The aforementioned National Library and Archives of Iran (NLAI) transformed its Trilingual Cultural Thesaurus (TCT) using the Simple Knowledge Organisation System (SKOS) which follows the Linked Data principles as proposed by Tim Berners-Lee (Khosravi and Akbari-Daryan, 2019).

Linked Data technologies have supported the availability of the information resources of these national libraries on the Web without any retrieval restrictions. However, there tends to

be low level of adoption of Linked Data in developing economies (Okoroma, 2023). For example, Okoroma (2023:8) noted that lack of awareness and in-depth knowledge about Linked Data among the librarians and information managers, hinders its adoption. Similarly, Mulumba et al. (2017) noted that one of the reasons why there is lack of Linked Data at Makerere university is due to a lack of awareness. The low levels of awareness hinder the adoption of Linked Data in libraries in these countries (Warraich and Rorissa, 2018a; Zhang, 2022:2). Pakistan university librarians found a general lack of awareness of the basic practices for the emerging Linked Data technology (Warraich and Rorissa, 2018a). Lack of awareness of basic Linked Data concepts (Warraich and Rorissa, 2022). According to Smith-Yoshimura (2016), data published as Linked Data includes descriptive metadata, bibliographic data, digital collections, ontologies/controlled vocabularies, and statistical data. Libraries publish Linked Data to increase the visibility of their resources on the Web and to support users on how they can use datasets as Linked Data (Smith-Yoshimura, 2016; Khosravi and Akbari-Daryan, 2019).

Linked Data offers several benefits to libraries and their users although there are challenges to its implementation (Gonzales, 2014; Chowdhury and Scholar, 2019; LIBRE LOD Working group, 2021; Kettouch and Luca, 2022; Unterstraßer, 2023). Linked Data provides opportunities for data to be reused using standard formats and to be linked to other resources for discovery on the Web (Eslami and Vaghefzadeh, 2013; LIBRE LOD Working group, 2021; Rahaman, 2021). It also enables data sharing among university libraries, promotes new research, supports studies on data collection methods and measurement, and facilitates new researchers' education. Therefore, Linked Data serves as a benchmark that allows other users to access and reuse data.

Furthermore, Linked Data allows for the integration of library data with data from other resources like scientific research, government data, commercial information, or even data that has been crowdsourced. Linked Data increases the sharing of library metadata and other information resources, thus making library data available for reuse through various reliable sources and eliminating any unnecessary duplication of data already available elsewhere

(Gonzales, 2014; Rahaman, 2021; Okoroma, 2023). Linked Data connects cultivated resources with different users on the Web and hence has much to offer libraries if they can leverage this technology for their own uses. The Semantic Web also enhances the richness of information using quality library data (Raza, Mahmood, and Warraich, 2019).

1.2.1 University libraries and Linked Data

Provision of quality education is achievable in universities when students and lecturers have access to library resources that support teaching, learning, and research both on campus and off campus (Buruga and Osamai, 2019:10). The library, therefore, is considered the heart of the university, and the Integrated Library System (ILS) is considered as the primary functional system of a university library (Li, 2008). As opined by Monyela (2022:1) academic libraries are supposed to contribute to the research, teaching and learning activities of the institution. Thus, requires the libraries to adopt innovative ways to improve discoverability of the library resources using emerging technologies like Linked Data.

Stanford university was one of the first universities to hold a workshop from June to July 2011, which included several librarians and technologists to examine the use of Linked Data in the academic environment and why it was worth pursuing (Schreur, 2012). This is because Schreur (2012) believed that Linked Data had the potential to revolutionize the academic world of information creation and exchange among the university libraries. As noted by Mulumba (2022), academic libraries in universities store large volumes of data that can be shared and reused to support research and innovation. However, only a small amount of this data appears in search engine results. Majority of these university libraries create stand-alone databases in various formats for accessing discreet collections, which isolates this data from broad discovery (Schreur, 2012). Yet the patrons require access to a wide variety of resources for research and learning (Exlibris, n.d), The Linked Data infrastructure enables the university libraries to increase discovery of information from one simple search (Exlibris, n.d). Linked Data technologies in academic libraries, therefore, can play a significant role in making the large volumes of data available to users on the Web (Warraich and Rorissa, 2018b). The academic libraries can therefore, take advantage of the Linked Data technologies to increase visibility and availability of their library resources on the World Wide Web

(Monyela, 2022). Several university libraries in developed countries have adopted or are adopting Linked Data to make their data available to a larger audience on the Web. These university libraries are using the RDF data-based model to link simple part three triple statements that include the subject, predicate and object expressions to describe their resources (IFLA, 2017). The universities include the University of Alberta, the Norwegian University of Science and Technology, and Queen's University, among others (OCLC, 2022). In addition, Cornell, Harvard, Columbia, Stanford and Princeton University libraries have a collaborative Linked Data for Libraries project (LD4L Project Team, 2016) to enable them to create an ontology compatible with Bibliographic Framework (BIBFRAME), a Linked Data replacement for Machine Readable Cataloguing (MARC) which lays the foundation for future bibliographic description on the Web (Petkova, 2017; Wang and Yang, 2018). RDF is currently used as BIBFRAME, and the Stanford University Libraries created a store of RDF triples for their data (Alemu et al., 2012; Rahaman, 2021; Chowdhury and Scholar, 2019).

Similarly, the Cornell University Library (CUL) has collaborated with Harvard Library Innovation Lab and Stanford University Libraries on theLD4L project since 2014 (Kovari, 2016).The three institutions have been looking at ways to gather context and relationships about their library resources beyond the traditional metadata approach (Krafft, 2015). The project was able to create a Scholarly Resource Semantic Information Store (SRSIS) model that works within individual institutions through a coordinated, extensible network of Linked Data (Krafft, 2015; Kovar, 2016). The SRSIS captures the intellectual value that librarians and other domain experts and scholars can add to information resources when they describe, annotate, organise, select, and use those resources, together with the social value evident from usage patterns. The LD4L products include an ontology and discovery interface that brings serialised linked data for the catalogues of Cornell, Harvard, and Stanford (Krafft, 2015; Kovari, 2016).

In addition, the LD4L model created by individual institutions has enabled users to improve their discovery of scholarly information resources, such as traditional monograph and journal publications, research datasets, images, recordings, cultural artefacts, newspapers and

magazines, and Web archives (Krafft, 2015).The Canadian Linked Data Initiative (CanLink) has a collection of over 5000 theses data from collaborating Canadian universities that include (University of British Columbia, university of Alberta Library and Archives Canada, Queens University, University of Toronto, McGill university, universite de Montreal and Memorial university of Newfoundland) (Warren, 2017).

Academic libraries whose Linked Data projects are still experimental in nature include North Carolina State University, and the Dalhousie University Institute for Big Data Analytics which hosts the multidisciplinary and multi-national Muninn project. The Muninn project aggregates data about World Wars in archives around the world. The project also extracts data from digitised documents and converts it into structured databases to support further research (Library and Archives Canada, 2015; Smith-Yoshimura, 2018). The Canadian Writing Research Collaboratory, an online infrastructure project, investigates links between writers, texts, places, groups, policies, and events hosted by the project (Smith-Yoshimura, 2016; Warren, 2017; Smith-Yoshimura, 2018). Pratt Institute's Linked Jazz projects expose relationships between musicians and enable jazz enthusiasts to make more connections (Pattuelli and Miller, 2015).

Although some university libraries have developed in-house integrated systems like the Kenneth Dike library at the University of Ibadan. The Kenneth Dike library developed a web-based software used to manage records and allow for the sharing of Linked Data with other libraries on request (Adetoun-Adebisi, 2020). However, the adoption of Linked Data has not been promising in developing countries because of a general lack of awareness and technical staff with knowledge of these emerging technologies (Mulumba et al, 2017; Okoroma, 2022). University libraries in Africa and other developing countries are encouraged to take advantage of Linked Data and make their library data accessible on the Web, where users can find it (Gonzales, 2014; Godby and Smith‐Yoshimura, 2017).

Some of the main obstacles to implementing Linked Data technologies as noted by Alemu, Stevens, Ross and Chandler (2012) and Rahaman (2021) include their complexity as

evidenced in technologies such as OWL, SPARQL RDFs, and RDF/XML. This makes it very difficult for the librarians to create Linked Data in their libraries (Alemu, et al., 2012:6). Hence, there is a need to make these technologies relatively easy to learn and use by the librarians and the IT staff. Raza, Mahmood and Warraich (2019) noted that the integration of educational resources across the Web is another challenge facing the implementation of Linked Data because of the equal shared principles of Linked Data and schemas.

The privacy concerns of organisations remain a big obstacle to the adoption of Linked Data technologies in digital libraries (Yadagiri and Ramesh, 2013; Okoroma, 2023). Copyright laws and legalities regarding the publishing of data on the Web (Gonzales, 2014) are further obstacles. Therefore, learning the use of Linked Data technologies should be made easier similar to what has occurred in terms of learning HTML.

Linked Data is increasingly becoming a reality, and academic libraries should endeavour to learn from their counterparts that have adopted and implemented it. In doing so they too can publish their data on the Web thereby benefitting from "being on the Web" and being able to reach out to a wider audience in a single data space (Saleem et al., 2018; LIBRE Linked Open Data working group, 2021). Training of academic librarians on how to implement Linked Data technologies in their respective libraries is required (Raza et al., 2019; Raza and Mahmood, 2021:11).

Libraries and information centres and their concerned professional associations should articulate the benefits of adopting and implementing Linked Data technologies to the relevant higher authorities (Raza et al., 2019; Raza and Mahmood, 2021:11). Professional bodies such as the American Library Association (ALA), International Association of Social Science and Information Services Technology (IASSIST), the IFLA, the OCLC, DataCite, African library and information associations and Institutions and the World Wide Web Consortium (W3C) as well as the Library of Congress, should address the challenges of implementing Linked Data technologies in libraries.

Library and information science schools should introduce linked Data courses in their curriculum. In addition, conferences, seminars, and workshops should be organised by professional bodies to improve the skills of library professionals to enable them to easily adopt and implement Linked Data technologies in their libraries. However, libraries also need to play a major role in increasing data awareness within their institutions because the researchers may not have the skills or resources needed to prepare their data for public sharing (Raza et al., 2019; Raza and Mahmood, 2021:11).

Ugandan higher education institutions emphasise innovation, capacity building for academic staff, infrastructure, and governance, but there is little emphasis on the quality of libraries and other support services (Buruga and Osamai, 2019). The Consortium of Uganda University Libraries (CUUL) is a professional body for university libraries in the country. It facilitates effective and efficient collaboration and resource sharing among the universities and other institutional libraries in Uganda to strengthen the library services provided to students, staff, and other patrons of the institutions (Consortium of Uganda University libraries, n.d). Through the CUUL partnership, libraries in Uganda provide access to a wide range of scholarly e-resources to various users (EIFL, n.d). The Electronic Information for Libraries (EIFL) has supported the launch of open-access repositories in the country (EIFL, n.d.). Collaborative efforts between the universities and national policymakers are underway to make all peer-reviewed research output openly available (EIFL, n.d.).

Over the past 10 years, libraries have been working towards Linked Data. However, it is disheartening to note that out of the 53 university libraries in Uganda, only 14 have adopted library-integrated systems such as Virtua, DSpace, Koha and other in-house systems like MAKLIBIS, which limit access to library data among the university libraries (Mwesigwa, 2016; Mulumba, 2022). While these ILSs allow access to documents on the Web, they limit access to other library data for other university libraries. Furthermore, there seems to be no inter-university library exchange of Linked Data in Uganda, yet this exchange has been beneficial elsewhere in the developed world. For example, Queen's University Library in Australia and North Carolina State Libraries in the USA have adopted Linked Data for inter-library exchange and reuse of data to make it available to the public (Neubert and

Tochtermann, 2012). A study conducted by Mulumba, Kinengyere, and Akullo (2017) aimed at exploring the level of data sharing at only Makerere University. It was found that the majority of the library staff were involved in data processing, although this data was not linked to the Open Data Cloud. Through its third National Development Plan (NDP 111) 2020/21-2021/25, the Government of Uganda noted that countries that invest in research, innovation, and adoption can transform faster (National Planning Authority, 2020:179). Scientific progress and innovation can be easily achieved through tertiary institutions of learning. Hence, the need to strengthen research and innovation through knowledge sharing nationally and internationally (National Planning Authority, 2020). According to Saleem et. al. (2018:14) and LIBRE LOD Working group (2021, the adoption of Linked Data will ensure the availability and accessibility of information and data, which will be reusable and provide for the serendipitous discovery of other resources.

This study, therefore, explored the adoption of Linked Data in university libraries to provide sharable, extensible, and reusable benefits to researchers, and librarians' resource descriptions.

1.3 Purpose of the study

Linked Data has gained acceptance in libraries (Heitmann, Cyganiak, Hayes and Decker, 2014; Rahaman, 2021) and university libraries have developed several initiatives to adopt and implement Linked Data (; Mitchell, 2013; OCLC, 2021). However, most of these initiatives have taken place in developed countries like the United States of America (USA), United Kingdom (UK), Norway, Canada and the Netherlands among others, and little progress with regard to Linked Data has been made in developing countries (Smith-Yoshimura, 2016; Warraich, 2016; Ali and Warraich, 2018).

Niu (2020b) conducted a study on the diffusion and adoption of Linked Data among libraries, however, the author's study scope was limited to libraries within the USA. The study found that the diffusion of Linked Data among libraries is a decentralised, continuous process with a high degree of re-invention that requires multiple stages and may last for many years.

The study by Warraich and Rorissa (2018), aimed at exploring Pakistani university librarians' perspectives on the adoption of Linked Data technologies and their levels of interest in doing so. Their findings revealed that the librarians were willing to explore Linked Data technologies in their institutions, although, there was a general lack of awareness of basic Linked Data concepts and best practices for this emerging technology.

A study conducted by Mulumba, Kinengyere and Akullo (2017) aimed at exploring the level of data sharing at Makerere University focusing on the multi-media collection. It was found that the majority of the library staff were involved in data processing, although this data was not linked to the Open Data Cloud. The majority of the librarians at the university were not aware of the functionality of the LOD concept and the Semantic Web and lacked the necessary skills associated with these concepts. However, their study is not conclusive in terms of the adoption of Linked Data because it focused on the multi-media collection of one university library.

This current study focused on the adoption of Linked Data among university libraries in Uganda. Linked Data assists in bridging the data sharing and reuse gap among university libraries. Therefore, this study is expected to provide an in-depth understanding of the issues concerning linked data adoption among these libraries. The study will thus not only be beneficial to the universities that formed part of the study but to other institutions and stakeholders in Uganda as well. Data sharing and reuse among the different university libraries will be enhanced as will their research capacities. The study will add knowledge to this field of study given that few empirical studies concerning the adoption of Linked Data in university libraries in developing countries have been done, and more so in Uganda.

1.4 Statement of the Problem

According to Hannemann and Kett (2010), the Web has evolved from just a global information space with linked documents to having both documents and data linked. Libraries can harness the creative potential of the Web community to accomplish more than individual institutions can alone, unlocking the full potential of interlinked library datasets. Having an established Linked Data service is achievable when data publication and exchange receive

widespread support among different institutions (Raza, Mahmood and Warraich, 2019). As noted by Summers and Salo (2013) and Rahaman (2021), while a majority of libraries and other cultural institutions do have vast amounts of rare and authentic information resources, these are, unfortunately, kept in silos (Warraich and Rorissa, 2018b:2).

University libraries underpin research, teaching, and information literacy among their users. The libraries provide access to a vast array of digital resources through their institutional repositories (IRs) and create innovative learning opportunities. A lot of research output is being realised from the different universities and research centres around the country. The datasets from these research projects may be physically available (and relevant) but not be accessible on the Web (Mulumba et al, 2017). Apart from the CUUL, there is no evidence of any initiative geared toward establishing a shared inter-university research data infrastructure (Ponelis and Adoma, 2018). This is despite the nature of data becoming more complex and datasets increasing in size and, therefore, requiring effective management in terms of their sharing (Ali and Warraich, 2018). One of the e-communication channels used for research output is the IR which allows for authors to easily distribute and share information, articles, and data (Akinola et al., 2022; Demetre, Delgado and Wright, 2020).

Out of the 53 accredited universities in the country, 14 have adopted library-integrated systems used as IRs such as DSpace, Koha, and other in-house systems, for example, MAKLIBIS (Mwesigwa, 2016; Mulumba, 2022). However, these systems limit access to the university libraries' data and hence, the data is not discoverable through the Semantic Web (Mulumba, 2022). It has been recommended that CUUL members provide such functionality to enable local resource sharing (Mwesigwa, 2016), This study, therefore, sought to discover why Ugandan university libraries have not adopted Linked Data like their counterparts in developed countries.

1.5 Aim and objectives of the study

The study aimed to explore the adoption of Linked Data among university libraries in Uganda. The aim was achieved through the following objectives:

1. To determine the level of awareness of Linked Data among the professional librarians in Ugandan university libraries.
2. To establish the extent of Linked Data adoption in Ugandan university libraries.
3. To determine the potential benefits of adopting Linked Data in Ugandan university libraries.
4. To investigate the factors that influence professional librarians' behaviour towards the adoption of Linked Data in Ugandan university libraries.
5. To investigate the strategies to promote the adoption and use of Linked Data in Ugandan university libraries.

1.6 Research questions

In light of the aim and objectives of the study, the following research questions were addressed:

1. What is the level of awareness of Linked Data among professional librarians in the Ugandan university libraries?
2. What is the extent of Linked Data adoption?
3. What are the benefits of Linked Data adoption?
4. What factors influence the behaviour of professional librarians towards the adoption of Linked Data?
5. What strategies can be used to promote the adoption and use of Linked Data?

1.7 Theoretical framework

This section briefly explains the theoretical framework used in the study. It is discussed in detail in Chapter Two. The theoretical framework for the study was derived from the Unified Theory of Acceptance and Use of Technology (UTAUT) model and the Diffusion of Innovation (DOI) theory. The DOI theory has five constructs, namely, Relative Advantage, Compatibility, Complexity, Trialability and Observability and it is the latter two constructs that were adopted by the study. The UTAUT model is based on four constructs, namely, Effort expectancy (EE), Performance expectancy (PE), Social influence (SI) and Facilitating conditions (FC) (Venkatesh, Morris, Davis, and Davis, 2003). The effects of these four

constructs are moderated by four other variables: age, gender, experience, and voluntariness of the UTAUT. The four constructs are direct determinants of technology and use.

The UTAUT was the main theory underpinning the study and it was complemented by the DOI theory. The UTAUT is a comprehensive model that can be applied across various applications and is widely used in technology acceptance studies. A combination of the UTAUT and the DOI theory was adopted as the theoretical framework for the study because they are comprehensive in nature and provide both validity and reliability in determining the factors that influence the adoption of technologies. All four constructs of the UTAUT were adopted while, as mentioned earlier, the constructs of trialability and observability were adopted from the DOI theory to explore the facts that determine the adoption of Linked Data among university libraries. The relationship between the research questions and the constructs from the DOI theory and the UTAUT model is shown in Table 1 below.

Table 1: Mapping research questions to constructs of the theories.

No.	Research Question	Theory	Construct
1	What is the level of awareness of linked data among university librarians?	UTAUT	Facilitating conditions, Social influence
		DOI	Observability
2	What is the extent of Linked Data adoption in Ugandan university libraries?	UTAUT	Effort expectancy, Facilitating conditions
		DOI	Trialability
3	What are the benefits of Linked Data adoption?	UTAUT	Performance expectancy
4	What factors influence the behaviour of university librarians	UTAUT	Effort expectancy, Social influence

	towards the adoption of Linked Data?		
5	What strategies can be used to promote the adoption and use of Linked Data	UTAUT	Facilitating conditions

The level of awareness of Linked Data among professional librarians in Ugandan university libraries was established through the first research objective and question. The facilitating conditions and social influence constructs of the UTAUT theory and the observability construct of the DOI theory (See Table 1 above) were applied to investigate the first question. The study further probed the extent of Linked Data adoption using the UTAUT and DOI theory. To answer this question, the trialability construct of DOI theory and effort expectancy and facilitating conditions of UTAUT were applied. The UTAUT theory was used to answer research question three and applied to identify the benefits of Linked Data adoption using the performance expectancy. The study further sought to investigate the factors that influence the behaviour of university librarians towards the adoption of Linked Data using the effort expectancy and social influence constructs of UTAUT. This led to research question five, where the UTAUT model was applied using the facilitating condition construct to investigate the strategies that can be used to promote Linked Data adoption and use.

1.8 Research methodology

This section briefly presents the research methodology used in the study. Chapter Four provides a detailed discussion of the methodology adopted. The pragmatic paradigm was used in the study. The paradigm uses pluralistic approaches to derive knowledge and focuses on the research questions to provide concrete solutions to social problems Creswell, 2013; Tashakkori and Teddlie, 2010). The study also employed a mixed method (qualitative and quantitative) approach and an exploratory research design given that little research has been done on the adoption of Linked Data in university libraries in developing countries (Creswell and Plano-Clark, 2007). Fourteen universities were purposively selected because they have adopted ILSs for their information services The population for this study comprised, 145 professional librarians, 14 heads of library technical services, 14 university librarians, and 14

heads of IT. The study purposively targeted the university librarians because they are responsible for policy formulation and implementation, and infrastructure development in the university libraries. The head of technical services is responsible for the library's technical services, including cataloguing and database management. The heads of IT oversee all technology operations in the universities. Finally, professional librarians support the academic departments in terms of meeting their information needs. The data for the study was derived from responses to online questionnaires (directed at the professional librarians and the heads of library technical services) and telephonic interviews (held with university librarians and the heads of IT). The Statistical Package for Social Sciences (SPSS) version 21.0 was used to generate descriptive and inferential statistics. Qualitative data was thematically analysed (Leedy and Ormrod, 2005).

1.9 Delimitation of the study

The focus of the study was on university libraries and their adoption of Linked Data. Thus, the study was delimited to only those members of the university staff who would be directly involved in the implementation and operation of Linked Data, that is, the professional librarians, the university librarians, the heads of IT and the heads of the library technical services. Thus, academic, and other administrative staff as well as students were not included. While they would be beneficiaries of Linked Data, they would not be directly involved in its implementation and operation.

1.10 Definitions of key operational terms and concepts

This section presents the definitions of key terms and concepts used in the study.

Head of Information Technology (IT)

The head of IT provides strategic technical expertise to the university. The individual is responsible for driving technological innovations and supporting the development of digital solutions in the university.

Head of library technical services

The head of library technical services manages the technical services of the library. The individual is responsible for, among others, cataloguing and classification, database management, collection development and technology.

Integrated library system (ILS)

The ILS is the primary functional system of a library. It is an automated system with several functional modules such as acquisition, circulation, cataloguing, serials, and an online public access catalogue (OPAC), and these functional modules share a common bibliographic database (Müller, 2011). An ILS usually comprises a relational database, software to interact with that database, and two graphical user interfaces (one for patrons, and one for staff) (Uzomba, Oyebola and Izuchukwu, 2015).

Library data

Library data refers to any type of digital information produced or curated by libraries that describes resources and aids their discovery. This includes metadata and research data that can be used to administer, describe, preserve, present, use or link other information held in resources, especially knowledge resources.

Library Linked Data (LLD)

LLDs are data standards used by libraries and applied to bibliographic and authoritative data sets. LLDs increase the visibility of library resources and their interoperability with non-library systems. Gaitanou, Andreou, Sicilia and Garoufallou (2022) noted that libraries need to complement their data by linking it to other external data sources.

Linked Data

According to Bizer, Heath and Berners-Lee (2011:28), Linked Data "refers to a set of best practices for publishing and connecting structured data on the Web". Linked Data provides the mechanism for sharing and reuse of data on the Web (Bizer and Heath, 2021). This data must be open and structured so that it links to other datasets to provide access to a wealth of data (Zengenene, 2013; Saleem et al., 2018). Linked Data can be summarised as the use of the Web to create connections between data that may be originally stored in various databases

maintained by different university libraries and distributed across different geographic locations.

Linked Open Data (LOD)

LOD is data that is linked and reused, open and free from any legal and copyright restrictions (open). It can be viewed as a mechanism through which libraries share data (Mitchell, 2013).

Ontology

An ontology is a vocabulary of terms that is used to model a domain of knowledge (Gruber, 1995). Ontologies are the main model for knowledge representation in the Semantic Web. They describe the entities that consist of a set of types, properties and relationships. They are considered ideal knowledge models to formally describe Web resources and their vocabulary (Abdelaziz and Kaffas, 2018:3).

Professional librarian

A professional librarian is an individual who has obtained a library and information science degree (or above) or similar qualification. The professional librarian conducts research, publishes, supervises, and carries out other academic growth of the university.

Research data

Research data can be defined as "raw data directly produced from the survey, or processed data which has been cleaned, refined, arranged, and combined in a manner that it is useful in research"(Dora and Kumar, 2015:484). Research data also includes data which is already published in journals or other scientific communication formats (Dora and Kumar, 2015:484). Research data includes discrete digital objects such as text, files, images, audio, videos and databases among others (Whyte and Tedd, 2011). Research data requires institutional policies to protect, preserve and ensure that it is available for future use (Burger and Kubiak, 2013).

Resource description framework (RDF)

The RDF is a model through which metadata about a resource is captured. It is used for making simple statements and connecting them so that a series of statements can be viewed as a complete descriptive record of a resource (Mitchell, 2013; Rahaman, 2021).

RDF Triple

A triple, also known as 3-tuples or triples, is a statement that consists of three parts (nodes), namely, subject, predicate and object and conforms to the structure of a graph. These nodes signify the relationship between a resource and a subject (Abdelaziz and Kaffas, 2018:3).

Semantic Web

The Semantic Web provides a set of standards and best practices that are used for sharing data and the semantics of data over the Web for use by an application. The Semantic Web provides links to explore the Web of Data by humans and computers/machines (Zhang, 2013). Berners-Lee, Hendler and Lassila (2001) described the Semantic Web as an extension of the current Web, provides well-defined meaning and enables computers and people to work together. The core goal of the Semantic Web is to enable machines to understand and interpret data on the Web like humans (Sure, Hitzler and Studer, 2005).

Structured data

Structured data is data that has been pre-defined and formatted to a set of structures before being placed in data storage and is often referred to as schema-on-write. The data is organised into a formatted repository in the form of a database so that its elements can be made addressable for more effective processing and analysis (Lurkevich, 2023). Structured data helps search engines like Google to better understand what the content is about. It is generally tabular with columns and rows that clearly define its attributes.

University libraries

University libraries are academic libraries connected with institutions of higher learning. The major function of a university library is to support the learning, teaching, and research activities of its institution and the community around it (Sawahel, 2017).

University librarian

The university librarian is the overall head of the university library. The university librarian is responsible for the development, control, management, and coordination of all the library and information services of the university (Segun-Adeniran, 2015).

1.11 Ethical considerations

Written informed consent was sought and obtained from all participants and permission was obtained from the "gatekeepers" of the participating universities (***Appendix IX***). Participants' confidentiality was also assured, and the researcher followed the ethical policy of the University of KwaZulu-Natal (UKZN). In addition, "Turnitin" was used to ensure that the UKZN's plagiarism policy was followed. The ethical considerations of the study are discussed in more detail in Chapter Four.

1.12 Structure of the thesis

The thesis comprises seven chapters based on the College of Humanities (UKZN) guidelines for a PhD thesis.

Chapter One: Introduction to the Study

This chapter provided the background to the research problem, the purpose of the study, the problem statement, the aim and the objectives of the study, as well as the research questions. It also provided a brief description of the theoretical framework, the research methodology and the ethical considerations. The delimitation of the study and the definitions of key terms and concepts were outlined. Finally, the structure of the thesis, by chapter, was provided.

Chapter Two: Theoretical Framework

The chapter explains the theories that were used to underpin this study as well as the commonly used theories for technology adoption and use. The latter theories include the Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975, 1980); the TAM by Davis (1986); and the TOE by Tornatzky and Fleischer (1990). Two theories were utilised in the study: the UTAUT model (Venkatesh, Morris and Davis, 2003) was the dominant theory

chosen to underpin the study while Roger's (2003) DOI theory complemented it. The UTAUT model was preferred because it is one of the most recent technology adoption theories and has been found robust with the ability to explain 70% of the variance in technology use. It has also been widely used across the globe, including in Africa.

Chapter Three: Literature Review

This chapter presents a synthesis of both empirical and theoretical literature based on the themes arising from the research questions, the key variables derived from the UTAUT model (performance expectancy, effort expectancy, social influence, and facilitating conditions) and the DOI theory (trialability and observability). Most of the reviewed literature was obtained from primary and secondary sources that were identified by searching various databases such as Google Scholar, Web of Science, Elsevier, and Emerald.

Chapter Four: Research Methodology

Chapter Four discusses the research paradigms, research approaches, research design, unit of analysis, population of the study, data collection, pretesting of the research instruments, reliability and validity, sampling procedures, data analysis, and ethical aspects of the research. Pragmatism was found to be the most appropriate philosophical foundation for the study. The study adopted the mixed method research approach by combining quantitative and qualitative research techniques. An exploratory research design was used because of its appropriateness for under-developed research areas and where new insights are required. Fourteen universities were purposively selected based on their having adopted ILSs. Four groups of participants were surveyed using either an online questionnaire or telephonic interviews.

Chapter Five: Data Analysis and Presentation of Findings

This Chapter provides the analysis and presentation of the quantitative and qualitative data that were collected. Qualitative results are presented thematically, while quantitative results are presented using charts, figures, tables, and narration.

Chapter Six: Discussion and Interpretation of Findings

Chapter Six presents the discussion and interpretation of the findings. The findings are discussed based on the extant literature and theories that underpinned the study.

Chapter Seven: Summary, Recommendations and Suggestions for Further Research

This chapter presents a summary of the main findings in light of the research questions posed. Recommendations are proposed. The chapter also discusses the contributions of the study to policy, practice and theory and makes suggestions for future research endeavours.

1.13 Summary

Chapter One introduced the study by highlighting the main components of the study as discussed and outlined in chapters two through seven. The chapter presented the background to the study and the university libraries that have been studied. The chapter further discussed the benefits Linked Data offers to libraries and its users such as data sharing among the university libraries, promoting new research, supporting studies on data collection methods and measurement, and facilitating research education. The chapter also highlights some of the libraries that have adopted Linked Data technologies in developed countries and elucidates why university libraries in developing countries including Uganda have not adopted Linked Data yet. Thus, the study explores the adoption of Linked Data among Ugandan university libraries. Ethical issues were followed to guide the study. The research methodology used as well as the theoretical frameworks applied were briefly presented with their significance to the study being highlighted.

Chapter Two follows in which the theoretical framework underpinning the study is discussed.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 Introduction

The study aimed to explore the adoption of Linked Data among the university libraries in Uganda. Despite efforts by university libraries to adopt ILSs, limited data accessibility persists among them due to the lack of interlinked data.

This chapter presents the theoretical framework underpinning the study. The chapter first reiterates the purpose of the study and then discusses the theory and theoretical framework as they apply to research. The different theories that are relevant to the study topic (technology adoption) are then briefly outlined. This is followed by a detailed discussion of the two theories informing the study including an explanation and justification for why they were chosen. After each theory or model is introduced and discussed, related studies that have used the theory or model as part of their investigation are reviewed.

2.1.1 Theory and theoretical frameworks in research

A theory is a set of interrelated constructs that include variables or concepts which explain the relationships between these constructs. It provides a systematic perspective on a phenomenon of interest, accompanied by specific assumptions and boundary conditions (Kerlinger, 1979:64; Bhattacherjee, 2012). Maxwell (2012:191) defines a theory as a "set of concepts and ideas with relationships amongst them." A scientific research theory helps explain how and why a phenomenon operates as it does rather than describe or predict it. There are empirically and non-empirically based theories that operate at a conceptual level based on logic (Bhattacherjee, 2012; Maxwell, 2012).

Non-empirically based theories result from synthesising ideas and not from analysing empirical data. On the other hand, empirically based theories emanate from carrying out qualitative, quantitative, or mixed-methods research (Maxwell, 2012:49). This study used

empirically based theories because it applied mixed-methods research to explore the adoption of Linked Data in Ugandan university libraries.

According to Grant and Osanloo (2014) and Mensah, Agyemang, Acquah, Babah and Dontoh (2020:60), a theoretical framework is based on theories that have already been tested. The theoretical framework guides research, determining what things to measure, and what statistical relationships to look for (Tamene, 2016:53). The UTAUT model was the principal theory used to underpin the study and was complemented by the DOI theory. A model helps the researcher understand the nature of theory, its constructs, and the concepts in a specific context (Ngulube, 2019:21).

As noted in the introduction above, theories relevant to the study are briefly outlined. Emphasis is, however, placed on the DOI theory and the UTAUT model. Also as noted, studies which have utilised these theories or models are reviewed.

2.2 Theories relevant to the study of technology adoption

According to Dwivedi, Rana, Janssen, Lal, Williams, and Clement (2017), one of the major concerns for research and practice is the acceptance and use of information systems and information innovations. A prominent area of research in information systems is technology adoption (Sharma and Mishra, 2014). According to Carr (1999), technology adoption is a stage in which a technology is selected for use by either an individual or an organisation. Information technology (IT) adoption has gained increasing prominence in recent times (Sharma and Mishra, 2014). Several theories can be used to measure and test the individual and organisational levels of user acceptance of technology (Taherdoost, 2018). This implies that the adoption of Linked Data technologies, for example, will depend on librarians' perceptions of its importance in their work and how easy it is to integrate into their existing systems.

As noted, several theoretical models have been applied to predict the adoption and use of technology. These include among others:

i. Technology Acceptance Model (TAM)

ii. Theory of Planned Behaviour (TPB)
iii. Technology – Organisation – Environment (TOE) Theory
iv. Diffusion of Innovation Theory (DOI)
v. Unified Theory of Acceptance and Use of Technology (UTAUT) Model and UTAUT2

2.2.1 Technology Acceptance Model (TAM)

The TAM has been widely used in technology adoption studies. It was proposed by Davis in 1985 in his doctoral thesis at the MIT Sloan School of Management. He proposed that the system use is a response that can be explained or predicted by user motivation and is directly influenced by an external impetus consisting of the actual system's features and capabilities (Chuttur, 2009). The TAM has two main constructs: Perceived Usefulness and Perceived Ease of Use. The two constructs are used for predicting the extent of adoption of new technologies at the individual level (Sharma and Mishra, 2014:21).

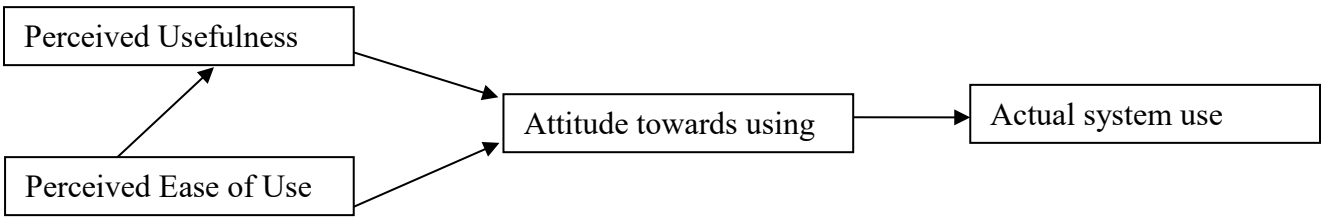

Figure 1: Diagrammatic representation of the TAM model

Source: Adapted from the TAM model (Davis, 1986)

As shown in Figure 1 above, Davis (1986) proposed that users' motivation can be explained using three factors: Perceived usefulness, Perceived ease of use, and Attitude towards using the system. He further hypothesised that the user's attitude towards the adoption of a system was a major determinant of whether they would use or reject it. The two major constructs that may influence the attitude of the user to adopt a system, are Perceived usefulness (the extent to which a potential user of the system believes that the use of that system will enhance his or her job performance) and the Perceived ease of use (the extent to which a potential user of an IT system perceives or believes that the use of that IT system will be free of effort). The

Perceived ease of use has a direct influence on Perceived usefulness. This implies that if the librarians in the universities believe that Linked Data is easy to use and will improve their job performance, it will be easy for them to adopt it; however, if it has many complexities, they may find it challenging to use and hence may reject it.

2.2.1.1 Literature review in terms of the TAM

User acceptance of technology has been an important field of study for over two decades. While several models have been proposed to explain and predict the use of a system, it is the TAM which has captured the most attention (Ma and Liu, 2004; Chuttur, 2009). The TAM explains and predicts the use of a system by drawing the attention of the information systems community and describing individuals' acceptance of the system (Chuttur, 2009; Ma and Liu, 2004; Lee et al., 2003). As noted by Sharma and Mishra (2014:21), the strength of the model lies in its simplicity because it has only two constructs that need to be used to predict the extent of adoption of new technologies at an individual level.

The TAM helps in understanding predictors of human behaviour towards the potential acceptance or rejection of a technology (Granić and Marangunić, 2019). For example, the application of TAM in educational technology acceptance has proven its effectiveness when compared with other theoretical models (Ma and Liu, 2004; Salloum, Alhamad, Al-Emran, Monem and Shaallan, 2019. While the effectiveness of the TAM has been confirmed in several other studies, there are still doubts shared among some researchers regarding the application and theoretical accuracy of the model (Ma and Liu, 2004; Chuttur, 2009:17).

The TAM is a very popular model for explaining and predicting system use, as well as measuring the degree of acceptance of technology by users (Ma and Liu, 2004; Chuttur, 2009; Granić and Marangunić, 2019). Due to its simplicity and ease of use, Ajibade (2018:1) argues that the TAM is suitable for individual use, perception, and purpose. However, it does not apply to companies, universities and most organisations (such as libraries) with rules and regulations, as they require integration of IT. Weerasinghe and Hindagolla (2017) concur, noting that the TAM is mostly utilised in explaining an individual's acceptance of IT or an information system. Additionally, empirical tests carried out on the TAM show mixed and

inconclusive results in terms of statistical significance, direction, or magnitude (Ma and Liu, 2004).

Hence, TAM is limited in explaining the technology adoption. The TAM ignores institutional rules and regulations that supersede the individual's intention and opinion about technology use (Ajibade, 2018). Therefore, these shortcomings of TAM make it unsuitable for this study because the university is an institutional setting.

2.2.1.2 Other related studies based on the TAM

Munabi, Aguti and Nabashawo (2020) applied the TAM to predict the factors that affect undergraduate distance learners' behavioural intention to use Makerere University's e-Learning Environment (MUELE) using the Learning Management System (LMS). According to their findings, enjoyment and perceived usefulness influenced the learners continued use of the LMS. Similarly, Qteishat, Alshibly and Al-Ma'atah (2013) applied the TAM to examine the factors contributing to students' attitudes toward e-learning in higher education in Jordan. The study developed a TAM for e-learning (TAM-EL) which was used to predict the intention to adopt e-learning using the constructs of the TAM. It was found that students play an important role in the adoption of e-learning in Jordan since they are the ones who largely use it.

Rafique, Almagrabi, Shamim, Anwar and Bashir (2020) applied the TAM to explore the acceptance of Mobile Library Applications (MLAs) in Pakistan. Their results revealed that Perceived usefulness and Perceived ease of use were direct and significant predictors in terms of the intention to use MLA, whereas the quality of the system and the habits of the users were the influencing factors towards the usage intention of MLAs. This was because the habits of the users usually change based on system quality.

Koloseni, Mandari and Msonge (2021) applied the TAM to assess whether identified external factors could significantly affect Perceived usefulness and Ease of use of e-book technology in Tanzania. The authors also examined if Perceived usefulness and Perceived ease of use could lead library users to form behavioural intentions to adopt e-book technology.

Finally, Hak (2015) applied the TAM to investigate the implementation of "Senayan" an open-source library automation system in the Madrassa Library. The results of their study showed that "easiness" was more important than "usefulness" when providing training for the Madrassa Library staff. Their study recommended that in implementing training on the "Senayan" for the staff, more attention should be paid to aspects concerning the Perceived ease of use of the available menu functions on the program.

2.2.2 Technology-Organisation-Environment (TOE) Framework

The TOE framework was created by Tornatzky and Fleischer (1990). The framework describes how a firm or organisation adopts and implements technological innovations influenced by the technological context, the organisational context, and the environmental context (Depietro, Wiarda and Fleischer, 1990; Baker, 2012) The TOE framework analyses the factors influencing a new information system's adoption in small and medium-sized enterprises (SMEs), especially since adoption and new technologies are persistently being developed (Hoti, 2015).

The technological context of the TOE framework includes the internal and external technologies that are relevant to the firm. The technologies may include equipment as well as processes. The organisational context describes the firm's characteristics and resources, including its size, degree of centralisation, degree of formalisation, managerial structure, human resources, number of slack resources, and linkages among employees (Tornatzky and Fleischer, 1990). The environmental context includes the size and structure of the industry, the firm's competitors, the macroeconomic context, and the regulatory environment (Depietro, Wiarda and Fleischer, 1990).

According to Depietro, Wiarda and Fleischer (1990:154), technological, organisational and environmental elements present both constraints and opportunities for technological innovation. The expected benefits of an organisation to receive an adoption include increased efficiency, quality and reliability while the obstacles in the adoption process may include complexity and compatibility with the efficiency of the organisation's technology systems

(Abrahams, 2010; Alemu et al., 2012). Salleh, Choy Chong, Noh Syed Ahmad and Omar Sharifuddin Syed Ikhsan (2013) noted that the fit between the existing technology setting and the intended technology innovation will be one of the determinants in the decision to adopt the technology innovation. For example, the organisational understanding of security-related issues will contribute to adopting a technology innovation like Big Data solutions (Salleh and Janczewski, 2018). The TOE framework is depicted in Figure 2 below.

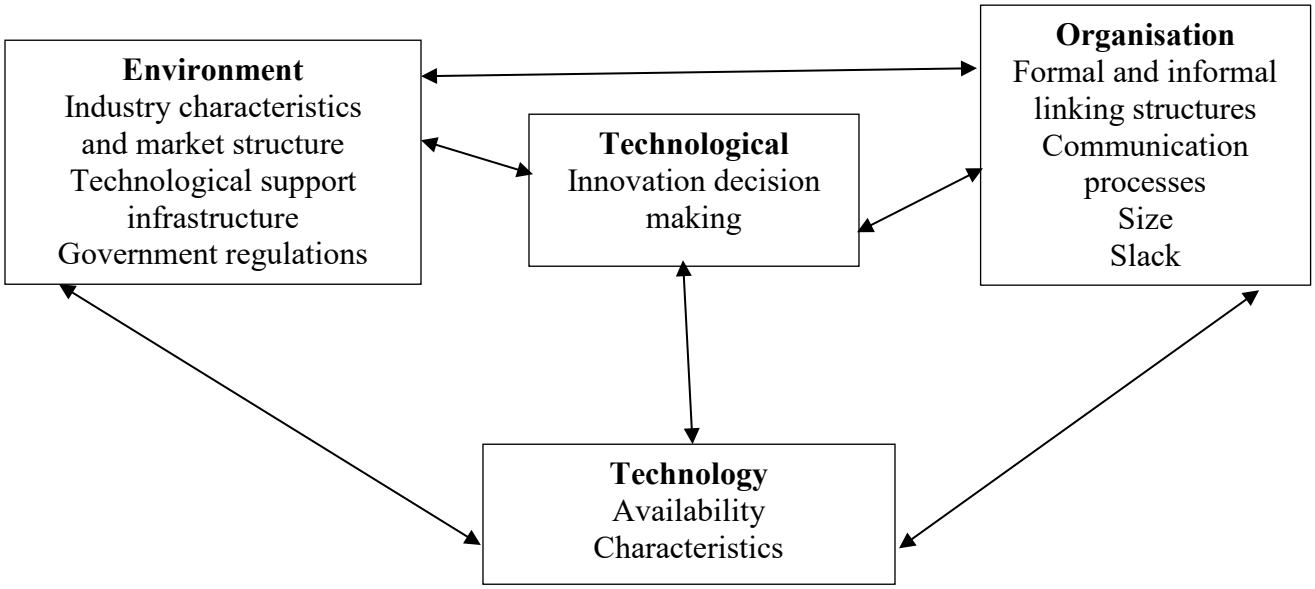

Figure 2: TOE framework

Source**:** Adapted from Tornatzky and Fleisher (1990)

2.2.2.1 Literature review in terms of the TOE

The TOE framework is an institutional-level theory widely used to investigate the adoption of various technologies (Tashkandi and Al-Jabri, 2015; Stjepić, Pejic-Bach and Bosilj-Vuksic, 2021). It has been considered the most appropriate framework for identifying the factors that push organisations to accept any technology (Abdollahzadehgan, Che-Hussin, Gohary and Amini, 2013). The TOE framework has been used in several studies as a lens to study the adoption of technology (Oliveira and Martins, 2011; Baker, 2012; Awa, Baridam and Nwibere, 2015). For example, the TOE framework has been used to understand the determinants that influence an organisation's adoption of new technology innovation

(Oliveira and Martins, 2011). The framework emphasises that an institution's decision to adopt a technological innovation is not only based on technology but also on the organisation and environment contexts (Singeh, Abrizah and Kiran, 2020). Tashkandi and Al-Jabri (2015) noted that when adopting an innovation, analysis should not be focused on technical factors only. The success of efficiency and effectiveness of an adoption requires good administration and corporate governance, and infrastructure that contributes to supporting the success of the new application/s (Tom, Virgiyanti and Rozaini., 2019). Support from top management plays a major role in determining IT innovation adoption at the organisational level (Jeyaraj, Rottman and Lacity, 2006; Abdollahzadehgan et al.,2013).

The TOE framework also provides a theoretical basis for exploring information systems and a taxonomy for classifying adoption decisions using technology, the organisation, and the environment. These three contexts influence the decision-making process in organisations (Oliveira and Martins, 2011; Singeh et al., 2020). As noted by Tom et al. (2019), one of the advantages of the TOE framework over other models like the DOI theory is that it includes environmental factors as one of the determinants of the adoption of an innovation. One of the pertinent factors in the technological context that affects the adoption of e-business is the technology readiness of the firm. In addition, other factors such as firm size, global scope, and financial resources should be studied to understand how the organisational context affects the adoption of e-business (Zhu, Kraemer and Xu, 2003).

Lautenbach, Johnston and Adeniran-Ogundipe (2017:26) noted that the TOE framework is relatively broad and can be adapted according to the specifics of a particular domain within the information system. However, Awa, Ukoha and Emecheta (2016) argued that the TOE framework's organisational context and practices that apply to a large business may not apply to small businesses because the former may have more resources and infrastructure to facilitate the innovation adoption than the latter. Therefore, different types of innovations have different factors that influence their adoption (Baker, 2012). Abdollahzadehgan et al., (2013) recommended incorporating other frameworks, such as the TAM.

The TOE framework is one of the most appropriate frameworks to explain organisational innovation adoption. However, it has evolved slowly since its initial development (Baker, 2012:8). The TOE framework is considered a generic theory because various factors can be placed there (Zhu and Kraemer, 2005:63). The framework is aligned with other explanations of innovation adoption rather than offering a competing explanation to them. For instance, the TOE framework is consistent with the DOI theory (Rogers, 1995) with DOI theory adoption predicators (individual leader and internal characteristics of organisational structure) which are comparable to the TOE framework's organisational context. Similarly, there has been limited research on enumerating the different factors that are relevant in the TOE framework adoption contexts. No new constructs have been added to the framework and little theoretical synthesis has occurred. Additionally, a scant critique of the framework has been offered. Therefore, this framework was not adopted for this study.

2.2.2.2 Other related studies based on the TOE framework

Tashkandi and Al-Jabri (2015) applied the TOE framework to determine and analyse the factors that directly affect the adoption of cloud computing by higher education institutions in Saudia Arabia. Their findings showed that non-adopters had issues with privacy and storage of intellectual property assets and students' records on the cloud. The authors recommended that cloud service providers need to play a major role in establishing trust and providing a high degree of security and service quality.

Singeh et al. (2020) applied the TOE framework to determine the factors that influence digital library adoption. They aligned the constructs of the digital library models to establish the likely success factors for the implementation of a digital library.

Salleh et al. (2013) applied the TOE framework to examine the security determinants of Big Data solutions adoption. They focused on the influence of various security technologies, organisational security, and security-related environmental factors.

2.2.3 Theory of Planned Behaviour (TPB)

Icek Ajzen proposed the TPB in 1991. It is an extension of the Theory of Reasoned Action (TRA) and is applied to predict an individual's intention to engage in a behaviour in a specific context (Fishbein and Ajzen, 1975; Ajzen, 1991; Yang, Lee and Zo, 2017). The TPB proposed by Ajzen (1991) adds the concept of Perceived Behavioural Control (PBC) to the constructs of attitudes and subjective norms which comprise the TRA (Sharma and Mishra, 2014). PBC refers to people's perception of ease or difficulty in performing the behaviour of interest (Sharma and Mishra, 2014:20). The TPB indicates that social attitude and personality traits play an important role to predict and explain human behaviour (Sherman and Fazio, 1983; Sommer, 2011). Behavioural intention is when an individual is willing to try and perform a certain behaviour based on their behavioural beliefs (Ajzen,1991; Sanne and Wiese, 2018).

The TPB has six constructs that represent a person's behaviour intention. These constructs are attitudes, behavioural intention, subjective norms, social norms, perceived power, and perceived behavioural control that represent a person's actual control over their behaviour (Ajzen, 1991).

2.2.3.1 Literature review in terms of the TPB

The TPB framework has been adopted in several studies. It captures individual beliefs that influence people's intention to perform a given behaviour (Opoku, Cuskelly, Perdersen and Rayner, 2021). For instance, it may focus on aspects related to the librarians' beliefs about the perceived importance of adoption of Linked Data technologies, support from the university management, and the librarian's confidence in their own skills to use and implement Linked Data practices.

Taherdoost (2018) noted that one's attitude towards an IT system will have little relevance if the system is not accessible. For example, Rana, Dwiredi, Lal, Williams and Clement (2017), noted that there is sluggish adoption of emerging electronic applications in governments in both developed and developing countries. India developed an Electronic Government

System, but a large portion of the population has not yet used it; however, it is difficult to measure the population's behaviour.

While the TPB has been used in several studies, one of its limitations is that it assumes that the person has acquired the opportunities and resources to be successful in performing the desired behaviour, regardless of their intention. The theory does not address the time frame between intention and behavioural action. As noted by Sommer (2011), there is a gap between intention and behaviour and, therefore, several researchers have indicated that some elements are missing in the model and have tried to enrich it by including other constructs like moral norms.

2.2.3.2 Other related studies related to the TPB

Kam, Hue and Cheung (2018) applied the TPB to examine and predict secondary school students' self-reported behaviour related to academic dishonesty in Hong Kong, an Asian educational environment. The study found that the learning environment moderated the relationship between intentions and behaviour.

Malebana (2014) applied the TPB to investigate the entrepreneurial intentions of commerce students at a rural university in Limpopo province, South Africa. The results indicated that the entrepreneurial intention of the respondents can be predicted from their attitude towards becoming an entrepreneur, perceived behavioural control, and subjective norms. Therefore, the TPB is a valuable tool in understanding the entrepreneurial intention of rural university students in South Africa.

2.2.4 Diffusion of Innovation (DOI) Theory

The DOI theory was developed by Everett M. Rogers in 1960 and has been applied by researchers over the years (Sharma and Mishra, 2014). The theory elucidates "the process by which an innovation is communicated to the members of a social system through different channels over time" (Rogers, 1995). There are four main elements of the theory that influence the spread of a new idea, namely, innovation, communication channels, time, and the social system (Ham, n.d.). These elements are further explained below.

i) Innovation

According to Rogers (2003:12), innovation is an idea, or technological project that is perceived as new by an individual or other unit of adoption. An innovation may include any new form of technology like Linked Data technologies regarding emerging library practices. Scott and McGuire (2017) noted that individuals are more likely to adopt an innovation if it is perceived as having some relative advantage over the current practice; it is compatible with the existing systems and their needs; it is not complicated; it can be tested for a limited time before its adopted; and it has observable results and outcomes. Innovations which offer flexibility are more likely to be adopted quickly.

ii) Communication channel

Communication is the "process by which participants create and share information with one another in order to reach a mutual understanding" (Rogers, 2003:12). Diffusion involves an innovation (new idea) communicated among members of a social system using various communication channels. In the university library context, the diffusion process requires that there is information exchange with the library so that an individual can communicate the innovation to one or several individuals. The diffusion process includes an innovation, an individual with knowledge of, or experience with using the innovation, other individuals who do not have yet knowledge of the innovation, and the communication channel to be used.

A communication channel is a means by which a message is disseminated from one person to another. Communication channels are used to distribute information about the innovation and the time taken by individuals to move through the adoption process (Scott and McGuire, 2017; Ham, n.d). Diffusion indicates that individuals who are most similar to the potential adopters are the most effective communication channels in promoting innovation adoption to their colleagues or institution (Scott and McGuire, 2017). This is because the majority of people depend upon a subjective assessment of an innovation that is conveyed to them from individuals like themselves but who have already adopted the innovation (Rogers, 2003).

Interpersonal communication channels involve face-to-face communication between two or more individuals. This can be done through professional conferences, workshops, and training and technical assistance structures, among others (Scott and McGuire, 2017). An interpersonal communication channel is more persuasive in encouraging individuals and organisations to adopt and embrace the innovation. For instance, the Library of Congress, one of the leading adopters, released the BIBFRAME vocabulary and MARC-BIBFRAME converter and is disseminating their adoption experiences and products to other libraries to encourage them to transform their MARC library data to Linked Data (Scott and McGuire, 2017; Niu, 2020b).

iii) Time

The time dimension is an important element in the diffusion process. Rogers (2003) noted that the innovation-decision period is the length of time that is required to pass through the innovation-decision process. The time dimension is involved in diffusion, in the innovation-decision process, the innovativeness of individuals or other units of adoption, and the innovations' rate of adoption in a system. The innovation-decision period is the length of time required for an individual or organisation to pass through the innovation-decision process (Rogers, 1995:197). The innovation-decision process is the process "through which an individual passes from first knowledge of an innovation through a decision to adopt or reject it, to implementation of the new idea, to confirmation of this decision" (Rogers,1995:201-202). Essentially, time in the context of the theory, refers to the time it takes for individuals to move through the adoption process (Ham, n.d.).

iv) Social system

Diffusion of an innovation occurs in a social system. The social system is comprised of members who have a common objective. The system exists around the adopters/non-adopters of the innovation (Ham, n.d.). The system may be made of individuals, information groups, sub-groups, or institutions such as universities (Scott and McGuire, 2017). The social system in the diffusion process is influenced by either or both formal and informal social structures (Scott and McGuire, 2017).

The above four elements involve the innovation-decision process, an "information–seeking and information-processing activity, where an individual is motivated to reduce uncertainty about the advantages and disadvantages of an innovation" (Rogers, 2003). Rogers presents five stages through which adopters move in the innovation-decision process. These five stages are knowledge about the innovation and its function; persuasion when a potential adopter formulates an opinion about the innovation; decision when a potential adopter decides to either adopt or reject the innovation; implementation when the potential adopter implements the innovation; and confirmation where the adopter seeks reinforcement of their decision to adopt the innovation. The five stages in the innovation-decision process are depicted in Figure 3 below.

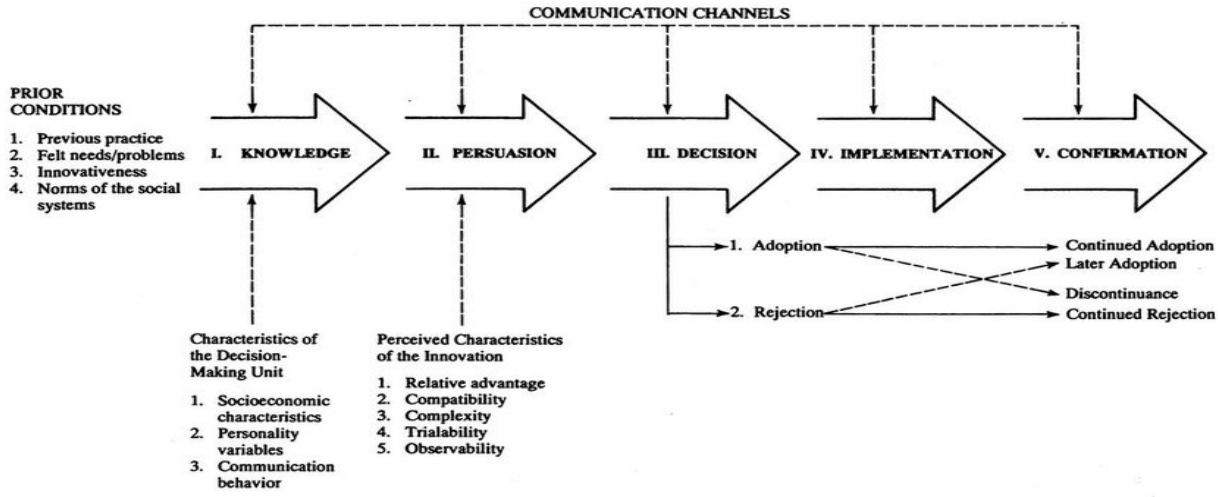

Figure 3: Five stages in the innovation-decision process

Source: Rogers (2003)

Adoption of an innovation is a process where some people in the social system are more apt to adopt the innovation than others. In the beginning, the innovation is exposed to very few people. However, as these people in the social system start accepting the innovation, they bring it into contact with more and more people. The rate of spread, therefore, keeps increasing, and eventually, most people in the social system accept the innovation. Once this occurs, the rate of spread suddenly declines. When there are no members left to accept the innovation, the spread stops (Sharma and Mishra, 2014).

There are five established adopter categories when promoting an innovation and different strategies that can be used to appeal to each of these categories (Sahin, 2006:5). These are:

i) **The Innovators** are the people who want to be the first to try out the innovation. They are interested in new ideas, willing to take risks, and are often the first to develop new ideas.
ii) **The Early Adopters** are the people who represent opinion leaders who enjoy leadership roles and embrace change opportunities.
iii) **The Early Majority** are the people who do adopt new ideas although they typically need to see evidence that the innovation works before they are willing to adopt it.
iv) **The Late Majority** are the people who are sceptical of change and will only adopt an innovation after it has been tried by the majority.
v) **The Laggards** are people bound by tradition and very conservative. They are very sceptical of change and are the hardest group to bring on board.

The categorisation of the innovation adopters is illustrated in Figure 4 below.

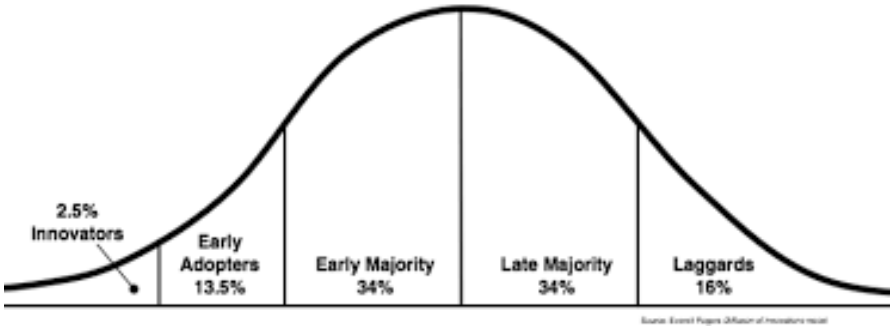

Figure 4: Categorisation of innovation adopters
Source: Rogers (2003)

Furthermore, five main factors influence the adoption of an innovation, and each of these factors plays a different role to varying extents in the five adopter categories. These factors include:

i) **Relative advantage** is the degree to which an innovation is seen as better than the idea, programme, or product it replaces.

ii) **Compatibility** is how consistent the innovation is with the values, experiences, and needs of the potential adopters.
iii) **Complexity** is how difficult the innovation is to understand and/or use.
iv) **Trialability** is the extent to which an innovation can be tested or experimented with before a commitment to adopt it is made.
v) **Observability** is the extent to which the innovation provides tangible results.

2.2.4.1 Literature review in terms of the DOI theory

Leading libraries, professional organisations, vendors, and external funders play important roles in facilitating the diffusion (Niu, 2020b). There are several innovations that libraries are currently facing. It is thus important to identify the consistent patterns of diffusion and adoption of these innovations so that libraries and relevant stakeholders are informed and well-prepared for these future innovations (Niu, 2020b). The DOI theory is considered one of the most appropriate theories that can be used to investigate the adoption or non-adoption of technology in higher education and other educational environments (Katz, Levin and Hamilton, 1963; Rogers, 1983; Ismail, 2006).

The DOI theory provides a foundation for understanding innovation adoption and the factors that influence an individual's choice about the innovation (Ham, n.d.). Lai (2017) defined diffusion as the process by which a technological innovation is communicated to the members of a social system (such as a higher education institution) through certain channels. The technology required comprises software and hardware. The hardware consists of the physical parts or components of the technology and the software is the information base for the tool. The physical parts or components are the infrastructure needed to implement the adoption while the software are the systems, for example, the Linked Data library systems that will facilitate the sharing and reuse of data among university libraries (Rogers, 2003; Nazari, Khosravi and Babalhavaeji, 2013).

The adoption or rejection of the innovation depends on the awareness of people who use it (Yu and Tao, 2009). Awareness of the innovation can be done through different communication channels. In the case of Linked Data, once libraries acquire sufficient

knowledge about the innovation, they will be able to make informed decisions regarding whether, when, and how to adopt it. For instance, George Washington University Libraries trained their cataloguing staff on Linked Data providing the necessary knowledge and skills through webinars, workshops, and exercises (Shieh and Reese, 2015). The concept of Linked Data is then shared among the university libraries (MacVaugh and Schiavone, 2010; Niu, 2020b). It is important to note that before an institution decides to adopt the innovation, they consider a variety of factors such as the technical expertise, availability of finances, institutional policies, and technological infrastructure, among others, which will impact on the use of the innovation (Nazari et al., 2017).

Adopters perceive and assess innovation in several ways. Rogers (2003), therefore, proposed that the analysis of an innovation should be made using the potential adopter's own perspective and situation. For instance, the Ugandan university situation is different from the university situation in developed countries. Thus, Ugandan universities will decide whether or not to adopt Linked Data based on how they perceive other universities in Africa are approaching the issue of adoption. The DOI theory, therefore, addresses the user's motivation and adoption behaviour (Chang, 2010).

The DOI theory explains the rate at which librarians will adopt a new technology like Linked Data. According to Niu (2020b), early adopters of Linked Data incurred high costs in implementing the innovation. Some of the metadata librarians and cataloguers took the initiative to learn programming skills and some tasks that could be easily done by future software such as constructing SPARQL queries or writing RDF graphs in Turtle language. Thus, the libraries that are considered early adopters of Linked Data have had the financial and technical capacity to do so (Mitchell, 2016). The DOI theory has some limitations: it works better with the adoption of behaviour rather than cessation or prevention of behaviour. Furthermore, it does not consider an individual's resources or social support to adopt the new behaviour (or innovation). Despite the usefulness in explaining the diffusion of technology innovation, it fails to explain the diffusion of technological ideas (MacVaugh and Schiavone, 2010). The theory doesn't overlap the effects of the different innovation contexts and domains (MacVaugh and Schiavine, 2010).

2.2.4.2 Other related studies based on the DOI theory

Rogers' (1962) theory of adoption and diffusion is a useful systemic framework to describe either adoption or non-adoption in an institution (Nazari et al., 2017). Therefore, the DOI theory helps explain the rate at which libraries will adopt a new technology. The theory seeks to explain how, why and at what rate new ideas and innovations/technology spread through cultures (Sahin, 2006).

Nazari, Khosravi and Babalhavaeji (2017) applied the DOI theory to determine the factors that impact the adoption and use of online databases at the Islamic Azad University (IAU) in Tehran. The findings of their study confirmed that the respondents perceived that relative advantage, compatibility, complexity, trialability and observability are all related to the adoption and use of online databases.

Neo and Calvert (2012) used the DOI theory to explore the factors that influence New Zealand public librarians' consideration of adopting Facebook. The findings showed that the main motivating factors for the librarians' adoption of Facebook included its benefits as a marketing and promotional tool; easy staff IT skills upgrades; the ability to personalise it; its interactive nature; and its providing a better public library image. The non-adopters of Facebook pointed to it placing a strain on staff resources and its poor customer response, along with many other risks. Librarians recommended that tools that are simple to learn and use and make it easy to track customers' information exchange online, were needed.

Niu (2020a) applied the DOI theory to identify the diffusion patterns, especially the communication channels, in the diffusion and adoption of research data management services (RDMS) among libraries. The findings indicated that early adopters conduct much original research to create RDMS and serve as change agents in diffusing their RDMS and related innovations to other libraries. Another study carried out by Niu (2020b) applied the DOI theory to investigate the diffusion and adoption of RDMS and Linked Data among libraries. The findings showed that although the library administration makes decisions regarding

innovation adoption, practicing librarians are not merely passive followers, in that they play an important role in the administration's decision to adopt an innovation.

2.2.4.3 Applicability of the DOI theory

The theory is useful because it leads to a deeper understanding of the process of adoption of technological innovations such as Linked Data. It posits that the characteristics of innovations, as perceived by individuals, help explain the different rates at which they are adopted (Rogers, 2003:15). The theory is relevant to this research because it explains the rates of adoption and the whole decision-making process concerning the adoption of Linked Data among the university libraries in Uganda. The study adopted two constructs of the DOI theory, namely, trialability and observability and these are explained below.

i) Trialability

Trialability is the extent to which an innovation may be experimented with (Rogers, 2003). If technological innovation is widely tried by different users, then it will consequently be adopted widely (Menzli, Smirani, Boulahia, and Hadjouni, 2022). Since Linked Data is still an innovation, university libraries may need to first experiment with it to determine its practicability before adopting it. This is because innovations require an investment of time, energy, and resources before being implemented. The study adopted this construct to determine how easily the librarians could explore the adoption of Linked Data technologies.

ii) Observability

The observability construct describes the degree to which the results of an innovation are visible to the adopters. The more the innovation is visible to other users, the more it is adopted (Menzli, Smirani, Boulahia, and Hadjouni, 2022), If there are observable positive outcomes from the implementation of the innovation, then the innovation is more adoptable. The study adopted the observability construct to determine the level of awareness of Linked Data among professional librarians in Ugandan Universities.

The study adopted the two constructs from DOI namely: trialability and observability to explore the adoption of Linked Data among the university libraries. The relationship between

the constructs with the research objectives, research questions and instruments is shown in Table 2 below.

Table 2: Mapping of DOI theory constructs to research objectives, questions, and instruments

Research Objectives	Research Question	Construct	Instrument (s)
To determine the level of awareness of Linked Data among professional librarians in Ugandan university libraries	What is the level of awareness of linked data among professional librarians?	Observability	Literature, Online questionnaire, Telephonic interviews
To establish the extent of Linked Data adoption and use in Ugandan university libraries	What is the extent of Linked Data adoption and use?	Trialability	Literature, Online questionnaire, Telephonic interviews

The level of awareness of Linked Data among professional librarians in Ugandan university libraries was established through the first research objective and question. The observability (See Table 2 above) was applied to investigate the first question. After identifying the level of awareness of professional librarians, the study followed to probe the extent of Linked Data adoption. To answer this question, the trialability construct was applied. The study reviewed literature and used an online questionnaire to solicit feedback from the respondents while telephonic interviews were used to gather in-depth knowledge from the university librarians and heads of IT.

2.2.5 Unified Theory of Acceptance and Use of Technology (UTAUT) Model

The UTAUT model is a framework devised by Venkatesh et al. (2003) to predict technology acceptance and elucidate the actual use of such technologies and systems in organisational settings (Chang, 2012; Chao, 2019). The UTAUT was developed through a comprehensive

review and consolidation of eight theoretical models that earlier research had adopted to describe technology acceptance and usage behaviour (Dwivedi, Shareef, Simintiras, Lal and Weerakkody, 2016; Quadri and Garaba, 2019). The eight theoretical models were: the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), and the Technology Acceptance Model (TAM) (Davis, 1989). the Motivational Model (Davis, Bag 1992), the Theory of Planned Behaviour (TPB) (Ajzen, 1991), the Combined TAM and TPB (Taylor and Todd, 1995), the Model of PC Utilization (MPCU) (Thompson, et al., 1991), the Diffusion and Innovation (DOI) theory (Moore and Benbasat, 1991), and the Social Cognitive Theory (Compeau, Higgins and Huff, 1999). The UTAUT aims to explain users' behavioural intention to use an information system (Venkatesh et al., 2003; Padhi, 2018).

Several studies that have been carried out indicate that the UTAUT can explain 70% of the intention to use a technology while the TAM explains 40% of the variance in technology acceptance and adoption in the workplace (Quadri and Garaba, 2019). As noted in Chapter One, the UTAUT model consists of four key factors or constructs: Performance expectancy (PE), effort expectancy (EE), social influence (SI), and facilitating conditions (FCs). Also as noted, the UTAUT has four moderators, namely, age, gender, experience and voluntariness to use the technology, that affect the usage of technology in the organisational context (Venkatesh et al., 2003). The study adopted all four constructs of the UTAUT to examine the four research questions and to explore the behavioural intention of university libraries in Uganda to adopt Linked Data to enable data sharing and reuse and these are discussed below.

i) Performance expectancy (PE)

Performance expectancy is defined as the degree to which an individual believes that using the system will help him or her to attain gains in his/her job performance. Zhou, Lu and Wang (2010) found that performance expectancy, task technology fit, SI, and FCs have significant effects on user adoption. For instance, if the librarians believe that adopting Linked Data will improve their job performance and provide better output in data sharing among the university libraries, they are more likely to adopt it for their university libraries. However, if it does not, then they will reject it.

ii) Effort expectancy (EE)

Effort expectancy is a crucial predictor of technology acceptance and usage. According to Venkatesh et al. (2003), it is the degree of ease associated with the use of the system. The antecedents of effort expectancy are ease of use, complexity, and perceived ease of use (PEOU). The PEOU factor is derived from the TAM. If Linked Data technology is perceived as easy to use and requires less technical skills or training by the librarians, they are more likely to adopt it.

iii) Social influence (SI)

Social influence is the degree to which an individual perceives that others believe that he or she should use the new system. It represents the interpersonal considerations of technology use. While social influence is not expected to have a direct effect on attitude or satisfaction in technology adoption research, some researchers suggest that individuals may gain satisfaction by conformity based on identification (Matsuo, Minami and Matsuyama, 2018). Given that user satisfaction is considered an attitude, social influence is considered to have a positive impact on user satisfaction. The effect of social influence is stronger in mandatory user settings due to individuals' tendency to comply with pressure from a higher authority (Venkatesh et al., 2003). University administrations play an important role in influencing the adoption of Linked Data in their university libraries. If they believe that the university library must adopt the Linked Data technology, the librarians will have no choice but to comply with the directive. However, if the university administrations do not perceive the technology as important, the librarians will not take it seriously and will find no reason to adopt it.

iv) Facilitating conditions (FCs)

FCs is the degree to which an individual believes that an organisation and technical infrastructure exists to support the use of the system (Diaz and Loraas, 2010). It is similar to the factor "subjective norm" as defined in the TAM 2, an extension of the TAM.

The underlying construct of FCs is operated to include aspects of the technological and/or organisational environment that are designed to remove barriers to use (Ling-Keong, Ramayah and Chiun, 2012). This UTAUT construct consists of items from perceived

behavioural control and is theorised to model the relationship between the organisation's attempts to overcome barriers to use and the potential users' intent to use. Like EE, the power of this construct predicts that usage decreases after initial acceptance. The university libraries that have established infrastructure and systems in place will easily adopt the innovation because they do not have high costs to incur, unlike those starting from scratch.

Gupta, Dagupta and Gupta (2008) found that PE, EE, SI, and FCs all positively impact the use of ICT. Figure 5 below depicts the UTAUT model.

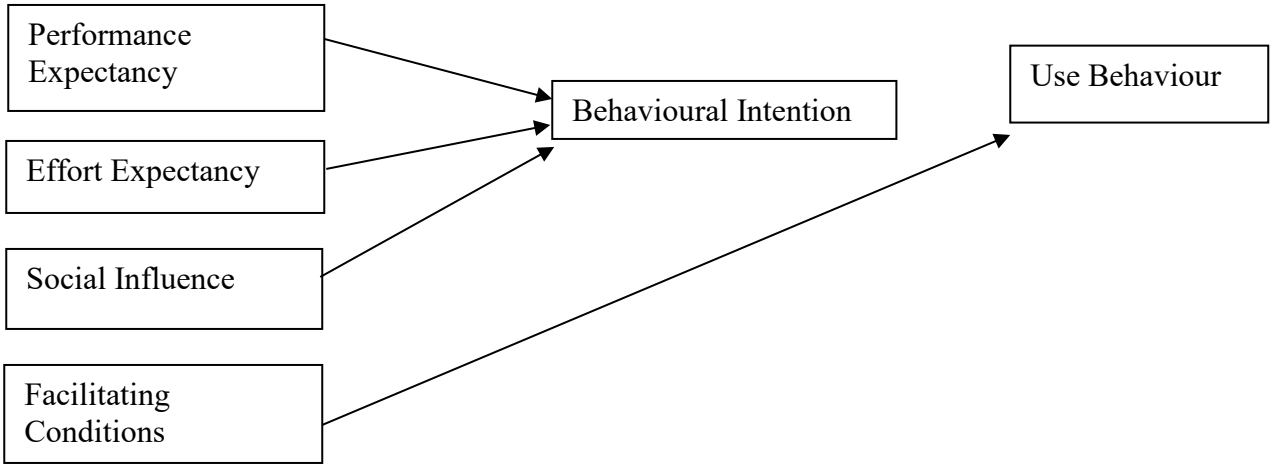

Figure 5: The UTAUT model

Source: Venkatesh, et al. (2003)

Extended Unified Theory of Acceptance and Use of Technology (UTAUT2)

The rise of consumer technologies necessitated the extension of the UTAUT model to the consumer context emphasising the hedonic value (intrinsic motivation) of technology users (Tamilmani, Rana, Wamba and Dwivedi, 2021). The UTAUT2 is an extension of the UTAUT model and was formulated to better adapt to the consumer use of the framework (Moorthy, Chun, Ming, Ping, Ping and Joe, 2019). The UTAUT was extended to include three further constructs, namely, hedonic motivation, price value, and habit (Venkatesh et al., 2016) as shown in Figure 6 below.

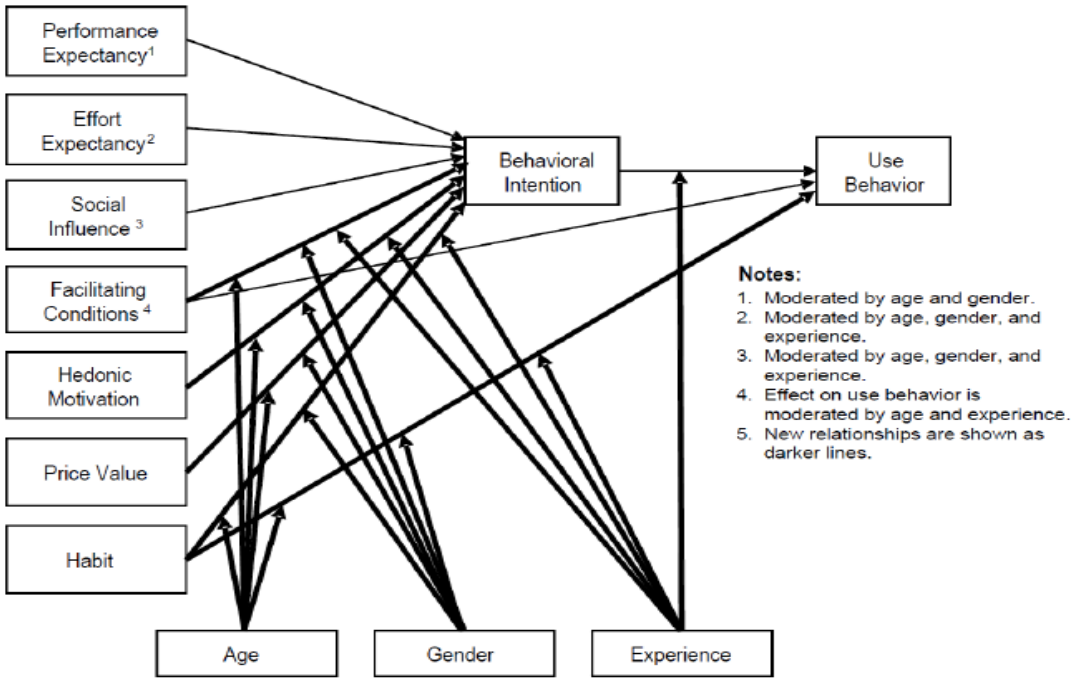

Figure 6: The UTAUT2 model

Source: Venkatesh, et al. (2003)

i) Hedonic motivation

Hedonic motivation is associated with positive emotions that an individual experiences in using a technology (Ain, Kaur and Waheed, 2016). It can also be conceptualised as perceived enjoyment in information systems research and has a direct effect on technology use (Thong, Hong and Tam, 2006). Brown and Venkatesh (2005) reported hedonic motivation as a key predictor of behaviour intention to use a technology.

ii) Price value

The price value is another theoretical addition to the extended UTAUT model. It refers to the return on investment that the consumer is aware of (Alghatrifi and Khalid, 2019).

iii) Habit

According to Ain et al., (2016), Habit relates to an individual's habitual or automatic behaviours when using the technology. It is the degree to which the consumer automatically performs actions with the technology (Alghatrifi and Khalid, 2019). Habit can be

conceptualised as a "perceptual construct that reflects the results of prior experiences" (Venkatesh, Walton, Thong and Xu, 2012:11). According to Ain et al. (2016) Hedonic motivation and Price value are related to intentions to use while Habit is related to both intentions to use and actual usage.

The UTAUT2 has been used in different research areas such as digital library adoption behavioural intention (Moorthy et al., 2019); learning value on learning management systems (Ain et al., 2016); acceptance of mobile learning in higher education (Arain, Hussain, Rizui and Vighio, 2019); adoption of e-learning systems (El-Masri and Tarhini, 2017); mobile learning among students (Venkataraman and Ramasamy, 2018); users' acceptance of online literature databases (Chaiyasoonthorn and Suksa-Ngiam, 2018); acceptance behaviours of Internet banking (Nasri, 2021); and finally, cyber security (Alqahtani and Braun, 2021). One of the challenges highlighted by Ain et al., (2016) is that the UTAUT 2 framework creates a gap that is unable to measure the perceived value of a particular technology. Hence their study incorporated the learning value extension to understand the perceived value of learning management systems.

Researchers in their quest to understand individual technology acceptance and use have either applied, integrated, and extended the UTAUT2 across a variety of settings. The UTAUT2 model has been generalised across contexts, countries, and cultures and the majority of studies done only examined the main effects of the UTAUT2 (Alemu and Negash, 2015; Ali and Arshad, 2016). This raises serious concerns about the generalisability of the UTAUT2 model as a whole. The UTAUT2 model, therefore, articulates the inside boundary conditions on the class of things, extending the individual technology acceptance and use to the consumers' context from the organisational users' context in the UTAUT (Tamilmani et al., 2021). Few studies have used the UTAUT2 to investigate users' intention to adopt Linked Data.

2.2.5.1 Literature review in terms of the UTAUT model

The UTAUT has become the latest and most powerful theory to predict and explain an information systems usage intention (Wasitarini and Tritawirasta, 2015; Rahman, Lesch,

Horrey and Strawderman, 2017). Researchers have applied the UTAUT to study the adoption of information systems in different types of organisations, including educational institutions. The UTAUT has been applied to study a variety of technologies, such as online learning, Internet banking, online recruitment processes, online ticketing systems, electronic resources and e-government. The UTAUT has also been used in the context of digital library systems to investigate the characteristics of these systems and modify them to make them more attractive for adoption (Chang, Wahid and Ismail, 2015, Alajmi and Alotaibi, 2020; Andrews, Ward and Yoon, 2021).

Andrews et al. (2021) applied the UTAUT to design and test the structural equation model to predict the likelihood of librarians' AI and related technologies adoption intentions. Their investigation found that the UTAUT is a viable theoretical framework for exploring librarians' attitudes towards the adoption of AI and related technologies. They pointed out that the framework can be applied in future approaches to designing and promoting technology adoption in library settings. Similarly, Chang et al (2015) noted that the UTAUT model has a good fit, making it usable as a reference for future academic research and management practice.

According to Williams (2021), the UTAUT has also been used to better understand the use and adoption of Facebook and Twitter by students at the University of Limpopo, South Africa and the University of Antwerp, Belgium. It was recommended that students should not be forced to use Facebook and Twitter but use should be voluntary which is a moderating variable in the UTAUT model. In addition, the integration of the UTAUT and information system success models has contributed to extending a deeper understanding of academic faculty's intention and facets of system use (Alajmi and Alotaibi, 2020).

The UTAUT's theoretical background of PE is derived from usefulness perceptions, extrinsic motivation, job-fit, relative advantage, and outcome expectations (Compeau and Higgins, 1995; Shin, 2009). Within each of the individual models tested, the variables related to PE were the strongest predictor of intention to use the target technology (Chang, 2012). For instance, Alajmi and Alotaibi (2020) argued that it is essential to focus on the role of PE,

which has a consistent influence on both behaviour intention and all facets of digital library usage among academic faculty. In their study, Rahman, Lesch, Horney and Strawderman (2017) noted that PE, EE, and information quality are positively related to the intention to use a digital library, while service quality is negatively related to the intention to do so. Venkatesh et al. (2016) and Rahman et al. (2017) recommended that researchers who would like to engage the UTAUT model should carefully choose the right combination of variables and data analysis method/s to yield excellent results.

2.2.5.2 Other related studies based on the UTAUT model

The UTAUT is a comprehensive model that can be applied across various applications and is widely used in technology acceptance studies. It is used cross-culturally across all continents of the world and has been widely used in Africa. Some of the studies that have applied the UTAUT are described below.

Zainab-Ajab (2017) applied the UTAUT model to study librarians' acceptance of open-source information systems in Malaysia. The study aimed to investigate the acceptance of an open-source library information system. The findings indicated a strong acceptance of the KOHA open-source library information system in both the library profession and the library market.

Tibenderana and Ogao (2008) applied the UTAUT to study "acceptance and use of electronic library services in Ugandan universities." Their study investigated the influence of the modified UTAUT model on university e-library services in Uganda. They also investigated what determines end-users in Ugandan universities to adopt and use e-library services. The results showed that end-users had not really felt the impact of e-library services in terms of PE, EE, SI and FCs This was attributed to the fact that it was premature to conduct such a study in Uganda.

Mtebe and Raisamo (2014) applied the UTAUT model to investigate students' behavioural intention to adopt and use mobile learning in higher education in East Africa. Their study showed that the four factors, PE, EE, SI, and FCs facilitating conditions had significant

positive effects on the students' acceptance of mobile learning, with PE being the strongest predictor.

Paul, Musa and Nansubuga (2015) also applied the UTAUT model to study the facilitating conditions for e-learning adoption in Ugandan universities. Although several studies have attempted to study technology adoption using the UTAUT, the FCs have been understudied. The findings of their study showed that institutions, while optimizing e-learning, should pay close attention to the FCs which include bandwidth, financial resources, infrastructure, human resource capacity, and the education content.

Williams (2021) applied the UTAUT to study students' perceptions of the adoption and use of social media in academic libraries in Belgium and South Africa. The purpose of the study was to understand students' perceptions of the adoption of social media, namely, Facebook and Twitter in an academic library setting. Their study applied the four constructs of the UTAUT and found that the adoption of social media is positively influenced by PE, EE and SI. The major challenge reported by the University of Limpopo respondents was the poor Internet access which negatively impacted the adoption of Facebook and Twitter. The respondents from the University of Antwerp had mixed feelings about the adoption of Facebook and Twitter for scholarly communication.

Mensah and Onyancha (2021) applied the UTAUT to investigate the demographic factors influencing the adoption and use of social media in university libraries in Ghana. Their study aimed to examine the influence of demographics as moderators of the factors influencing library workers' and library patrons' behavioural intention toward the use of social media. The findings showed a significant relationship between the mediating roles of the demographics of library workers and patrons on the factors influencing the intention to use and actual use of social media in the university libraries.

Andrews et al. (2021) applied the UTAUT to explore the intention to adopt various artificial intelligence (Al) and related technologies by academic and public librarians in North America. Their findings confirmed that the UTAUT can partially predict the likelihood of Al

and related technologies adoption among librarians. The model showed that PE and attitude towards the use of AI and related technologies had significant effects on librarians' intention to adopt Al and related technologies. However, social influence and effort expectancy did not have a significant effect.

Hariri (2014) applied the UTAUT model to study the adoption of learning innovations within UK Universities. His study aimed to investigate the influence of the adoption of learning innovations within UK universities. Findings revealed that PE was the strongest predictor of behavioural intention. EE, FCs, and reinvention were also found to significantly influence behavioural intention. Using logistic regression, their study found that the actual use of the innovation was influenced by behavioural intention, students' requirements and expectations, FCs, experience, and teaching hours.

2.2.5.3 Applicability of the UTAUT model

According to Andrews et al. (2021:1), the UTAUT is a helpful framework for designing and promoting the adoption and use of emerging technologies by librarians. This study adopted all four constructs of the UTAUT to explore the behavioural intention of university libraries in Uganda to adopt Linked Data to enable data sharing and reuse. The UTAUT was considered appropriate for this study because Linked Data is an innovative initiative.

The study adopted the four constructs from UTAUT namely: performance expectancy, effort expectancy, social influence and facilitating conditions to explore the adoption of Linked Data among the university libraries. The relationship between the constructs with the research objectives, research questions and instruments is shown in Table 3 below.

Table 3: Mapping of UTAUT model constructs to the research objectives, questions, and instruments

Research Objectives	Research Questions	Constructs	Instrument (s)
To determine the level of awareness of Linked Data among professional librarians in Ugandan university libraries	What is the level of awareness of linked data among professional librarians?	Facilitating conditions, Social influence	Literature, Online questionnaire, Telephonic interviews
To establish the extent of Linked Data adoption in Ugandan university libraries	What is the extent of Linked Data adoption?	Facilitating conditions, Effort expectancy	Literature, Online questionnaire, Telephonic interviews
To determine the potential benefits of adopting Linked Data in Ugandan university libraries	What are the benefits of Linked Data adoption?	Performance expectancy	Literature, Online questionnaire, Telephonic interviews
To investigate the factors that influence professional librarians' behaviour towards the adoption of Linked Data in Ugandan university libraries	What factors influence the behaviour of professional librarians towards the adoption of Linked Data?	Effort expectancy, Social influence	Literature Online Questionnaire Telephonic Interviews
To investigate the strategies to promote the adoption and use of Linked Data in	What strategies can be used to promote the adoption and use of Linked Data in	Facilitating conditions	Literature, Online questionnaire, Telephonic interviews

Ugandan university libraries	Ugandan university libraries?		

The level of awareness of Linked Data among professional librarians in Ugandan university libraries was established through the first research objective and question, guided by the UTAUT Model. The two constructs, facilitating conditions and social influence (See Table 3 above) were applied to investigate the first question. After identifying the level of awareness of professional librarians, the study followed to probe the extent of Linked Data adoption. To answer this question, the facilitating conditions and effort expectancy constructs were used. This led to question three in identifying the perceived benefits of Linked Data adoption using the performance expectancy construct. Lastly, research objective four was sought through question four to identify the factors that influence the professional librarians' behaviours towards to the adoption of Linked Data using the two construct of effort expectancy and social influence. To answer these research questions, literature was reviewed, an online questionnaire was used to solicit feedback from the respondents while telephonic interviews were used to gather in-depth knowledge from the university librarians and heads of IT.

The UTAUT model was, therefore, considered a good fit for this study for three reasons:

i) Its capability to integrate different technology acceptance models.
ii) Its substantial contribution to the exploration of technology acceptance and usage.
iii) Its wide acceptance and use cross-culturally on all five continents (including Africa).

A combination of the UTAUT model and the DOI theory was adopted as the theoretical framework for the study because of their comprehensiveness, validity, and reliability in determining the factors influencing the adoption of technologies.

2.3 Summary

This chapter discussed the study's theoretical framework and in doing so reviewed several information systems adoption models that could predict the adoption of Linked Data among the Ugandan university libraries. It provided the relevant Linked Data adoption models considered to contribute to a better understanding of the study's theoretical framework that

include UTAUT by Venkatesh et al. (2003); TAM by Davis (1986) among others with TAM the most prominent of all the theories. The UTAUT as the dominant theory guided this study because it accounts for 70% of variance in use intention, offering strong predictive power compared to other technology acceptance models. The Diffusion of Innovation theory is the second theory on technology acceptance and use that is chosen to guide this study. Other technology acceptance and use models such as TAM, TPB and TOE were discussed as theoretical models underpinning the UTAUT. These models, which were initially introduced in Chapter One, were discussed in detail. The chapter also highlighted the constructs of these theories, their relationships and relevant studies. The chapter also presented the strength and weaknesses of these technology adoption and use theories. The four main constructs of the UTAUT; performance expectancy, effort expectancy, social influence and facilitating conditions together with the two constructs of trialability, and observability were reviewed to show their applicability and understand the phenomenon raised in the present study.

Chapter Three follows and presents the reviewed literature.

CHAPTER THREE

LITERATURE REVIEW

3.1 Introduction

This chapter reviews the relevant literature on the adoption of Linked Data among university libraries. A literature review is the thematic synthesis of sources that the researcher used and provides the reader with an up-to-date summary of the theoretical and empirical findings on a particular research topic (Cisco, 2014). The literature review is a central part of any research project; it concisely summarises the findings from prior research efforts on a given subject (Knopf, 2006; Mortenson and Vidgen, 2016). It provides a general overview of the body of research which may reveal new theoretical hypotheses, research methods, or policy recommendations that may be incorporated into the research being undertaken (Knopf, 2006:127). The literature review thus establishes the foundation for an academic inquiry and validates the assumptions and opinions made through insights gleaned from the findings of other studies and, in doing so, the inquiry may offer more conclusive results (Baker, 2016; Xiao and Watson, 2019). According to Xiao and Watson (2019:93), literature reviews should be valid, reliable, and repeatable. This study adopted themes for the analysis of the literature review guided by the research questions, theoretical framework and variables of the study. The importance of themes is to show, overall, what the literature has demonstrated in the study to identify similarities or dissimiliarities, contracts and draw conclusions (Philbrook, 201 7; Greetham, 2021).

In light of the above, the next section provides a brief history and overview of Linked Data. This is followed by an in-depth discussion of the concept and its application in libraries. Literature is drawn from studies in both developed and developing countries.

3.2 Brief history and overview of Linked Data

The World Wide Web (WWW or Web) has evolved over several years as a global information space not just of linked documents (Web of Documents) but also linked data (Web of Data) (Heath and Bizer, 2011; Warraich and Rorissa, 2018b). Data on the Web was not previously

utilised because people and institutions focused on the presentation part of data which included the layout, interaction, and structure rather than raw data (Hausenblas, 2009). With the vast amount of data available on the Web, there have been several initiatives including the development of techniques for their (that is, data) representation, storage and usage (Jovanovik, 2017). One of these techniques is Linked Data, which provides a logical step in ensuring that data is available on the Web (Jovanovik, 2017; Warraich and Rorissa, 2022:1).

Tim Berners-Lee, the founder of the Web in 1989, has led the Linked Data movement worldwide (Zengenene, 2013). Berners-Lee's initial intention for the Web was to create a virtual environment whereby anyone could add and share documents (Mendez and Greenberg, 2012; Warraich and Rorissa, 2018b). However, Berners-Lee realised that the idea had not developed as had initially hoped. And, therefore, proposed a new project to include data on the Web (and not only documents). In the author's TED talk of 2009, the author envisioned a world where everybody could put data on the Web and share it with others. The author called it "Linked Data"(Berners-Lee, 2009). Berners-Lee also proposed the idea of the Semantic Web, an extension of the current Web in which information has a well-defined meaning so that it is understandable by both computers and people (Berners-Lee, 1997, 2009).

In 1999, the first revision of the RDF was released (Hausenblas, 2009). The RDF is a foundation for processing metadata and provides interoperability between applications that exchange machine-understandable information on the Web (W3C, 1999). The RDF can be used in cataloguing to describe the content and the relationships available at a particular website, web page, or digital library (W3C, 1999).

In 2006, Berners-Lee developed four Linked Data principles that differed from the principles that underpin the Web of Documents (Villazón-Terrazas et al., 2011; Mukhopadhyay, 2020; Meherehera, Mekideche, Zemmouchi-Ghomari and Ghomari, 2021). These principles were:

iv) All items should be identified using uniform resource identifiers (URIs).

ii) All URIs should be dereferenceable using HTTP; URIs allow for looking up an item identified through the URI.

iii) When looking up a URI that is an RDF property and is interpreted as a hyperlink, it leads to more data, which is usually referenced.
iv) Links to other URIs should be included to enable the discovery of more data.

In 2007, the World Wide Web Consortium (W3C) released new standards. These W3C standards included RDFs, Gleaning Resource Description from Dialects of Language (GRDDL), and SPARQL, among others, that provide data access. The SPARQL is the standard query language and protocol that is used for LOD and RDF databases. Users and developers can query information from databases or data sources using SPARQL and this information can be mapped to RDF across the Web. On the other hand, the GRDDL is a technique used to obtain RDF data from XML documents, in particular XHTML pages (W3C, 1999). For example, the Technical University of Marcilly designed a wiki that stores its pages directly in XHTML and RDF annotations are used to represent the wiki structure and annotate the wiki pages and objects it contains. The wikis foster knowledge exchange between the lecturers and students (Camacho, Carrion, Chayah and Campos, 2016).

Whereas the 2011, Schema.org created by Google, Yahoo and Microsoft Bing was designed for the Web environment, rather than the library community (Park and Kipp, 2019). The OCLC applied other ontologies beyond the Schema.org vocabulary such as BiblioGrap, which is an extension of Schema.org, to create awareness and improve the discoverability of library resources on the Web (Park and Kipp, 2019).

In 2011, the Library of Congress announced the development of the Bibliographic Framework (BIBFRAME) Transition Initiative (Library of Congress, 2011; Chowdhury and Scholar, 2019). The BIBFRAME is a bibliographic description with flexible metadata for cataloguing the Web to enhance the discoverability and visibility of library data on the Web (Park and Kipp, 2019; Chowdhury and Scholar, 2019) The BIBFRAME initiative provides a road map for transitioning the MARC-based catalogues to a system founded on Linked Data principles so that library catalogue information is integrated with the Web (Library of Congress, 2011; Super, 2015). In 2012, the Library of Congress replaced the library MARC records with the BIBFRAME (Library of Congress, 2012; Chowdhury and Scholar, 2019).

Stanford University in 2011 hosted a group of librarians and technologists to address the issues and challenges regarding the use of Linked Data for library applications among university libraries (Keller et al., 2011). Similarly, a group of technologists, librarians, business people and other stakeholders gathered in Florence, Italy to discuss the role of Linked Data in libraries, and to analyse the standards, experiences and best practices for adopting Semantic Web technologies in libraries (Zengenene, 2013; Warraich, 2016). In 2016, the Library of Congress released BIBFRAME 2.0 the latest model (and second generation) which included additional features such as core categories, agents, subjects and events (Library of Congress, 2016). The BIBFRAME 2.0 ontology is integrated with the RDF environment and synchronises with the RDA (Resource Description and Access) cataloguing rules (McCallum, 2017). The world's first union catalogue to release bibliographic data as Linked Data was the Swedish Union Catalogue with joint effort of cataloguers working in more than 500 member libraries (Shen. Li, and Han, 2015; Wennerlund and Berggren, 2019).

Although the Linked Data movement is a relatively new technological trend on the Web, it has gained interest in the library community. Linked Data has increased several connected datasets providing semantic and easy access to numerous data over the Web, although there are still some challenges of connecting externally published datasets with the related data sources (Shidik and Ashari, 2014; Kettouch and Luca, 2022). Linked Data empowers machines to be able to search and retrieve resources or their representations based on that semantic understanding, as well as publish and share structured data through RDF (Rahaman, 2021; Warraich and Rorissa, 2022:1). Raza et al. (2019) noted that the evolution of Linked Data technologies and the Semantic Web has changed the traditional role of libraries. The library community's focus is now on how Linked Data compares and integrates with existing library metadata structures (Hanson, 2015; Papadakis, Kyaprianos and Stefanidakis, 2015).

The growth of Linked Data has shown that the Semantic Web principles support the expression of data and the acquisition of new and related data, creating much more value for the data (Berners-Lee and O'Hara, 2013; Poble, Casanovas and Rodriguez-Doncel, 2019). The basic assumption behind Linked Data is that once data is linked, then its value and

usefulness increase. Linked Data, therefore, has been able to redefine the Web by creating huge datasets collected from various sources on the Internet (Warraich and Rorissa, 2018b). These datasets are then linked and can be reused because their relationships can be understood by both computers and humans. After the datasets are linked, they are published on the Internet to enhance visibility and accessibility to all users (Berners-Lee, 2006). Libraries in developed countries are adopting Linked Data technologies, while libraries in developing countries are yet to do so (Warraich and Rorissa, 2022:1).

3.2.1 Linked Data concept

Linked Data or Linked Open Data is a "best practice approach" of publishing data on the Web whereby related information is connected through hyperlinks (Berners-Lee, 2009). LOD is comprised of two key concepts. First, data published on the Web is connected with other related information so that it can be accessible to humans and computers. Second, for the data to be linked and reused, it must be open and free from legal and copyright restrictions (Mitchell, 2013; Rodríguez-Doncel, Santo, Casanovas and Gómez-Pérez, 2016; Mukhopadhyay,2020).

Linked Data refers to a set of principles of best practices for publishing and interlinking structured data on the Web so that machines can understand and interpret the data (Wood, Zaitman, Ruth and Hauserib, 2014; Warraich, 2016:700; McKenna et al., 2022; Warraich and Rorissa, 2022:1). Linked Data is a technology that creates links between systems or entities to describe interrelations of data accessible on the Web (Warraich, 2016; Saleem et al., 2018; Kettouch and Luca, 2022).

Linked Data can also be described as a data publication technique that uses Web standard technologies to connect and make available related data on the Web using Linked Data principles that were recommended by Tim Berners-Lee and being implemented by various universities (Hallo et al., 2014; Bizer, Vidal and and Skaf-Molli, 2018). Linked Data can either be linked to other external datasets or from other external sources (Warraich, 2016). Unlike traditional libraries or library-integrated systems (LISs), Linked Data supports the sharing of structured metadata created and maintained by Libraries, Archives and Museums

(LAMs) so that the general community can interact with and enrich the data (McKenna et al., 2022). A Linked Data dataset is structured information in the form of triples (subject, predicate and object), encoded using RDF, which is used to represent and exchange Linked Data (Brickley and Guha, 2014; Hawkins, 2022:322). The core importance of Linked Data is to provide accessibility of data, with the help of RDF which allows for access points to be established which, in turn, enhances library search capabilities (Faith and Chrwanowski, 2015).

Figure 7 below shows the diagrammatic presentation of datasets published in the Linked Data format.

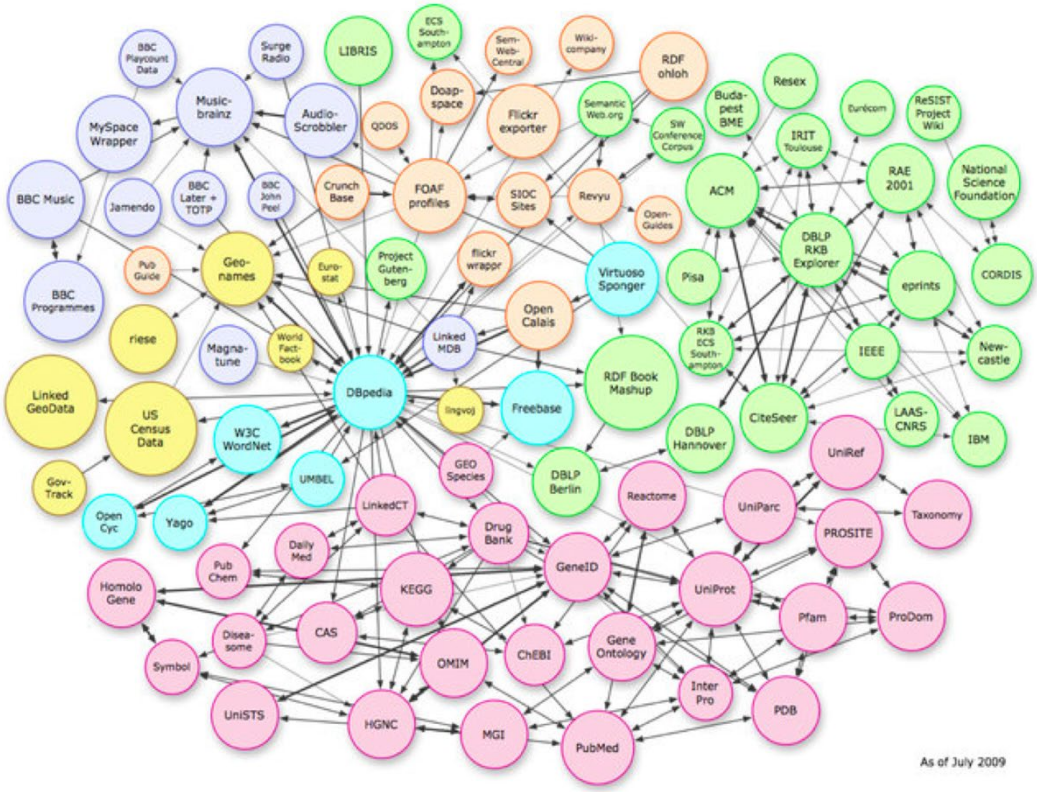

Figure 7: Latest version of the LOD Cloud

Source: Abele, Buitelaar, Cygnaniak, Jentzch, Andryusheckin and Nasir (2017)

3.2.2 Linked Data principles

For data to be linked it has to follow the Linked Data principles recommended by Tim Berners-Lee. These principles provide the guidelines or rules that are used when setting data level links between data from other sources using standardised Web technologies (Bizer, 2009; Chowdhury and Scholar, 2019). Berners-Lee (2001) described four rules that need to be used to create Linked Data on the Web. These rules provide for the best practices in publishing and connecting structured data on the Web (Bizer, 2009; Warraich, 2016). They are outlined below:

i) **Use uniform resource identifiers (URIs) as names for things**

This first Linked Data principle requires that URI references are used to identify both Web documents and digital content, as well as real-world objects and abstract concepts. A URI is a unique sequence of characters used by Web technologies to identify and distinguish one logical or physical resource from another. URIs are used to identify real-world objects such as people and places, concepts, or information resources such as Web pages and books.

ii) **Use hypertext transfer protocol (HTTP) URIs so that people can look up those names**

This principle advocates for the use of HTTP URIs to identify objects and abstract concepts. It enables the searching of URIs over the HTTP protocol and describes the identified object or concept**.**

iii) **When someone looks up a URL, useful information is provided, using standards (RDF, SPARQL)**

This principle requires the use of a single data model to publish structured data on the Web using the RDF, in addition to using the SPARQL standard as a way to search for and find data.

iv) **Include links to other URIs so that they can discover more things**

As earlier noted, Linked Data enables users to access data from various sources. Linked Data uses HTTP URIs to help it identify Web documents, real-world entities and abstract concepts.

In 2010, Tim Berners-Lee also proposed the 5-Star principle model that people could use to publish their data in a LOD environment (Das and Arpita, 2019). The principles describe the order in which data should be published on the Web. As can be seen in Table 4 below, the last star category aims at promoting Open Linked Data.

Table 4: 5-Star LOD model

Stars	**Principle Description**
*1-star	One's own data is available on the Web (in whatever format) but with an open license to be Open Data
**2-star	The material put on the Web is available as machine-readable structured data (for example, Excel instead of an image scan of a table)
***3-star	Choosing a non-proprietary format (for example, CSV instead of Excel)
****4-star	All the above plus, the use of open standards from W3C (RDF and SPARQL) to identify things, so that people can point at your stuff
*****5-star	One's own data are linked to data produced by others to define a context

Source: (Hallo, et al.,2015)

3.2.3 Linked Data publishing steps

The LIBER Linked Open Data working group founded with the aim to examine best practices in publishing Linked Open Data within the research libraries developed six standardised steps of publishing Linked Data. According to the LIBER Linked Open Data working group (2022:4), these steps should serve as a guideline and can be adapted according to Linked Open Data models. The six steps for publishing library Linked Open Data

comprise of planning for publication process, choosing and curating the dataset, identifying the resources to link to, applying a model, converting the data and making and keeping data available and up to date.

Figure 8 below shows an overview of the six steps for publishing Linked Open Data

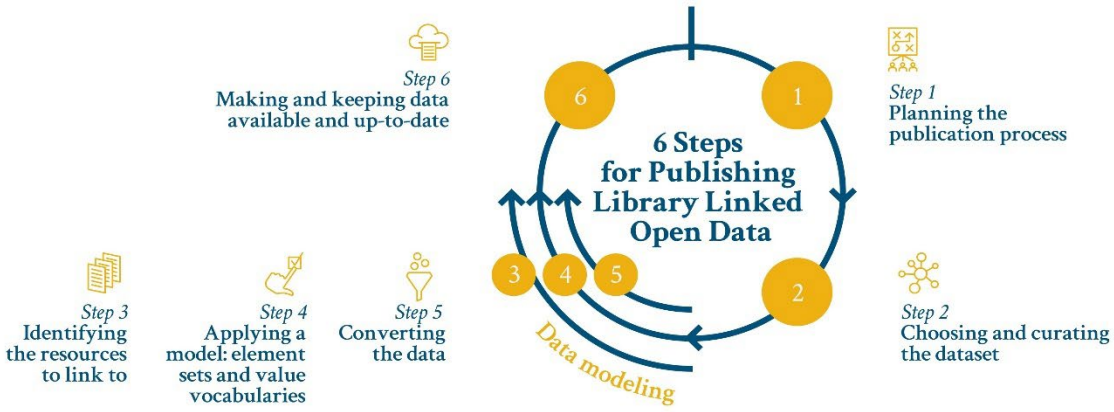

Figure 8: Overview of the six steps for publishing Linked Open Data

Source: LIBRE Linked Open Data working group (2022:4)

Below are the six steps for publishing Linked Open Data as highlighted by LIBRE Linked Open Data working group (2022).

i) Plan for publication process

As noted by Wang and Yang (2018) Linked Data can be complex, therefore it is advisable to start small, know the scope of the Linked Data project; have a knowledgeable project team that is familiar with the relevant tools for converting the data; have well planned resources to cater for the workload and time of the project among others.

ii) Choose and curate the dataset

According to the W3C Library Linked Data Incubator group report (2011), a dataset refers to a set of library related resources. A dataset can include bibliographic data extracted from bibliographic records and authority files, a local value vocabulary or data related to a specific collection. It is vital to choose the type of dataset you are going to use for your Linked Data

project. Curate the dataset and clean it up to fix errors, inconsistences, duplications among others.

iii) Identify the resources to link to

Semantic Web aims to create links between data and make the links understandable by machines. Therefore, it's important to identify the right external source to link the resources depending on the information you need to add your dataset; you may target linking between local data and external ones. Some of the eight most linked datasets by libraries include; GeoNames, Wikidata, DublinCore, Virtual International Authority file, Library of Congress International standards Name Identifiers. (LIBRE Linked Open Data working group (2022:9).

iv) Apply a model: Elements sets and value vocabularies.

One of the major reasons for publishing library data as Linked Data is to free data out of the MARC silos. Therefore, libraries are encouraged to use widely known models to describe their resources whenever possible. By applying models to data publication, the bibliographic entities, their attributes, and relationship will be better understood both in the context of the library externally. These models include FRBR, RDA and BIBIFRAME 2.0.

v) Convert the Data

Once the data model has been identified and the data cleaned up, then it can be converted to a chosen schema to make it available in a format suitable for Linked Data. There is need ensure that the identifiers are functional so that access to the metadata about the things is granted. After the conversion is done, the results should be verified.

vi) Making and keeping Data available and up to date.

Publication of the Linked Open dataset should be done and made available on the Web using several formats such as creative commons license . Ensure that the data is maintained, and an updated version is published.

3.2.4 History of Linked Data in libraries

Libraries have used MARC since the 1960s as a computer-readable format for the existing Anglo-American Cataloguing Rules (AACR) developed by the Library of Congress. However, there was, and still is, a need to replace MARC records (which are in silos) with new bibliographic descriptions built for the Web (Caplan, 2003; Park and Kipp, 2019).

Papadakis et al. (2015) noted that some university libraries have adopted Online Public Access Catalogues (OPACs) to access and publicise their collections. The OPAC is one of the components of an ILS which facilitates access to information to the average user with both bibliographic and authority data stored in the MARC format (Papadakis et al., 2015). The OPAC aids users in locating books on the shelves and/or linking books that share a common aspect such as subject (Papadakis et al., 2015). However, institutional needs have changed to include sharing, collecting, preserving, and providing access to information on the Web (Summers and Salo, 2013). Therefore, with the emergence of Linked Data technologies in the information service environment, the landscape of bibliographic standards and models from the Anglo-American Cataloguing Rules, 2nd edition (AACR2) has changed to the aforementioned RDA and BIBFRAME (Warraich and Rorissa, 2018b).

Linked Data, when compared to MARC, promises great benefits for information description, thus attracting the library community. While the latter is considered an international standard, it lacks a unified standard with its format (Miller and Westfall, 2011; Niu, 2020b). Libraries worldwide have recognised the potential of Linked Data, and several institutions have either implemented or are planning to publish their data as Linked Data. As noted by Warraich and Rorissa (2018b), Linked Data enables libraries to publish their hidden data on the Web for global accessibility and exchange this data with non-library institutions.

Paquet (2020) and Khan, DeMarto, Fernsebner, Eslao, Folsom Warer, Worrall, Kovari and Usong (2022) argued that libraries are positioned to lead the Linked Data efforts because they are already familiar with collecting, curating, accessing, preserving, and delivering data to users. With their expertise in search metadata, generation and ontology development, librarians should be well-positioned to understand and implement Linked Data (Basit and Hussain, 2019). The key concept of Linked Data is to publish structured data on the Web using the RDF and interlinking it (Warraich and Rorissa, 2018b; Kettouch and Luca, 2022). Linked Data provides the opportunity for libraries to integrate their authoritative data with user-generated data from the Web (Gonzales, 2014; McKenna et al., 2022).

3.3 Awareness of Linked Data

The nature of data is becoming more complex and effective management and sharing of large datasets are challenges for libraries (Ali and Warraich, 2018). To make library data accessible, the organisation and integration of this data are vital (Monyela, 2022). In the Web of Documents, the catalogues of libraries are usually inaccessible through search engines (Warraich and Rorissa, 2018b). While the majority of users begin their search for information through search engines, these search engines are unable to search library resources. Thus, some libraries in developed countries have converted their library bibliographic information or metadata to Linked Data (Ali and Warraich, 2018). It is therefore crucial that Ugandan university libraries explore Linked Data so that they are able to have their library data exposed and accessible on the Web where the users seem to first seek information.

As noted by Faith and Chrzanowski (2015), Linked Data is still new to many librarians, and some may not even be aware of the Linked Data technologies. Yet Linked Data provides an excellent solution to how information can best be created, shared, harvested, and used in Web-based environments (Monyela, 2022). According to Saleem et al. (2018), knowledge and awareness of Linked Data is still an issue and requires an institutional willingness to share data. Librarians lack the in-depth knowledge of the Semantic Web, experience, and success stories concerning Linked Data that may be used for their libraries (Unterstraßer, 2023). Linked Data is still new to many librarians, and some may not be aware of it, which may explain why university libraries in developing countries have not yet adopted Linked Data. The literature reviewed does not show any experienced or success stories of university libraries that have adopted and implemented Linked Data in developing countries, the majority of the Linked Data projects are in developed countries and are experimental in nature (Stapleton, 2022).

Some universities such as the Queen's University in Australia and North Carolina State Libraries in the USA have adopted Linked Data for interlibrary exchange and reuse of data and to make it available to the general public (Neubert and Tochtermann, 2012). This implies that university libraries worldwide seem to embrace Linked Data and several

institutions have either implemented or are planning to publish their data as Linked Data (Papadakis et al., 2015). Technological options for Linked Data technologies are still in development with poor documentation that would be used by institutions wanting to adopt and implement Linked Data. Hawkins (2022) recommends the use of Wikidata, a Wikimedia Foundation project, to overcome some of the infrastructure challenges. For example, some of the cultural heritage institutions that have drawn in authority data from Wikidata to their datasets, include the Library of Congress and WorldCat, among others (Thornton, 2017). The Penn University Libraries have also added their collections to Wikidata, an open and easily editable type of Linked Data dataset (Ortenberg, 2021). According to Garoufallou and Papatheodorou (2014), Wikidata offers new opportunities for cultural heritage professionals to participate in the Linked Data community by saving time and energy. The benefits of being linked to Wikidata include rich results enhanced and connected to repositories to increase visibility and establish a strong online presence (Garoufallou and Papatheodorou, 2014) Oregon State University libraries, on the other hand, developed a Linked Data metadata infrastructure called Oregon Digital for its digital collections, repository functionality, and interoperability with other related resources on the Web.

Carlson, Lampert, Melvin and Washington (2020) noted that, whereas, the library community has managed to provide machine-readable, structured data, Linked Data has not been fulfilled and, therefore, a lot of progress still needs to be made. Linking library collections to external data sources enables information and data service providers to make their collections widely available and accessible (Warraich and Rorissa, 2022:2 and Gaitanou et al., 2022). Librarians need to transform their expertise in working with metadata into expertise in working with ontologies or models of knowledge so that their libraries can fully participate as information providers in the digital age.

According to Ali and Warraich (2018) and Niu (2020b), there are still low levels of awareness of Linked Data among the librarians and information professionals in both developed and developing countries which hinders its adoption and implementation. This was confirmed by Mulumba (2022) who asserted that in developing countries the adoption of Linked Data has not been promising because of a lack of awareness and technical staff with knowledge of

these new technologies. The authors, therefore, proposed that conferences, seminars and workshops related to Linked Data in libraries should be conducted to make library professionals aware of and motivated to adopt the emerging technology, and this is especially needed in developing countries (Ali and Warraich, 2018:935). The authors pointed out that librarians are eager to attend events on Linked Data applications in their libraries and are willing to explore ways to incorporate Linked Data standards in bibliographic records management as well as library-linked data (Warraich and Rorissa, 2018b). Uganda librarians should take advantages of the several events about Linked Data, so that they are able to get themselves abreast of the latest trended in emerging technologies.

Warraich and Rorissa (2018) and Niu (2020b) noted that although some librarians have heard about the term and concept of Linked Data through staff development opportunities such as conferences, workshops and seminars, there is still a general lack of awareness of the basic concepts of Linked Data and the Semantic Web among librarians and information professionals. The key concept of Linked Data is to publish structured data on the Web in an interoperable, machine-understandable way so that it can be accessible to both humans and computers (Gaitanou et al, 2022; Miller and Westfall, 2011; Warraich and Rorissa, 2018b). To develop and work with non-library ontologies, librarians need to collaborate with IT professionals to help fulfil their library needs (Warraich and Rorissa, 2018b). On the contrary, a study conducted by LaPolla (2013) showed that the majority of academic librarians surveyed had some familiarity with key Semantic Web terms. The author argued that this apparent awareness of key concepts among a segment of librarians highlights the opportunity to move towards more practice research than education efforts (LaPolla, 2013). LaPolla (2013) pointed to the need for increased dialogue between cataloguers, technical service professionals, and institutional administrators regarding the potential for these technologies to play a transformative role in the academic library.

Wang and Yang (2018) noted that due to the complexity and vast scope of Linked Data, many people have a hard time understanding its technical details and its potential for the library community. The information professionals in Malaysia perceived Linked Data as having the potential to publish and interlink their hidden data on the Web for better global accessibility

(Warraich and Rorissa, 2018b). Therefore, there is a strong need to spread awareness of Linked Data's potential within the library environment (Cagnazzo, 2017).

As previously pointed out, the George Washington University Libraries cataloguing staff and programmers did not have sufficient expertise in Linked Data at the beginning of their experimental project with the technology (Shieh and Reese, 2015). However, through countless hours of webinars, workshops and exercises, the cataloguing staff were able to learn how to tease MARC data and repackage it in RDF triples (Shieh and Reese, 2015). To keep abreast of Linked Data initiatives, some university libraries (for example, the University of Nevada Las Vegas and the University of Florida) have created Linked Data study groups (Niu, 2020b). Information professionals in developing countries could also devise ways of joining such groups to benefit from the knowledge sharing.

3.4 Extent of Linked Data adoption

Writing in 2014, Wood et al. (2014) pointed out that for over 10 years there has been a rapid adoption and usage of Linked Data by various companies. Companies such as Google and Facebook use Linked Data to enhance their search capability and connections (Wood et al., 2014). The British Broadcasting Corporation (BBC) and the American National Public Radio provide users with access to their raw data which convert it into new applications and media streams. Other organisations making use of Linked Data are the World Bank, non-governmental organisations (NGOs) such as the World Health Organization, and the UK and the USA governments (the latter through its data.gov website) (Miller and Westfall, 2011; Zemmouchi-Ghomari, Sefsaf and Azni, 2018).

Libraries are exploring Semantic Web technologies such as Linked Data to publish and enrich their catalogues which they share to collect, preserve and provide information (Summers and Salo, 2013; Candela, Escobar, Carrasco and Marco-Such, 2022). Linked Data provides potential benefits for libraries and information centres to make their data accessible on the Web. However, as previously pointed out by Ali and Warraich (2018), most of the Linked Data initiatives and activities in libraries and information centres have taken place in

developed countries. The extent to which libraries have adopted Linked Data is discussed below.

3.4.1 Linked Data and National libraries

Since 2010, libraries have undertaken several initiatives to transform bibliographic data into Linked Data which is the required format for the Semantic Web (Hanson, 2015; Wang and Yang, 2018). The Library of Congress, OCLC and other national libraries are the leading forces in Linked Data projects.

The Library of Congress has been the world leader in promoting Linked Data technologies and their potential applications in libraries (Wang and Yang, 2018). The Library of Congress has a Linked Data service which was initiated in 2009, exposing around 260,000 authority records of the Library of Congress Subject Headings (LCSHs) as Linked Data. It is commonly referred to by its URI: id.loc.gov (Library of Congress, 2010). The Library of Congress also uses the services of linkable authority files and the Virtual International Authority File (VIAF) (Hallo et al, 2015). In 2011, the library embarked on implementing a new bibliographic environment that facilitates the interconnection of new resources (Hallo et al., 2014:5).

The British National Library, one of the greatest research libraries in the world, has also implemented Linked Data. It provides world-class information services to the academic, business, research and scientific communities with access to the world's largest and most comprehensive research collection (Danskin, 2020). The British National Library converted its MARC 21 bibliographic data into Linked Data; however, it has faced many challenges in implementing Linked Data technology (Ali and Warraich, 2018). It will, however, be the first institution to contribute its national bibliography to Share-VDE, a library-driven initiative that uses Linked Data technology to create connections between bibliographic information contributed by different institutions (Danskin, 2020).

The National Library of France (NLF) (data.bnf.fr) adopted Linked Data for its catalogue data to allow users to access the library's data on the Web, and to link the data to DBpedia,

the VIAF and other sources (Papadakis et al., 2015; Wang and Yang, 2018). The motivation to adopt Linked Data was because of difficulties associated with cataloguing the growing number of resources without a concomitant increase in staffing. However, if the metadata are published as Linked Data, it is disseminated more widely and enriched from external sources, thereby increasing its reuse (Wenz, 2013). The National Library of Spain also has an initiative similar called "datos.bne.es" whose aim is to release its bibliographic data as Linked Data and become part of the Semantic Web (Wang and Yang, 2018:17).

The Europeana (data.europeana.eu) is a European Digital Library offering free access to multilingual publications and linked metadata from multiple European institutions (Hallo et al., 2014). The library provides information on millions of digitised items from museums, libraries, archives and multimedia collections (Haslhofer and Isaac, 2011). The library uses the Europeana Data Model based on the principles and practices of the Semantic Web and Linked Data to build links to several datasets to improve usability and content search queries (Hallo et al., 2016). The problems encountered in the adoption of Open Linked Data include the lack of metadata expressed in the Europeana Data Model, the lack of links to other sources, and the lack of agreements to provide data (Haslhofer, Momeni, Gay and Simon, 2010). On the other hand, five of Canada's largest research libraries adopted Linked Data and BIBFRAME for their MARC records to embrace the changes in bibliographic control and allow for a smooth transition into the Linked Data world (Wang and Yang, 2018).

Other national libraries that have implemented Linked Data include the Smithsonian American Arts Museum which has its datasets linked with Getty Vocabularies and DBpedia (Szekely, Knoblock, Yang, Zhu, Fink, Allen and Goodlander, 2013). The National Library and Archives of Iran (NLAI) has transformed its Trilingual Cultural Thesaurus (TCH) using the Simple Knowledge Organisation System (SKOS) which follows the Linked Data principles as proposed by Tim Berners-Lee (Khosravi and Akbari-Daryan, 2019). The author noted that the TCH using the SKOS is valuable for the NLAI because it provides a good start to optimal use of Linked Data and, therefore, more effective participation in the Semantic Web. The major challenge they faced was technical (Khosravi and Akbari-Daryan, 2019).

3.4.2 Linked Data and university libraries

A study conducted by OCLC shows that most of the Linked Data projects in academic libraries are experimental in nature (Smith-Yoshimura, 2016). For example, the North Carolina State University Organisation Name Linked database includes links created by the Acquisition and Discovery staff to describe the same organisation in other Linked Data using the VIAF, the Library of Congress Name Authority File, and DBpedia (Smith-Yoshimura, 2016). Smith-Yoshimura further noted that other Linked Data projects are done entirely in-house – acquiring, cataloguing, and circulating information materials. For example, the Kenneth Dike Library at the University of Ibadan in Nigeria developed in-house integrated system. The Kenneth Dike Library uses Web-based software to manage records and allows for the sharing of Linked Data with other libraries on request (Adetoun-Adebisi, 2020).

The Cornell University Library (CUL) has collaborated with the Harvard Library Innovation Lab and Stanford University Libraries on the Linked Data for Libraries (LD4L) project since 2014 (Kovari, 2016). The three institutions have been looking at ways to gather context and relationships about their library resources beyond the traditional metadata approaches (Krafft, 2015). The project's purpose was to create a Scholarly Resource Semantic Information Store (SRSIS) model that works both within individual institutions and through a coordinated, extensible network of Linked Data (Kovari, 2016; Cagnazzo, 2017). The SRSIS captures the intellectual value that librarians and other domain experts and scholars add to information resources when describing, annotating, organising, selecting, and using those resources, together with social value evident from usage patterns. The LD4L project includes an ontology and discovery interface that brings serialised linked data for the catalogues of Cornell, Harvard, and Stanford universities (Krafft, 2015; Kovari, 2016).

A study by Wang and Yang (2018:13) asserted that big libraries and organisations are the ones with the technical expertise and financial resources to devote to the testing and development of Linked Data projects. They further noted that the majority of small libraries, including those in developing countries, are instead watching and waiting rather than participating in this initiative because they do not have the needed infrastructure in place. Okoroma (2023:35) found that the majority of institutions and libraries have poor

infrastructure and other cutting-edge facilities that hinder their adoption of Linked Data. Phoblet, Casanovas, and Rodriguez-Doncel (2019) indicated that the Linked Data movement is relatively new, and the technological options are still largely in development with poor documentation making it a challenge for new institutions to adopt. Ashiq and Warraich (2022) and Okoroma (2023:35) noted that there is a lack of infrastructure and systems, poor infrastructure, and high cost of infrastructure mitigating the adoption of a system. Unfortunately, many institutions cannot afford them, especially in the context of an economic downturn. Several studies involving librarians have shown that the lack of organisational and technical infrastructure will result in a low adoption rate of a technology or system, and this also applies to the adoption of Linked Data (Lwoga and Questier, 2015; Clohessy and Acton, 2019). For example, Lwoga and Questier (2015) found that the low adoption of open access by both faculty members and librarians was due to low support and, importantly, the lack of ICT infrastructure. In addition, IT teams lack the expertise needed to implement Linked Data technologies in their universities (Okoroma, 2023:35).

Other academic libraries whose Linked Data projects are still experimental in nature include the Dalhousie University Institute for Big Data Analytics which hosts the multidisciplinary and multi-national Muninn project aggregating data about World War in archives around the world. The Muninn project extracts data from digitised documents and converts it into structured databases that can support further research (Smith-Yoshimura, 2016). Pratt Institute's Linked Jazz projects expose relationships between musicians and enable jazz enthusiasts to make more connections. It generates triples from the content of interview transcripts from the data of five jazz archives rather than converting existing metadata (Smith-Yoshimura, 2016). The University of Wisconsin-Madison Libraries has a search interface for its Linked Data augmented catalogue, while Colorado College has a website that showcases the tools and procedures they use to generate or convert to Linked Data (Niu, 2020b).

The North Carolina State University reported two Linked Data projects, one converting the consortium database of electronic resources into Linked Data and the second converting a database of organisation names into Linked Data (Niu, 2020b). The Montana State University

Libraries connected its local staff database to the LOD Cloud, which has helped them to improve the search engine optimization (SEO) for pages of the people and to create a network of graph visualisations (Clark and Young, 2017). Stanford University Libraries Tracer Bullets project converted four of their traditional technical services workflows, namely, copy cataloguing, original cataloguing, deposit of a single item, and the deposit of a collection of resources, into the Digital Repository (Schreur, 2018). The University of Illinois Urbana - Champaign libraries mapped ContentDM metadata to Linked Data (Lampron et al., 2016). The UCLA libraries have published a library guide which provides "Semantic Web and Linked Data" access for those library communities in the transition phase (UCLA Library, 2022). Unterstraßer (2023:47), however, pointed out that switching from MARC21 to RDF and BIBFRAME would be difficult since most libraries are dependent on the MARC21 format to receive their data. This seems to be the case with Ugandan university libraries who are not able to publish their information resources on the Web because they are dependent on MARC21 and access to the LOC Catalogue. Mukhopadhyay (2020) asserted that ILSs are integrating the LOD available in the public domain through appropriate APIs. The author further noted this can be done through the cataloguing module of Koha which can be linked with the VIAF to get authority data automatically to control name authority in a local library catalogue.

Furthermore, Stanford University Libraries with the Council on Library and Information Resources (CLIR) conducted workshop training on Linked Data which increased familiarity and learning among the librarians (Keller et al., 2011; Williams, 2021). Other libraries such as the University of Nevada Las Vegas (UNLV) and the University of Florida (Niu, 2020b), have created Linked Data study groups to keep abreast of Linked Data initiatives. Some metadata librarians or cataloguers have made extra efforts to learn programming skills or conduct some tasks that could be easily done by future software, such as constructing SPARQL queries or writing RDF graphs in Turtle language (Mitchel, 2016). The study by Unterstraßer (2023:45) emphasised the need for library professionals to acquire Linked Data competencies instead of hiring new people or creating new job positions such as "Linked Data Librarian". Zainab, Kiran, Karim and Sukmawati (2018), revealed that if the librarians are confident that a system is easy to use, with least effort, and contributes to

completing their task with little assistance then they would readily use the system Warraich (2016:706) and Warraich and Rorissa (2022) also recommended that substantial training programmes and ICT skills are needed for information professionals to get updated with Linked Data technologies.

Many studies involving librarians have shown that the lack of organisational and technical infrastructure results in low adoption rates for an innovation (Clohessy and Acton, 2019). Hamzat (2018:14) noted that facilitating conditions in terms of technical infrastructure, accessibility, human resources, and skills had a significant positive impact on the use of a digital library by engineering lecturers. Similarly, a study by Musa (2016) applied the UTAUT to explore the factors that influenced the use of open-access resources for research productivity by academic librarians in federal universities in the North-Western states of Nigeria. Rogers (2003) noted that the more complicated a technology or system is, the slower its speed of adoption. Scott and McGuire (2017) pointed out that individuals are more likely to adopt an innovation that is not complicated to use and has a relative advantage over the existing systems and their needs.

According to Faith and Chrzanowski (2015:122), libraries have started investing their resources into Linked Data. This shows that there is now potential to transform library service delivery to benefit librarians as workers, software vendors, users, and libraries as institutions (Ogar and Tangkat, 2018). Okoroma (2023:35), however, noted that there is inadequate funding for academic libraries in Nigeria. This is the case for most of the university libraries in the developing countries. Only big libraries and organisations have the financial resources to devote to the test and development of Linked Data projects (Wang and Yang, 2018: 13). Several library research activities and experimental projects are funded externally while many of the research activities related to the early adoption of Linked Data are without external funding because of the high costs involved. Warraich (2016:706) recommended investing financial resources to foster research and set Linked Data best practices in libraries and other cultural heritage institutions.

Librarians are potentially powerful advocates for the adoption of new technological innovations (Lund et al., 2020:869). Rogers (2003) posits that trialability is fundamental to the adoption and use of technology because it provides librarians the opportunity to learn and practice before, they adopt it. As earlier noted by Mulumba et al. (2017) Linked Data adoption has not been promising in developing countries because of a lack of technical staff with knowledge of these new technologies. George Washington University Libraries had to train its cataloguing staff by providing Linked Data knowledge and skills through webinars, workshops, and exercises (Shieh and Reese, 2015). Moi (2020) asserted that one of the obstacles to the adoption of Linked Data technologies is the lack of expertise and knowledge about the implementation process of these new technologies. Hawkins (2022:329) emphasised that some of the challenges of publishing and producing Linked Data include technological issues. Niu (2020b) believes that a library does not need to know the technical details of Linked Data, or even know what Linked Data is all about, as long as they are able to use the Linked Data functionalities of the newly adopted software platform. The author believes that since the librarians already know how to use several repositories, they should find it easy to adopt and implement Linked Data technologies. Libraries considered to be the early adopters of Linked Data, have had both the financial and technical capacity to do so (Mitchell, 2016).

Wang and Yang (2018), noted that Linked Data is complex, and many people have difficulty understanding its technical details and potential for the library community. For example, a finding by Okoroma (2023:34) revealed that a majority of librarians in Nigeria have not adopted Linked Data because they lack the knowledge and proper training. This is confirmed by Hallo et al. (2014) who asserted just 10 years ago that librarians lack the knowledge, experience, and success stories that are needed for the adoption of Linked Data. Warraich and Rorissa (2018a) noted that there is no tangible evidence of Linked Data usage in developing countries. Studies by Okoroma (2023:35) and Ashiq and Warraich (2022) revealed that lack of proper training and limited training opportunities for data roles are hindering the adoption of Linked Data in libraries. Okoroma (2023) noted that there is a drastic low level of integration of Linked Data standards in academic libraries in Nigeria and only a few institutions are at the conceptualisation stage about the adoption of Linked Data.

Librarians are therefore encouraged to transform their expertise in working with metadata into expertise in working with ontologies or models of knowledge that Linked Data technologies use so that their libraries can fully participate as information providers in this digital age. Unterstraßer (2023) recommended that library professionals support one another, especially those from smaller libraries that may struggle to find people with sufficient Linked Data expertise to transform their systems. In addition substantial training programmes are needed for information professionals to get them updated with Linked Data technologies (Warraich (2016). For example, through countless hours of webinars, workshops and exercises, the cataloguing staff learned how to tease MARC data and put it back together in RDF triples (Shieti and Reese, 2015; Williams, 2021).

Since Linked Data is still a "new" innovation, university libraries may need to first experiment with it to determine its practicability before adopting it. This is because such innovations require an investment in time, energy, and resources before being implemented. Mitchell (2016) pointed out that several libraries, before fully adopting Linked Data, start with individual collections or library functions such as converting cataloguing workflows to the Linked Data environment or a Linked Data-enabled digital repository system. Warraich, Rorissa and Rasool (2021) noted that libraries are willing to adopt Linked Data technologies even though these initiatives are still at the infancy level. For example, a study by Okoroma (2023:34), revealed that seven percent of the libraries in Nigeria were still in their Linked Data adoption infancy. Similarly, a study by Warraich and Rorissa (2020) revealed that Linked Data technology applications in Pakistan are also still at the infancy level. It is, therefore, commendable to provide a trial period or basic features used by the commercial application developers of these systems (Masrek and Hussein, 2021:43). Williams (2021) found out that making a complete transition to a new encoding scheme would be a big challenge for many libraries that have not adopted RDA higher-quality bibliographic data and enable cataloguers to easily identify any errors. To transition from human-readable records to knowledge graphs, the library professionals would need to acquire new skills for the associated tasks (Godby, Smith-Yoshimura, Washburn, Knudooli, Detiling, Fernesebner, Folsom, Li, McGee, Miller, Eslao, Moody, Thomas and Tomren, 2019). Interestingly, a study

by Park and Tosaka (2017) found that library staff, after testing with Linked Data technologies, never went back to cataloguing with AACR.

In Uganda, Makerere University has a National Biodiversity Data Bank with biodiversity data that is linked internally but not yet linked to external sources to allow for wider discoverability and access (Mulumba, 2022). Other Linked Data in the Makerere University IR is linked to external open data repositories where it is stored, such as Mendeley Web (data.mendeley.com), where administrative and research data from collaborative projects are stored (Mulumba, 2022). There are 1495 data sets directly linked through Mendeley data (Mulumba, 2022:5). Mulumba (2022) recommended that Makerere University Library and the Directorate of Research and Graduate Teaching needs to champion the Linked Data process, create awareness, lobby for a budget allocation, institute a policy, and acquire a skilled labour force, so as to overcome the prevalent challenges. Unfortunately, there seems to be no other data bank or data repository in Uganda that is linked with other external sources on the Web.

3.5 Benefits of adopting Linked Data

According to Paquet (2020), the interest of LAMs in Linked Data is spreading to the extent that the term Linked Data is now becoming part of the vocabulary of librarianship. Libraries have started investing their resources in Linked Data (Faith and Chrzanowski, 2015:122). For example, there are now widely used resources such as the Library of Congress Subject Headings and Authorities as well as more specialised resources such as the Getty Vocabularies (Faith and Chrzanowski, 2015). By adopting Linked Data, there is the potential to transform library service delivery in a way that benefits librarians as workers, software vendors, users, and libraries as institutions (Ogar and Tangkat, 2018). This is because Linked Data allows LAMs to expose their physical and digital resources to a larger community of potential users (McKenna et al., 2022). Large innovative projects such as the VIAF, Europeana, and the Library of Congress are notable successes with prototype cases that are yet to mature (McKenna et al., 2022). Thus, the benefits of Linked Data for libraries and their users are potentially great and diverse and these benefits are further elaborated on below.

According to McKenna et al. (2022), Linked Data has the capability to open and share materials that are held in the LAMs, in ways that are restricted by many existing metadata standards. For example, the conversion of bibliographic data to Linked Data will enhance the searching and discovery capabilities, making metadata available and authentic datasets accessible through Linked Data technology (Deliot, 2014; McKenna, Debruyne and O'Sullivan, 2018). Faith and Chrzanowski (2015) argued that although technical services, metadata or cataloguing librarians may derive benefits from adopting Linked Data, doing so can also help librarians in public, academic, and special libraries to connect more people to more relevant information than the current methods being used. This is because LAMs' metadata created by information professionals is enriched with authoritative interlinks to improve data discovery and promote increased use of the LAM resources (McKenna et al., 2022). Users will be able to interpret and navigate seamlessly between related entities held in internal and external datasets and hence be empowered in complex searches (Faith and Chrzanowski, 2015; Chowdhury and Scholar, 2019; McKenna et al., 2022). Linked Data can use systems which reflect the hierarchical nature of vocabularies and the relationships between entities (Ryan et al., 2015). Data quality is a key factor for researchers when choosing a dataset for reuse and several tools and methods have emerged to assess the quality of datasets built using Semantic Web technologies (Debattista, McKenna and Brennan, 2018; Färber, Bartscherer Menner and Rettinger, 2017). The goal of Linked Data is accessibility and to satisfy the needs of Internet users (Faith and Chrzanowski, 2015; Abdelaziz and Kaffas, 2018).

Similarly, the adoption of Linked Data by university libraries will not only increase use by their patrons and attract non-patrons, it will also increase the visibility of the libraries considering that most library users (and non-users) today often, in the first instance, go to Google to search for information (Gonzales, 2014; Chowdhury and Scholar, 2019). This seems to be lacking in the Ugandan university libraries. Linked Data, therefore, is seen as a disruptive technology with the potential to move libraries and other information providers beyond the restrictions of MARC (Schreur and Carlson, 2020). Libraries, need to free their data from the insulated databases and publish them on the Web (Gonzales, 2014:13). Linked Data technologies will be able to transform the library catalogue from a separate, closed

database to an integration with the technology that people use for research (Neish, 2015; Park and Kipp, 2019).

In addition, linking data in different parts of the university will benefit research, enrich discovery and create a model that can be used by other institutions (Wang and Yang, 2018; McKenna et al., 2022). This will improve the sharing and reuse of related resources across datasets and institutions. However, currently, there is a lack of interlinking across the Linked Data projects in LAMs, which affects the discoverability of their materials (McKenna et al., 2022). Hawkins (2022:321) noted that Linked Data enriches and provides a better context of data, which makes it easier to discover, access and utilise. Various governments are opening and publishing their data in semi-structured format using RDF to improve service delivery to their citizens. For example, as earlier pointed out, the USA government has set up data.gov to release public data and the UK government has also unlocked its economic and social gain of public sector information reuse by setting up data.gov.uk, an open data website which provides the public access to datasets published by the central government, local authorities and public bodies (Deloitte, n.d; Krishamurthy and Awazu, 2016). On the other hand, Queen's University in Australia and North Carolina State Libraries in the USA have adopted Linked Data for interlibrary exchange and reuse of data to make it available to the general public (Neubert and Tochtermann, 2012). The reuse of the unique identifiers allows the data providers to contribute portions of their data as statements (Keller et al., 2011; William, 2021). Public universities in Uganda have adopted the Academic Management Information System (ACMIS) which provides them more control over the students' information (The Independent, 2021). The ACMIS is linked to other systems, including the library management system, to provide services to the users.

Linked Data, especially LOD, is sharable, extensible, and easily re-usable. It supports the multilingual functionality for data and user services and increases the interoperability of digital cultural heritage data (Keller et al., 2011; Miyakita et al. 2018). Linked Data allows anyone to contribute unique expertise in a form that can be reused and combined with the expertise of others (Hilario, Fernandez and Gampo, 2014). For example, identifiers allow diverse descriptions to refer to the same thing. Through rich linkages with complementary

data from trusted sources, libraries can increase the value of their data beyond the sum of their sources individually (Keller et al., 2011; Bianchini, Bargioni and Girotano, 2021)). The library authority data for names and subjects helps reduce the redundancy of bibliographic descriptions on the Web by clearly identifying key entities shared across Linked Data (Keller, et al., 2011; Okoroma, 2020).

By using LOD, libraries will create an open, global pool of shared data that can be used and reused to describe resources, with a limited amount of redundant effort compared with current cataloguing processes (Unterstraßer, 2023:23). Instead of requiring data to be accessed using library centric protocols (for example, Z39.50), Linked Data uses well-known standard Web protocols such as HTTP and widely used publishing mechanisms and protocols (Zike-Wehimann, Kirschenbaum, Palma, Charvat and Reznik, 2021).

Hallo et al. (2014) pointed to the many benefits of Linked Data in digital libraries. These include:

i) Improved visibility of data;
ii) possibility to establish links with other online services;
iii) facilitation of transformation of topics in SKOS and improved open data recovery;
iv) interoperability is enabled without affecting the data source models;
v) possibility to query linked metadata from multiple institutions; and
vi) allows modelling things of interest related to a bibliographic resource such as people, places, events and themes, and the end-user resource annotations improve their credibility.

Faith and Chrzanowski (2015:128) pointed to further benefits of using Linked Data, including:

i) Enabling more content aggregation and repurposing;
ii) understanding the patron's information needs and better addressing them;
iii) allowing for more serendipitous information discovery; and

iv) creating a knowledge graph to help librarians and patrons see the overall themes in the library's collection, connections to other library databases, and what topic/s might be associated with the search.

In summary, the literature points to several libraries and information centres being at the beginning stages of Linked Data implementation (Ali and Warraich, 2018); Linked Data has gained some acceptance in libraries (Heitmann et al., 2014; Monyella, 2022); and some university libraries have undertaken various initiatives to adopt and implement Linked Data (Warraich and Rorissa, 2018b; Ali and Warraich, 2018; Zhang,2022).

3.6 Factors that influence the perception of Linked Data adoption

Despite the growing interest in Semantic Web technologies, it remains unclear where perceptions are regarding Linked Data in the academic library community (LaPolla, 2013). Librarians find integrating and interlinking Linked Data datasets a challenge, and current tools do not meet their needs (McKenna et al., 2018). Librarians, therefore, need successful cases of Linked Data use to best support and motivate the choice of adhering to the Web of Data principles (Cagnazzo, 2017).

Linked Data is an emerging set of standards and technologies that could potentially enable information environments such as libraries to publish and interlink their hidden data on the Web for better global accessibility. Information professionals in Pakistan perceived that Linked Data has the potential to interlink and publish library data on the Web and it will also assist patrons in discovering relevant information through links to other repositories (Warraich, 2016).

A study carried out by McKenna et al. (2018) found that Linked Data tools are often challenging for librarians to learn and use; are inadequate for use in LAMs and difficult to integrate into workflows; are functionally inadequate for the library domain requirements; and are difficult to integrate into cataloguing (McKenna et al., 2022). Despite this, librarians are eager to embrace the benefits of Linked Data technologies for better service quality to their patrons in their institutions (Warraich and Rorissa, 2018a). Librarians are keen to use

Linked Data technologies to improve library resources and services that will subsequently enhance users' satisfaction with the library and help them find content on the Web (Warraich and Rorissa, 2018a). Faith and Chrzanowski (2015) argued that the goal of Linked Data is to make things easier to find through multiple access points.

Librarians and information professionals appear motivated to implement Linked Data technologies although there is much work to be done and challenges to be met (Ali and Warraich, 2018). Therefore, before libraries decide to implement Linked Data they have to review and assess available tools and the Linked Data vocabularies and datasets, to decide which ones to adopt or adapt, or whether they develop new ones (Niu,2020b). For example, the Library of Congress originally used SKOS in converting its Subject Headings (LCSH) into Linked Data. It then realised SKOS's limitations and, as a result, created its own vocabulary for conversion (McCallum, 2017).

According to a study conducted by McKenna et al. (2018) for Linked Data technology to be adopted by information professionals, it should be:

i) easily integrated into the existing library management systems;
ii) easily incorporated into cataloguing workflows;
iii) available in the public domain;
iv) considerate of the information professional's point of view;
v) tuned to the information professional's working environment;
vi) usable without having to understand the Linked Data technicalities or requiring the help of an IT professional; and finally
vii) standards compliant with a user-friendly interface.

As more and more interoperable datasets are becoming available, an increasing number of studies have focused on the development of tools, user interfaces, and Web services to allow for the access of Linked Data from multiple sources without the need for advanced technical expertise (Hawkins, 2022:326).

Niu (2020b) noted that many libraries, before adopting the Linked Data technologies, first attempted to gain knowledge of them before deciding whether and how to adopt them or not. Ramzan and Singh (2010:342) asserted that librarians' fear of handling technologies and involvement in IT-related decision-making impacts their level of adoption. To reduce or eliminate this fear, librarians need to be trained before using these new technologies. Zengenene (2013:86) and Rahaman (2021) recommended that librarians need to transform their expertise in working with metadata into expertise in working with ontologies or models of knowledge so that their libraries can fully participate as information providers in the digital age. The Ugandan Library and Information Association (ULIA) is encouraged to promote the participation of all academic librarians in CPD to keep themselves abreast of the new trends that will support new library innovations.

Neish (2015) found that a majority of the respondents in the study were struggling to obtain management buy-in for their project approval. Neish (2015) asserted that high-level management must see tangible proof of Linked Data's benefits to justify the substantial investment required. Similarly, European national libraries have had difficulties obtaining management buy-in because they are required to show tangible proof in terms of for whom and how their data is being used (Zhang, 2022). The study by Okoroma (2023:34) revealed that institutions in Nigeria have not adopted Linked Data because they believe it is not their decision but rather that of management to automate the system. The National Library of Germany, however, had the buy-in of senior management from the beginning, built knowledge networks as part of their long-term strategy, and refined the Linked Data service as part of their strategic priorities (Zhang, 2022).

Warraich et al. (2021) and Ashiq and Warraich (2022) identified a lack of technical skills among professional librarians and proposed that LIS professionals should acquire advanced technical skills to enable them to adopt Linked Data technology in their libraries. Miyakita, Leskinen and Hyvonen (2018), however, noted that there are several tools, user interfaces, and Web services being used to adopt and implement Linked Data from multiple sources without the need for advanced technical expertise. As alluded to earlier, Zengenene (2013:86) and Rahaman (2021) recommended that librarians transform their expertise in

working with metadata into expertise in working with ontologies or models of knowledge so that their libraries can fully participate as information providers in the digital age.

Librarians from developed countries need to transfer their expertise in working with metadata and ontologies or models of knowledge to the librarians in developing countries to enable the latter to fully participate as information providers in the digital age (Zengenene, 2013:86 and Rahaman, 2021). Libraries may adopt processes and learn how other libraries and organisations are sharing their knowledge resources with the world at large (Faith and Chrzanowski, 2015). However, as an early Linked Data adopter, the British Library did not have existing examples against which to benchmark but rather had to do most of the work from scratch (Zhang, 2022).

3.7 Strategies to promote the adoption of Linked Data

Technological innovations have changed how information is generated, transferred, shared and consumed. Never before has the role of libraries in the information society been challenged (McKenna, et al., 2022). This change is forcing libraries and other cultural institutions to reconsider their role in the new information society, especially with libraries inundated with digital information and electronic materials (Faith and Chrzanowski, 2015; Nworie, Ubochi and Chukumaobi, 2023). Library practices, services and resources must now follow their users on the Web so that they can interact with other Web resources (Keshav Gavit, 2019; Mohanan and Mohanan, 2020). Faith and Chrzanowski (2015) argued that there is a need for better methods of describing and leveraging library data and materials (Faith and Chrzanowski, 2015). Libraries need to start forming action plans and road maps to make their libraries Linked Data compatible as well as to leverage their own catalogues into Linked Data (Faith and Chrzanowski, 2015:133). There are several strategies that university libraries may adopt to promote the adoption of Linked Data and these are discussed below.

According to Abdelaziz and Kaffas (2018), efforts for implementing Linked Data require collaborations that focus on creating links between concepts and their definition in global datasets, to form an Open Linked Data Cloud like Wikipedia, DBpedia, and WorldNet, among others. A study by Pennington and Cagnazzo (2019) also recommended the need for

collaborations between libraries and non-library services such as Wikipedia, GeoNames, MusicBrainz, and the BBC, among others. These collaborations will connect local collections to the larger universe of information on the Web which will widen the participation of libraries in the Semantic Web (Super, 2015). Mahdi and Hadi (2021) and LIBRE Linked Open Data working group (2021) suggested the creation of forums to discuss Linked Data issues and find solutions. The authors also pointed to the need to promote partnerships and cooperation to advance the Semantic Web for libraries that lack resources to implement Linked Data and that lack the technical skills needed for promoting training across their library staff.

Assisting information professionals in creating Linked Data interlinks will enable them to acquire some basic knowledge about Linked Data, which they can then use to promote its importance.

Ali and Warraich (2018) recommended the following strategies to promote Linked Data:

i) Library schools in developing countries should include Linked Data courses in the Library and Information Science (LIS) Curriculum at the master's and PhD levels to make information managers aware, rather than experts in, Linked Data technology, as the Web is evolving around Linked Data.
ii) Conferences, seminars and workshops related to linked Data in library and information centres should be conducted in developing countries to make library and information professionals aware of and motivated to use this emerging technology (Raza et al., 2019; Niu, 2020b).
iii) IFLA, OCLC and the W3C should devise guidelines to deal with the diverse nature of technical challenges faced by libraries and information centres, especially the challenges related to the transformation of existing datasets of libraries other than in the English language in Linked Data (Raza et al., 2019).
iv) LIS academicians in developing countries should focus on Linked Data technology in their research activities.
v) IFLA, OCLC, the ALA and other leading associations in LIS should collaborate to establish professional networks and actively work towards ensuring the availability

of data with open licenses on the Web, as open licensing is required for Linked Data (Niu, 2020b).

vi) Library and information centres should make efforts to inform and motivate their relevant authorities about the benefits of Linked Data.

Linked Data is increasingly becoming a reality and, therefore, libraries are encouraged to learn from others and also publish their data so that they benefit from "being of the Web" and reaching out to as many users as possible (Niu, 2020b). Linked Data is a means to connect more people with more relevant information (Faith and Chrzanowski, 2015). Librarians from developed countries need to transfer their expertise in working with metadata and ontologies or models of knowledge to librarians in developing countries to enable them to fully participate as information providers in the digital age.

A study conducted by McKenna et al. (2018) listed some of the issues that information professionals identified, which could help them appreciate the Linked Data concept. These issues include: allowing LAMs to fully engage with Linked Data; making Linked Data creation and usage more accessible for information professionals; enabling Linked Data to be incorporated into cataloguing workflows; and making it easier for information professionals to understand the benefits of Linked Data and help reduce the technological barrier. Chowdhury and Scholar (2019) and Alemu (2022) asserted that libraries need to adopt the minimum requirements of Linked Data principles, adopt a mixed-metadata approach, and become part of the Linked Data Web. Singer (2009) and McKenna et al. (2018) proposed that instead of librarians sticking to models and resources they have complete control over, they should rather begin to explore publicly editable user-centred tools. In addition, make library data compatible with other formats such as Linked Data.

Mulumba (2022) recommended the development of data management awareness plans for university staff and student communities either physically or virtually, and that the university administration should put in place a policy to govern data management and linking. The policy should require research submissions to be accompanied by data files and the creation of linked data. The university should hire technical personnel to manage data (Mulumba,

2022). However, this should depend on the type of data generated because the management of big data varies from subject-specific conventional data, as pointed out by Roth and Luczak-Roesch (2020). The university should dedicate a budget to support data-linking activities and associated initiatives (Mulumba, 2022).

In the final sections of this chapter, studies relating to Linked Data are reviewed. Studies done in developed countries are first examined, followed by those done in developing countries. The Ugandan situation is then focused on.

3.8 Studies done in developed countries

Unterstraßer (2023) conducted a study on how library practice has been impacted by linked (open) data at the National library of Sweden. The National Library of Sweden is the first national library worldwide to adopt Linked Data as its core data model. The library provides deeper insights into how Linked Data is affecting the work practices of its library professionals. The findings revealed that Linked Data has significantly impacted library practice in changing knowledge and information organisation in the digital age. The library professionals believe that although Linked Data is still in its beginning stages of implementation in the library community, they are confident of its benefits and transformation it will bring. The findings suggest that Linked Data is only part of a paradigm – shifting change happening in knowledge and information organization community accompanied by other developments.

Niu (2020a) conducted a study on the diffusion and adoption of Linked Data among libraries in the USA. The study found that the diffusion of linked Data among libraries is a decentralised process with a high degree of reinvention and continuous processes that included multiple stages and that might last for many years. It further found that the diffusion of Linked Data among libraries involves the diffusion of knowledge about Linked Data experiences, including adoption experiences, and three related innovations (software tools, Linked Data vocabularies, and datasets). Leading libraries, professional organisations, vendors, and external funders played an important role in facilitating the diffusion. To speed

up both diffusion and adoption, the library community should reuse existing tools and resources as much as possible to develop standards that pave the way for commercial vendors and service providers to lower the barriers to adoption.

Pennington and Cagnazzo (2019) conducted a study titled "Connecting the Silos: Implementation and Perceptions of Linked Data across European Libraries". Their study aimed to determine how information professionals in Scotland and in European national libraries perceive Linked Data and how they are implementing it. According to their study, some of the projects demonstrated Linked Data's potential to improve the visibility and discoverability of library data, alongside overcoming linguistic barriers and supporting interoperability. The authors pointed to the strong need to demonstrate the Semantic Web's potential within libraries. A major challenge identified is obtaining management buy-in for Linked Data initiatives even when open data are government-mandated. The study proposed collaboration between information professionals and vendors to develop tools for implementation. It also proposed the dissemination and review of successful Linked Data implementations in libraries to solve practical difficulties and obtain management buy-in.

A study conducted by Cagnazzo (2017) aimed at delivering a comprehensive picture of the current state of Linked Data implementation in Europe. The study found that although various institutions have applied Linked Data to their resources, they are still in the minority and a considerable lack of expertise was also identified. Cagnazzo (2017) concluded that there is a strong need to spread awareness of the Semantic Web's potential within the library environment.

3.9 Studies done in developing countries

Okoroma (2022) examined the level of integration, challenges and potential solutions in the adoption of Linked Data and Linked Open Data in academic libraries in Nigeria. The study found that most of the academic libraries in Nigeria have not started the implementation of linked data standards at all. One of the major challenges identified was the lack of in-depth knowledge on the potential values and procedural activities of LD and LOD technology amongst librarians and information managers, and poor infrastructure, coupled with the

concerns that the system could be hacked. The study identified the need for investment of both social and financial capital into LD technology. Librarians and other key stakeholders should be exposed to trainings and events on LD application. Such trainings can be pioneered by the host institutions.

Mulumba (2022) conducted a study aimed at establishing the status of Linked Data at Makerere universities, the challenges encounted in data management, and prospects strategies. The findings revealed that Makerere university researchers archived their data in external repositories. Furthermore, whereas the university has an institutional repository which has the potential to host Linked Data, this service has not yet been exploited because of lack of skilled labour force, awareness, financial resources, and policy among other.

Monyela (2022) conducted a study to investigate the introduction of Linked Data in the ogranisation of knowledge in the academic libraries. The findings revealed that organisations that have adopted Linked Data have increased the visibility of their products Thus, academic libraries are encouraged to adopt Linked Data to increase exposure and retrieval of their information, as well as eliminate inaccuracies in the catalogue data.

Warraich and Rorissa (2018a) explored Pakistani university librarians' perspectives on the adoption of Linked Data technologies. Their study found that the librarians believed that Linked Data technology can enhance navigation between traditional online tools to access library resources. The librarians also believed that Linked Data would soon be the standard for creating metadata and records for information resources. The librarians were willing to explore Linked Data technologies in their institutions; however, there was a general lack of awareness of basic Linked Data concepts and best practices for this emerging technology.

A second study conducted by Warraich and Rorissa (2018b) aimed to assess the willingness and level of interest in applying Linked Data by university librarians in Pakistan and determine their perceptions of the barriers to Linked Data applications in their respective libraries. The study found that the librarians were interested in implementing Linked Data in their respective libraries. They were also willing to participate in events to learn more about

the potential of Linked Data technologies and how to integrate them into their library services.

3.10 Studies done in Uganda

A study conducted by Mulumba et al. (2017) aimed at exploring the level of data sharing at Makerere University focusing on the library's multimedia collection. Their study found that although the majority of the library staff are involved in data processing, this data is not linked to the Open Data Cloud. The majority of the librarians at the university were not aware of the LOD concept and Semantic Web functionality and lacked the skills associated with the concepts. Mulumba et al.'s (2017) study is not generalisable to other university libraries in Uganda given its focus on Makerere University Library.

Mulumba (2022) conducted a study on library services and Linked Data also at Makerere University. The main objective of the study was to establish the status of Linked Data at the University and the prospects of linking the data through the University's IR. The study noted that biodiversity data from the country is archived in the National Biodiversity Data Bank hosted by the university, although most of the data remains stored on personal computers and other storage devices. The study proposed that Makerere University Library champions Linked Data awareness, institutes a policy, and ensures that biodiversity data in the NBDB is available for wider discoverability and access. This study will add knowledge to the subject field because there are still few empirical studies supporting the adoption of Linked Data in university libraries in developing countries.

Research carried out in Uganda Universities only focused on the status of Linked Data at Makerere University and other public university libraries; how data is shared within these institutions; and recommendations for collaboration with other institutions implementing Linked Data in the country. However, none investigated the adoption of Linked Data among university libraries and how Linked Data can be used to improve data sharing and reuse among university libraries.

3.11 Summary

The chapter reviewed the empirical and theoretical literature derived from academic studies in both developed and developing countries. The themes discussed in the chapter reflect the research objectives and the problem under investigation. The literature review was arranged systematically based on the research objectives and key research questions underpinning this study. The major themes included history and overview of Linked Data, awareness of Linked Data, extent of Linked Data adoption, benefits of adopting Linked Data, factors that influence the perception of Linked Dtaa adoption, strategies to promote the adoption of Linked Data.

Key studies related to the adoption of Linked Data by university libraries were reviewed and it was found that university libraries in developed countries are embracing Linked Data to expose their collections to larger audiences on the Web for improved discovery and interoperability. It was observed, however, that there are still low levels of awareness of Linked Data concept among the university libraries in developing countries which impacts on its adoption. Majority of the university libraries in developed countries have undertaken several initiatives through collaborations with other university libraries to transform their bibliographic data into Linked Data, a format required for the Semantic Web. University libraries in developing countries are also encouraged to do so inorder for them to promote the adoption of Linked Data in their institutions.

Further still, from the literature reviewed, it is evident that Ugandan university libraries need to adopt Linked Data in order to expose their library data and improve their visibility on the Web. Libraries are encouraged to learn from others and also to publish their data so that they benefit from " being of the the Web" and reaching out to as many users as possible; enable Linked Data to be incorporated into the cataloguing workflows; and making i easier for the information professiona to understand its benefits and reduced the technological barriers; university administration should put in place a policy to govern data management and linking. Although most Linked Data initiatives and activities have taken place in developed countries, the Linked Data projects in academic libraries are still experimental in nature. This study on the adoption of Linked Data is, therefore, important since its findings can add to the body of knowledge on the topic.

The research methodology used to investigate the research problem of this study follows in Chapter Four.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

This chapter presents the research methodology and methods used to investigate the adoption of Linked Data among the university libraries in Uganda. The chapter outlines the research paradigm, research approaches, study design, population, sampling techniques, data collection methods, and the instruments used for data analysis. The study used questionnaires and interviews as data collection instruments due to the nature of the problem investigated. The validity and reliability of the instruments were also discussed. Quantitative data was analysed using SPSS version 21.0 and qualitative data analysis was done through thematic content analysis. The chapter ended with an outline of the ethical considerations of the study.

4.2 Research methodology

Research can be defined as a systematic approach towards purposeful investigation which is planned and organised with the specific goal of gaining new knowledge concerning already existing facts (Goddard and Melville, 2004; Mishra and Alok, 2017; Mukul, 2011; Pandey and Pandey, 2021). The purpose of research is to "discover answers to questions through the application of specific procedures" (Kothari, 2004:2). Methodology outlines the operational steps in the research process for both quantitative and qualitative research (Taylor, Sinha and Ghoshai., 2006; Kumar, 2011). Methodology guides the researcher in deciding the type of data required for a study and the data collection tools most appropriate for the purpose of the study (Abdul and Alharthi, 2016). Research methodology, therefore, is a systematic way to solve the research problem and a critical analysis of data production techniques (Kothari, 2004:8: Mukul, 2011). It does not only deal with the research methods but also considers the logic behind the methods used in the context of the research study and explains why a particular method or technique was used (Daniel and Sam, 2011; Mukul, 2011). The research methodology should be appropriate in addressing the research questions that define the focus of the research study (Taylor et al., 2006).

4.3 Research paradigm

According to Kivunja and Kuyini (2017), the term paradigm was first used in 1962 by Thomas Kuhn, an American philosopher, to mean a philosophical way of thinking. It is a conceptual lens through which a researcher examines the methodological aspects of their research project to determine the research methods to be used and how the data will be analysed (Kivunja and Kuyini, 2017:26). Paradigms are conceptual and practical tools that are used to solve specific problems (Kaushik and Walsh, 2019:1). The paradigm of scientific research includes ontology, epistemology, methodology and methods (Pandey and Pandey, 2021). A paradigm supports the researcher in conceptualising their beliefs about the nature of knowledge and selection of methods best suited to address their research questions (Allemang, Sitter and Dimitropoulos, 2022).

A research paradigm as a theoretical framework consists of a set of values and beliefs which guide how research is conducted and knowledge is conceptualised within scientific communities (Allemang et al., 2022). A research paradigm, therefore, is a set of guiding values about scientific inquiry consisting of one's ontological commitment, epistemological beliefs and methodological preferences (Morgan, 2007; Grant, 2022). According to Adil, Nagu, , Muhammadiyah, Rustan and Winarsir (2022), the use of paradigms produces findings that are right on target because they guide scientific discoveries through their assumptions and principles (Park, Konge and Artino, 2020). There are four common research paradigms and each is discussed below.

4.3.1 Positivism

According to Fadhel (2008:348), positivism emerged as a philosophical paradigm in the 19th Century with Auguste Comte's rejection of metaphysics and his assertion that only scientific knowledge can reveal the truth about reality. Positivism is considered a philosophical stance of the natural scientist who is working with observable reality within society leading to the generalisation of the study's findings (Alharahsheh and Pius, 2020:41). Positivism adopted David Hume's theory of the nature of reality according to which the senses are used to generate knowledge about reality and René Descartes's epistemology which held that reason is the best way to generate knowledge about reality (Fadhel, 2008).

The positivist paradigm is grounded in what is known in research methodology as the scientific method of investigation (Kivunja and Kuyini, 2017). The positivist paradigm asserts that real events can be observed empirically and explained with logical analysis (Fadhel, 2008:348). The paradigm helps the positivist researcher to clearly understand the objects through empirical tests and methods such as sampling, measurement, questionnaire, and focus group discussion (Thi and Pham, 2017). According to Alharahsheh and Pius (2020:41), if a researcher adopts positivism the following will result:

i) The researcher would view an organisation or other related social entities as real similar to how they would view physical objects as well as natural phenomena.
ii) In terms of epistemology, the research would focus on the discovery of facts or regularities that are observable and measurable. Furthermore, the phenomena to be observed and measured should lead to the development of credibility and meaningfulness in the data.
iii) The researcher would aim to find casual relationships between the data gathered to further enable the creation of law-like generalisations similar to the ones developed by scientists.
iv) The researcher would use and include key universal rules and laws to support and explain the studied behaviour or event within the organisation/s.

Research located in this paradigm relies on deductive logic, formulation of hypotheses, testing those hypotheses, offering operational definitions and mathematical equations, calculations, extrapolations and expressions, to derive conclusions. It aims to provide explanations and to make predictions based on measurable outcomes. This study did not adopt the positivist research paradigm because it relies on hypothesis formulation and aims to provide explanations and make predictions based on measurable outcomes (Kivunja and Kuyini, 2017:30).

4.3.2 Post-Positivism

Post-positivism is a philosophy of reality that believes in external objectivity but is sensitive to the “complexity of the realities, limitations and biases of the researchers who study them”

(Schutt, 2006). The history of the post-positivistic research paradigm points to the fact that it is a "term that was first used in the mid-1960s" (McGregor and Murnane, 2010:423). Post-positivism is a "revised form of positivism that addresses several of the most widely known criticisms of quantitative orientation yet maintains an emphasis on quantitative methods" (Henderson, 2011).

Post-positivists view that "all observation is fallible and has error, and all theory is revisable" (Wang, Duff and Haffey, 2017). They believe that the goal of scientific research should lead to an inter-subjective agreement among researchers about any phenomenon under investigation. This makes the post-positivism paradigm a broad one which brings together practices that allow, acknowledge, and encourage the researcher's motivation and commitment to the research topic (Ryan, 2006). Post-positivism is a useful approach that facilitates accurate interpretation and in-depth analysis of empirical research. The research paradigm, however, has been criticised by Kurki and Wight (2013:23) who noted that "although alternatives to positivism are commonly grouped under the heading post-positivism, in many aspects, all they have in common is a rejection of positivism".

4.3.3 Interpretivism

According to Guba and Lincoln (1989), the interpretivist paradigm helps the researcher to understand the subjective world of human experience. This paradigm involves understanding, interpreting, and contextualising the subject's thinking. Theory does not precede research in the interpretivism paradigm but follows it so that it is grounded on the data generated by the research act (Kivunja and Kuyini, 2017). The interpretivist paradigm enables researchers to treat the context and the situation of the research as unique, taking into consideration the given circumstances and the participants involved (Alharahsheh and Pius, 2020).

Some of the advantages of using interpretivism as noted by Thi and Pham (2017) include:

i) The researcher has diverse views of a phenomenon and can not only describe objects, humans or events but also deeply understand them in a social context;
ii) Valuable data collected provides researchers with better insights for further action later.

Thi and Pham (2017) noted that one of the limitations of the interpretivism paradigm is that it tends to leave a gap in verifying the validity and usefulness of research outcomes which occurs when using scientific procedures. In addition, it targets the understanding of current phenomena, rather than focusing on problems related to the empowerment of individuals and societies.

4.3.4 Pragmatism

This study employed the pragmatic paradigm which has made a significant contribution in the field of social science research and is used to solve practical problems (Kaushik and Walsh, 2019). According to Kivunja and Kuyini (2017:35), the pragmatism paradigm arose among philosophers who argued that it was not possible to access the "truth" about the real world using a single scientific method as advocated by the positivist paradigm. In terms of pragmatist philosophy, human actions can never be separated from past experiences and beliefs that have originated from other experiences (Kaushik and Walsh, 2019:3). Pragmatism as a worldview "arises out of actions, situations, and consequences rather than antecedent conditions" (Creswell, 2018:51). People take actions based on the possible consequences of their actions, and they use the results of their actions to predict the consequences of similar actions in future. Actions are pivotal in pragmatism and focus on what can be achieved or what works rather than the absolute truth or reality (Morgan, 2014).

Characteristics of pragmatism include the following:

i) Pragmatism is not committed to any one system of philosophy and reality; pragmatist inquirers draw liberally from both quantitative and qualitative assumptions when they engage in research;
ii) Individual researchers have the freedom of choice. They are free to choose the methods, techniques, and procedures of research that best meet their needs and purposes.
iii) Pragmatists do not see the world as an absolute unity, instead, researchers look to many approaches to collecting and analysing data rather than subscribing to only one way.

Kivunja and Kuyini (2017:36) noted that research located within the pragmatist paradigm should:

i) Reject of the positivist notion that social science inquiry can uncover the "truth" about the real world.
ii) Emphasise "what works" to allow the researcher to address the questions being investigated without worrying as to whether the questions are wholly quantitative or qualitative in nature.
iii) Adopt a worldview that allows for a research design and methodologies that are best suited to the purpose of the study.
iv) Utilise lines of action that are best suited to studying the phenomenon being investigated.
v) Reject the need to locate one's study in either a positivist or interpretivist paradigm.

The pragmatism paradigm advocates for the use of mixed methods as a pragmatic way to understand human behaviour (Morgan, 2014; Kivunja and Kuyini, 2017). This is emphasised by Teddlie and Tashakkori (2009) who maintain that pragmatism is the most suitable paradigm for justifying the use of mixed-methods research. This is because a researcher not only uses one approach to solve a problem but a mixture of approaches to help him/her better solve a problem and find the truth (Kaushik and Walsh, 2019). Therefore, this paradigm helps the researcher to draw both qualitative and quantitative assumptions when they engage in research (Creswell, 2018). The researcher can argue that the main reason behind the choice of the pragmatic approach is the research problem, where the use of either quantitative or qualitative approaches does not completely address the research problem, whilst a combination of approaches does (Saunders, Lewis and Thornhill, 2003; Creswell and Plano-Clark, 2011).

The paradigm was found appropriate for this study because it supported the adoption of the mixed-methods approach and allowed the researcher to make decisions on the appropriate strategies based on the research problem. The study thus adopted both quantitative and qualitative approaches within the pragmatic paradigm.

4.4 Research approaches

Research approaches are plans and procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis and interpretation (Grover, 2015:1; Creswell, 2013:64). Creswell (2018:40) noted that the selection of a research approach depends on the nature of the research problem, issue/s being addressed, the researcher's personal experiences, and the population under study. There are three generally recognised research approaches, namely, quantitative, qualitative and mixed methods (Creswell, 2009:3). The quantitative approach dominated research in the social sciences until the late 20th Century when the interest in qualitative approaches increased alongside the development of mixed-methods research.

4.4.1 Qualitative approach

The qualitative research approach is the "systematic inquiry into social phenomena in natural settings" (Teherani, Matimianakis, Stenfors-Hayes, Wadhwa and Varpio, 2015:1). This approach helps the researcher to explore and understand the meaning individuals or groups give to a social or human problem. The approach seeks to investigate the complexities of the social world (Creswell, 2013:68; Tuffour, 2017). The qualitative research approach collects data through observations, interviews and document reviews and summarises the research findings through narrative or verbal means (Lodico, Spaulding, Voegtle, 2006:15; Kabir, 2016:203). This approach aims to address the "how" and "why" of a study topic and uses unstructured methods of data collection to fully explore the topic (Kabir, 2016).

Kabir (2016:6) noted that although qualitative approaches are good for further exploring the effects and unintended consequences of a study, they can, however, expensive and time-consuming to implement.

Creswell (2005) provided the following characteristics of the qualitative research approach:

i) Exploring a problem and developing an understanding of the central phenomenon.
ii) Having the literature review plays a minor role but justifies the problem.

iii) Stating the purpose and research questions in a general and broad way to obtain the study participants' experiences.
iv) Analysing the data for description and themes using text analysis and interpreting the larger meaning of the findings.
v) Writing the report using flexible, emerging structures and evaluative criteria

4.4.2 Quantitative approach

The quantitative approach involves the generation of data in a quantitative form which can be subjected to rigorous quantitative analysis using statistical procedures (Creswell, 2013:68). The quantitative approach is used for testing objective theories by examining the relationship among variables (Creswell, 2013:68). The quantitative approaches address the "what" of a study and uses systematic standardised approaches, and employs methods such as surveys (Kabir, 2016). One of the benefits of the quantitative approach is that it is cheaper to implement, is standardised (thus, comparisons can be easily made), and the extent of the effect can usually be measured (Kabir, 2016:203).

The quantitative approach has a more "positivist worldview, experimental strategy of enquiry, and pre-test measures of attitudes" (Creswell, 2009:17). It is best suited for testing a theory or explanation (Creswell, 2009). Eyisi (2016:94) provided five advantages of the quantitative research approach:

i) The quantitative approach uses statistical data as a tool for saving time and resources (Kabir, 2016).
ii) The use of scientific methods for data collection and analysis in this approach makes generalisation possible.
iii) Replicability is another benefit derivable from the use of this research approach since it relies on hypothesis testing.
iv) The approach also provides room for the researcher to use control and study groups.
v) In the quantitative approach, the researcher is "detached" which helps to eliminate research biases.

4.4.3 Mixed-methods approach

The mixed-methods approach is used to conduct research which involves collecting, analysing and interpreting both qualitative and quantitative data in one study to improve the quality of the study (Fidel, 2008; Creswell, 2018). Bazeley (2008) defined the mixed-methods approach as the application of more than one methodological approach to conduct research. The use of mixed methods provides the researcher with logical and methodological flexibility and sufficient in-depth understanding of smaller cases (Maxwell, 2016). Mixed methods combine the quantitative and qualitative approaches to enable the researcher to answer the research questions (Johnson, Onwuegbuzie and Turner, 2007). The mixed-methods approach widens the researcher's inquiry with sufficient depth and breadth, which provides the researcher with a better understanding of the research problem (Dawadi, Shrestha and Giri, 2021).

Kabir (2016:209) pointed to the common areas in which mixed-method approaches may be used:

i) Initiating, designing, developing, and expanding interventions.
ii) Evaluation.
iii) Improving research design.
iv) Corroborating findings, data triangulation or convergence.

Kabir (2016:209) also identified some of the challenges of using a mixed-methods approach:

i) Delineating complementary qualitative and quantitative research questions.
ii) Time-intensive data collection and analysis.
iii) Decisions regarding which research methods to combine.

This study used the mixed-methods approach to better understand the phenomenon under study (that is, Linked Data in Ugandan university libraries) and to gather richer data to answer the research questions holistically (Ivankoval, Creswell and Stick, 2006; Ngulube, Mokwatlo and Ndwandwe, 2009). According to Amaratunga, Baldry, Sarshar and Newton (2002), using one single methodology often fails to explore all the components of a research problem

and, therefore, proposed the use of a mixed methods approach to counteract this weakness and to enhance the research. Quimby (2012) noted that mixed methods provide for a clearer and more accurate questioning of the meaning(s) of questions essential for data collection (Maarouf, 2019:5). Quantitative and qualitative methods complement each other and allow for a complete analysis of the research problem (Migiro and Magangi, 2011). As noted by Plano-Clark and Ivankova (2016:312), combining qualitative and quantitative methods provides a better understanding of the research problem than only using one research approach. As pointed out earlier, a qualitative approach is used to help explore and understand the meaning individuals or groups give to a social or human problem, while the quantitative approach is used to address the "what" of a study (Kabir, 2016). The mixed-methods approach was suitable for this study because it involved the investigation of attitudes, opinions, experiences, and behaviour of the research participants (Cohen, Manion and Morrison, 2011). In addition, the quantitative method was used to corroborate the findings and to improve the understanding of the insights attained with the qualitative method (Creswell and Plano-Clark, 2007).

4.5 Research design

Research design is the "arrangement of conditions for collecting and analysing data and analysis of data in a manner that aims to combine relevance to the research purpose" (Kothari, 2010:31). Research designs are "plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis" (Creswell, 2019:22). The research design ensures that a better, systematic, and organised plan of the research is undertaken and, therefore, enhances the efficiency of the researcher. This study applied the exploratory research design. Before elaborating on this design, two other research designs, namely, the case study and survey research are explained below.

4.5.1 Case Study

Case studies are mainly used in qualitative research. Case study research is richly descriptive because it is grounded in deep and varied sources of information that address a phenomenon (Marczyk, Dematteo and Festinger, 2005; Hancock and Algozzine, 2006:15). Case studies focus on small groups or individuals within a group and document the individual or group's

experience in a specific setting (Lodico. Spaulding and Voegtle, 2006:17). Case studies involve an in-depth examination of a smaller sample, and a greater number of measurements with more frequency (Grover, 2015:8; Yin, 2018:50). Data collection in case studies of individual participants includes the use of in-depth interviews and observations and the goal is to provide an accurate and complete description of the case (Marczyk et al., 2005). Case study research employs quotes from key participants, anecdotes, prose composed from interviews, and other literary techniques to create mental images that bring to life the complexity of the many variables inherent in the phenomenon being studied (Hancock and Algozzine, 2006:15; Yin, 2018).

One of the benefits of the case study design is that it helps the researcher to expand knowledge about the variations in human behaviour (Marczyk et al., 2005). In addition, it also enables the researcher to gather information or data through multiple sources and perspectives (Lodico et al., 2006:17). Marczyk et al. (2005:15) noted that a case study requires a considerable amount of information, and the conclusions are based on much more detailed information. The information examined may be retrospective as contained in archival materials. Generalising the findings in a case study is not possible (Marczyk et al., 2005). In case studies, the researcher seeks to identify themes or categories of behaviour and events rather than prove relationships or test hypotheses (Hancock and Algozzine, 2006:16). "Case studies are relevant, and the questions designed require an extensive and in-depth description of some social phenomenon" (Yin, 2018:33). Case studies are preferred when relevant behaviours cannot be manipulated and when the desire is to study some contemporary event or set of events (Yin, 2018:43). They rely on direct observation of the events being studied and interviews with the person/s who may still be involved in those events (Yin, 2018:43).

This study chose not to employ the case study design. Instead, it focused on soliciting responses from several accredited universities which had implemented an ILS.

4.5.2 Survey

A survey design provides a quantitative description of trends, attitudes, and opinions of a population, or tests for association among variables of a population, by studying a sample of

that population (Creswell, 2018:207). The survey design can be used to obtain information from large samples of the population (Glasow, 2005). Surveys rely on asking people standardised questions and the responses to the questions are analysed statistically. Researchers can generalise the study findings to the larger population from which the sample was drawn (Leavy and Patricia, 2017:101).

The survey designs help researchers answer three types of questions, that is, descriptive questions, questions about relationships between variables, and questions about predictive relationships between variables over time (Creswell, 2018:207). Surveys are used to ascertain individuals' attitudes, beliefs, opinions, and experiences (Leavy and Patricia, 2017:101). According to Babbie (2004) and Singh (2007), survey research is considered one of the best methods that a social researcher can use if they are interested in collecting original data to describe a population too large to observe directly. The survey research design solicits self-reported verbal information from the respondents about themselves (Creswell, 2019). The survey information is usually collected via questionnaires (which can be distributed physically, via email, or be Web-based) and interviews (conducted by telephone, over the Internet, or in-person) (Rea and Parker, 2014:4). The survey process assists to collect data that can inform the researcher about the research questions (Blair et al., 2005: Rea and Parker, 2014).

4.5.3 Exploratory research

The exploratory research design is conducted to clarify ambiguous situations and is not intended to provide conclusive evidence from which to determine a particular course of action problems (Zikmund, 2003:54). The goal of exploratory research is to formulate problems, clarify concepts, and also form hypotheses. According to Saunders et al. (2009), exploratory research is conducted when little is known about a phenomenon and the problem has not been clearly defined. This type of research is used by a researcher when he/she has a general idea or specific question about the research problem under study. Exploratory research forms the basis for more conclusive research and determines the initial research design, sampling methodology, and data collection method (Singh, 2007).

One of the major disadvantages of exploratory research is that it lacks conclusive results resulting in bias and subjectivity due to the lack of pre-existing knowledge about the topic. However, according to Tegan and Merkus (2021), the advantages of exploratory research include:

i) It may help to narrow down a challenging problem that has not been previously studied.
ii) It can serve as a guide for future research and does not usually have conclusive results.
iii) It can be flexible, cost-effective and open-ended.

The study used the exploratory research design because it is considered appropriate when the phenomenon under study has not been extensively researched and where insights into the phenomenon are needed. The research design was suitable for this study because Linked Data is still an emerging phenomenon in university libraries in developing countries and more so Uganda, and there is still much to learn and understand about its adoption and implementation in such a context. The study enabled the researcher to explore the adoption of Linked Data among the university libraries and come up with strategies that can use when promoting adoption of Linked Data in their university libraries.

4.6 Unit of analysis

The unit of analysis for this study was Ugandan university libraries. The study focused on accredited universities offering postgraduate programmes because they generate more research data than those that do not offer postgraduate programmes. Of the 33 universities offering postgraduate programmes, 14 were purposively selected for this study on the basis that they had adopted an ILS for their information services. These universities were: Makerere, Nkumba, Uganda Martyrs (UMU), Ndejje, Gulu, Cavendish, Lira, Kyambogo, Clarke International (CIU), Uganda Christian (UCU), Kabale, Muni, Busitema and Kampala International (KIU) (Alikoba et al., 2019)

4.7 Population

According to Busha and Harter (1980:57), a research population is “any group of persons, objects, or institutions that have at least one characteristic in common”. Rea and Parker

(2014) further define a population as a "set of elements that are used as inference in the study." Before the selection of a sample, the researcher must have a clear idea of the population that they wish to study (Blair, Czaja and Blair, 2013). The target population of the study was 187 from the selected university libraries. The group of people that were involved in this study included the university librarians, heads of IT, head librarians of technical services and professional librarians in the university libraries. All other members of university staff and students were excluded as noted in Chapter One.

The study purposively targeted the university librarians because they are responsible for policy formulation and implementation, and infrastructure development. The head librarians of the technical services oversee the library's technical services including cataloguing and data management. The heads of IT oversee all technology operations in the universities, and the professional librarians support the research and teaching needs of the academic departments.

4.7.1 Sampling of the population

A census provides the complete enumeration of all the items in the population (Kothari, 2004:55) and involves "obtaining information from each member of the population" (Laxton, 2004). Israel (1992) asserts that where populations are less than 200, it is prudent to conduct a census. In this study the targeted population from the 14 universities totalled 187 individuals and, given Israel's assertion above, no sampling per se was done and the entire population was included. Table 6 below provides the number of respondents per category from each university.

Table 5: Distribution of the respondents per category from each university

	University	University Librarian	Head of Library Technical Services	Head of IT	Professional Librarian	Total
1.	Makerere	1	1	1	21	24
2.	Kyambogo	1	1	1	18	21
3.	Busitema	1	1	1	8	11
4.	Kabale	1	1	1	16	19
5.	Lira	1	1	1	2	5
6.	Muni	1	1	1	2	5
7.	Gulu	1	1	1	11	14
8.	Ndejje	1	1	1	8	11
9.	Nkumba	1	1	1	4	7
10.	UCU	1	1	1	20	23
11.	UMU	1	1	1	6	9
12.	Cavendish	1	1	1	5	8
13.	KIU	1	1	1	21	24
14.	CIU	1	1	1	3	6
	Total	**14**	**14**	**14**	**145**	**187**

Source: Field data (2022)

4.8 Data collection

Data collection is a process of gathering and measuring information on variables of interest systematically aimed at answering the research questions, testing hypotheses and evaluating outcomes (Kabir, 2016:202). Kabir (2016) further noted that data collection is one of the most important stages in conducting research and therefore requires proper planning.

4.8.1 Data collection methods

According to Patil (2020:95), data collection methods are systematic and standardised procedures for observing and recording data in relation to a study's objectives. Jupp (2006) further defines data collection as a process of collecting data for analysis so that it provides answers to the research questions. Data collection methods used in this study included interviews and questionnaires.

Triangulation of methods for data collection was applied in this study. Noble and Heale (2019) state that triangulation ensures and increases the credibility and validity of research findings which arise from the use of a single method. It also helps the researcher to counteract the weaknesses of both qualitative and quantitative research (Kothari, 2004). According to Kroll and Neri (2009), qualitative and quantitative data can be collected concurrently or in parallel, although one method dominates while the other is embedded or nested in it. The study adopted concurrent triangulation to validate the findings generated by each method through evidence produced by the other. The quantitative and qualitative data were analysed separately but combined when the findings were interpreted and discussed (Creswell, 2005). The concurrent triangulation adopted provided a comprehensive analysis of the research problem by integrating both forms of data in the interpretation of the results (Harwell, 2011).

The following is a brief description of some of the popular data collection methods used in the research:

(i) **Interviews** – This is where a series of questions are asked by the researcher and the informant addresses them, and the responses are recorded. Laws et al. (2013:201) argue that interviews are most useful when the study is interested in "people's experiences, views in some depth when relying on information from a fairly small number of respondents" and dealing with sensitive information where respondents may not be able to speak freely in groups. These were the reasons for employing this method in the current study. There are two types of interviews that include; structured interviews that involve using a set of pre-determined questions which are standardised; unstructured interview don't follow a system of pre-determined questions and any standardised recording of the information.

This study used a semi-structured interview because it allowed for the collection of some quantitative information regarding the demographic background of the respondents and qualitative information where the questions could be asked in different ways. The semi-structured interviews lasted between 25- 30 minutes and were used to collect data on Linked Data awareness, extent of adoption and its use, perceived benefits, policies and related regulatory framework, strategies among others.

(ii) **Questionnaire Method** - This method is one of the popular data collection methods It consists of a list of written questions that are given or mailed to respondents to fill by themselves. The questionnaire can be translated into the local language to cater for those who may not understand the English language. The participants with low literacy levels can be asked verbally and their responses filled in on their behalf. The questionnaire method is very useful in extensive inquiries and where there are a large number of respondents involved, providing more dependable and reliable results (Kothari, 2004:101). Some of the demerits of the method are that it may result in a low return rate; respondents may misunderstand the questions and wrongly answer them. This method was used with the professional librarians and the heads of library technical services.

(iii) **Observation** – This method is usually employed in research related to behavioural sciences. Under this method, the investigator gathers information by observing without asking the respondent. The observation method could not be used because the study was interested in finding out the "attitudes, opinions and motivations of the research participants" that could not be recorded using this method (Zikmund, 2003:69).

4.8.2 Data collection instruments

Data collection instruments are used for obtaining information relevant to the researcher's study (Birmingham and Wilkinson, 2003:6). They enable the researcher to collect data with which they can then test the hypothesis or answer the research questions (Sahoo, 2022). Two data collection instruments were used in this study to collect primary data, namely, semi-structured interviews ***(Appendix II and III***) and questionnaires ***(Appendix V and VI).*** The two data collection instruments were used to increase the validity of the findings, this is

because the weakness of one instrument will be compensated for by the strengths of the other, and vice versa. The questionnaires were used to collect quantitative data while the interviews collected qualitative data. The questionnaires were directed at the heads of library technical services and the professional librarians, while the interviews were used to collect data from the university librarians and heads of IT.

4.8.2.1 Questionnaire

According to Kabir (2016:208), the questionnaire was invented by Sir Francis Galton in the late 1800s. It is one of the most widely used instruments to collect data, especially in social sciences (Taherdoost, 2016:29). The questionnaire is considered the main means of collecting primary data (Roopa and Ranlatei, 2012:273). It is associated with quantitative research which is used for either descriptive or exploratory purposes related to the research problem under study. The questionnaire consists of a series of questions used to obtain statistically useful information from respondents about a given topic (Roopa and Rani, 2012:278; Parveen and Showkat, 2017). The respondents are required to record the most appropriate response to the question. These questions can be very detailed covering many subjects or issues related to the objectives of the study.

The questionnaire is a favoured instrument in research because it is an inexpensive and effective way of collecting data in a structured and manageable format (Birmingham and Wilkinson, 2003:7). It should be noted, however, that questionnaires can be difficult to design and responses to questions difficult to analyse (Birmingham and Wilkinson, 2003:8). An effective questionnaire should enable transmission of useful and accurate data or information from the respondent to the researcher (Birmingham and Wilkinson, 2003:8). The current study employed an online questionnaire to collect data because it was the most convenient considering the prevailing Covid-19 pandemic restrictions where social distancing was enforced by government regulations.

Questionnaires require the researcher to present questions in an unambiguous way for the respondent to easily interpret them, articulate his or her response, and transmit it effectively to the researcher (De Leeuw, 2001; Birmingham and Wilkinson, 2003). The questionnaire method is useful when the study has many respondents, the researcher knows the kind of data

to be collected, and the "information is straightforward and can be standardised and when the respondents are literate and comfortable filling in the questionnaires by themselves" (Laws, Harper, Jones and Marcus, 2013:208).

Questionnaires consist of open-ended and closed-ended questions. An open-ended question requires the respondent to formulate his/her answer, whereas a closed-ended question requires the respondent to choose an answer from a given list of options (Kabir, 2016:208).

Some of the challenges of this method include the respondents misunderstanding the questions and answering incorrectly, an often low response rate, and respondents' answers being limited to a fixed set of responses assigned by the researcher (Roopa and Rani, 2012:274). This method is best employed in studies with large sample sizes (as with the professional librarians in this study). Importantly, identical questions are asked to all the participants to achieve standardisation of the data collection process (Flick, 2011:106). This study used online questionnaires to collect data. They contained both open-ended and closed-ended questions; however, the vast majority of the questions were closed-ended. The questionnaire directed at the professional librarians and that directed at the heads of the library technical services had minor differences but were essentially the same. They were divided into six main sections each reflecting different categories of information. These were:

- Demographic data and affiliate university information.
- Level of awareness of Linked Data.
- Extent of adopting Linked Data.
- Benefits of adopting Linked Data.
- Factors that influence the behaviour towards the adoption of Linked Data.
- Strategies that can be used to adopt the use of Linked Data.

Questionnaires have several advantages compared to other data collection instruments. According to Kabir (2016:208), these advantages include:

i) Large amounts of data can be collected from many people in a short period and is a relatively cost-effective way to collect data.

ii) Questionnaires can be utilised by the researcher or any person with limited effect on their validity and reliability.
iii) Questionnaire responses can usually be quickly and easily quantified by either the researcher or the use of a software package.
iv) Responses can be analysed more scientifically and objectively than those obtained from other methods of research.
v) When data has been quantified, it can be used to compare with other research findings and may be used to measure change.

Kabir (2016:211) also noted that questionnaires have disadvantages which researchers should look out for and these include:

i) The respondent may not understand some of the questions.
ii) There is no way to tell how truthful a respondent is being.
iii) There is no way of telling how much thought a respondent has put into a response.
iv) The respondent may be forgetful.
v) Respondents may interpret questions differently and this may impact on the validity of the study findings.

This study adapted the questionnaire used by Venkatesh et al. (2003) in their study on user acceptance of IT, and by Warraich and Rorissa (2018) in their study on Linked Data technologies adoption among university librarians in Pakistan.

4.8.2.2 Interview

A widely employed data collection tool is the interview. According to Birmingham and Wilkinson (2003:43), interviews have been used in research to obtain detailed and in-depth information from a respondent on a topic in terms of the research questions posed. Interviews allow for greater depth of information which is not possible with other data collection methods. The use of the interview is a popular way of gathering research data (Griffee, 2005).

In social science, interviews are methods of data collection that involve two or more people exchanging information through a series of questions and answers (Patil, 2020; Sahoo, 2022).

The purpose of the interview is to get in-depth knowledge/ information from the respondents about a given phenomenon. Interviews should be recorded and transcribed verbatim to avoid bias and provide a permanent record of what was said (Gill, Stewart, Treasure and Chadwick, 2008:293; Leavy and Patricia, 2017:142). Interviews are used to seek qualitative, in-depth and descriptive data that is specific to an individual (Pickard, 2017). Interviews usually produce rich and detailed data that can be complex to analyse (Pickard, 2017).

Characteristics of interviews as opined by Sahoo (2022) include:

i) A purposeful interaction in which one person obtains information from one or more individuals.
ii) It is a verbal interchange, often face-to-face (although the telephone may be used), in which an interviewer tries to elicit information, beliefs, or opinions from another person.
iii) It is an interchange of views between two or more people on a topic of mutual interest and is premised on the centrality of human interaction for knowledge production.
iv) It is a process where the interviewer can observe certain aspects of a person's behaviour, such as his manner of speaking, his poise, and other non-verbal aspects.
v) It involves a series of questions and answers.
vi) It includes questions that a researcher designs to elicit information from interview participants on a specific topic or set of topics.
vii) It is not a mere conversation but a purposeful, directed conversation.
viii) It is useful when the research topic is rather complex, requires a lengthy explanation, or needs a dialogue.
ix) It helps the investigator to gain an impression of the person concerned.
x) It can deal with delicate, confidential, and even intimate topics.

Kothari (2004) noted that the interview method has some weaknesses. These include:

i) It can be very expensive when there is a large and geographically widely spread sample.
ii) It can be very time-consuming when the sample is large and recalls of the respondents are necessary.

iii) Some of the respondents may not have the desired information.
iv) Interviewing requires high-level questioning and interpretation skills.

Research tools help researchers collect data to answer a study's research questions. Numerous tools can be used to collect data such as the above-mentioned interview. The tool for conducting an interview is called the interview schedule. The interview schedule is a data collection tool consisting of properly worded, sequentially arranged questions relevant to the objective/s of the research (Kothari, 2004:17; Patil, 2020). The interview schedule guides the researcher in conducting the interview. There are three main kinds of interview schedules, namely, structured, unstructured and semi-structured. The current study employed a semi-structured interview schedule to guide the researcher in collecting data from the university librarians and heads of IT.

Semi-structured interviews contain standardised and open-ended questions which can, where necessary, be modified by the interviewer (Gill, Stewart, Treasure and Chadwick, 2008; Sahoo, 2022). The semi-structured interview allows the interviewer and the interviewee to discuss the topic under study in more depth especially if the interviewee is having trouble answering a question (Sahoo, 2022:7). The interviewer also has the option of probing the interviewee further to clarify the original response or to pursue a line of inquiry (Sahoo, 2022:7). The strengths of the semi-structured interview are that:

Sahoo (2022:7) opined on the strengths of the semi-structured interview as follows:

i) It provides for flexibility.
i) It provides an opportunity for the interviewer and interviewee to discuss the subject matter in detail.
ii) It allows the interviewer the freedom to probe.

Sahoo (2022:7) also noted that the semi-structured interview has limitations:

i) It is much more time-consuming to conduct than structured interviews.
ii) Since it uses open-ended questions, it may be difficult to have uniformity of responses across all the respondents.

iii) There is also the possibility of bias on the part of the interviewer.

There are several methods of gathering data using semi-structured interviews. These include:

- **Face-to-face interviews:** In this interview, the interviewer reads the questions to the respondent and records the answers. According to Sahoo (2022), the interviewer has the opportunity to observe the respondent during the interview.
- **Focus group interviews:** An interviewer invites a group of people who are interested in a certain topic and has a discussion with them. The participants not only respond to the researcher but also to the responses of other participants.
- **Online interviews:** With the technological changes and growth of the Internet, conducting interviews online is now possible. This has reduced the problems related to face-to-face interviews (such as geographical distance and interview venues). As with the other methods of conducting interviews, online interviews are used to gather original data via the Internet with the intention of analysing it to provide new evidence in relation to specific research questions (Witz, 2006).

This study conducted telephone interviews to collect the data.

Telephone interviews

Telephone interviews involve communicating with the respondents using the telephone (King, Marston and Bower, 2014; Sahoo, 2022). The telephone interview has become popular and compares quite favourably with face-to-face interviews (Sahoo, 2022). Telephonic interviews are considered to be convenient because the researcher does not have to travel to meet with the interviewees (Hofisi et al., 2014:63). In addition, the respondents may also provide more information due to facial anonymity as compared to the face-to-face interview. However, King et al. (2014) argued that the telephonic interview is not used regularly, although it is faster to collect data compared to other methods. Also, it is not appropriate in cases where complete responses are needed to answer numerous and lengthy questions; the questions must be short and to the point (King et al., 2014). The telephone interview can be utilised when face-to-face interviews are not feasible. For example, this study adopted the telephone interview due to the Covid-19 pandemic requirement of social distancing.

Telephone interviews can be conducted over a relatively short period with people scattered over a geographical area (Sahoo, 2022) This study interviewed university librarians and heads of IT located in universities in different geographic areas of Uganda. There was no need to travel, and travel-related expenses were thus avoided. Each telephonic interview took approximately 30 minutes. Although the telephone interview has several strengths, it also has weaknesses as noted by Sahoo (2022) and these include:

i) It provides less opportunity for establishing rapport with the respondents than would occur with face-to-face interviews.
ii) It requires skill to carry out a telephone interview to obtain valid results.
iii) Respondents may not disclose information or tell lies (a problem also associated with face-to-face interviews).
iv) It is often more difficult for strangers to communicate via telephone than face-to-face, especially where non-verbal cues are involved.
v) There is an increased possibility of bias on the part of the interviewer (Kothari, 2004:100).

Whereas the questionnaire was used to provide general information regarding the adoption of Linked Data. The interviews were used to supplement the questionnaire to get in-depth information with regard to Linked Data awareness, extent of adoption, benefits, factors that influence its adoption, data sharing policies and Linked Data adoption strategies.

Interview schedule

The interview schedule is a data collection tool that consists of a written list of open-ended or closed questions prepared by the interviewer in a person-to-person interaction either face-to-face, by telephone, or by other electronic media (Kothari, 2004:17; Kumar, 2011:389).

The study employed an interview schedule/guide to collect data from the university librarians and heads of IT. The interview schedule was adapted from the same two studies that the questionnaire was adapted from. The interview schedules used in the study (***see Appendices***

II and III) were divided into six main sections each reflecting different categories of information. These were:

- Demographic data and affiliate university information.
- Level of awareness of Linked Data.
- Extent of use of Linked Data.
- Benefits of adopting Linked Data.
- Factors that influence the behaviour of university librarians towards the adoption of Linked Data.
- Strategies required to promote the adoption and use of linked data.

The interview schedule has several advantages compared to other data collection instruments. According to Kothari (2014:104), these advantages include:

i) It is very useful for in-depth inquiries which ensures the reliability and credibility of data collected. The interviewer can ask follow-up questions or clarifications to the questions asked.
ii) It is easier to conduct and complete an interview within a specific time since the questions have already been pre-prepared, in case the respondent misunderstands a question, the interviewer can provide corrections.
iii) Non-response is very low because the interviewer records the answers to the questions him/herself.
iv) It also offers flexibility and customisation when interviewing different types of people.
v) It enables the respondent to provide a perspective about the issues that are of key significance to the research.

Williamson, Given and Scifleet (2017) noted that an interview schedule has disadvantages that researchers should look out for, and these include:

i) It is time-consuming because it requires a lot of preparation, especially for an extensive or in-depth interview.
ii) Sometimes it suffers from the bias of the interviewer because the interviewer is the one who prepares and chooses the questions to be asked during the interview.

iii) The variability of responses may be high when multiple interviewers use the interview schedule. This may result in unreliable information gathered during the interviews.
iv) Information obtained from the interviewees is not standardised from one person to another.

4.9 Pre-testing the research instruments

Van der Stoep and Johnson (2009:199) defined a pretest as a "small-scale implementation of a draft questionnaire used to assess such critical factors as questionnaire clarity, comprehensiveness and acceptability." Before embarking on data collection, it is important to pretest both the questionnaire and interview guide. This is because some survey questions, for example, may require modifications to provide more clarity and improve or remove any possible problems that the pretest respondents may have with them (Kumar, 2011:393). Modification of these questions will help ensure that the respondents interpret the questions as intended (Lavrakes, 2008:38).

Pretesting of the research instruments ensures their effectiveness and brevity (Rea and Parker, 2014:27). For example, once a draft questionnaire has been prepared, it is important to pretest the instruments under actual survey conditions to achieve the aim of the study (Rea and Parker, 2014:27). This will also assist the researcher to identify poorly worded questions and overall quality of the instrument will be improved (Rea and Parker, 2014:31). Following the pretest, the researchers should be able to revise the questions as needed (Rea and Parker, 2014:38).

The instruments for the study were pretested at Kampala University. Content validation and pre-testing of the interview schedule were done with the university librarian and the head of IT on the 19th and 20th of August 2022 respectively. The questionnaire was pre-tested on four professional librarians, and the librarian in charge of technical services between 12th and 17th August 2022. Kampala University is a private, chartered, and accredited university in Uganda. It is located at Ggaba, Kampala City Council Authority and has resources, facilities and characteristics similar to the 14 universities which took part in the study. Kampala

University was not part of the study because it had recently installed a library management system (KOHA) which is accessible on the Internet.

The findings relating to the pre-tests are outlined under 4.10.1 below.

4.10 Validity and reliability of the instruments

The validity and reliability of research instruments are crucial aspects of research. The researcher usually establishes the validity and reliability of an instrument as part of the process of developing a pre-established instrument (Lodico et al., 2006:88). According to Lodico et al., (2006:87), reliability refers to the ability of an instrument to produce approximately the same score for an individual over repeated testing. Reliability is the "consistency or repeatability of an instrument" (Creswell, 2018:215). It is important to test for reliability because it provides consistency across the parts of the instrument (Huck, 2008). Acceptable research should be valid and reliable correctly representing what the data sources provided irrespective of differences in time and place (Taherdoost, 2016:33).

Validity ensures that what the instrument "claims" to measure is truly what it is measuring (Lodico et al., 2006:88). The research drew meaningful and useful inferences from the scores generated from the instruments used in the study. The researcher, therefore, ensured that the data collected was valid and reliable using the most appropriate and accurate instruments to serve as measurement tools for the study (Lodico et al., 2006:88).

The study adopted tools already validated in previous related studies. As earlier noted, the questions asked were adopted from the instruments used by Venkatesh et al. (2003) and Warraich and Rorissa (2018). The former has been tested and widely used for the adoption of technologies while the latter contributed Linked Data questions that had also been tested. This ensured a level of validity and reliability of the instruments used in this study. However, by pre-testing the instruments, the researcher was able to further improve the validity and reliability of the instruments and thus of the study as a whole.

4.10.1 Librarians' questionnaire pretest

The head librarian in charge of technical services and professional librarians at Kampala University were emailed the questionnaire and were able to respond to the questions. Several what could be considered minor suggestions were made:

The need to provide a brief explanation of Linked Data to introduce section B of the questionnaire ***(Appendix V and VI)***. The need to include a "Not sure" option for question B1 to cater for the respondents who may not be sure that their institutional research data is not linked on the Web. The need to remove the option of (10 years and above) (Question B3) because it seemed out of context.

The corrections were duly done and apart from the above, the pre-test respondents felt that while the questions were clear and detailed, there were too many. However, the researcher had to retain all the questions to answer the research questions posed.

4.10.2 University librarian and head of IT interview guide pretest

The Kampala University librarian and head of IT pre-tested the semi-structured interview guides ***(Appendix II and III)***. After the pre-test, it was suggested that questions F. 20 and E.18 be included to solicit opinions from the respondents on policies available for data sharing. Also, a question on what the respondents understood by Linked Data was included. The inclusion of these questions affected the numbering of the interview guides and this was rectified. No other problems or concerns with the questions asked were identified or raised and the researcher was able to finalise the two interview schedules and proceed to collection of the data.

4.11 Data collection procedures

The researcher obtained the respondents' contact details from the university librarian's office. An informed consent and declaration form was emailed on 23rd and 24th September 2022 to the respondents (professional librarians and the heads of library technical services) for their consent and signature on the consent form. The majority of the respondents returned the

signed declaration between 23rd September to 17th October 2022, while others consented to participation via an email message. Once consent was received, the researcher then emailed the respondents a link to the online questionnaire for their completion. For those who did not respond, follow-up phone calls were made, and emails were resent between 17th October and 9th November 2022.

The interviews were conducted via telephone with the university librarians and heads of IT. The university administration provided their contact details, enabling the researcher to easily reach out to them. Telephone calls were made to the respondents whereby the researcher introduced herself, provided a brief overview of the study and requested their participation. Once their participation was confirmed, appointments for the telephonic interviews were made. The researcher then emailed the respondents the informed consent and declaration form for their signatures. The declaration forms were returned between 12th November 2022 and 19th December 2022. The interviews commenced on 21st November 2022 with the last interview being conducted on 12th January 2023. Where necessary, the researcher provided supplementary explanations to the university librarians, and the heads of IT on the purpose of the research.

4.12 Data analysis

After the data had been collected, it was analysed to derive meaning. According to Kothari (2004), data analysis requires establishing categories and applying these categories to draw raw data through coding, tabulation and then drawing statistical inferences. For example, coding makes data analysis easier for the researcher (Birmingham and Wilkinson, 2003). Data analysis involves preparing data for analysis, understanding the data, representing the data and making interpretations of the data (Creswell, 2013:217). In this study, both quantitative and qualitative data analysis techniques were used.

4.12.1 Analysis of the quantitative data

The data collected through the online questionnaires and the closed-ended questions of the semi-structured interviews was analysed using the Statistical Package for Social Sciences (SPSS) which is user-friendly and enables researchers to obtain statistics ranging from simple

descriptive statistics to inferential statistics (Bala, 2016; Ong and Puteh, 2017). The raw data collected was organised by first checking for any missing data, ambiguity and errors. The data file was transferred into SPSS after downloading it from google form as a csv excel file. This was followed by coding of the data and assigning a label to each question and a value to each of the responses. SPSS was used to derive descriptive statistics, frequency count and percentages to report the survey responses. The descriptive statistics was used to help the researcher simplify the large data and make meaning out of it.

4.12.2 Analysis of the qualitative data

The data collected through the open-ended questions of the semi-structured interviews was thematically analysed. The thematic analysis involved sorting the data collected from the interviews according to the research questions, and then thematically arranging the data into themes to identify patterns, trends and biases.

Creswell (2013) opined that the analysis of qualitative data involves the following steps:

i) Organise and prepare the data analysis by transcribing interviews from the audio-recorded and written information, sorting and arranging the data into different types depending on the source of information.
ii) Identify and obtain the general sense of the information and its overall meaning. Sometimes qualitative researchers write notes in margins or start recording general thoughts about the data at this stage.
iii) The researcher can then begin with the detailed implementation of the coding process.

The study used telephone interviews to collect qualitative data. The interviews were recorded and transcribed verbatim. The following steps were followed in the analysis of the qualitative data;

i) After transcription of the interviews, codes were assigned to each response for the university librarians (UL1-14) while heads of ITs (HITs 1-10)
ii) The interview transcripts were then thematically grouped
iii) The researcher re-read the transcripts to make sense of the data and its overall meaning

iv) The researcher listened to the audio recorded responses to ensure no information was missed.
v) Thereafter the analysis was done and presented under themes related to the research questions.

4.13 Ethical considerations

Ethics defines what is or is not legitimate to do or what a "moral" research proposal is (Neuman, 2014:145). Ethical issues are, therefore, the "concerns, dilemmas and conflicts that arise over the proper way to conduct research" (Neuman, 2014:145). One of the most important ethical principles in research is that the grounds for action and decision-making should be transparent and open (Oliver, 2010:159). Research ethics requires that the researcher provides the participants with details about the research and what they intend to do with the information the participants provide (Israel and Hay, 2006:13).

This research study complied with the ethical standards of informed consent, confidentiality, and anonymity as stipulated by the University of KwaZulu-Natal's Research Ethics Policy (University of KwaZulu-Natal, 2014). The proposal and ethical clearance documents were submitted to the Higher Degrees Committee of the University for approval which was subsequently granted (***Appendix VIII***). Written permission was sought to collect data from the administrators of the 14 selected universities Ethical clearance was also sought from the Mildmay Research Ethics Committee and the Uganda National Council of Science and Technology **(*Appendix VII)***.

The participants were informed about the aim of the study through the cover letter. As outlined earlier, informed consent was sought from the research participants before the data was collected from them. The informed consent and declaration forms were emailed to the participants before data collection; some responded promptly while follow-up phone calls were made for those who did not respond. For those, who had challenges of sending scanned signed informed consent forms, appointments were made for them to sign the forms physically; these were respondents living mainly in Kampala and Wakiso districts.

Confidentiality of the information was ensured, and the participants were assured about their rights, including the right to withdraw from the study at any point.

4.14 Summary

In this chapter, detailed discussions on the research methodology adopted in the study were highlighted.

The chapter first discussed the various research paradigms that exist. It discussed the pragramatic research paradigm that underpinned this study and its relevance to the study. The research approaches were also discussed and their relevance to the study. The study adopted the mixed research approach, which was deemed the most appropriate because of the strength of the combination of quantitative and qualitative research approaches. The exploratory research was made explicit, and how it was applied. The population of the study was described sampling strategy used in the respondent's selection, which included purposive sampling. The data collection instruments were presented and included an online questionnaire and telephonic interviews for quantitative and qualitative data respectively. The validity and reliability of the instruments were addressed which included their pre-testing. The chapter ended with how the data collected was analysed and an overview of the ethical considerations of the study and how they were dealt with.

Chapter Five, the next chapter, presents the results of the study.

CHAPTER FIVE

DATA ANALYSIS AND PRESENTATION OF FINDINGS

5.1 Introduction

This chapter comprises the analysis and presentation of the findings from the online questionnaires and telephonic interviews. The study sought to explore the adoption of Linked Data among university libraries in Uganda.

The study addressed five research questions:

i) What is the level of awareness of Linked Data among professional librarians in Ugandan university libraries?
ii) What is the extent of Linked Data adoption in Ugandan university libraries?
iii) What are the benefits of Linked Data adoption in Ugandan university libraries?
iv) What factors influence the behaviour of professional librarians towards the adoption of Linked Data in Ugandan university libraries?
v) What strategies can be used to promote the adoption and use of Linked Data in Ugandan university libraries?

5.1.1 General background

The study aimed to explore the adoption of Linked Data among University libraries in Uganda. The study purposively selected 14 universities on the basis that they had adopted ILSs for their information services. Both quantitative and qualitative data were collected. Two data collection instruments were used – the questionnaire to collect quantitative data and the interview to collect qualitative data. The Statistical Package for Social Sciences (SPSS) version 21.0 was used for sorting, coding and analysing the quantitative data. The interviews were audio recorded, and transcribed, and the subsequent qualitative data was analysed using content themes.

The quantitative data was collected from the professional librarians and heads of the technical services of the 14 libraries. The qualitative data was collected from the university librarians and heads of IT. Codes were automatically assigned to the respondents based on the responses

received from the online questionnaire: PL1-PL122 for professional librarians and HL1-HL14 for the heads of library technical services. The university librarians were given the codes UL1-UL14 and the heads of IT were coded HIT1-HIT10.

The study's findings are presented in the form of text, graphs and tables. However, before doing so the response rates achieved are described.

5.1.2 Response rates

According to Fincham (2008:2), the response rate is the ratio of the number of participants in a study to the number of participants who were asked to participate. This ratio is expressed as a percentage. It is critical to have a respectable response rate to generalise the results of the study.

The response rate for this study for the different categories of respondents is presented in Table 6 below.

Table 6: Response rates

(n=160)

S/N	Respondents	Data Collection tool	Sample Size	Response Rate	Percent
1.	Professional librarians	Questionnaire	145	122	84.1%
2.	Heads, library technical services	Questionnaire	14	14	100%
3.	University librarians	Interviews	14	14	100%
4.	Heads, IT	Interviews	14	10	71%

Source: Field data (2022)

Of the 145 professional librarians targeted to take part in the study, 122 completed the online questionnaire giving a response rate of 84.1%. All 14 heads of library technical services and all 14 university librarians participated thus giving a 100% response rate in both instances.

However, of the 14 heads of IT who were expected to take part in the study, 10 participated giving a response rate of 71%.

5.2 Presentation of results

The results from the questionnaires and interviews are presented separately. The results from the professional librarians and heads of library technical services are presented first to provide general information about their level of awareness of Linked Data, the perceived benefits of Linked Data adoption, the factors that may influence them to adopt Linked Data, the extent of adoption of Linked Data and the strategies that their institutions may use to adopt Linked Data. This was followed by the university librarians and heads of IT to gain in-depth knowledge regarding Linked Data adoption. The questionnaires' results are rounded off to one decimal point; thus, total percentages may at times exceed 100%.

5.2.1 Results of the professional librarians

This section presents the responses of the professional librarians based on the data collected using an online questionnaire ***(Appendix V*)**.

5.2.1.1 Demographic data of the professional librarians

The demographic data is derived from the five questions that were asked in section one of the questionnaire. Information about respondents' university affiliation, gender, age, duration at the university library and their highest academic qualification is presented.

University affiliation of the professional librarians

Table 7: University affiliation of the professional librarians

(n=122)

University	Count	Percent (%)
Makerere	21	17.2
Kyambogo	14	11.5
Busitema	8	6.6
Kabale	11	9.0
Lira	2	1.6
Muni	2	1.6

Gulu	10	8.2
Ndejje	7	5.7
Nkumba	4	3.3
UCU	15	12.3
UMU	8	6.6
Cavendish	4	3.3
KIU	13	10.6
CIU	3	2.5
Total	**122**	**100**

Source: Field data (2022)

Table 7 above shows the university affiliation of the professional librarian respondents. The highest number of respondents were from Makerere University, 21(17.2%), followed by Kyambogo University with 14 (11.5%). On the other hand, the universities of Lira and Muni had the lowest number of respondents, with each having two (1.6%).

Gender of the professional librarians

Table 8: Gender of the professional librarians

(n=122)

Gender	Count	Percent (%)
Female	60	49.2
Male	62	50.8
Total	**122**	**100**

Source: Field data (2022)

As can be seen in Table 8 above, of the 122 professional librarians who participated in the study, 62 (50.8%) were male and 60 (49.2%) female.

Age range and highest educational qualification of the professional librarians

Table 9: Cross-tabulation of age range and highest level of education of the professional librarians

(n=122)

Age range	Level of Education							
	Bachelor's degree		Master's degree		PhD		Total	
	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)
26-30	16	14.8	2	1.6	0	0.0	18	14.8
31-35	22	23.0	6	4.9	0	0.0	28	23.0
36-40	20	16.4	23	18.9	0	0.0	43	35.2
41-45	5	4.1	10	8.2	2	1.6	17	13.9
46-49	1	0.8	3	2.5	0	0.0	4	3.3
50 and above	13	10.7	8	6.6	1	0.8	12	9.8
Total	**67**	**69.7**	**52**	**42.6**	**3**	**2.5**	**122**	**100**

Source: Field data (2022)

Table 9 above shows a cross-tabulation of the age of the respondents with their highest level of education. Forty-two (39.4%) respondents were in the age range 31-35 years and 36-40 years and had attained a bachelor's degree. Ten (8.2%) respondents in the age range 41-45 years had attained a Master's degree and two (1.6%) in the same age range had attained a PhD.

Duration at the university library

Figure 10 below indicates that the highest number of professional librarians, 41 (33.6%) have worked at their university library between 10-15 years, followed by 31 (25.4%) who have worked at the university library between 1-5 years. Two (1.6%) respondents have worked at the university library for less than one year.

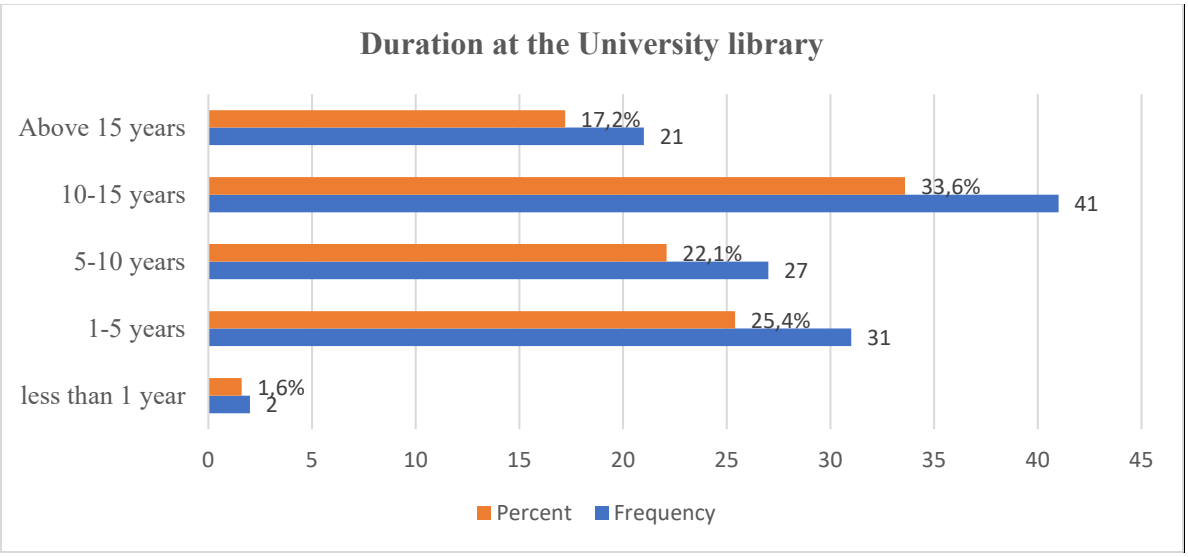

Figure 9: Duration at the university library

(n=122)

Source: Field data (2022)

5.2.1.2 Level of awareness of Linked Data

This section presents the findings from the respondents concerning various issues related to their level of awareness of Linked Data.

Awareness of research Data Linked on the Web

The professional librarians were asked if they were aware of any research data in their institution linked on the Web. Figure 11 below shows that the majority of the respondents 85 (69.7%) were aware of research data of their institution linked on the web. Twenty-six (21.3%) respondents were not aware and 11 (9%) were unsure of the situation.

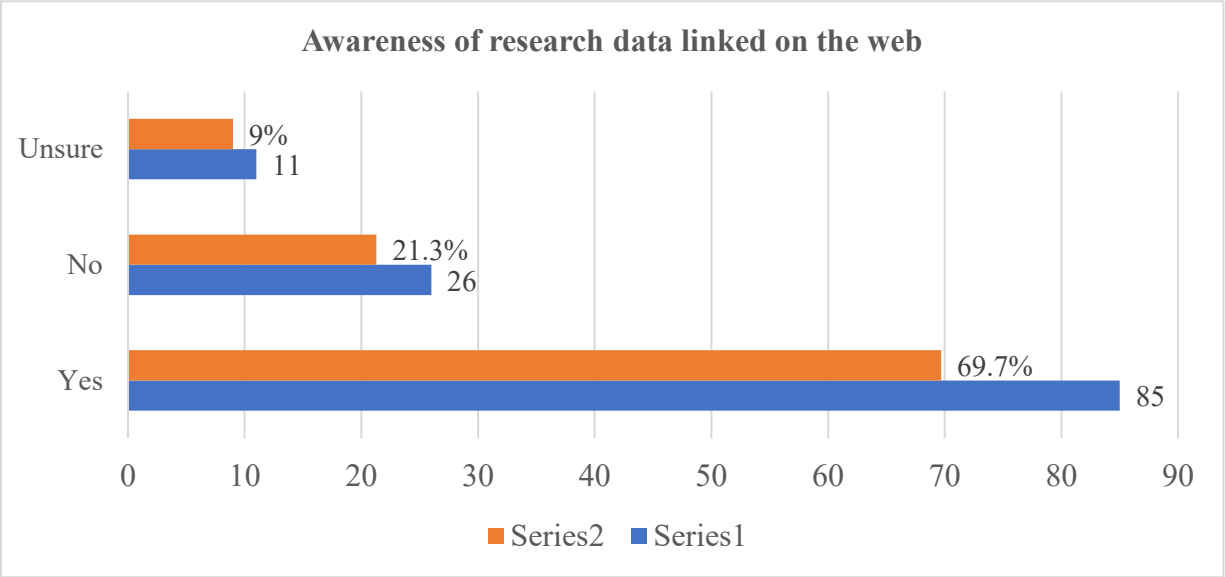

Figure 10: Awareness of research data linked on the Web

(n=122)

Source: Field data (2022)

Data Repository where research data is linked

The 85 respondents who were aware of research data being linked were asked to indicate the repository where the data is linked. As reflected in Figure 12 below, over half of the respondents 52 (61.2%) indicated that their institutions were using Mendeley Data to link their research data on the Web. This was followed by 24 (28.2%) respondents who indicated that their institutions were using "other" data repositories to link data. These included the National Biodiversity Data Bank. The least used repositories were Figshare and Zenodo each mentioned by two (2.4%) respondents.

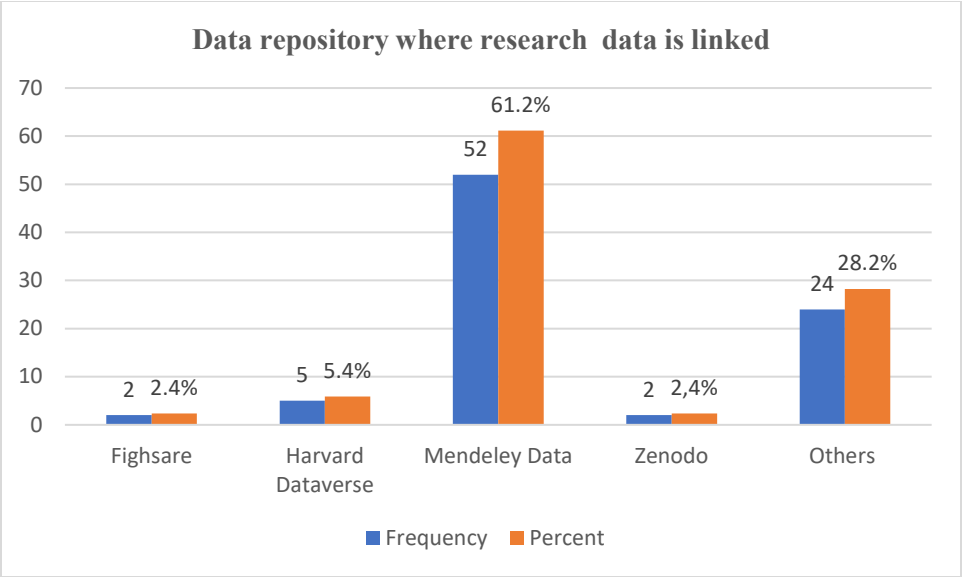

Figure 11: Data repository where data is linked

(n=85)

Source: Field data (2022)

Knowledge about the Linked Data concept

The professional librarians were asked how they knew about Linked Data. Table 10 below presents the results.

Table 10: Knowledge about the Linked Data concept

(n=122)

Statement	**Count**	**Percent (%)**
I don't have knowledge about Linked Data	32	26.2
I had prior knowledge before I joined this university library	21	17.2
I was introduced to Linked Data in my current university library	60	49.2
Others (Please specify)	9	7.4
Total	**122**	**100**

Source: Field Data (2022)

Just under half of the respondents, 60 (49.2%), were introduced to the Linked Data concept in their current university library, while 21(17.2%) respondents indicated that they had prior knowledge of Linked Data before they joined the university library. Interestingly, 32 (26.2%) respondents did not know about the Linked Data concept. Of the nine (7.4%) respondents who indicated "Other", four learnt about Linked Data from their own research, while the other five sources were a consultative workshop webinar, training from another institution, a conference, the university, and by coincidence.

When introduced to Linked Data technologies

The professional librarians were asked when (approximately) they were introduced to Linked Data technologies. The analysis is based on the 90 respondents who indicated in the previous question that they knew the Linked Data concept. The results are shown in Table 11 below.

Table 11: When introduced to Linked Data technologies

(n=90)

Years	**Count**	**Percent (%)**
Less than 6 months ago	14	15.6
6 months to 2 years	31	34.4
2 to 3 years ago	15	16.7
3 to 5 years ago	14	15.6
5 to 10 years ago	16	17.8
Total	**90**	**100**

Source: Field data (2022)

Table 11 shows just over a third, 31 (34.4%), of the respondents were introduced to the Linked Data concept quite recently, that is, between six months and two years ago. The numbers of respondents over the other four periods are relatively evenly spread. Interestingly, 14 (15.6%) respondents were introduced to Linked Data in the preceding six months.

Knowledge about Linked Data

Question B4 asked the professional librarians how they came to know about Linked Data. Figure 13 below presents the findings.

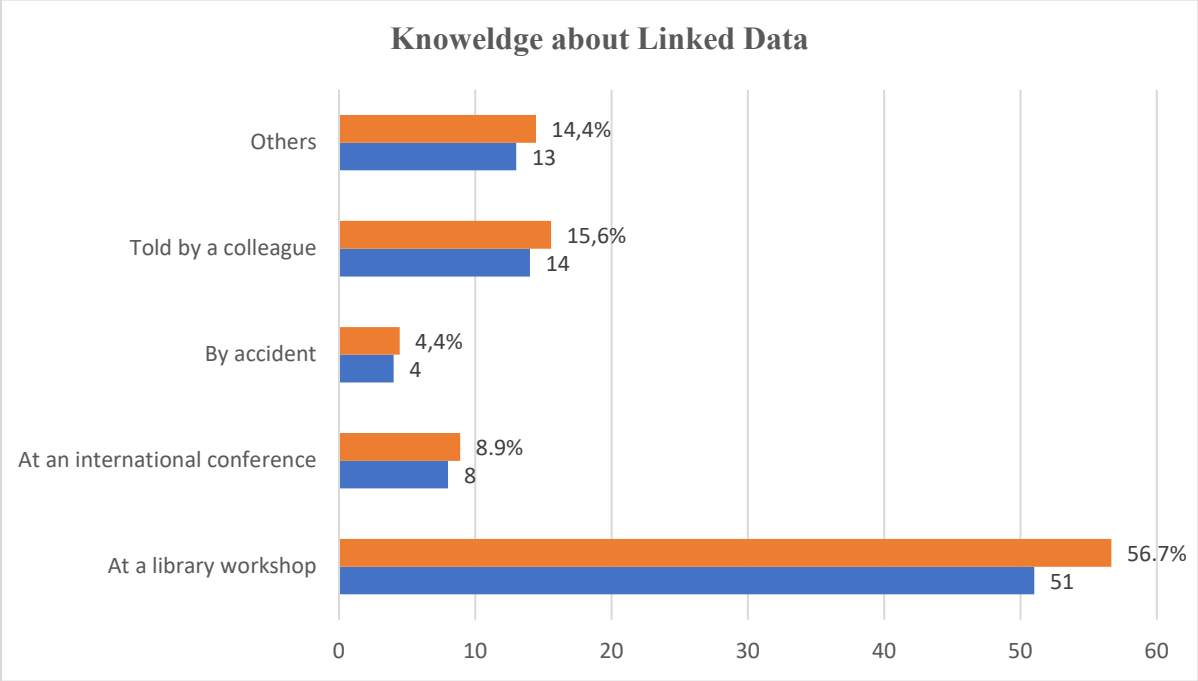

Figure 12: Knowledge about Linked Data

(n=90)

Source: Field data (2022)

Slightly over half of the 90 respondents who answered, 51 (56.7%), got to know about Linked Data at a library workshop. This was followed by 14 (15.6%) who indicated that a colleague told them about the concept. Thirteen (14.4%) respondents learned about Linked Data from other sources. These other sources included:

- During a short course from another university
- At a consultative workshop webinar aimed at mapping the Data Literacy Curriculum Development Program for LIS institutions
- During the Consortium of Ugandan University Libraries (CUUL) training;
- At an open science/research data management training;
- At the university study in the digital library;
- Personal reading on the Internet.

Interestingly, four (4.4%) respondents learnt about Linked Data by accident.

5.2.1.2.1 Level of awareness of Linked Data – the UTAUT and DOI theory constructs

In the final question of this section, the professional librarians were asked how the constructs of the UTAUT (facilitating conditions and social influence) and the DOI theory (observability) facilitated their level of awareness of Linked Data. The facilitating conditions comprise the degree to which an individual believes that an organisation and technical infrastructure exist to support the use of the system (Diaz and Loraas, 2010). The underlying construct of facilitating conditions includes aspects of the technological and/or organisational environment designed to remove barriers to use (Keong et al., 2012). Social influence is the degree to which an individual perceives that others believe he or she should use the new system. Social influence represents the interpersonal considerations of technology use. The observability construct describes the degree to which the result of an innovation is visible to the adopters. If there are observable positive outcomes from implementing the innovation, then the innovation is more adoptable.

To further address the first research question underpinning the study, the respondents were presented with a series of statements under each of the constructs. The respondents were requested to choose from SA-strongly agree; A-Agree; D-disagree; SD-strongly disagree and NA/D- neither agree nor disagree for each statement. The findings are presented in Table 12 below.

Table 12: Level of awareness of Linked Data

(n=122)

Statements **Facilitating Conditions**	**SD**		**D**		**NA/D**		**A**		**SA**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%.**	**F**	**%**
I am aware of the Linked Data concept	9	7.4	9	7.4	18	14.8	71	58.2	15	12.3	122	100

I am aware Linked Data offers best practices for publishing structured data on the web	3	2.5	6	4.9	32	26.2	60	49.2	21	17.2	122	100
I am aware Linked Data offers best practices for sharing structured data on the web	6	4.9	6	4.9	19	15.6	66	54.1	25	20.5	122	100
I am aware Linked Data offers best practices for interlinking structured data on the web	3	2.5	7	5.7	23	18.0	70	57.4	19	15.6	122	100
I am aware Linked Data offers best practices for publishing, sharing and interlinking structured data on the web	4	3.3	7	5.7	22	18.0	62	50.8	27	22.1	122	100
I am aware some university libraries have adopted Linked Data for their data sharing and reuse	3	2.5	11	9.0	25	20.5	65	53.3	18	14.8	122	100
Social Influence	**SD**		**D**		**NA/D**		**A**		**SA**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
I am aware the university has acquired the necessary infrastructure to facilitate the data sharing among other universities	8	6.6	22	18.0	32	26.3	51	41.8	9	7.4	122	100
I am aware of the university library's use of URIs to link data	9	7.4	18	14.8	30	24.6	55	45.1	10	8.2	122	100

to explore information referenced and interconnected on the web										
I am aware of the university library's use of the web interface to enable patrons find and search published datasets.	4	3.3	14	11.5	23	18.9	65	53.3	16	13.1	122	100
I am aware the university library needs to use the web of data to enable access and sharing of data with users without barriers	4	3.3	3	2.5	14	11.5	71	58.2	30	24.6	122	100
I am aware my institution needs to support global efforts to make data available, accessible, and usable for unrestricted use worldwide	2	1.6	3	2.5	19	15.6	61	50.0	37	30.3	122	100
Observability	**SD**		**D**		**NA/D**		**A**		**SA**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%.**	**F**	**%**
I was influenced by what I observed as the benefits of using Linked Data	8	6.6	12	9.8	24	19.6	66	54.1	12	9.8	122	100
I observed colleagues from other institutions using Linked Data technologies and appreciated the advantages of using it	8	6.6	25	20.5	21	17.2	47	38.5	21	17.2	122	100
I have seen how my colleagues use Linked Data technologies	10	8.2	31	25.4	23	18.8	45	36.9	13	10.7	122	100

before I could use it												
I have the opportunity to try out how I can make use of Linked Data	2	1.6	4	3.3	42	34.4	62	50.8	12	9.8	122	100
It didn't take me a lot of time before I started using it	10	8.2	32	26.2	29	23.8	43	35.2	8	6.6	122	100

Source: Field data (2022)

Facilitating conditions

How facilitating conditions influenced the level of awareness of Linked Data among the professional librarians is depicted in Table 12 above. Respondents were presented with the statement "I am aware of the Linked Data concept". Seventy-one (58.2%) respondents agreed with the statement; 18 (14.8%) neither agreed nor disagreed; 15 (12.3%) strongly agreed; nine (7.4%) strongly disagreed; and nine (7.4%) disagreed.

In terms of the statement concerning Linked Data offering best practices for publishing structured data on the Web, just under half of the respondents, 60 (49.2%), agreed with the statement; 32 (26.2%) neither agreed nor disagreed, while 21 (17.2%) strongly agreed; six (4.9%) disagreed; and three (2.5%) strongly disagreed.

In response to the statement concerning Linked Data offering best practices for sharing structured data on the Web, the majority of the respondents, 66 (54.1%), agreed with the statement; 25 (20.5%) strongly agreed, while 19 (15.6%) respondents neither agreed nor disagreed; six (4.9%) strongly disagreed; and six (4.9%) disagreed.

In terms of the statement concerning Linked Data offering best practices for interlinking structured data on the Web, the majority of the respondents, 70 (57.4%) agreed with the statement; 22 (18.0%) neither agreed nor disagreed; 19 (15.6%) strongly agreed; seven (5.7%) disagreed; and four (3.3%) strongly disagreed.

When presented with the statement concerning Linked Data offering best practices for publishing, sharing and interlinking structured data on the Web, 62 (50.8%) respondents agreed with the statement; 27 (26%) strongly agreed; 23 (18.8%) neither agreed nor disagreed; while seven (5.7%) disagreed; and four (3.3%) strongly disagreed.

Finally, respondents were presented with a statement concerning their awareness of some university libraries having adopted Linked Data for their data sharing and reuse. Just over half of the respondents 65 (53.3%) agreed with the statement; 25 (20.5%) neither agreed nor disagreed; 18 (14.8%) strongly agreed; 11 (9.0%) disagreed; and three (2.5%) strongly disagreed.

Social influence

As noted, how social influence affects technology adoption was also investigated. The respondents were presented with various statements to this effect. In response to the statement "I am aware the university has acquired the necessary infrastructure to facilitate the data sharing among other universities", 51 (41.8%) respondents agreed with the statement; 32 (28.3%) neither agreed nor disagreed; 22 (18.0%) disagreed; nine (7.4%) strongly agreed and eight (6.6%) strongly disagreed.

The respondents were presented with a statement concerning their awareness of the university library's use of URIs to link data to explore information referenced and interconnected on the web. Fifty-five (45.1%) respondents agreed with the statement; 30 (24.6%) neither agreed nor disagreed; 18 (14.8%) disagreed; 10 (8.2%) strongly agreed; and nine (7.4%) strongly disagreed.

With regard to the statement concerning the university library's use of the Web interface to enable patrons to find and search published datasets, just over half of the respondents 65 (53.3%) agreed with the statement; 23 (18.0%) neither agreed nor disagreed; 16 (13.1%) strongly agreed; 14 (11.5%) disagreed; and four (3.3%) strongly disagreed.

In terms of the statement concerning awareness of the university library's need to use the Web of Data to enable access and sharing of data with users without barriers, 71 (58.2%) respondents agreed with the statement, 30 (24.6%) strongly agreed; 14 (11.5%) neither agreed nor disagreed, while four (3.3%) strongly disagreed; and three (2.5%) disagreed.

Finally, the respondents were presented with a statement regarding their institution's need to support global efforts to make data available, accessible, and usable for unrestricted use worldwide. Half of the respondents 61(50%) agreed; 37 (30.3%) strongly agreed; 19 (15.6%) neither agreed nor disagreed; four (3.3%) strongly disagreed; and three (2.5%) disagreed.

Observability

Respondents were presented with five statements concerning the observability construct. In terms of the first statement which concerned respondents being influenced by what they had observed as the benefits of using Linked Data, 66 (54.1%) respondents agreed with the statement; 24 (19.6%) neither agreed nor disagreed; 12 (9.8%) strongly agreed; 12 (9.8%) respondents disagreed; and eight (6.6%) strongly disagreed.

A second statement concerned respondents having observed colleagues from other institutions using Linked Data technologies and appreciated the advantages of using it. The findings revealed that 47 (38.5%) respondents agreed with the statement; 25 (20.5%) disagreed; 21 (17.2%) neither agreed nor disagreed; 21 (17.2%) strongly agreed; eight (6.6%) strongly disagreed.

In response to the statement "I have seen how my colleagues use Linked Data technologies before I could use it", 45 (36.9%) respondents agreed with the statement; 13 (10.7%) strongly agreed; 31 (25.4%) disagreed; and 10 (8.2%) strongly disagreed.

A statement was presented to the respondents regarding having the opportunity to try to make use of Linked Data. Just over half of the respondents 62 (50.8%) agreed; 42 (34.4%) neither agreed nor disagreed; 12 (9.8%) strongly agreed while four (3.3%) disagreed; and two (1.6%) strongly disagreed.

In terms of the statement concerning the respondents not taking a lot of time before starting using Linked Data, 42 (46.7%) respondents agreed with the statement; 32 (26.2%) disagreed; 29 (23.9%) neither agreed nor disagreed; 10 (8.2%) strongly disagreed, while eight (6.6%) strongly agreed.

5.2.1.3 Extent of adopting Linked Data in the university libraries

To address the second research question, the study sought to establish the extent of Linked Data adoption in the university libraries using the two factors of the UTAUT, namely, effort expectancy and facilitating conditions, and one of the factors of the DOI theory, namely, trialability. As with the previous question, respondents had to indicate their agreement or disagreement with a series of statements. Responses from the 122 professional librarians are presented in Table 13 below.

Table 13: Extent of adopting Linked Data in the university libraries.

(n=122)

Statements	**SD**		**D**		**NA/D**		**A**		**SA**		**Total**	
Effort Expectancy	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%.**	F	%
Linked Data technologies are easy to use for me	3	2.5	13	10.7	34	27.9	64	52.5	8	6.6	122	100
The use of Linked Data does not need a lot of effort	5	4.1	22	18.0	37	30.3	49	40.2	9	7.4	122	100
The use of Linked Data requires a lot of technical knowledge	5	4.1	29	23.8	38	31.1	35	28.7	15	7.4	122	100
I don't need a trial to be convinced to use Linked Data	11	9.0	41	33.6	31	25.4	30	24.6	9	7.4	122	100
It did not take me much time to try Linked Data technologies before I finally accepted it.	6	4.9	32	26.2	32	26.2	44	36.1	8	6.6	122	100
A trial convinced me that using Linked Data is better than using the	8	6.6	21	17.2	35	28.7	44	36.1	14	11.5	122	100

library traditional methodologies												
Facilitating Conditions	**SD**		**D**		**NA/D**		**A**		**SA**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
My institution has provided me with the required training to enable me to adapt to use of Linked Data.	19	15.6	36	29.5	16	13.1	41	33.6	10	8.2	122	100
My institution has provided the library with the technological infrastructure support to facilitate the adoption of Linked Data	9	7.4	29	23.8	27	22.1	46	37.7	11	9.0	122	100
My institution has acquired specialised IT personnel to provide technical assistance to the library staff regarding the use of Linked Data technologies	11	9.0	30	24.6	30	24.6	41	33.6	10	8.2	122	100
My institution has allocated a financial budget to facilitate data sharing and its use in my library	22	18.0	33	27.0	35	28.7	27	22.1	5	4.1	122	100
There is a library technical team established to ensure data sharing and its reuse.	17	13.9	23	18.9	21	17.2	51	41.8	10	8.2	122	100
My institution has a policy that requires research datasets to be deposited in the library	16	13.1	22	18.0	30	24.6	41	33.6	13	10.7	122	100
Trialability	**SD**		**D**		**NA/D**		**A**		**SA**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Using Linked Data technology may need someone with technical knowledge and an IT background.	3	2.5	22	18.0	23	18.9	60	49.2	14	11.5	122	100

It is better to experiment with how Linked Data works before adopting and implementing it.	0	0	3	2.5	7	5.7	78	63.9	34	27.9	122	100
It is better and easier to use Linked Data technologies after ascertaining that other institutions have successfully implemented it.	2	1.6	9	7.4	20	16.4	67	54.9	24	19.7	122	100
Linked Data tools may be complicated to use	7	5.7	35	28.7	44	36.1	33	27.0	3	2.5	122	100
Transition to Linked Data technologies in the library may be a big challenge	7	5.7	30	24.6	42	34.4	38	31.1	5	4.1	122	100
I am willing to learn about Linked Data technologies to improve data sharing and reuse in my institutional library.	0	0	0	0	8	6.6	41	33.6	73	59.8	122	100

Source: Field data (2022)

Effort expectancy

The researcher sought to determine how effort expectancy influenced the adoption of Linked Data technology. In response to the statement "Linked data technologies are easy to use for me", slightly more than half of the respondents, 64 (52.5%) agreed with the statement; 34 (27.9%) neither agreed nor disagreed; 13 (10.7%) disagreed; and eight (6.6%) strongly agreed.

In response to the statement concerning Linked Data not needing a lot of effort, 49 (40.2%) respondents agreed with the statement; 37 (30.3%) neither agreed nor disagreed; 22 (18.0%) disagreed; nine (7.4%) strongly agreed; and five (4.1%) respondents strongly disagreed.

The statement "The use of Linked Data requires a lot of technical knowledge" elicited the following responses. Just under a third of the respondents 38 (31.1%) neither agreed nor

disagreed; 35 (28.7%) agreed; 29 (23.8%) disagreed; 15 (12%) strongly agreed; and five (4.1%) strongly disagreed.

A statement concerning whether respondents needed a trial to be convinced to use Linked Data, 41(33.6%) respondents disagreed with the statement; 31 (25.4%) neither agreed nor disagreed; 30 (24.6%) agreed; and 11 (9.0%) strongly disagreed.

In responding to the statement "It did not take me much time to try Linked Data technologies before I finally accepted it", 44 (36.1 %) respondents agreed with the statement; 32 (26.2%) neither agreed nor disagreed; 32 (26.2%) disagreed; eight (6.6%) strongly agreed; and six (4.9%) strongly disagreed.

Finally, respondents were presented with a statement concerning whether a trial convinced them that using Linked Data is better than using traditional library methodologies. Of the respondents, 44 (36.1 %) agreed with the statement; 35 (28.7%) neither agreed nor disagreed; 21 (17.2%) disagreed; 14 (11.5%) strongly agreed; and eight (6.6%) strongly disagreed.

Facilitating conditions

How facilitating conditions influenced the extent of the adoption of Linked Data among the university libraries was also determined. The researcher sought to find out from the respondents whether their institutions provided them with the required training to enable them to adapt to the use of Linked Data. In terms of their responses to the statement, 41 (33.6%) respondents agreed that their institutions provided them with the required training; 36 (29.5%) disagreed; 19 (15.6%) strongly disagreed; 16 (13.1%) neither agreed nor disagreed; and 10 (8.2%) strongly agreed.

In terms of whether respondents' institutions had provided the library with the technological infrastructure support to facilitate the adoption of Linked Data, 46 (37.7%) respondents agreed with the statement; 29 (23.8%) disagreed; 27 (22.1%) neither agreed nor disagreed; 11 (9.0%) strongly agreed; and nine (9.0%) respondents strongly disagreed.

The third statement under facilitating conditions read as follows: “My institution has acquired specialised IT personnel to provide technical assistance to the library staff regarding the use of Linked Data technologies”. Forty-one (33.6%) respondents agreed with the statement; 30 (24.6%) disagreed; 30 (24.6%) neither agreed nor disagreed; and 11 (9.0%) strongly agreed.

In responding to the statement concerning whether they (the respondents) knew their institutions had allocated a financial budget to facilitate data sharing and its reuse in their library, 35 (28.7%) respondents neither agreed nor disagreed with the statement; 33 (27.0%) disagreed; 21 (23.3%) agreed; 22 (18.0%) strongly disagreed; and 5 (4.1%) strongly agreed.

The statement “There is a library technical team established to ensure data sharing and its reuse” was agreed to by 51 (41.8%) of respondents. Twenty-three (18.9%) respondents disagreed; 21 (17.2%) neither agreed nor disagreed; 17 (13.9%) strongly disagreed; and 10 (8.2%) strongly agreed.

The final statement under facilitating conditions, concerned the respondents’ institutions having a policy that required research datasets to be deposited in the library. The findings show that 41 (33.6%) respondents agreed that their institutions did indeed have such a policy; 30 (24.6%) neither agreed nor disagreed; 22 (18.0%) disagreed; 16 (13.1%) strongly disagreed; and 13 (10.7%) strongly agreed.

Trialability

The researcher sought to determine how trialability could influence the adoption of Linked Data technology among the professional librarians. Six statements were again presented to the respondents. The first statement concerned the use of Linked Data possibly needing someone with technical knowledge and an IT background. Just under half, 60 (49.2%), of the respondents agreed with the statement; 23 (18.9%) neither agreed nor disagreed; 22 (18.0%) disagreed; 14 (11.5%) strongly agreed; and three (2.5%) strongly disagreed.

The statement concerning whether it is better to experiment with how Linked Data works before adopting and implementing it had a majority of the respondents, 78 (63.9%) agreeing;

34 (27.9%) strongly agreeing; seven (5.7%) neither agreeing nor disagreeing; and three (2.5%) disagreeing.

When presented with the statement "It is better and easier to use Linked Data technologies after ascertaining that other institutions have successfully implemented it", 67 (54.9%) respondents agreed with it; 24 (19.7%) strongly agreed; 20 (16.4%) neither agreed nor disagreed; nine (7.4%) disagreed; and two (1.6%) strongly disagreed.

The statement concerning whether Linked Data tools may be complicated to use elicited the following: Thirty (33.3%) respondents agreed with the statement; the same number disagreed; 25 (27.8%) neither agreed nor disagreed; four (4.4%) strongly disagreed; and one (1.1%) strongly agreed.

The respondents were asked whether they agreed or not with the statement "Transition to Linked Data technologies in the library may be a big challenge." The findings revealed that 44 (36.1%) respondents neither agreed nor disagreed; 35 (28.7%) disagreed; 33 (27.0%) agreed; seven (5.7%) strongly disagreed; and three (3.5%) strongly agreed.

Lastly, in terms of trialability, respondents were presented with a statement concerning their willingness to learn about Linked Data technologies to improve data sharing and reuse in their institutional libraries. The majority of the respondents 73 (59.8%) strongly agreed with the statement; 41 (33.6%) agreed; while eight (6.6%) neither agreed nor disagreed. Perhaps understandably, none of the respondents disagreed with the statement.

5.2.1.4 Benefits of adopting Linked Data in university libraries

The third research question concerned the potential benefits of adopting Linked Data in university libraries using the performance expectancy construct of the UTAUT. As done previously, the respondents were presented with a list of statements (in this instance nine) and requested to choose from S/A-strongly agree; A-Agree; D-disagree; SD-strongly disagree; and NA/D- neither agree nor disagree. The findings are presented in Table 14 below.

Table 14: Benefits of adopting Linked Data in university libraries

(n=122)

Statement Performance Expectancy	SD F	SD %	D F	D %	NA/D F	NA/D %	A F	A %	SA F	SA %	Total F	Total %
Linked data shall reduce the unnecessary duplication of data that is already available elsewhere	1	0.8	1	0.8	9	7.4	63	51.6	48	39.3	122	100
Linked data shall improve users' overall search experiences with the existing library data once it's integrated into the Web.	0	0	0	0	7	5.7	73	59.8	42	34.4	122	100
The linking of data from university libraries to the Web will allow for an increased richness in overall data	0	0	1	0.8	6	4.9	75	61.5	40	32.8	122	100
Linked Data will be useful for library patrons to find content on the Web.	0	0	0	0	8	6.6	67	54.9	47	38.5	122	100
Linked Data will assist patrons to discover relevant information and data through links to other data repositories	0	0	1	0.8	3	2.5	70	57.4	48	39.3	122	100
Linked Data has the potential to interlink and publish libraries on the Web.	0	0	2	1.6	14	11.5	67	54.9	39	32.0	122	100
Increased exposure of institutional repository collection to web search engines	0	0	1	0.8	7	5.7	70	57.4	44	36.1	122	100
Traditional institutional repository software shall facilitate the integration of	0	0	4	3.3	29	23.8	72	59.0	17	13.9	122	100

vocabularies published as Linked Open Data.												
Benefit research, discovery, and enrich discovery and create a model other universities can use.	0	0	0	0	10	8.2	73	59.8	39	32.0	122	100

Source: Field data (2022)

Performance expectancy

The researcher sought to determine how performance expectancy, in terms of the benefits, could influence the adoption of Linked Data among the professional librarians.

The findings above show that a small majority of the respondents, 63 (51.6%), agreed that Linked Data shall reduce the unnecessary duplication of data that is already available; 48 (39.3%) strongly agreed; nine (7.4%) neither agreed nor disagreed; one (0.8%) strongly disagreed and a further one (0.8%) respondent also disagreed.

The results concerning the statement "Linked data shall improve users' overall search experiences with the existing library data once it's integrated into the Web" were equally positive with 73 (59.8%) respondents agreeing with the statement; 42 (34.4%) strongly agreeing; and seven (5.7%) neither agreeing nor disagreeing.

Seventy-five (61.5%) respondents agreed with the statement that linking data from university libraries to the Web will allow for an increased richness in overall data; 40 (32.8%) strongly agreed; six (4.9%) neither agreed nor disagreed; and one respondent (0.8%) disagreed.

The statement "Linked Data will be useful for the library patrons to find content on the Web" was agreed to and strongly agreed to by 67 (54.9%) and 47 (38.5%) respondents respectively. Eight (6.6%) neither agreed nor disagreed.

Seventy (57.4%) respondents agreed with the statement concerning Linked Data assisting patrons to discover relevant information and data through links to other data repositories; 48

(39.3%) strongly agreed; three (2.5%) neither agreed nor disagreed and one (0.8%) respondent disagreed.

Again, a majority of the respondents either agreed, 67 (54.9%) or strongly agreed, 39 (32.0%), that Linked Data has the potential to interlink and publish libraries on the Web. Fourteen (11.5%) respondents neither agreed nor disagreed, and two (1.6%) disagreed.

The statement "Linked Data will increase the exposure of institutional repository collection to web search engines" was agreed to by 70 (57.4%) respondents and strongly agreed to by 44 (36.1%). There were seven (5.7%) respondents who neither agreed nor disagreed and one (0.8%) respondent who disagreed.

The statement concerning traditional IR software facilitating the integration of vocabularies published as LOD was agreed to by 72 (59.0%) respondents; 29 (23.8%) respondents neither agreed nor disagreed; 17 (13.9%) strongly agreed; and four (3.3%) respondents disagreed.

The final statement in terms of the benefits of Linked Data was that it would "Benefit research, discovery, and enrich discovery and create a model other universities can use". Seventy-three (59.8%) respondents agreed with the statement; 39 (32.0%) strongly agreed; and 10 (8.2%) respondents neither agreed nor disagreed. Again, it is understandable that no respondent disagreed with the statement.

5.2.1.5 Factors that influence the behaviour of professional librarians towards the adoption of Linked Data in university libraries

To address the fourth research question, the study further sought to investigate the factors that influence the behaviour of professional librarians towards the adoption of Linked Data using two constructs of the UTAUT, namely, effort expectancy and social influence. The responses from the 122 professional librarians are presented in Table 15 below.

Table 15: Factors that influence the behaviour of professional librarians towards the adoption of Linked Data in university libraries

(n=122)

Statement	SD		D		NA/D		A		SA		Total	
Effort Expectancy	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Prior knowledge of using Linked Data	4	3.3	6	4.9	18	14.8	80	65.6	14	11.5	122	100
Fear of using Linked Data technologies	10	8.2	41	33.6	26	21.3	40	2.8	5	4.1	122	100
Fear of change from traditional tools to new technologically innovative tools	10	8.2	35	28.7	18	14.7	48	39.3	11	9.0	122	100
Perceived threats to job security	12	9.8	35	28.7	23	18.9	44	36.1	8	6.6	122	100
Age and Gender to adapt to the Linked Data technologies	7	5.7	35	28.7	21	17.2	46	37.7	13	10.7	122	100
Perceived availability of training and skills enhancement opportunities	1	0.8	4	3.3	12	9.8	87	75.6	18	14.8	122	100
Social influence	**SD**		**D**		**NA/D**		**A**		**SA**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Top management buy-in and support	0	0	7	5.7	23	18.9	65	53.3	27	22.1	122	100
Technical skills will be required to adapt to using Linked Data	1	0.8	3	2.5	18	14.8	73	59.8	27	22.1	122	100
Benchmarking with other institutional libraries using Linked Data	0	0	1	0.8	8	6.6	75	61.5	38	31.1	122	100
Human resources with the expertise will be required.	3	2.5	11	9.0	10	8.2	74	60.7	24	19.7	122	100
Researchers 'will be able to access datasets on the Web	1	0.8	0	0	14	11.5	76	62.3	31	25.4	122	100
Support from the IT staff shall be required	1	0.8	1	0.8	8	6.6	69	56.6	43	35.2	122	100

Source: Field data (2022)

Effort expectancy

The study sought to determine how effort expectancy influenced the adoption of Linked Data technology. The first of the seven statements (or factors) concerning effort expectancy was "Prior knowledge with using Linked Data". A large majority of the respondents either agreed, 80 (65.6%), or strongly agreed, 14 (11.5%). Eighteen (14.8%) neither agreed nor disagreed, six (4.9%) disagreed, and four (3.3%) strongly disagreed.

A third of the respondents, 41 (33.6%), disagreed that "Fear of using Linked Data technologies" would influence the adoption of Linked Data and 10 (8.2%) strongly disagreed with the statement. In terms of agreement, 40 (32.8%) respondents agreed; five (4.1%) strongly agreed; and 26 (21.3%) neither agreed nor disagreed.

The third statement (or factor) influencing the adoption of Linked Data was the fear of change from traditional tools to new technologically innovative tools. Forty-eight (39.3%) respondents agreed that it would influence adoption; 35 (28.7%) disagreed; 18 (14.7%) neither agreed nor disagreed; 10 (8.2%) strongly disagreed; and 11 (9.0%) respondents strongly agreed.

Forty-four (36.1%) respondents agreed that perceived threats to job security would influence the adoption of Linked Data; 35 (28.7%) disagreed with the statement; 23 (18.9%) neither agreed nor disagreed; 12 (9.8%) strongly disagreed; and eight (6.6%) strongly agreed.

Just under half of the respondents perceived age and gender as a factor in adapting to Linked Data technologies with 46 (37.7%) respondents agreeing and 13 (10.7%) strongly agreeing. Thirty-five (28.7%) respondents disagreed; 21 (17.2%) neither agreed nor disagreed; and seven (5.7%) strongly disagreed.

Finally, the vast majority of respondents either agreed, 87 (71.3%), or strongly agreed, 18 (14.8%), that the "Perceived availability of training and skills enhancement opportunities" would influence professional librarians towards the adoption of Linked Data. Twelve (9.8%)

respondents neither agreed nor disagreed, four (3.3%) disagreed, and one (0.8%) strongly disagreed.

Social influence

How social influence may influence technology adoption was also investigated. Again, the professional librarians were presented with six statements (or factors) and asked whether they agreed or disagreed.

The majority of the respondents either agreed, 65 (53.3%), or strongly agreed, 27 (22.1%), that top management buy-in and support would influence the adoption of Linked Data. Twenty-three (18.9%) neither agreed nor disagreed, while a surprising seven (5.7%) respondents disagreed.

Seventy-three (59.8%) respondents agreed that technical skills will be required to adapt to using Linked Data; 27 (22.1%) strongly agreed; 18 (14.8%) neither agreed nor disagreed; three (2.5%) disagreed; and one (0.8%) strongly disagreed.

The statement "Benchmarking with other institutional libraries using Linked Data" would influence the librarians' adoption of Linked Data was agreed to by an overwhelming majority of respondents with 75 (61.5%) agreeing and 38 (31.1%) strongly agreeing. Eight (6.6%) respondents neither agreed nor disagreed, and one (0.8%) disagreed.

A similar majority of respondents either agreed, 76 (62.3%), or strongly agreed, 31 (25.4%), that researchers being able to access datasets on the Web would influence Linked Data adoption. Fourteen (11.5%) respondents neither agreed nor disagreed, and one (0.8%) strongly disagreed.

Lastly, 69 (56.6%) respondents agreed and 43 (35.2%) strongly agreed that support from the IT staff shall be required to influence the adoption of Linked Data among professional librarians. Eight (6.6%) neither agreed nor disagreed; one (0.8%) disagreed, and a further one (0.8%) respondent strongly disagreed.

5.2.1.6 Strategies that university libraries can use to promote the use of Linked Data

To address the fifth research question, the study investigated the strategies that university libraries can use to promote the use of Linked Data using the effort expectancy construct of the UTAUT. The responses from the 122 professional librarians are presented in Table 16 below.

Table 16: Strategies that university libraries can use to adopt the use of Linked Data (n=122)

Statement Effort Expectancy	SD		D		NA/D		A		SA		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Be proactive in gaining administrative support instead of passively waiting for administrative decisions.	0	0	1	0.8	5	4 .1	73	59.8	43	35.2	122	100
Include research assignments in some of the employees' workload for them to conduct research during the exploratory stages of innovation adoption	1	0.8	5	4.1	12	9.8	75	61.5	29	23.8	122	100
Collaborate effectively with professionals in and out of the library community	0	0	0	0	6	4.9	61	50.0	55	45.1	122	100
Benchmark with other institutions already implementing Linked Data	0	0	0	0	4	3.3	53	43.4	65	53.3	122	100
Lobby for budget allocation to facilitate the adoption and implementation of	0	0	0	0	4	3.3	49	40.2	69	56.6	122	100

Linked Data at the university library in addition to infrastructure and training of workforce												
Establish a policy governing data management and linking. Requiring research submissions to be accompanied by data files and creation of Linked Data.	0	0	1	0.8	5	4.1	63	51.6	53	43.4	122	100
Collaborate with other university libraries through the Consortium of Uganda University Libraries and establish a central data repository	0	0	0	0	7	5.7	46	37.7	69	56.6	122	100
Develop data management awareness plans for staff and users	0	0	0	0	5	4.1	61	50.0	56	45.9	122	100
Start with the adoption of minimum requirements of Linked Data principles	0	0	0	0	11	9.0	75	61.5	36	29.5	122	100
Develop courses on Linked Data applications in libraries by professional organizations.	0	0	2	1.6	7	5.7	69	56.6	44	36.1	122	100
Encourage staff to keep themselves up-to-date and explore the potential of Linked Data technologies in libraries	0	0	0	0	3	2.5	47	38.5	72	59.0	122	100

Source: Field data (2022)

Effort expectancy

The researcher sought to determine how effort expectancy could influence the adoption of Linked Data technology among professional librarians.

It is evident from the table above that few, if any, respondents disagreed with the 11 statements presented. Conversely, there was overwhelming positive support (in the form of agreed and strongly agreed) for the statements. Given this, only the significant findings as presented in Table 16 are highlighted below.

The statement with the most significant support in terms of strategies that libraries can use to promote the adoption of Linked Data was "Encourage staff to keep themselves up-to-date and explore the potential of Linked Data technologies in libraries" with 119 (97.5%) of the 122 professional libraries either agreeing or disagreeing. The statement with the "least" amount of support was "Include research assignments in some of the employees' workload for them to conduct research during the exploratory stages of innovation adoption" with a still significant number of respondents, 104 (85.3%) either agreeing or strongly agreeing. Perhaps understandably, this was the statement that had the highest number of respondents disagreeing, namely six (4.9%).

5.2.2 Results pertaining to the heads of library technical services

This section presents the responses collected from the heads of the technical services of the 14 university libraries using the online questionnaire (***Appendix VI***).

5.2.2.1 Demographic data of the heads of library technical services

The demographic data was derived from the five questions that were asked in section one of the questionnaire. As with the professional librarians above, this section provides general information about the heads' university affiliation, gender, age range, duration at the university library, and their highest academic qualification.

Gender of the heads of library technical services

Table 17: Gender of the heads of library technical services

(n=14)

Gender	Count	Percent (%)
Female	9	64.3
Male	5	35.7
Total	**14**	**100**

Source: Field data (2022)

As can be seen in Table 17 above, the majority of respondents, (64.3%), were female.

Age and educational qualifications of the heads of library technical services

Table 18 shows the cross-tabulation of the age range and the highest level of education of the heads of library technical services.

Table 18: Cross-tabulation of age and the highest level of education of the heads of library technical services

(n=14)

Age range	Level of Education					
	Bachelor's degree		Master's degree		Total	
	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)
26-30	0	0	0	0	0	0
31-35	2	14.3	0	0	2	14.3
36-40	3	21.4	3	21.4	6	42.9
41-45	2	14.3	1	7.1	3	21.4
46-49	0	0	3	21.4	3	21.4
Total	**7**	**50**	**7**	**50**	**14**	**100**

Source: Field data (2022)

In terms of Table 18, three (21.4%) respondents in the age range 36-40 years had attained a bachelor's degree and three (21.4%) in the same age range had attained a master's degree.

Similarly, three (21.4%) respondents in the age range of 46-49 years had attained a master's degree.

Duration at the university library

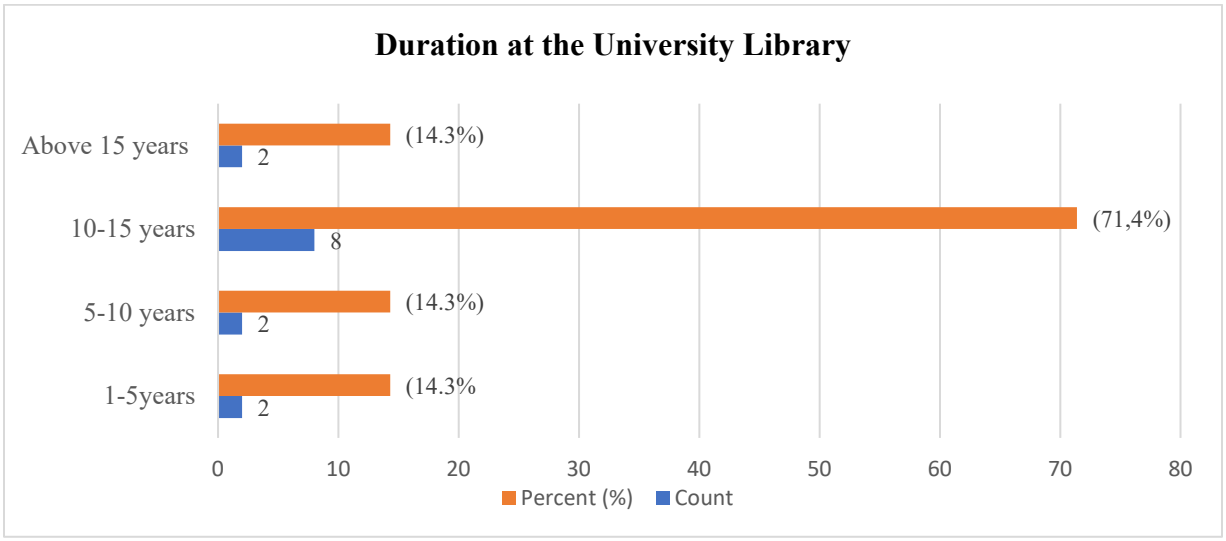

Figure 13: Duration at the university library

(n=14)

Source: Field data (2022)

As reflected in Figure 14 above, a majority of the respondents, eight (71.4%), indicated that they have worked at the university library between 10-15 years. The remaining respondents' duration was evenly distributed with two (14.3%) for 5-10 years, two (14.3%) for 1-5 years, and 15 years and above.

5.2.2.2 Level of awareness of the Linked Data concept

This section presents the findings from the respondents concerning various issues related to their level of awareness of Linked Data.

Awareness of research data linked on the Web

The heads of library technical services were asked whether they were aware of any research data in their institution linked on the Web. Figure 15 below shows that over half of the respondents, 10 (71%), were aware of research data linked on the Web while four (29%) were unaware. One respondent pointed out that metadata is also linked through the Library of Congress to KOHA and other integrated systems such as DSpace.

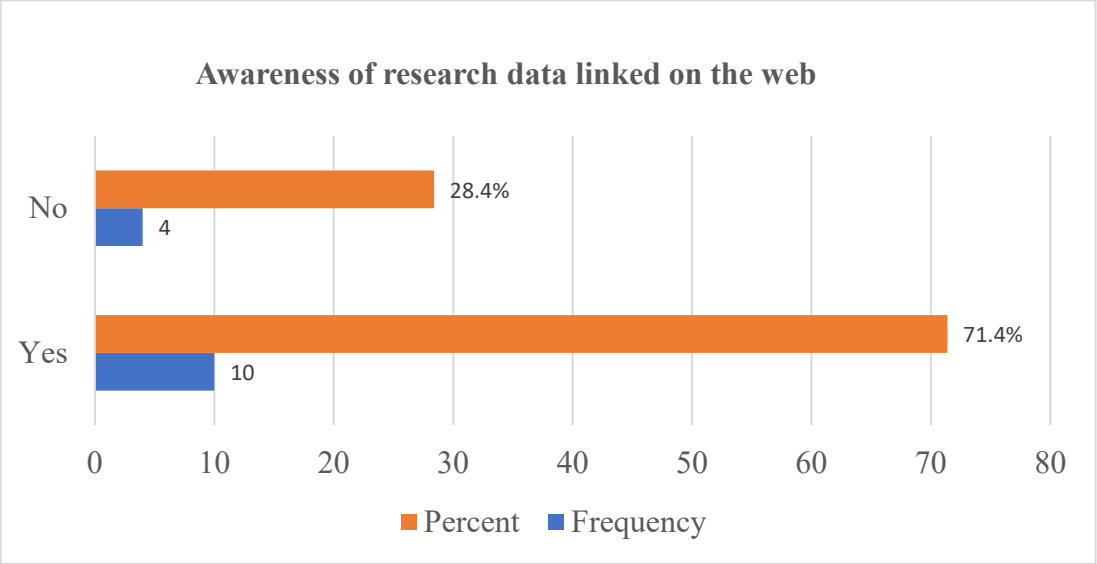

Figure 14: Awareness of research data linked on the Web

(n=14)

Data repository where research data is linked

The 10 respondents who answered yes to the preceding question were asked to indicate which linked data technology they have used or are using. As can be seen in Figure 16 below, over half of the respondents, seven (70%), indicated that their institutions were using Mendeley Data to link their research data. This was followed by two (20%) respondents who indicated that their university library uses other repositories, namely, OpenDOAR, Matomo and Zotero for linking research data, and one (10%) respondent pointed to the use of Zenodo.

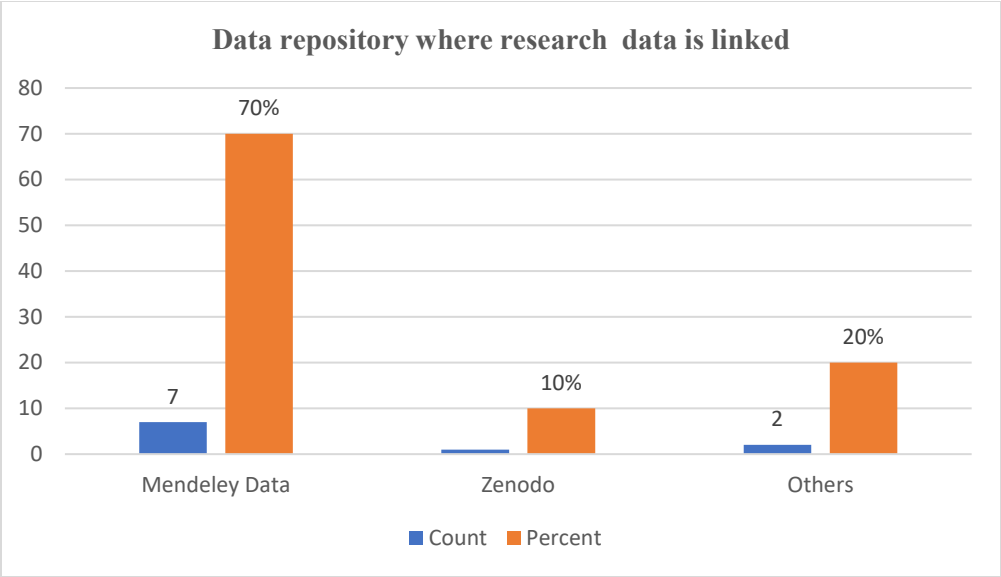

Figure 15: Data repository where research data is linked

(n=10)

Knowledge of the Linked Data concept

The heads of technical services in the libraries were asked how they knew about Linked Data. The findings are shown in Table 19 below.

Table 19: Awareness of the Linked Data concept

(n=14)

Statement	**Frequency**	**Percent (%)**
I don't have knowledge about Linked Data	3	21.4
I had prior knowledge before I joined this university library	3	21.4
I was introduced to Linked Data in my current university library	6	42.9
Other	2	14.3
Total	**14**	**100**

Source: Field data (2022)

The highest number of respondents, six (42.9%), were introduced to the Linked Data concept in their current university library, while three (21.4%) had prior knowledge about the Linked Data concept before they joined the university library. In addition, two (14.3%) respondents learned about Linked Data from other sources, namely, CUUL projects, and self-study and research. Three (21.4%) respondents did not have knowledge about Linked Data.

When introduced to Linked Data technologies

The 11 respondents who were aware of the Linked Data concept were asked to indicate when they were introduced to the technologies. The results are shown in Table 20 below.

Table 20: When introduced to Linked Data technologies

(n=11)

Years	Count	Percent (%)
Less than 6 months ago	1	9.1
6 months to 2 years	3	27.3
2 to 3 years ago	1	9.1
3 to 5 years ago	3	27.3
5 to 10 years ago	2	18.2
Non-response	1	9.1
Total	**11**	**100**

Three (27.3%) respondents were introduced to Linked Data between 6 months and two years ago and a further three (27.3%) between three and five years ago. They were followed by two (18.2%) respondents who were introduced to Linked Data technologies between five and 10 years ago. Of the remaining two respondents one (10%) was introduced to the technologies less than six months ago.

Knowledge about linked data

The same 11 respondents were asked how they had come to know about Linked Data. Table 21 below presents the responses.

Table 21: Knowledge about Linked Data

(n=11)

Statement	Frequency	Percent (%)
At a library workshop	4	36.4
By accident	1	9.1
Told by a colleague	3	27.3
Other	3	27.3
Total	**11**	**100**

Source: Field data (2022)

Four (36.4%) respondents indicated that they got to know about Linked Data at a library workshop; three (27.3%) were told about the technology by a colleague; and a further three (27.3%) respondents indicated that they got to know about Linked Data from other sources. These other sources were international continuous professional development (CPD) training, a master's study programme, and the Mendeley website. Lastly, one (9.1%) respondent got to know about Linked Data by accident.

5.2.2.2.1 Level of awareness of Linked Data – the UTAUT and DOI theory constructs

In the final question of this section, the heads of library technical services were asked how the constructs of the UTAUT (facilitating conditions and social influence) and DOI (observability) facilitated their level of awareness of Linked Data. This was in line with the first research question underpinning the study.

As with the professional librarians, the respondents were presented with a series of statements under each of the constructs and were requested to choose from SA-strongly agree; A-Agree; D-Disagree; SD-Strongly disagree and NA/D-Neither agree nor disagree for each statement. Out of the 14 respondents, 13 responded and one (7.1%) did not respond as indicated in Table 22 below.

Table 22: Level of awareness of the Linked Data concept

(n=14)

Statement Facilitating Conditions	SD F	%	D F	%	NA/D F	%	A F	%	SA F	%	Non Response F	%	Total F	%
I have the knowledge necessary to use Linked Data	4	28.6	0	0	2	14.3	7	50.0	0	0	1	7.1	14	100
Linked Data technologies are not compatible with other systems I use	3	21.4	8	57.1	1	7.1	1	7.1	0	0	1	7.1	14	100
IT staff are available for assistance in case I experience difficulties	3	21.4	3	21.4	1	7.1	4	28.6	2	14.3	1	7.1	14	100
I am aware Linked Data offers best practices for publishing, sharing and interlinking Structured data on the Web.	3	21.4	0	0	0	0	3	21.4	7	50	1	7.1	14	100
It would be good to use Linked Data in my work even if it is not compulsory	2	14.3	0	0	0	0	4	28.6	7	50	1	7.1	14	100
Social Influence	**SD F %**		**D F**	**%**	**NA/D F**	**%**	**A F**	**%**	**SA F**	**%**	**Non Response F**	**%**	**Total F**	**%**
I am aware of the university library's use of URIs to link data to explore the information referenced and interconnected on the web	3	21.4	0	0	3	21.4	4	28.6	3	21.4	1	7.1	14	100
I am aware my institution needs to support global efforts to make data available, accessible, and usable for	2	14.3	0	0	0	0	2	14.3	9	64.3	1	7.1	14	100

unrestricted use worldwide.														
I am aware the university library needs to use the Web of Data to enable access and sharing of data with users without barriers	2	14.3	0	0	0	0	2	14.3	9	64.3	1	7.1	14	100
Observability	**SD**		**D**		**NA/D**		**A**		**SA**		**Non Responsive**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
I observed colleagues from other institutions using Linked Data technologies and appreciated the advantages of using it	3	21.4	1	7.1	1	7.1	4	28.6	4	28.6	1	7.1	14	100
I have seen how my colleagues use Linked Data technologies before I could use it	4	28.6	4	28.6	1	7.1	3	21.4	1	7.1	1	7.1	14	100
I have the opportunity to try out how I can make use of Linked Data	1	7.1	2	14.3	1	7.1	8	57.1	1	7.1	1	7.1	14	100
It did not take me a lot of time before I started using Linked Data	3	21.4	4	28.6	2	14.3	4	28.6	0	0	1	7.1	14	100

Source: Field data (2022)

Facilitating conditions

How facilitating conditions influenced the level of awareness of Linked Data among the heads of the library technical services is depicted in Table 23 above. In terms of the statement concerning respondents having the necessary knowledge to use Linked Data, seven (50.0%) respondents agreed, four (28.6%) strongly disagreed and two (14.3%) neither agreed nor disagreed.

The statement “Linked Data technologies are not compatible with other systems I use” elicited a clear disagreement from respondents with eight (57.1%) disagreeing and three (21.4%) strongly disagreeing. One (7.1%) respondent neither agreed nor disagreed and one (7.1%) agreed with the statement.

The respondents were further asked whether the IT staff were available for assistance in case they experienced any technical difficulties. Slightly more than a quarter of the respondents four (28.6%) agreed with the statement that IT staff are available to assist when difficulties are experienced; three (21.4%) strongly disagreed and a further three (21.4%) disagreed; two (14.3%) strongly agreed; and one (7.1%) respondent neither agreed nor disagreed.

In terms of Linked Data offering best practices for publishing, sharing, and interlinking structured data on the Web, the majority of respondents, 10 (71.4%) either agreed or strongly agreed, while three (21.4%) strongly disagreed.

The majority of respondents, 11 (78.6%) either agreed or strongly agreed with the final statement “It would be good to use Linked Data in my work even if it is not compulsory”. Two (14.3%) respondents strongly disagreed.

Social influence

The heads of library technical services were presented with three statements with regard to the construct of social influence affecting technology adoption. The first statement concerned respondents being aware of their university library’s use of URIs to link data to explore the information referenced and interconnected on the Web. Half, seven (50%), of the respondents either agreed or strongly agreed with the statement, three (21.4%) strongly disagreed, and the remaining three (21.4%) who responded neither agreed nor disagreed.

The statement “I am aware that the university library needs to use the Web of data to enable access and sharing of data with users without barriers” elicited the following responses: nine (64.3%) respondents strongly agreed, two (14.3%) agreed, and two (14.3%) strongly disagreed.

In terms of the statement concerning respondents being aware that their institution needs to support global efforts to make data available, accessible, and usable for unrestricted use worldwide, the majority of respondents, nine (64.3%), strongly agreed, two (14.3%) agreed, while two (14.3%) strongly disagreed with the statement.

Observability

There were four statements concerning the observability construct of the DIT influencing the heads of library technical services' awareness of Linked Data. In the first instance, respondents were presented with the following statement: "I observed colleagues from other institutions using Linked Data technologies and appreciated the advantages of using it." The findings revealed that four (28.6%) respondents strongly agreed with the statement; four (28.6%) agreed; three (21.4%) strongly disagreed; one (7.1%) disagreed; and one (7.1%) neither agreed nor disagreed.

The statement concerning respondents having seen how their colleagues used Linked Data technologies before they could adopt it had a majority disagreement with eight (57.1%) respondents either disagreeing or strongly disagreeing. Four (28.6%) respondents either agreed or strongly agreed, and one (7.1%) neither agreed nor disagreed.

The third statement concerned whether the respondents had the opportunity to try out how they could make use of Linked Data. Eight (57.1%) respondents agreed with the statement, one (7.1%) strongly agreed, three (21.4%) either disagreed or strongly disagreed and one (7.1%) neither agreed nor disagreed.

The final statement "It did not take me a lot of time before I started using Linked Data" elicited the following: four (28.6%) respondents agreed with the statement, two (14.3%) neither agreed nor disagreed, and half of the respondents, seven (50%), either disagreed or strongly disagreed.

5.2.2.3 Extent of adopting Linked Data in the university libraries

To address the second research question, the study sought to find out from the heads of library technical services the extent of adoption of Linked Data in their university libraries using the two factors of the UTAUT, namely, effort expectancy and facilitating conditions, and one factor of the DOI, namely, trialability. The findings presented in Table 23 show the responses from the 14 respondents (including the one respondent who did not respond).

Table 23: Extent of Linked Data adoption in the university libraries

(n=14)

Statement Effort Expectancy	**SD**		**D**		**NA/D**		**A**		**SA**		**Non Response**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
My interaction with the Linked Data technologies would be clear and understandable	1	7.1	2	14.3	1	7.1	7	50.0	2	14.3	1	7.1	14	100
It would be easy for me to easily adapt to using Linked Data	2	14.3	0	0	0	0	10	71.4	1	7.1	1	7.1	14	100
I would find the Linked Data technologies easy to use	1	7.1	0	0	2	14.3	9	64.3	1	7.1	1	7.1	14	100
Learning to use Linked Data will be easy for me	2	14.3	0	0	1	7.1	7	50.0	3	21.4	1	7.1	14	100
Facilitating Conditions	**SD**		**D**		**NA/D**		**A**		**SA**		**Non Response**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
I have the resources necessary to use the Linked Data technologies.	1	7.1	3	21.4	0	0	7	50.0	2	14.3	1	7.1	14	100
I have the technical expertise to use Linked Data	0	0	4	28.6	2	14.3	5	35.7	2	14.3	1	7.1	14	100
I have support from my team to adopt and use Linked Data	2	14.3	0	0	1	7.1	6	42.9	3	21.4	1	7.1	14	100

Trialability	SD		D		NA/D		A		SA		Non Response		Total	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
Using Linked Data technologies needs an IT technical background.	4	28.6	2	14.3	1	7.1	4	28.6	2	14.3	1	7.1	14	100
It is better to experiment with how Linked Data works before adopting and implementing it in the library.	3	21.4	0	0	0	0	6	42.9	4	28	1	7.1	14	100
It is better to adopt Linked Data after ascertaining that other institutions have successfully used it.	4	28.6	0	0	1	7.1	7	50.0	1	7.1	1	7.1	14	100
Linked Data tools may be complicated to incorporate in the current library tools	2	14.3	5	35.7	4	28.6	2	14.3	0	0	1	7.1	14	100
The transition from Machine Read Catalogue (MARC) to Resource Description Framework or BIBLIFRAME is a big challenge	5	35.7	1	7.1	4	28.6	2	14.3	1	7.1	1	7 .1	14	100
I am willing to learn about Linked Data technologies to improve data sharing and discovery of data on the Web.	4	28.6	0	0	0	0	3	21.4	6	42.9	1	7.1	14	100

Source: Field data (2022)

Effort expectancy

Respondents were presented with four statements relating to how effort expectancy influenced their adoption of Linked Data technology. The first statement concerned the respondents' interaction with Linked Data technologies being clear and understandable. A

majority of the respondents, nine (64.3%), either agreed or strongly agreed, three (21.4%) either disagreed or strongly disagreed, and one (7.1%) neither agreed nor disagreed.

A majority of the respondents, 10 (71.4%) agreed with the statement "It would be easy for me to easily adapt to using Linked Data". In addition, one (7.1%) respondent strongly agreed while two (14.3%) respondents strongly disagreed with the statement.

Nine (64.3%) respondents agreed and one (7.1%) strongly agreed with the statement concerning their finding Linked Data technologies easy to use. One respondent (7.1%) strongly disagreed, and two (14.3%) neither agreed nor disagreed.

The majority of the respondents, 10 (71.4%), either agreed or strongly agreed with the statement concerning Linked Data being easy for them to use. Two (14.3%) respondents strongly disagreed, and one (7.1%) neither agreed nor disagreed.

Facilitating conditions

Facilitating conditions was the second factor or construct concerning the extent of adoption of Linked Data among the university libraries. Respondents were presented with three statements in this regard, the first of which concerned them having the resources necessary to use the Linked Data technologies. Seven (50%) respondents agreed with the statement, two (14.3%) strongly agreed; three (21.4%) disagreed; and one (7.1%) strongly disagreed.

Only half of the respondents, seven (50%) either agreed or strongly agreed with the statement "I have the technical expertise to use Linked Data". Four (28.6%) respondents disagreed, and two (14.3%) neither agreed nor disagreed.

The third statement concerned the respondents having the support from their team to adopt and use Linked Data. Six (42.9%) respondents agreed; three (21.4%) strongly agreed; two (14.3%) strongly disagreed; and two (14.3%) neither agreed nor disagreed with the statement.

Trialability

The third construct or factor as noted above was trialability and it was drawn from the DOI theory. It comprised six statements the first of which read "Using Linked Data technologies needs IT technical background". Four (28.6%) respondents agreed with the statement; four (28.6%) strongly disagreed; two (14.3%) strongly agreed; two (14.3%) disagreed; and one (7.1%) neither agreed nor disagreed.

The majority of respondents, 10 (71.4%) either agreed or strongly agreed with the statement "It is better to experiment with how Linked Data works before adopting and implementing it in the library". Three (21.4%) respondents strongly disagreed with the statement.

Just over half of the respondents, eight (57.1%), either agreed or strongly disagreed with the statement concerning it being better to adopt Linked Data after ascertaining that other institutions have successfully used it. Four (28.6%) respondents strongly disagreed, and one (7.1%) neither agreed nor disagreed.

The respondents were presented with a statement concerning Linked Data being complicated to incorporate into their current library tools. Half, seven (50%) of the respondents either disagreed or strongly disagreed with the statement; four (28.6%) neither agreed nor disagreed, while two (14.3%) agreed.

The statement "The transition from Machine Readable Catalogue (MARC) to Resource Description Framework or BIBLIFRAME is a big challenge" received the following responses: five (35.7%) respondents strongly disagreed; four (28.6%) neither agreed nor disagreed; two (14.3%) agreed; one (7.1%) strongly agreed; and a further one (7.1%) respondent disagreed.

The final statement concerned the respondents' willingness to learn more about Linked Data technologies to improve data sharing and discovery of data on the Web. Six (42.9%) respondents strongly agreed with the statement while three (21.4%) agreed. A surprising four (28.6%) respondents strongly disagreed.

5.2.2.4 Benefits of adopting Linked Data in university libraries

In the third research question, the study sought to determine the benefits of adopting Linked Data in university libraries using the performance expectancy construct of the UTAUT. As previously, the respondents were presented with a list of statements (in this instance four) and requested to choose from S/A-strongly agree; A-Agree; D-disagree; SD-strongly disagree and NA/D- neither agree nor disagree.

The findings in Table 24 are based on the results of the 13 responses and one non-response.

Table 24: Benefits of adopting Linked Data in university libraries

(n=14)

Statement Performance Expectancy	SD		D		NA/D		A		SA		Non Response		Total	
	F	%	F	%	F	%	F	%	F	%	F	%	F	%
I would find Linked Data useful in my job	2	14.3	0	0	0	0	3	21.4	8	57.1	1	7 .1	14	100
Using Linked Data enables me to accomplish tasks more quickly	2	14.3	0	0	0	0	4	28.6	7	50	1	7 .1	14	100
Using Linked Data increases my productivity	2	14.3	0	0	1	1.7	3	21.4	7	50	1	7 .1	14	100
If I use Linked Data, I would have more chances to improve data sharing	2	14.3	0	0	0	0	6	42.9	5	35.7	1	7 .1	14	100

Source: Field data (2022)

Performance expectancy

As noted above, the respondents were presented with four statements concerning the potential benefits of adopting Linked Data. According to the findings, eight (57.1%) respondents

strongly agreed with the statement, three (21.4%) agreed, and two respondents, surprisingly, (14.3%) strongly disagreed.

A majority of respondents also positively responded to the second statement "Using Linked Data enables me to accomplish tasks more quickly". Eleven (78.6%) either agreed or strongly agreed with the statement and two (14.3%) strongly disagreed.

The third statement concerned Linked Data increasing the respondents' productivity. Again, a significant majority, 11 (78.6%) either agreed or strongly agreed with the statement, while two (14.3%) respondents strongly disagreed.

The final statement "If I use Linked Data, I would have more chances to improve data sharing" again elicited a positive response with 11 (78.6%) respondents either agreeing or disagreeing and two (14.3%) strongly disagreeing.

5.2.2.5 Factors that influence the behaviour of professional librarians towards the adoption of Linked Data in university libraries

To address the fourth research question, the study investigated the factors that influence the behaviour of the heads of library technical services towards the adoption of Linked Data using two of the factors or constructs of the UTAUT, namely, effort expectancy and social influence. Table 25 below reflects the responses of the respondents to 15 statements reflecting the constructs.

Table 25: Factors that influence the behaviour of professional librarians towards the adoption of Linked Data

(n=14)

Statement Effort Expectancy	SD F %	D F %	NA/D F %	A F %	SA F %.	Non Response F %	Total F %
Prior knowledge of using Linked Data	2 14.3	0 0	1 7.1	6 42.9	4 28.6	1 7.1	14 100
Fear of using Linked Data technologies	2 14.3	1 7.1	4 28.6	3 21.4	2 14.3	2 14.3	14 100

Fear of change from traditional tools to new technologically innovative tools	3	21.4	1	7.1	2	14.3	3	21.4	4	28.6	1	7.1	14	100
Perceived threats to job security	5	35.7	0	0	3	21.4	3	21.4	2	14.2	1	7.1	14	100
Age and gender to adapt to the Linked Data	4	28.6	1	7.1	1	7.1	5	35.7	2	14.3	1	7.1	14	100
Perceived availability of training and skills enhancement opportunities	2	14.3	0	0	1	7.1	8	57.1	2	14.3	1	7.1	14	100
Social Influence	**SD**		**D**		**NA/D**		**A**		**SA**		**Non Response**		**Total**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Top management buy-in and support	2	14.3	0	0	0	0	7	50	4	28.6	1	7.1	14	100
People who influence my work think that using Linked Data will improve our services in the library.	3	21.4	0	0	2	14.3	3	21.4	5	35.7	1	7.1	14	100
Technical skills will be required to adapt to using Linked Data	2	14.3	1	7.1	0	0	5	35.7	5	35.7	1	7.1	14	100
Benchmarking with other institutional libraries using Linked Data	2	14.3	0	0	0	0	5	35.7	6	42.9	1	7.1	14	100
Management would motivate me to use the system	2	14.3	1	7.1	2	14.3	5	35.7	3	21.4	1	7.1	14	100
Human resources with the expertise will be required	2	14.3	1	7.1	1	7.1	7	50	2	14.3	1	7.1	14	100
I shall require external training in Linked Data technologies for me to integrate with the library systems we currently have	2	14.3	0	0	0	0	7	50	4	28.6	1	7.1	14	100
Researchers will be able to access datasets on the Web	1	1.7	0	0	1	9.1	6	54.5	5	35.7	1	7.1	14	100
Support from the IT staff shall be required	1	1.7	0	0	0	0	6	54.5	4	36.4	1	7.1	14	100

Source: Field data (2022)

Effort expectancy

Respondents were requested to indicate how effort expectancy influenced their adoption of Linked Data technology. In terms of the first statement a majority of the respondents, 10 (71.4%) either agreed or strongly agreed that "Prior knowledge with using Linked Data" would influence its adoption. Two (14.3%) respondents either disagreed or strongly disagreed, while one (7.1%) neither agreed nor disagreed. Two (14.3%) respondents did not answer the question.

The second statement concerned respondents having a fear of using Linked Data technologies. Four (28.6%) respondents neither agreed nor disagreed with the statement; three (21.4%) agreed and two (14.3%) strongly agreed. In terms of disagreement, two (14.3%) respondents strongly disagreed and one (7.1%) disagreed.

The "Fear of change from traditional tools to new technologically innovative tools" impacting the adoption of Linked Data was agreed to by half, seven (50%), of the respondents. Four respondents (28.6%) while two (14.3%) neither agreed nor disagreed.

A statement concerning Linked Data's perceived threats to job security elicited the following responses: five (35.7%) respondents strongly disagreed with the statement; three (21.4%) neither agreed nor disagreed; three (21.4%) agreed; and two (14.2%) disagreed.

Age and gender affecting the ability to adapt to Linked Data was agreed or strongly agreed to by seven (50%) respondents. Five (35.7%) respondents either disagreed or strongly disagreed with the statement, while one (7.1%) neither agreed nor disagreed.

The final statement under effort expectancy, the "Perceived availability of training and skills enhancement opportunities" affecting the adoption of Linked Data was agreed or strongly agreed to by a majority, 10 (71.4%), of respondents. Two (14.3%) respondents strongly disagreed with the statement while one (7.1%) neither agreed nor disagreed.

Social influence

The first statement in terms of how social influence impacts the adoption of technology was carried out was “Top management buy-in and support”. A majority of the respondents seven (50.0%) agreed and four (28.6%) strongly agreed that such buy-in and support will influence the behaviour to adopt Linked Data. Two (14.3%) respondents strongly disagreed with the statement.

Five (35.7%) respondents strongly agreed and three (21.4%) agreed with the statement that people who influence their work think that using Linked Data will improve their services in the library. Three (21.4%) respondents strongly disagreed and two (14.3%) neither agreed nor disagreed.

The majority of respondents, 10 (71.4%), either agreed or strongly agreed with the statement that technical skills will be required to adapt to using Linked Data. Three respondents (21.4%) either disagreed or strongly disagreed.

The statement “Benchmarking with other institutional libraries using Linked Data” was agreed or strongly agreed to by a significant majority of respondents, 11 (78.6%). Two (14.3%) strongly disagreed with the notion that benchmarking would influence the adoption of Linked Data.

Just over half of the respondents, eight (57.1%), either agreed or strongly agreed that management would motivate them to use the system. Two (14.3%) respondents neither agreed nor disagreed, while the remaining three (21.4%) respondents either disagreed or strongly disagreed with the statement.

Half of the respondents, seven (50.0%), agreed and two (14.3%) strongly agreed that human resources with the expertise will be required to influence the adoption of Linked Data. Two (14.3%) respondents strongly disagreed, one (7.1%) disagreed and a further one (7.1%) neither agreed nor disagreed with the statement.

The statement "I shall require external training in Linked Data technologies for me to integrate with the library systems we currently have" was either agreed or strongly agreed to by 11 (78.6%) of respondents. The remaining two (14.3%) who responded, strongly disagreed.

A majority of the respondents, 10 (71.4%), were in agreement that researchers being able to access datasets on the Web would influence the adoption of Linked Data. Two (14.3%) respondents strongly disagreed, and one (7.1%) neither agreed nor disagreed with the statement.

The final statement "Support from the IT staff shall be required" was agreed to or strongly agreed to by a large majority of respondents, 11 (78.6%). Again, two (14.3%) respondents strongly disagreed with the statement.

5.2.2.6 Strategies that university libraries can use to promote the adoption and the use of Linked Data

To address the fifth (and final) research question, the study sought to determine from the respondents the strategies that university libraries can use to promote the adoption of Linked Data using the effort expectancy construct of the UTAUT. Out of 14 respondents, 13 responded (one of the respondents did not respond to the statements asked). The findings are presented in Table 26 below.

Table 26: Strategies that can be used by university libraries to promote the adoption and use of Linked Data

(n=14)

Statement	SD F	%	D F	%	NA/D F	%	A F	%	SA F	%	Non Responsive F	%	Total F	%.
Be proactive in gaining administrative support instead of passively waiting	1	7.1	0	0	1	7.1	3	21.4	8	57.1	1	7.1	14	100

for administrative decisions.							
Include research assignments in some of the employees' workload for them to conduct research during the exploratory stages of innovation adoption	1 7.1	0 0	2 14.3	6 42.9	4 28.6	1 7.1	14 100
Collaborate effectively with professionals in and out of the library community	2 14.3	0 0	0 0	4 28.6	7 50	1 7.1	14 100
Benchmark with other institutions already implementing Linked Data	2 14.3	1 7.1	0 0	3 21.4	7 50	1 7.1	14 100
Lobby for budget allocation to facilitate the adoption and implementation of Linked Data at the university library in addition to infrastructure and training of the workforce	2 14.3	0 0	2 14.3	2 14.3	7 50	1 7.1	14 100
Establish a policy governing data management and linking, requiring research submissions to be accompanied by data files and creation of Linked Data.	2 14.3	0 0	0 0	4 28.6	7 50	1 7.1	14 100
Collaborate with other university libraries through the Consortium of Uganda University Libraries and	2 14.3	1 7.1	0 0	4 28.6	6 42.9	1 7.1	14 100

establish a central data repository												
Develop data management awareness plans for staff and users	2	14.3	0	0	0	0	4	28.6	7	50	1	7.1	14	100
Start with adoption of minimum requirements of Linked Data principles	2	14.3	0	0	1	7.1	5	35.7	5	35.7	1	7.1	14	100
Develop courses on Linked Data applications in libraries by professional organisations.	2	14.3	1	7.1	1	7.1	3	21.4	6	42.9	1	7.1	14	100
Encourage staff to keep themselves up-to-date and explore the potential of Linked Data technologies in libraries	2	14.3	0	0	1	7.1	4	28.6	6	42.9	1	7.1	14	100

Source: Field data (2022)

As with the findings from the professional librarians relating to the strategies that can be used, the heads of library technical services were also, overall, positively supportive (in the form of agreed and strongly agreed) of the 11 strategies (or statements) put forward that university libraries can use to promote the adoption and use of Linked Data. The support, unlike that provided by the professional librarians, was not as overwhelming. Given this, only the significant findings are presented (as was done with Table 16).

As pointed out above, all the statements received majority support with nine of the 11 being agreed or strongly agreed to by either 10 (71.4%) or 11 (78.6%) respondents. The two statements with the least amount of positive support (both with nine (64%) respondents agreeing or strongly agreeing) were as follows:

"Lobby for budget allocation to facilitate the adoption and implementation of Linked Data at the university library in addition to infrastructure and training of the workforce", and "Develop courses on Linked Data applications in libraries by professional organisations".

On the other hand, there were three statements which were each disagreed or strongly disagreed with by three (21.4%) respondents. These statements were as follows:
"Benchmark with other institutions already implementing Linked Data", "Collaborate with other university libraries through the Consortium of Uganda University libraries and establish a central data repository", and "Develop courses on Linked Data applications in libraries by professional organisations".

There remained the one head of library technical services who did not respond at all.

5.2.3 Results pertaining to the university librarians

This section presents the responses of the university librarians based on the data collected using the interview schedule ***(Appendix II*)**.

The researcher conducted telephone interviews with the university librarians (and heads of IT – see 5.2.4 below) to gather in-depth knowledge about the subject. However, four university librarians insisted on having interviews in person for, in their view, a better discussion. The researcher first made phone calls to the respondents to introduce herself, the study topic, the purpose and objectives of the study, and also sought their consent and when they would be available for the interviews. The consent forms and permission letters to conduct research in their respective institutions were emailed to them, and their feedback was sought. All 14 university librarians consented to be interviewed. The interview guide was emailed to them in advance for them to understand the questions to be asked before the actual interviews took place.

5.2.3.1 Demographics of the university librarians

Gender of the university librarians

Table 27 shows the gender of the university librarians

Table 27: Gender of the university librarians

(n=14)

Gender	Count	Percent (%)
Female	9	64.3
Male	5	35.7
Total	**14**	**100**

Source: Field data (2022)

As reflected in Table 27, nine (64.3%) respondents were female and five (35.7%) were male.

Age and educational qualifications of the university librarians

Table 28: Cross-tabulation of age and the highest level of education

(n=14)

Age range	Level of Education					
	Master's degree		PhD		Total	
	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)
31-40	2	14.2	0	0	2	14.3
41-50	5	35.7	3	21.4	8	57.1
51-60	2	14.3	0	0	2	14.3
61-above	0	0	2	14.3	2	14.3
Total	**9**	**64.3**	**5**	**35.7**	**14**	**100**

Source: Field data (2022)

Table 28 above shows a comparison of the age of the respondents and their highest level of education. The highest number of respondents, five (35.7%), were in the age range 41-54 years and had attained a master's degree compared to three (21.4%) in the same age range

who had attained a PhD. Two (14.3%) respondents in the age group 51-60 years had attained a master's degree and two (14.3%) in the age group 61-above had attained a PhD.

5.2.3.2 Level of awareness of Linked Data

Section A of the interview schedule sought to determine the respondents' level of awareness of Linked Data by asking them, in an open-ended question, what their understanding of Linked Data was. Their responses are summarised below.

The majority of respondents acknowledged that Linked Data was a new concept to them and that their understanding of the concept was basic. They defined Linked Data as data that can be put together so that it can be shared with others. Similarly, other respondents defined Linked Data as data that is hyperlinked with other data or data that links to other data and that this data is shared between different networks, websites or systems. Other respondents pointed to Linked Data being about sharing and availing one's library catalogue data to various repositories so that researchers and librarians from other university libraries can access it.

The respondents were asked when they were introduced to Linked Data technologies. Ten (71.4%) respondents were introduced to Linked Data technologies between two and six years ago, while the remaining four (28.6%) respondents were introduced to Linked Data 10 years ago.

When asked how they came to know about Linked Data technologies, the respondents mentioned that they did so from training workshops, during the cataloguing section workshops at IFLA conferences, and from personal research.

Respondent UL-6 said:

"During the Covid-19 when we were locked down, I had the opportunity to virtually attend an open data conference where Linked Data was one of the topics discussed and a number of presentations made. This provided me with the opportunity to learn about Linked Data."

Respondent UL-8 said:
"*I had an opportunity to work with an international organisation for many years which exposed me to several technologies. I remember when we went for benchmarking to another international organisation, they introduced us to Linked Data and how they are using it to link their data with their organisational networks around the globe."*

The respondent added that she/he got to learn more about Linked Data *"when I travelled to* South Africa for a training workshop and appreciated its benefits."

Question 8 of the interview schedule concerned the facilitating conditions needed to create awareness of Linked Data among the university librarians. Below are their responses.

The majority of the respondents indicated that librarians had embraced information and communication technologies (ICTs) and were currently working with library data and several databases. This, they believed, would make it easier for them to adapt to Linked Data technologies.

Respondent UL-4 specifically said:
"I am aware that librarians have now embraced ICTs and currently using a number of library-integrated systems to capture their metadata in different repositories through KOHA and Dspace. The librarians can link the Library of Congress library metadata to their library-integrated systems. This will help in facilitating them to easily adapt to Linked Data technologies."

Another facilitating condition noted was CUUL, libraries being able to share and link data with each other through the CUUL. In this regard, respondents UL-1 said:
"CUUL has several initiatives aimed at promoting collaboration among academic libraries to strengthen their effectiveness in research. The Head, Librarians' Round Table of CUUL brings together head librarians to discuss issues pertaining to their libraries and, therefore, can use this forum to advocate and lobby for the promotion and adoption of Linked Data."

Respondent UL-13 gave a similar response.

Respondent UL-11 said:
"Most of the university libraries have institutional repositories with a section in charge of digitisation where librarians receive e-documents and the metadata is captured and thereafter uploaded on the institutional repository."

UL-14 further said:
"For us, we even go ahead to include external links of research datasets to some of the electronic resources on the institutional repository."

Respondent UL-4 said:
"*I had an opportunity to pursue my PhD from one of the developed countries and these university libraries have already adopted Linked Data and are sharing data among themselves. I am also trying to implement it in my library and other library networks. Having such university libraries to benchmark from surely facilitates awareness and I hope other libraries will benchmark from my library once we have fully implemented it".*

In question 9, the respondents were also asked what social influence is needed to promote the adoption of Linked Data among university libraries. Their responses are presented below.

The majority of the respondents indicated that the support of top management plays a significant role in promoting the adoption of linked Data technologies.
According to respondent UL-9:
"Since libraries play a strategic role in the university, there is, therefore need for us to take advantage of that and advocate and lobby in these strategic meetings to inform top management of the new innovations and how the libraries and institutions can benefit especially with Linked Data technologies."

The users' or research community's influence will play a fundamental role in ensuring the promotion and adoption of Linked Data. If these users/researchers demand Linked Data, the

administration will be forced to adopt and implement it. Without the researchers showing an interest and pointing to the need for Linked Data, it may be difficult for the university librarians to motivate for and justify it, since there would be no apparent demand for it.
According to respondent UL-4:
"As librarians, we don't have much to do when there is no demand for Linked Data technologies in case the users or the research community don't demand it. Management would not see the need to adopt it and therefore won't prioritise it. However, in case there is demand for it, it will become easier for us to advocate and lobby top management with justification".

The CUUL also has a significant influence on Linked Data adoption especially through collective lobbying since it is an umbrella body for university libraries in Uganda.
According to respondent UL-7
"It may be very difficult for my or any other university library to lobby for Linked Data technologies because currently we have insufficient funding, and each university's priorities differ. But with CUUL, the consortium may be in a position to collectively lobby for the university libraries during the Vice Chancellors' forum which was the case with the establishment of the institutional repositories – they can articulate the benefits of Linked Data to them."

In the final question of section A of the interview schedule, the university librarians were asked if they thought that their library staff were aware of Linked Data.

The majority of the respondents believed that their staff were not aware of Linked Data.
Respondent UL-3 said:
"*I don't think the librarians have knowledge because none has shown any interest or informed me about it. In case there are some who have the knowledge then they have just decided to keep it to themselves."*

Respondent UL-1 noted:
"Maybe there are some librarians who are aware but have not got an opportune time to share with me or the rest of their colleagues."

Section B of the interview schedule asked a series of questions relating to the use of Linked Data in the university libraries. The findings are presented under 5.2.3.3 below.

5.2.3.3 Use of Linked Data in the university libraries

Questions 11 and 12 concerned whether any Linked Data technologies had been adopted by their university libraries and what these were.

All the respondents indicated that they were using the KOHA library management system and DSpace with other digital repositories to share their information resources via the OPAC. They were also using Mendeley Data for linking their research data. Other institutionally linked data systems were the academic registrar's information system, which links the students and library data and assists in the circulation of information resources in the university libraries.

The respondents were asked about the extent of data sharing among the university libraries in the country.

All the respondents indicated that data sharing among the university libraries in Uganda was non-existent. They believed that the adoption of Linked Data would enable university libraries to advocate for data sharing. Respondent UL-7 indicated that their university library has adopted Linked Data for sharing their information resources with its library branches. However, respondent UL–7 said:
"Currently, there is no data sharing among the university libraries, but efforts are being made to at least share data within institutional campuses. University libraries with regional branches can share data amongst themselves".

The researcher sought to determine the section responsible for ensuring that data is uploaded to the IR and shared with users.

Four respondents (UL-2, UL-3, UL-5, and UL-12) indicated that the section responsible for data upload is the Research Support Unit which digitises theses and uploads them onto the IR. A further four respondents (UL-4, UL-6, UL-13, and UL-14) indicated that the ICT section was responsible for doing so, while one respondent (UL-7) indicated that the E-resources section is responsible for uploading digitised materials. However, four respondents (UL-1, UL-7, UL-8 and UL-9) said that their institutions did not have any specific section handling uploads. In this regard, respondent UL-7 opined:

"We don't have a specific section which uploads data on the institutional repository, instead the staff share this responsibility to allow them to learn, instead of doing a specific role."

Finally, the researcher sought to find out from the respondents the facilitating conditions available to support data sharing and reuse among the university libraries. The factors (or facilitating conditions) mentioned by the respondents included: collaboration among the university libraries through CUUL; already existing resource-sharing mechanisms among the university libraries; experienced technical library staff with knowledge of technologies; and the availability of information systems.

5.2.3.4 Benefits of adopting Linked Data in university libraries

Section D of the interview schedule contained one question, namely, "What benefits do you think Linked Data provides to the university libraries in the country?"

The majority of the 14 university librarians believed that with the adoption of Linked Data, there would be improved sharing of data and information resources among the university libraries. According to respondent UL-7:

"Having one central repository where university libraries can deposit their data and information resources, will not only reduce financial, technical and human resources that may accrue with the adoption of Linked Data, but it will also encourage the standardisation of data among the universities in the country."

Respondents noted that sharing data and other information resources would strengthen collaboration, knowledge sharing, and networking among the university libraries. In this regard, respondent UL-2 noted:

"*With the collaboration, university libraries shall share technical expertise with other university libraries, for example, in case there is a staff in another university library who has more technical skills, he/she can be requested to train other staff in another university library."*

Similarly, the respondents mentioned that adopting Linked Data will reduce or eliminate duplication, research, and other information resources. According to respondent UL-4:

"*Currently each university has its own institutional repository with its own data, however, if these repositories and data are linked to one central repository, it will enable eliminate duplication of research and library data."*

Another benefit of Linked Data mentioned by the respondents was that it will help researchers discover more information in their field of research and increase the visibility of university libraries' research. Libraries will also be able to assess library data from other university libraries that have already catalogued a given information resource.

Respondent UL-3 noted:

"With Linked Data many researchers will be able to discover more data and information which they couldn't have known, which is the current situation now. A researcher is not able to know what other people may have done from other university libraries. Data will be easily accessible by the different university libraries instead of each of them having different databases."

Respondent UL-5 also noted:

"Currently we have university libraries cataloguing a similar information resource differently, for example, a book published by a local author. When you check in the repositories of the university universities, that book will have different data captured. We are fortunate that for some of the books by international authors, the metadata can be easily accessed from the Library of Congress which makes the data standardised."

Respondents also mentioned that Linked Data could boost research and bring people to utilise the library like never before. According to respondent UL-4:
"If the university libraries link their data, researchers will be able to access it and reuse it for other research, thereby contributing to national development. A researcher will be able to know where the data can be accessed and this may enable him/her to find out more data and information resources, hence enabling more people to utilise the libraries."

Furthermore, respondents indicated that adopting Linked Data will improve data sharing and reuse among the university libraries. Data will also be available to those who cannot access it with standardised clean data. Respondent UL-6 mentioned:
"Right now, no university library shares its data, however, in case Linked Data is adopted among the university libraries it will enable the university libraries to share their data and encourage others to reuse it for further research and eliminate plagiarism."

Respondent UL-10 said:
"Libraries capture different metadata for the same information resource, yet if there was a provision of data sharing, it will not only make cataloguing easier but also provide standardised cataloguing procedures."

Finally, it was pointed out that with a data sharing policy amongst the university libraries in Uganda, researchers will be mandated to deposit their data with their university library and the university libraries will also be required to share their library data as well.
In this regard, respondent UL-14 said:
"The Linked Data concept seems to be good; however, we cannot achieve it without a policy in place. This policy would mandate all university libraries to share their data and researchers to deposit their research data."

5.2.3.5 Factors that influence the adoption of Linked Data

Section E of the interview schedule examined the factors influencing the university librarians in adopting Linked Data. Their responses are outlined below:

One of the significant factors influencing the adoption of Linked Data noted by the respondents was how easy it is to use and its applicability to library work. Respondent UL-4 said:

"In case the librarians don't find it easy to use and it doesn't apply to their library work, it will be very difficult to convince the university libraries to adopt it. In addition, if it doesn't easily integrate with their other library systems it may be difficult as well."

A second factor noted by the respondents was the technical expertise needed to implement Linked Data. They believed that this would have a major influence on its adoption. Respondent UL-8 said:

"Many systems are introduced and yet require technical skills which the majority of the librarians may not have and therefore require IT staff to come and provide support. Yet, the IT staff usually take their time to provide the support. Therefore, if Linked Data requires a lot of technical skills, it will be very difficult to convince the librarians to adopt it and also require some training."

The university librarians also pointed to top management playing a vital role in the adoption of Linked Data. Once top management mandates that the university libraries must use Linked Data technologies to promote data sharing and reuse, then the librarians will be forced to adopt and even go for training. But without such a mandate from top management, librarians will sit back, and business will remain as usual.

The university librarians indicated that one of the factors that may hinder the adoption of Linked Data is the mindset and knowledge skills of the librarians. Respondent UL-13 said:

"The majority of the librarians have a bad mindset regarding technologies; they want to be in their comfort zone and are not bothered to learn or to acquire new technical skills and knowledge."

A further factor indicated by the respondents was the issue of cooperation and collaboration among the university libraries. Respondent UL-5 said:

"Having assured cooperation among the university libraries may contribute to the influence of the adoption of Linked Data, especially where there is a need for technical assistance among the university libraries. For example, if there is a librarian in Makerere University with technical skills in Linked Data, that librarian should be able to assist other librarians in universities, train them and provide any technical support."

The final factor that may influence the adoption of Linked Data among the university libraries identified by the respondents was having an established Linked Data or Data Management policy in place which mandates all university libraries to deposit their data in a central repository. Respondent UL- 4 reiterated a point made above concerning policy:
"If there are policies which mandate librarians to adopt and implement Linked Data, this will influence their adoption because they will have no choice but to adopt it. For example, right now majority of the university libraries have institutional repositories which require them to upload data and theses. However, there is no policy for data sharing among the university libraries and hence they see no need for it."

5.2.3.5.1 Challenges that hinder university librarians to adopt and implement Linked Data

As part of section E, the university librarians were asked what they thought were the challenges that hinder university librarians from adopting and implementing Linked Data. Below are the responses.

One of the major challenges noted was the general lack of knowledge about Linked Data among librarians. According to respondent UL-2:
"Whereas Linked Data is one of the emerging technologies that libraries ought to know about, unfortunately, most of the librarians don't have much knowledge about it. So, such people cannot be able to advocate or lobby for its adoption and implementation."

In a similar vein, respondents UL-2 and UL-5 noted that librarians do not have the skills and knowledge of how Linked Data technologies work. However, respondent UL-6 pointed out that:

"Some of the junior librarians may have the knowledge but because they don't have a platform or forum to share this information, they instead prefer to keep this knowledge to themselves. Some even fear their supervisors who seem to be conservative and don't allow for innovations."

Indeed, respondents UL-1 and UL-4 noted the challenge of changing the mindset of the librarians to adopt Linked Data. According to respondent UL-1:
"We have a big challenge of changing the mindset and attitude of the librarians to change. They seem to be in their comfort zone and do not want to learn any new innovations and emerging technologies."

Another challenge noted was the lack of support from the top management regarding library innovations. While the library is considered the "lifeblood" of the university it, in general, receives little support from the university's top management. The latter tends to point to insufficient resources and when it comes to budget cuts, libraries are the first to be affected. Library fees collected by the universities are of little help, as they tend to be used for other activities which are considered priorities at the time. Yet library fees could assist in boosting university library innovations such as Linked Data.

It was also pointed out that the actual costs of implementing Linked Data technologies require human, financial, and infrastructural resources. This may hinder the adoption and implementation of Linked Data technologies because of the limited library budget. This was mentioned by respondents UL-2, UL-3, and UL-5. The latter respondent noted:
"Usually, these new technologies require a lot of resources, which may hinder its adoption, considering that most universities have competing priorities and yet the university library budget is very limited."

Respondent UL-4 also noted that*: "Developing countries are used to free things or funding and therefore, we expect some funding for such emerging technologies. In such cases where the technologies are not open source, or no funding included, it will hinder its adoption."*

With concerns about implementation costs, the respondents further noted that the hardware and software costs associated with Linked Data services. For example, the private universities have inadequate ICT infrastructure and challenges with Internet connectivity and low bandwidth.

The respondents also noted a lack of people with the technical skills needed for Linked Data technologies as a major challenge. Respondent UL-3 pointed out:
"*Very few librarians may have the technical skills to use the Linked Data technologies. The public universities that you think may take this initiative because of government funding, are also lagging behind just like the private universities."*

A final challenge noted by all the respondents was the absence of a research data policy that would mandate all researchers to submit their datasets together with their theses. According to respondent UL-14:
"Currently, there is no interest to deposit research data by the researchers."

The respondents pointed out that they do not have any policy to enable Linked Data or data sharing among the university libraries. All that they do have are the IRs which only authorised people can access and few of the information resources in the repositories have links to research data in external data repositories.

5.2.3.6 Strategies to promote the adoption and use of Linked Data in university libraries
In the final section of the interview schedule, the university librarians were asked two questions. The first question concerned whether they had any policy in place addressing data sharing. All the respondents indicated that they do not have a specific policy on data sharing in their university libraries. Nine of the respondents (UL-3, UL-4, UL-5, UL-7, UL-8, UL-9, UL-12, UL-13 and UL-14) indicated that they have IR policies; however, they pointed out that IR policies do not cover the issue of data sharing. Five respondents (UL-1, UL-2, UL-6, UL-10, UL-11) indicated their IR policies were still in development.

The second question in this final section concerned the strategies that university libraries should use to adopt the use of Linked Data. Their responses are provided below.

A strategy proposed was the need for librarians to first educate themselves about the Linked Data concept and then partner and work together with researchers to encourage them to deposit their data. In terms of the need to educate themselves, respondent UL-14 stated:
"*As university librarians, we need to understand this concept clearly so that we can sell it to the researchers and Senate for their buy-in".*

Similarly, respondent UL-4 noted:
"We cannot promote what we are not sure about, in addition, the researchers need to request for it for us to make a justification for it. There is also a need to train librarians and the technical support staff in use of the Linked Data technologies".

A second strategy proposed by the respondents was the need to develop policies that promote data sharing. There was an urgent need for a data management policy that would highlight the issues concerning the deposit of data in the library. Respondents UL-3, UL-5 and UL-14 specifically noted that while they were advocating for Linked Data, the deposit of research data, and bibliographic metadata, there was a need for a data management policy. This policy should start at the national level and be implemented downwards in institutions so that researchers are mandated to deposit their research data as is done with the deposit of theses in the repository and that this should be, as with theses, an enforceable requirement. The respondents also noted that if they had policies supporting the sharing of data among universities, this would not only improve the research output in the country but would enable users to access and discover more data and information available from the universities.

Respondent UL-5 pointed to the importance of cataloguing standards. They said:
"*Libraries have a standard for the cataloguing bibliographic data for linking their local metadata; [and that] each university library has its different way of cataloguing library metadata."*

In this regard, respondent UL-7 proposed that:
"There is a need for a National Union Catalogue spearheaded by the National Library of Uganda to enable all libraries to share and make their data discoverable like it is with accessing Library of Congress data which is integrated with the KOHA library system."

The respondents also noted that there was a need to benchmark with institutions that have already adopted and implemented Linked Data.
According to respondent UL-1, benchmarking *"will help us to decide whether it's the best technology for our libraries".*

Respondent UL-8 added that:
"In addition, we shall need to identify Linked Data champions who will be able to promote these initiatives to the researchers and the university community."

Respondent UL-3 pointed to the need for collaboration and networking within the university libraries in Uganda and abroad which are already implementing Linked Data. According to the respondent:
"This will help create a network of libraries who will be able to support each other and as the Consortium of Uganda University Libraries [CUUL] promoted and advocated for open institutional repositories, [it] needs to spearhead this initiative; also, the consortium is better placed to advocate at the VC forum. Therefore, there is a need to strengthen the CUUL".

Respondent UL-2 pointed to the importance of creating awareness of Linked Data. The respondent stated:
"*There is a need to create continuous awareness of Linked Data and its services among the librarians and the researchers to enable them to appreciate its importance. This will enable the librarians equipped with knowledge about Linked Data services which they will render to the researchers, staff and management."*

It was noted that participation in international conferences will expose librarians to emerging trends in libraries, such as Linked Data. In this regard, respondent UL-1 pointed out:

"Personally, I got to learn about Linked Data at an international conference I attended."

Finally, in the context of limited budgeting, respondent UL-2, suggested that university librarians should seek funding through writing grant proposals to finance the adoption and implementation of Linked Data.

5.2.4 Results pertaining to the heads of IT

This section presents the responses of the heads of IT in the universities selected based on the data collected from the telephonic interviews ***(Appendix III)***.

As with the university librarians, the interview schedule for the heads of IT comprised, in addition to the demographic data of the respondents, five sections. These were their level of awareness of Linked Data, the extent to which Linked Data has been adopted, factors that influence the adoption of Linked Data among university libraries, the benefits of adopting Linked Data among the university libraries, and the strategies the university libraries require to promote the adoption of Linked Data.

As noted earlier in the chapter, of the 14 heads of IT who were expected to participate in the study, only 10 participated, giving a response rate of 71.2%. The findings presented below are based on the responses of the 10 respondents.

5.2.4.1 Demographics of the heads of IT

Gender of the heads of IT

Table 29: Gender of the heads of IT

(n-=10)

Gender	Count	Percent (%)
Female	0	0
Male	10	100
Total	**10**	**100**

Source: Field data (2022)

Table 29 above shows that all the 10 heads of IT who participated in the study were male.

Age and Educational qualifications of the heads of IT

Table 30 provides the cross-tabulation of the age and the highest level of education of the respondents.

Table 30: Age and educational level of the heads of IT

(n=10)

Age range	Level of Education					
	Bachelor's degree		Master's degree		Total	
	Count	Percent (%)	Count	Percent (%)	Count	Percent (%)
31-35	1	10	3	30	4	40
36-40	0	0	1	10	1	10
41-45	0	0	2	20	2	20
46-49	0	0	1	10	1	10
50 – above	0	0	2	20	2	20
Total	**1**	**10**	**9**	**90**	**10**	**100**

Source: Field data (2022)

The highest number of respondents, four (40%) were in the age range 31-35 years. Of the four respondents, three had attained a master's degree and one had attained a bachelor's degree.

5.2.4.2 Level of awareness of Linked Data

The study sought to determine the heads of IT's level of awareness of Linked Data by asking them what they thought Linked Data was. Their responses are summarised below.

i) Linked Data is where communities or organisations decide to share data amongst themselves using hyperlinks.

ii) Linked Data is data linked and shared among universities using well-defined IT infrastructure and integrating information systems in the different institutional data repositories.
iii) Data is interconnected using URIs to allow for easy access and elimination of data duplications.

The respondents indicated that they were aware of some of the Linked Data technologies used by libraries, such as KOHA and DSpace (which are used as IRs) and Mendeley Data (which is mainly used by researchers). Some respondents indicated that they learned about Linked Data during the data linkage process between library systems and the academic registrars' systems; while others learned about it through training, workshops, and personal research.

In question 6 of the interview schedule, respondents were asked what facilitating conditions were available for the IT section to create awareness of Linked Data among the university librarians.

What was emphasised by the respondents was the need for mutual collaboration between the IT staff and the library staff. In this regard, respondent HIT-3 said:
"*We work together with the library staff especially when they need any IT support, installation of some of the library systems and customization of the systems to fit their needs. Therefore, in case the library adopts Linked Data we shall be able to work with them to assist them implement it by providing IT support and the IT infrastructure required."*

In the following question, respondents were asked what social influence they think is needed to promote the adoption of Linked Data among university libraries. Their responses are summarised below.

The majority of respondents indicated that top management support was paramount for promoting the adoption of linked Data technologies in the university libraries. In this regard, respondent HIT-10 said:

"Once there is the blessing of the top management towards implementation of Linked Data, then the librarians will not have to do a lot of lobbying."

The respondents also pointed out that in the social media era, libraries need to use social media platforms to promote the adoption of Linked Data by engaging their users and sharing with them what Linked Data means, how it will benefit them, and the research community as a whole. Doing so will make users appreciate its importance and, consequently, demand it.

In the final question of the section, the heads of IT were asked whether their IT staff were aware of and had the skills to easily adapt to Linked Data technologies. The majority of the respondents indicated that while their IT staff were not aware of Linked Data technologies, they believed that like any other technologies or system, they would be able to easily adapt to them. All they would require was training and benchmarking with other institutions that have already adopted Linked Data.

The respondents also indicated that the skills the IT staff need to configure, integrate and operationalise the backend of the Linked Data technologies are like any other technologies. These skills can be attained through training, research, and eLearning using YouTube education channels.

5.2.4.3 Extent of use of data sharing among university libraries

Section B attempted to determine the extent of data sharing among the university libraries in the country. All the respondents indicated that data sharing among the university libraries in Uganda was non-existent. However, it was hoped that the adoption of Linked Data would enable university libraries to advocate for data sharing in the country.

Respondent HIT-9 said:

"Currently, there is no data sharing among the university libraries, but efforts are being made to at least share data within institutional campuses. University libraries with regional branches can share data amongst themselves. So that a student doesn't have to travel to the main campus but instead access the information and data online through the institutional repository."

The majority of respondents indicated that their IT departments have not developed any in-house linked data technologies. They were still in the development stages but hoped that the technologies would assist them in linking their institutional data. The majority of the systems currently used were being sourced externally. However, a new Academic Management Information System (ACMIS) has been locally developed with government support. The ACMIS provides students and staff access to educational programmes and other learning-related materials and information.

Respondent HIT-1 noted that their IT section had
"customised the KOHA library system's Online Public Access Catalogue (OPAC) and DSpace institutional repository that the library is using to share its data and information with the students and the staff."
Respondents HIT-1 and HIT-6 had dome similar customisations in their institutions.
Respondent HIT-3 added:
"*During the Covid-19 pandemic, as the IT department, we were required to develop online learning systems which we did and we are using them to link to the other IT systems in the university."*

Question 13 sought to determine whether the respondents had the necessary IT infrastructure to facilitate the adoption and implementation of Linked Data in their university libraries.

The majority of the respondents indicated that they do have the necessary infrastructure. They do have data centres and Internet services through the national backbone infrastructure. However, three respondents, HIT-4, HIT-5, and HIT-6, indicated that they had very limited infrastructure, and were struggling with what they already have. They attributed this to their universities being in rural areas some distance away from the city of Kampala. However, CUUL's partnership with the Research and Education Network of Uganda (RENU), an Internet service provider, has improved Internet access. The respondents believed that given the infrastructural challenges, they may not be ready to embrace Linked Data unless they received top management support and/or donor funding.

5.2.4.4 Benefits of adopting Linked Data

In question 15, respondents were asked what they thought the benefits of adopting and implementing Linked Data in the university library are. Their responses are provided below.

One of the benefits of adopting Linked Data, as noted by the respondents, was that it would provide access to data and information that the users may not have otherwise been able to find. Respondent HIT-7 said:

"I think Linked Data will enable the researchers to access data that they cannot find in other institutional repositories, hence making discovery of data easier. In addition, it will enable researchers and librarians to reuse data."

A second benefit emphasised by the respondents was that it would avoid duplications and minimise errors.

Respondent HIT-1 was of the opinion (shared by respondents HIT-3) that:

"With Linked Data, I think the libraries will be able to avoid duplications of data entries especially where they have similar information resources. Also, sometimes you are not sure whether there are some students duplicating other students' research from another university."

Respondents also mentioned that adopting Linked Data will alleviate the shortage of space for institutional data and information. As pointed out by respondent HIT-5:

"Most of the universities are struggling with data storage, yet in case there is a central repository where data is deposited, it will require the university libraries to only access a link on their website. The data resources will be shared among the university libraries and improve on bandwidth".

5.2.4.5 Factors that influence the adoption of Linked Data among university librarians

In section D of the interview schedule, the heads of IT were asked to mention some of the factors that may influence university librarians' adoption of Linked Data. These factors are outlined below.

One of the factors mentioned was the need for university librarians to be motivated to learn more about Linked Data and be able to appreciate it. As noted by respondent HIT-4:
"I don't think Linked Data is a new concept to the librarians, the systems they are using are interlinked and they are working with metadata, so for them to shift from what they are doing now; they need to be self-motivated so that they can request support from the other departments."

A second factor mentioned by the respondents was the value of Linked Data to the university library in that it would be able to add value and visibility to the library. As pointed out by respondent HIT-9:
"If Linked Data will enable the users to access the library and improve the visibility of the library, then they [university librarians] will adopt it. However, if it does not add any value to their work, they won't adopt it."

The respondents noted that a further factor that may affect the adoption of Linked Data by university libraries is how efficient and effective the Linked Data technologies are. In addition, how Linked Data technologies can easily integrate with the other existing library systems. For example, does the system improve their work and can it be integrated with the KOHA library management system or DSpace, or any other system? However, if librarians find it difficult to use or have to capture already existing metadata, then they may not embrace it.

The librarians' mindset and attitude towards adopting Linked Data were also pointed to as having a significant influence. As noted by respondent HIT-7:
"*Librarians seem to be comfortable with their old ways of doing things and some are not even interested in learning new innovations or acquiring some IT skills. They seem to be comfortable with the status quo and don't want to be bothered with new technologies although a few of them are now gaining some training in information systems."*

Further factors mentioned by the respondents were the university librarians' level of awareness of and the benefits associated with, adopting Linked Data. For example, if librarians are aware of Linked Data and its benefits to them and the libraries, they may adopt it. Also, if any university libraries are already adopting it, it will enable them to benchmark and learn from them.

The final factor mentioned by respondents was the empowerment that Linked Data would provide to the university librarians through training and capacity building to enable them to spearhead its implementation. As pointed out by respondent HIT-3:
"Librarians need to be empowered and trained so that they can easily adapt to Linked Data technologies. Once the librarians are trained, then they will find it easier to adapt and can even champion it."

5.2.4.5.1 Challenges faced by the IT sections

The second question in section D sought to determine the challenges that the IT sections may face in providing support to their university libraries regarding the adoption of Linked Data technologies. Below are the responses.

One of the challenges the respondents pointed to was that they are not experts in the university library field and cannot assume to know what the university librarians want. As a result, librarians need to request support because they are not technical and lack basic skills or knowledge about IT.

Another challenge noted was the low Internet bandwidth and high cost of acquiring data bundles in the university libraries. This was emphasised by respondents HIT-4, HIT-5 and HIT-7 all of whom were from universities in rural areas. Respondent HIT-4 noted:
"Whereas there is the national backbone we are still experiencing the low Internet bandwidth in the rural universities. RENU through the CUUL is providing Internet bandwidth at a slightly subsided cost which is still not good enough but it's much better than not having Internet at all. As IT staff we are focused on buying our own modems and data bundles which assist with our work."

Inadequate financial resources to acquire new systems in the university libraries and sustaining them being very costly was also pointed to. It was noted that the focus had been on e-learning due to the Covid-19 pandemic where virtual learning was emphasised and encouraged. As alluded to earlier, allocating an adequate budget to library systems may not be a priority.

The final challenge mentioned Heads of IT was that IT staff only have basic knowledge about library technologies, for example, Mendeley Data, the KOHA Library Management System, and DSpace, which often need to be customised.

5.2.4.6 Strategies required by university libraries to promote the adoption of Linked Data

In the final section of the interview schedule, the heads of IT were asked if they were aware of any policies in place that enable data sharing, and secondly, what strategies the university libraries should use to promote the adoption of Linked Data. In terms of the first question, the respondents indicated that they were not aware of any policies that enabled data sharing in the university libraries. In terms of the second question, their suggestions are presented below.

There is a need to strengthen CUUL to advocate for a Data Management Policy in university libraries. In this regard, respondent HIT-1 said:

"I know the university libraries have a consortium which has helped them advocate for several resources, among them is the sharing of e-resources. If this consortium is strengthened it will have the capacity to lobby the VCs to facilitate the initiatives of these libraries and moreso the Linked Data initiative."

Also in terms of policy, universities need to lobby for a national data policy that can mandate them to request that researchers deposit their research data in addition to the deposit of students' theses at universities. This will enable university libraries to share their data with other university libraries. Respondent HIT-1 made the following points:

"For the adoption of Linked Data to take place among the university libraries, there is a need to have a national data policy, this is, the universities through the National Council of Higher Education in collaboration with the Ministry of Education and Sports, Ministry of ICT and National Guidance, and National Library of Uganda can lobby and advocate for it at the Parliament. Once it is appreciated at the national level it will be great for everyone. It will not only encourage universities but also Ministries, Departments and Agencies. Once they have a national data repository it will promote research and national development".

The need to have seminars, workshops, and campaigns to promote the adoption of Linked Data among users was suggested. In this regard, the respondent said:
"Linked data is a new concept for us, and I also believe for the librarians; therefore, there is a need to have training, seminars and workshops to sensitise us and the users on what Linked Data is about and how it can benefit us and then we can be able to champion for it. Expertise in technical skills on how to actually use the technologies as well as identify communities that may be introduced to Linked Data."

The issue of top management support was again raised, and it was pointed out that there was a need to lobby for support from top management to facilitate IT infrastructure and innovations that the universities will use. Respondent HIT-5 said:
"I think Linked Data technologies require better IT infrastructure that we may not have now. Therefore, there is a need to lobby top management to increase the IT infrastructure budget which will be used to facilitate the adoption and implementation of Linked Data".

Finally, the respondents pointed to university libraries needing to mobilise resources to assist in the implementation of Linked Data technologies. Respondent HIT-2 said:
"Even if an innovation is good but there are no resources (human, financial or IT infrastructure), it will not be possible to implement it. University libraries need to first seek funding and benchmark with other institutions implementing it so that they find ways how they can adopt it through writing proposals for funding justifying its importance."

5.3 Summary

This chapter presented the findings from the data collected from the professional librarians and the heads of the library technical services using an online questionnaire. It also presented the findings from the university librarians and the heads of IT of the various universities using interviews conducted, mainly by telephone. Questionnaire findings were presented in tables, graphs and, in the case of interview responses, in the form of text. Findings relating to each of the four groups of respondents comprising the sample were presented separately. The findings, which included specific demographic characteristics of the four groups, were presented in the light of the research questions underpinning the study.

Chapter Six follows and comprises the discussion and interpretation of the findings presented in this chapter.

CHAPTER SIX

DISCUSSION AND INTERPRETATION OF FINDINGS

6.1 Introduction

This chapter interprets and discusses the results presented in Chapter Five. Interpretation and discussion of the research findings are needed to make meaning and sense of the findings. According to Dunton (2021), the discussion reviews the research findings and connections between each part of the research. The interpretation and the discussion follow the sub-themes of the study as drawn from the research questions and the two theories used to underpin the study. The study aimed to explore the adoption of Linked Data among the university libraries in Uganda.

The study employed the UTAUT and the DOI theory as the theoretical framework. An online questionnaire was used to collect quantitative data from the professional librarians and heads of the library technical services. Semi-structured interviews were used to collect qualitative data from the university librarians and heads of IT. SPSS version 21.0 was used for the quantitative data analysis, while the qualitative data was analysed using thematic content analysis. The discussion of the findings is arranged according to the research questions guiding the study. These were:

1. What is the level of awareness of Linked Data among professional librarians in Ugandan university libraries?
2. What is the extent of Linked Data adoption in Ugandan university libraries?
3. What are the benefits of Linked Data adoption in Ugandan university libraries?
4. What factors influence the behaviour of professional librarians towards the adoption of Linked Data in Ugandan university libraries?
5. What strategies can be used to promote the adoption and use of Linked Data in Ugandan university libraries?

The chapter begins with a discussion of the demographics of the study participants. It then, as outlined above, discusses the research findings in light of the research questions posed, the literature review, and the theoretical framework adopted.

6.2 Demographics of the respondents

The respondents who participated in the study are described in terms of their gender, age, educational qualifications, and length of time at the university library (the latter did not apply to the heads of IT).

6.2.1 Gender, age, and educational qualifications of the respondents

Professional librarians

The study surveyed a total of 122 professional librarians. In terms of gender, the respondents were almost evenly spread, with males, 62 (50.8%), being in a slight majority. This finding does tend to contradict Namaganda (2019) who asserts that females dominate the LIS field within the public university libraries in Uganda.

In terms of age and education, the highest number of respondents, 40 (39.4%), were in the age range 31-35 years and 36-40 years and had attained a bachelor's degree. Ten (8.2%) respondents were in the age range 41-45 years and had attained a master's degree and two (1.6%) in the same age range had attained a PhD. These findings indicate that the majority of the respondents had attained a bachelor's degree and were in the age range of 31-40 years. The respondents are still relatively "young" and this suggests that they will easily further their education and training in new technologies such as Data Linking. The theoretical model of the UTAUT suggests that how the complexity of technology is viewed may be determined by gender, age and experience. Venkatesh et al. (2016) noted that performance expectancy of the intention to use a new technology is stronger for younger people than older people. This implies that since a majority of the professional librarian respondents were in the younger age group, they are more likely to easily accept and adopt Linked Data to enhance their job performance. Their "older" counterparts may be less inclined to do so and may be more concerned about the ease of use of Linked Data technologies.

Heads of library technical services

The majority of the heads of the library technical services that participated in the study were female, that is, nine (64.3%) while five (35.7%) were male. The findings revealed that three (21.4%) respondents in the age range 36-40 years had attained a bachelor's degree and three (21.4%) in the same age range had attained a master's degree. A further three (21.4%) respondents in the age range of 46-49 years had attained a master's degree.

University librarians

Of the 14 university librarians who participated in the study, nine (64.3%) were female and the remaining five (35.7%) were male. The highest number of respondents, five (35.7%), in the age range 41-54 years had attained a master's degree compared to three (21.4%) in the same age range who had attained a PhD. Interestingly, only 21.4% of the respondents had attained a PhD despite that qualification being one of the requirements to become a university librarian. It must, however, be noted the majority of respondents were employed in acting capacities and indicated that they were pursuing their PhDs.

Heads of IT

All 10 (100%) respondents were male. The highest number of respondents, three (30%), in the age range 31-35 years had attained a master's degree compared to one (10%) in the same age range who had attained a bachelor's degree.

6.2.2 Duration at the university library

The study sought to determine how long the respondents had been at the university library. A third, 41 (33.6%), of the professional librarians indicated that they have worked at the university library between 10-15 years, while only two (1.6%) have worked for less than one year. On the other hand, the majority of the heads of library technical services, eight (71.4%), have worked at the university library for 10-15 years This implies that since the majority of the librarians have worked in university libraries for 10 or more years, they have gained experience in using the library systems and thus may find it easier to accept and incorporate Linked Data in their work. The study by Rahman, Jamaludin and Mahmud (2011) on the

intention of Malaysian postgraduate students to use digital libraries noted that experience in using a digital library significantly interacts with effort expectancy and intention to use such a library.

6.3 Level of awareness of Linked Data among the professional librarians

The first research question of this study sought to determine the level of awareness of Linked Data among professional librarians in Ugandan university libraries. To answer this question, the researcher was guided by the facilitating conditions and social influence constructs of the UTAUT and the observability construct of the DOI theory. Creating awareness of Linked Data can be done through different communication channels which libraries may use. The findings revealed that facilitating conditions and social influence were important factors that influenced the adoption and implementation of Linked Data in the university libraries involved in the study.

6.3.1 Facilitating conditions of Linked Data among the professional librarians

One of the aspects of the research question was to establish whether the librarians were aware of Linked Data and the facilitating conditions for its adoption. The UTAUT model explains facilitating condition as the degree to which an individual believes that an organisation and technical infrastructure exists to support the system (Venkatesh et al., 2003). In this study, facilitating conditions were regarded as the awareness of the Linked Data concept, its principles, and other university libraries' approaches to it, all of which can foster the adoption of Linked Data.

The results revealed that the majority of the respondents were aware of the Linked Data concept and its use in publishing, sharing and interlinking structured data on the Web. In addition, they were also aware of other university libraries' adoption of Linked Data for data sharing and reuse. This implies that professional librarians are most likely to accept and use Linked Data since they are aware of the concept and that other university libraries have already adopted it. This finding is consistent with what was reported by Venkatesh et al. (2003) in terms of facilitating conditions influencing the use of the system.

However, the finding contradicts the findings of a study by Tibenderana and Ogao (2008) who applied the UTAUT to determine end users' acceptance and use of hybrid services in Uganda. Their study revealed that the most prominent factor that contributed to the non-acceptance and use of e-library services was the lack of awareness among the end-users.

6.3.1.1 Awareness of the Linked Data concept

The responses from the professional librarians indicated that 85 (70%) of the 122 respondents were aware of the Linked Data concept. Seven (50%) of the heads of library technical services stated that they knew Linked Data. This may be due to exposure to the Linked Data concept and other emerging technologies during the Covid-19 pandemic, where such workshops and conferences were attended virtually without any financial implications. However, this was contradicted by the university librarian who believed that their library staff were not aware of the Linked Data concept. Respondent UL-1 said:

"I don't think the librarians have knowledge about Linked Data because they have not informed me."

Similarly, respondent UL-3 said:

"None of the librarians has shown any knowledge about Linked Data; in case they have known then they may have just decided to keep it to themselves or are waiting for an opportune time to share with me or the rest of their colleagues."

The findings of this study contradict those of earlier studies (Hallo et al., 2014; Warraich and Rorissa, 2018b; Raza et al., 2019; Niu, 2020b). These studies found that there is a general lack of awareness of the basic concepts of Linked Data and the Semantic Web among librarians and information professionals in both developed and developing countries which hinders the adoption and implementation of Linked Data. This was also confirmed by Hallo et al. (2014) and Mulumba (2022) who asserted that in developing countries the adoption of Linked Data has not been promising because of a lack of awareness and technical staff with knowledge of these new technologies. A study by Unterstraßer (2023) further revealed that the Linked Data concept seemed hard to understand especially for people who lacked the in-depth knowledge of the Semantic Web. This is because Linked Data is still new to many

librarians, and some may not even be aware of the Linked Data technologies used (Faith and Chrzanowski, 2015).

6.3.1.2 Linked Data awareness and best practices

One hundred and eight (89%) professional librarians indicated that they were aware that Linked Data offers best practices for publishing, sharing, and interlinking data on the Web for better global accessibility. Seven (50%) of the heads of library technical services corroborated that they were also aware of Linked Data best practices for publishing, sharing and interlinking data. The finding of this study corroborates with those of Warraich and Rorissa (2018). In a similar study, they found that information professionals in Malaysia perceived Linked Data as having the potential to publish and interlink their hidden data on the Web for better global accessibility. The key concept of Linked Data is to publish structured data on the Web in an interoperable, machine-understandable way so that it can be accessible to both humans and computers (Gaitanou et al, 2022; Warraich and Rorissa, 2018b). Carlson, Lampert, Melvin and Washington (2020) noted that whereas the library community has managed to provide machine-readable, structured data, Linked Data has not been fulfilled and, therefore, a lot of progress still needs to be made. Linking library collections to external data sources enables information and data service providers to make their collections widely available and accessible (Warraich and Rorissa, 2022:2 and Gaitanou et al., 2022). Unfortunately, this is the case with developing countries, including the linking library collections.

6.3.1.3 Awareness of Linked Data adoption by other university libraries

The vast majority of professional librarians, 110 (90%), were aware that some universities had adopted Linked Data for their data sharing and reuse. This finding corroborates with Papadakis et al. (2015) who indicated that libraries worldwide seem to embrace Linked Data and several institutions have either implemented or are planning to publish their data as Linked Data. According to Omitola et al. (2010), Queen's University in Australia and North Carolina State Libraries in the USA have adopted Linked Data for interlibrary exchange and reuse of data and to make it available to the general public (Neubert and Tochtermann, 2012).

6.3.2 Social influence concerning Linked Data among the professional librarians

The UTAUT model conceptualises social influence as the extent to which an individual perceives that others believe they should use a particular technology (Venkatesh et al., 2003). In this study, social influence was regarded as awareness about the acquisition of infrastructure by the university, the use of the university library's URIs to link data, and the Web interface to enable patrons to find and search published datasets. The results revealed that 32 (26.3%) professional librarians were unsure and 30 (24.6%) disagreed that their university had acquired the necessary infrastructure. In addition, 30 (24.6%) were unsure and 27 (23.8%) disagreed about their university library's use of URIs to link data. This implies that the adoption of Linked Data may not be influenced by the social influence construct. The finding corroborates Andrews et al. (2021) who asserted that social influence does not have any significant effect on the librarians' intentions to adopt AI and related technologies. Similarly, Saulus, Mutula and Dlamini (2017) applied the UTAUT model to investigate the technology acceptance factors in the use of the IR at the University of Eswatini Faculty of Agriculture and Consumer Sciences. Their findings confirm that the use and acceptance of the IR are not influenced by the social influence construct.

6.3.2.1 Linked Data awareness in terms of the university infrastructure

A study by Hannemann (2013:4) revealed that for an institution to set up a Linked Data service, they need to have a specific amount of infrastructure in place. The responses from the professional librarians in this study show that slightly more than half of the respondents, 62 (50.9%), were not aware that their universities had acquired the necessary infrastructure to facilitate data sharing with other universities. This finding corroborates a finding by Hannemann (2013:4) which revealed that technological options for Linked Data technologies are still in development with poor documentation that would be used by institutions wanting to adopt and implement Linked Data. The majority of university libraries in Uganda and other developing countries do not have established IT infrastructure to facilitate data sharing. The university libraries may therefore utilise already established infrastructure like Wikidata. Hawkins (2022) recommends the use of Wikidata, a Wikimedia Foundation project, to overcome some of the infrastructure challenges. For example, some of the cultural heritage

institutions that have drawn in authority data from Wikidata to their datasets, include the Library of Congress and WorldCat, among others (Thornton, 2017). The Penn University Libraries have also added their collections to Wikidata, an open and easily editable type of Linked Data dataset (Ortenberg, 2021). The Oregon State University libraries, on the other hand, developed a Linked Data metadata infrastructure called Oregon Digital for its digital collections, repository functionality, and interoperability with other related resources on the Web. According to Garoufallou and Papatheodorou (2014), Wikidata offers new opportunities for cultural heritage professionals to participate in the Linked Data community by saving time and energy. The benefits of being linked to Wikidata include rich results enhanced and connected to repositories to increase visibility and establish a strong online presence (Garoufallou and Papatheodorou, 2014).

6.3.3 Observability among the professional librarians

The DOI theory is considered one of the most appropriate theories that can be used to investigate the adoption or non-adoption of technology in higher education and other educational environments (Nazari, Khosravi and Bablhavvaeji, 2017). The diffusion of innovation process is described by Rogers (1998) as "an information-seeking and information-processing activity" where individuals use information about an innovation to determine whether or not they will adopt (use) the innovation. Linked Data is an innovation whose adoption may be limited.

Librarians, as key players in the diffusion of information to others, are potentially powerful advocates for the adoption of new technological innovations like Linked Data. The librarians are considered leaders in the adoption of technologies, as long as the technologies are useful for their library services (Lund et al., 2020). As indicated by the DOI theory, the professional librarians will only support the diffusion of innovations that they find valuable, and which do not threaten their jobs.

The DOI theory has been used in several impactful studies in the LIS field. For example, Neo and Calvert (2012) applied the DOI theory to study the diffusion of social media innovations in New Zealand public libraries. Similarly, Liu and Hsu (2018) applied the DOI theory in

their study on the integration of technology into library information services. Qazi, Raza and Shah (2018) applied the DOI theory to study the acceptance of e-books among university students in developing countries. Finally, Lund et al. (2020) applied the DOI theory to examine the alignment between adopter categories among librarians and their perspectives toward AI technology.

Results from this study revealed that a majority of the respondents agreed with all four observability attributes. However, many respondents disagreed or were unsure about the four attributes. This implies that the professional librarians who have recognised the value of Linked Data are most likely to adopt and use it and even influence their sceptical colleagues. These findings corroborate a study by Menzli, Smirani, Boulahia and Hadjouni (2022) that investigated open educational resources (OERs) adoption in higher education. Their study found that observability showed that most of the faculties in the study recognised the value of OERs and were willing to commit to their use and adoption. Observability plays a role in the adoption of Linked Data, especially if professional librarians appreciate the positive impact of Linked Data on other libraries. Hence, from this study, observability will influence the adoption of Linked Data.

6.3.3.1 Observation of Linked Data benefits

The DOI theory seeks to explain how, why, and at what rate new ideas and innovations/technology spread through cultures.

Reponses from the professional librarians show that over half of the respondents, 78 (63.9%), indicated that they were influenced by observing the benefits of using Linked Data. The majority of librarians learnt about new emerging technologies through being exposed to the experiences of other institutions, and through conferences and online blogs, among others (Niu, 2020b). According to Rogers (2003), observability describes the degree to which the result/s of an innovation is/are visible to the adopters. Therefore, if there are positive outcomes regarding the adoption and implementation of the innovation, then the innovation is likely to be adopted. This is true from the responses of the professional librarians.

6.4 Extent of Linked Data adoption in Ugandan university libraries

The second research question sought to establish the extent of the adoption of Linked Data in Ugandan university libraries. To answer this question, the researcher was guided by the effort expectancy and facilitating conditions constructs of the UTAUT. In addition, the trialability construct of the DOI theory was also used. The effort expectancy is posited in the UTAUT because it directly affects the use of the technology. For example, if Linked Data is perceived to be easy to use then the librarians will find it easier to adopt. The facilitating conditions construct is posited in the UTAUT because it directly affects the usage behaviour of users in a technological environment.

This section discusses the research findings on the extent of adopting Linked Data in the university libraries that were presented in Chapter Five.

6.4.1 Effort expectancy of Linked Data among the university librarians

The UTAUT model effort expectancy construct is defined as the degree of ease associated with the use of the system (Venkatesh et al., 2003). This implies that if Linked Data technology is perceived to be easy to use and does not require a lot of technical skills or training, then the librarians will most likely adopt it.

Findings from the study revealed that while many of the professional librarians believed that Linked Data technologies do not require a lot of effort to use, 64 (52.4%) respondents were either unsure or disagreed. Similarly, many respondents believed that Linked Data requires a lot of technical knowledge and trial for them to be convinced to use it. The majority of these professional librarians are not involved in the library technical services, they, will require a lot of technical knowledge and trial to use Linked Data. Fortunately, they believe that Linked Data technologies do not require a lot of effort to use and, hence, may not be resistant. This implies a need to change the perceptions of professional librarians towards the adoption of Linked Data. Based on the results, it can be concluded that the adoption of Linked Data by the professional librarians is likely to be influenced by the effort expectancy construct. A study by Zainab, Kiran, Karim and Sukmawati (2018), revealed that if the librarians are

confident that a system is easy to use, with least effort, and contributes to completing their task with little assistance then they would readily use the system. On the contrary, a study by Owolabi, Adeleke, Tella and Mudasiru (2021) which examined librarians' behavioural intentions to adopt big data technology in Nigerian universities, found that effort expectancy did not influence the behavioural intention of the librarians to adopt big data technology. This is not the case with this study since Linked Data is an emerging technology that requires a mindset change from the traditional library methodologies. Hence, the effort expectancy construct will influence the adoption of Linked Data technologies.

6.4.1.1 Ease of use of Linked Data

The responses from the professional librarians in this study show that over half of the respondents, 72 (59.1%), indicated that they believed that Linked Data is easy to use. The extent to which a potential user perceives that the use of Linked Data technology will be free of effort will directly influence its perceived usefulness. According to the UTAUT construct of effort expectancy, the degree of ease associated with the use of the system determines whether the system will be adopted or not (Venkatesh et al., 2003). In this case, since a majority of the respondents believe that Linked Data is easy to use, they are more likely to adopt and implement it in their university libraries. This was also confirmed by 64 (52.4%) respondents who indicated that they believed Linked Data does not need a lot of effort to use. Usually, new technologies that are easy to use do not face resistance from the users because they easily adapt to it, which is not the case with new technologies that are deemed very difficult to use. This finding corroborates with Laitenberger and Dreye (1998), who noted that users accept software tools if they find them effective and easy to use. For example, they noted that users preferred using Web-based inspection data collection tools over paper-based forms for data collection inspection because they were effective and easier to use. From the findings, the effort expectancy will influence the adoption of Linked Data since the majority of the respondents believe that Linked Data is easy to use.

6.4.1.2 Linked Data and technical knowledge

According to Wang and Yang (2018), Linked Data is complex, and many people have difficulty understanding its technical details and potential for the library community. In

developing countries, the adoption of Linked Data has not been promising due (amongst other reasons) to the lack of technical staff with knowledge of Linked Data technologies (Hallo et al., 2014; Mulumba et al., 2017)

The responses from the professional librarians revealed that a majority of the respondents, 74 (59.0%), believed that Linked Data requires a lot of technical knowledge, while 64 (52.6%) respondents believed that they needed a trial to be convinced to use Linked Data. In addition, 79 (64.8%) respondents indicated they were convinced that using Linked Data is better than traditional library technologies. For users to adopt a new system, they need to acquire technical knowledge to utilise it effectively. Therefore, it is not surprising from the responses that the professional librarians believed that Linked Data requires a lot of technical knowledge and a trial before they are convinced to use it. A finding by Okoroma (2023:34) revealed that a majority of librarians in Nigeria have not adopted Linked Data in their institutions because they lack the knowledge and proper training. A study by Warraich (2016) recommended that substantial training programmes are needed for information professionals to get them updated with Linked Data technologies. Warraich (2016) asserted that in the adoption of an innovation, there might be a need to acquire new knowledge and, in the case of this study, training in the use of Linked Data technologies. Zengenene (2013:86) recommended that librarians need to transform their expertise in working with metadata into expertise in working with ontologies or models of knowledge that Linked Data technologies use so that their libraries can fully participate as information providers in this digital age. Unterstraßer (2023) recommended that library professionals support one another, especially those from smaller libraries that may struggle to find people with sufficient Linked Data expertise to transform their systems. Whereas Venkatesh et al., (2003) indicated that the degree of ease associated with the use of the system will influence its adoption. This study also notes that professional librarians must have the technical knowledge to use Linked Data technologies before determining whether it's easy or difficult to use.

6.4.2 Facilitating conditions and adoption of Linked Data

The UTAUT's facilitating conditions construct represents organisational support for using the technology or innovation (Venkatesh and Bala, 2008). Many studies involving librarians

have shown that the lack of organisational and technical infrastructure results in low adoption rates for an innovation (Lwoga and Questier, 2015; Saravani and Haddow, 2011). This study reported that facilitating conditions in terms of training, technological infrastructure support, specialised IT personnel for technical assistance, the allocation of finances (a budget), and the library technical team all influenced the adoption of Linked Data by the professional librarians. The results revealed that the majority of the respondents agreed with the attributes regarding the facilitating conditions. Similarly, several respondents disagreed or were unsure of the availability of necessary conditions to facilitate the adoption of Linked Data in their university libraries. Based on the results it can be concluded that the facilitating conditions construct is likely to influence the respondents' decision to adopt Linked Data. This finding is in line with the study by Hamzat (2018:14) who noted that facilitating conditions in terms of technical infrastructure, accessibility, human resources, and skills had a significant positive impact on the use of a digital library by engineering lecturers. Similarly, a study by Musa (2016) applied the UTAUT to explore the factors that influenced the use of open-access resources for research productivity by academic librarians in federal universities in the North-Western states of Nigeria. The study found that almost all facilitating factors were considered as either important or very important determinant factors for using open-access resources by approximately 75% of all the respondents.

6.4.2.1 Linked Data training

The findings revealed that 71 (58.2%) respondents indicated that they have not been provided with the required training to adapt to using Linked Data. Studies by Okoroma (2023:35) and Ashiq and Warraich (2022) revealed that lack of proper training and limited training opportunities for data roles are hindering the adoption of Linked Data in libraries. This finding concurs with the situation in Uganda and other developing countries. Professional librarians do not have data management knowledge and skills, which, unfortunately is not taught at the LIS schools. The librarians who may have the knowledge is due to their own initiative for personal development. Furthermore, a study by Warraich (2016) asserted that substantial training programmes for information professionals to get them updated with Linked Data applications are needed. For example, through countless hours of webinars,

workshops and exercises, the cataloguing staff learned how to tease MARC data and put it back together in RDF triples (Shieti and Reese, 2015; Williams, 2021).

Furthermore, Stanford University Libraries with the Council on Library and Information Resources (CLIR) conducted workshop training on Linked Data which increased familiarity and learning among the librarians (Keller et al., 2011; Williams, 2021). Other libraries such as the University of Nevada Las Vegas (UNLV) and the University of Florida (Niu, 2020b), have created Linked Data study groups to keep abreast of Linked Data initiatives. Some metadata librarians or cataloguers have made extra efforts to learn programming skills or conduct some tasks that could be easily done by future software, such as constructing SPARQL queries or writing RDF graphs in Turtle language (Mitchel, 2016). The study by Unterstraßer (2023:45) emphasised the need for library professionals to acquire Linked Data competencies instead of hiring new people or creating new job positions such as "Linked Data Librarian". Warraich (2016:706) and Warraich and Rorissa (2022) also recommended that substantial training programmes and ICT skills are needed for information professionals to get updated with Linked Data technologies.

6.4.2.2 Institutional technological infrastructure support for Linked Data

Just over half of the professional librarians, 67 (54.9%), indicated that their institutions had not provided the university libraries with the technological infrastructure support required to facilitate the adoption of Linked Data. A study by Wang and Yang (2018:13) asserted that big libraries and organisations are the ones with the technical expertise and financial resources to devote to the testing and development of Linked Data projects. They further noted that the majority of small libraries, including those in developing countries, are instead watching and waiting rather than participating in this initiative because they do not have the needed infrastructure in place. Whereas university libraries in developed countries may have technological infrastructure institutional support due to the benefits alluded to Linked Data. There seems not to be any or minimal institutional support for Ugandan universities because such emerging technologies are not given top priority which makes it difficult for them to adopt and implement Linked Data technologies. Okoroma (2023:35) found that the majority of institutions and libraries have poor infrastructure and other cutting-edge facilities that

hinder their adoption of Linked Data. Hannemann and Kett (2010) indicated that the Linked Data movement is relatively new, and the technological options are still largely in development with poor documentation making it a challenge for new institutions to adopt. The findings by Ashiq and Warraich (2022) and Okoroma (2023:35) revealed that there is a lack of infrastructure and systems, poor infrastructure, and high cost of infrastructure mitigating the adoption of a system. Unfortunately, many institutions cannot afford them, especially in the context of an economic downturn.

Several studies involving librarians have shown that the lack of organisational and technical infrastructure will result in a low adoption rate of a technology or system and this also applies to the adoption of Link Data (Lwoga and Questier, 2015). For example, Lwoga and Questier (2015) found that the low adoption of open access by both faculty members and librarians was due to low support and, importantly, the lack of ICT infrastructure. This finding confirms that the UTAUT model prediction that organisational and technical infrastructure influences the adoption and use of technology (and in the case of this study, Linked Data). Most of the professional librarians and university librarians in this study acknowledged that their institutions had not provided them with the technological infrastructure to support the adoption of Linked Data; however, the heads of IT said otherwise. The support of institutions is crucial to the adoption of Linked Data; without their support, university libraries would not have much to do.

6.4.2.3 Linked Data and specialised IT personnel for technical assistance

A third of the professional librarians, 41 (33.6%), agreed that their institutions had acquired specialised IT personnel to provide technical assistance to the library staff regarding the use of Linked Data technologies; however, over half of the respondents (53.6%) were unsure or disagreed that their institutions had acquired the specialised IT personnel to provide the technical assistance they needed. This may be because the professional librarians had not interacted with the IT staff to ascertain whether they had the expertise or not, usually, the libraries work in isolation from the IT department or train their staff to gain the IT skills, so that they do not have to rely on the IT staff. This finding concurs with Okoroma (2023:35), who noted that while there are complex technological issues related to the adoption of Linked

Data in universities, the IT teams lack the expertise needed to implement Linked Data technologies in their universities (Nwa, 2023:36).

6.4.2.4 Linked Data and the allocation of finances

According to Faith and Chrzanowski (2015:122), libraries have started investing their resources into Linked Data. This shows that there is now potential to transform library service delivery to benefit librarians as workers, software vendors, users, and libraries as institutions (Ogar and Tangkat, 2018). Thirty-five (28.7%) professional librarians in the study were unsure as to whether there was a financial budget allocated to facilitate data sharing and its reuse in their libraries and 33 (27.0%) respondents indicated that they do not have a financial budget to facilitate the adoption of Linked Data. Ugandan university libraries like other libraries in developing countries have challenges regarding budget allocation of resources because they are not considered priority, especially when other pressing activities are needed. Data sharing may not be considered a priority, especially when they can access other information resources. It is not therefore surprising to note that the librarians are unware of a financial budget allocated to facilitate data sharing. Since there is a belief that university libraries can access open or free systems and is not considered one of the major priorities. This finding corroborates with the study of Okoroma (2023:35) which revealed that there is inadequate funding for academic libraries in Nigeria. As pointed out earlier, Wang and Yang (2018: 13) noted that only big libraries and organisations have the financial resources to devote to the test and development of Linked Data projects. Several library research activities and experimental projects are funded externally while many of the research activities related to the early adoption of Linked Data are without external funding because of the high costs involved. This was also confirmed by Cagnazzo (2017:17) who pointed to the lack of resources as one of the primary obstacles for institutions interested in adopting Linked Data. Warraich (2016:706) recommended investing financial resources to foster research and set Linked Data best practices in libraries and other cultural heritage institutions.

6.4.2.5 Linked Data and the libraries' technical teams

LOD offers much potential for cultural heritage institutions like libraries to make their data and collections available on the Web. For libraries to fully participate in the Linked Data

community and movement, they need to have technical expertise. The findings revealed that 61 (50%) respondents agreed that their libraries have established library technical teams to ensure data sharing and its reuse. However, the same number, 61 (50%), of respondents were unsure or disagreed. Libraries are required to have a technical team who provide technical services such as cataloguing, digitisation and data management, among others. According to Saleem et al. (2018), knowledge and awareness about Linked Data is still an issue and requires an institutional willingness to share data. Hawkins (2022:329) noted that one of the challenges of publishing and producing Linked Data is the lack of skilled human resources within the profession. Zengenene (2013:86) recommended that the librarians need to transform their expertise in working with metadata into expertise in working with ontologies or models of knowledge so that their libraries can fully participate as information providers in the digital age.

6.4.3 Trialability of Linked Data adoption among the professional librarians

The DOI theory was used to examine the trialability of the adoption of Linked Data among the professional librarians. The study adopted this construct to establish the extent of Linked Data adoption in Ugandan Universities. Librarians are potentially powerful advocates for the adoption of new technological innovations (Lund et al., 2020:869). From the analysis of the results on trialability, it can be inferred that the professional librarians believe that the use of Linked Data requires technical knowledge and IT skills. They also believe that transition from the traditional tools to Linked Data in the libraries may be a challenge because the Linked Data tools appear complicated. The professional librarians, therefore, believed that a trial run is required before they can adopt and implement Linked Data. Rogers (2003) posits that trialability is fundamental to the adoption and use of technology because it provides librarians the opportunity to learn and practice before they adopt it.

6.4.3.1 Linked Data technical knowledge and IT skills

From the analysis of the results on trialability, it can be inferred that 85 (70%) professional librarians in the selected universities for this study indicated that using Linked Data would require someone with technical knowledge and IT skills. This view is supported by Mulumba et al. (2017) who noted that Linked Data adoption has not been promising in developing

countries because of a lack of technical staff with knowledge of these new technologies. This was confirmed by the heads of library technical services and the university librarians who indicated that the implementation of Linked Data technologies requires staff with an IT technical background. For example, George Washington University Libraries trained its cataloguing staff by providing Linked Data knowledge and skills through webinars, workshops, and exercises (Shieh and Reese, 2015). Moi (2020) asserted that one of the obstacles to the adoption of Linked Data technologies is the lack of expertise and knowledge about the implementation process of these new technologies. Hawkins (2022:329) emphasised that some of the challenges of publishing and producing Linked Data include technological issues. Mitchell (2016) noted that those libraries, considered to be the early adopters of Linked Data, have had both the financial and technical capacity to do so.

However, a finding by Niu (2020b) contradicts the findings of this study. According to Niu (2020b), a library does not need to know the technical details of Linked Data, or even know what Linked Data is all about, as long as they are able to use the Linked Data functionalities of the newly adopted software platform. He believes that since the librarians already know how to use several repositories, they should find it easy to adopt and implement Linked Data technologies. According to this current study, the university libraries already have an established library technical team, which should be able to transfer their expertise and technical IT knowledge with the rest of the library team. This will enable them to appreciate the Linked Data technologies.

6.4.3.2 Linked Data trial run

According to Rogers (2003), trialability determines the extent to which an innovation may be experimented with on a limited basis. Since Linked Data is still a "new" innovation, university libraries may need to first experiment with it to determine its practicability before adopting it. This is because such innovations require an investment in time, energy, and resources before being implemented.

The findings revealed that the vast majority of the professional librarians, 112 (91.8%), preferred to first experiment with how Linked Data works before adopting and implementing

it. This was confirmed by 91 (74.6%) respondents who indicated that it would be better and easier for them to use Linked Data technologies after ascertaining that other institutions have successfully implemented them. This was also confirmed by the heads of library technical services who indicated that university libraries first experiment with how Linked Data works before adopting and implementing it. Just like any other system, Linked Data requires the university libraries to first try it on a particular dataset and get feedback from the users before it can be fully adopted. This finding corroborates with Mitchell (2016) who pointed out that several libraries, before fully adopting Linked Data, start with individual collections or library functions such as converting cataloguing workflows to the Linked Data environment or a Linked Data-enabled digital repository system. Warraich, Rorissa and Rasool (2021) noted that libraries are willing to adopt Linked Data technologies even though these initiatives are still at the infancy level. For example, a study by Okoroma (2023:34), revealed that seven percent of the libraries in Nigeria were still in their Linked Data adoption infancy. Similarly, a study by Warraich and Rorissa (2020) revealed that Linked Data technology applications in Pakistan are also still at the infancy level. It is, therefore, commendable to provide a trial period or basic features used by the commercial application developers of these systems (Masrek and Hussein, 2021:43). Hence, trialability will influence the adoption of Linked Data, especially when the users are able to successful run a trail on it.

6.4.3.3 Linked Data tools complicated usage

Rogers (2003) noted that the more complicated a technology or system is, the slower its speed of adoption. The current study revealed that 44 (36.1%) professional librarians were not sure whether Linked Data tools were complicated to use while 35 (28.7%) indicated that they were not complicated to use. Scott and McGuire (2017) pointed out that individuals are more likely to adopt an innovation that is not complicated to use and has a relative advantage over the existing systems and their needs. The professional librarians expressed a willingness to learn about Linked Data technologies so that they can improve the sharing and reuse of data in their institutional libraries.

6.4.3.4 Transition to Linked Data in the library

According to Rogers (2003:13), an innovation is an idea, or technological project that is perceived as new by an individual or other unit of adoption. Since libraries are already using other library standards like MARC, Linked Data would appear to be new and, therefore, will require the libraries to transition to the technology. Just over a third, 44 (36.1%) of the respondents were unsure as to whether transitioning to Linked Data in the library would be a big challenge or not. However, 35 (28.7%) professional librarians did not believe that the transition would be a challenge while 33 (27.0%) thought that it would. The heads of library technical services, the university librarians, and the heads of IT confirmed that the libraries may indeed find the transition to Linked Data a significant challenge due to the lack of expertise and infrastructure, and the limited budget to finance its adoption.

The above findings corroborate a study by Williams (2021) who found that making a complete transition to a new encoding scheme would be a big challenge for many libraries that have not adopted RDA. Unterstraßer (2023:49) noted that the MARC21 format may be difficult to do away with since most libraries are dependent on it to receive their data. However, libraries like UCLA have published a library guide which provides "Semantic Web and Linked Data" access for those library communities in the transition phase (UCLA Library, 2022). Respondents in the study by Unterstraßer (2023:47) pointed out that switching from MARC21 to RDF and BIBFRAME would provide higher-quality bibliographic data and enable cataloguers to easily identify any errors. To transition from human-readable records to knowledge graphs, the library professionals would need to acquire new skills for the associated tasks (Godby, Smith-Yoshimura, Washburn, Knudooli, Detiling, Fernesebner, Folsom, Li, McGee, Miller, Eslao, Moody, Thomas and Tomren, 2019). Interestingly, a study by Park and Tosaka (2017) found that library staff, after testing with Linked Data technologies, never went back to cataloguing with AACR.

The findings revealed that complications in the use of Linked Data were not considered to be an influencing variable. While many of the respondents agreed with the rest of the instances, very few disagreed or gave neutral responses regarding the trialability variable vis a vis the adoption of Linked Data technologies. Based on these results, it can be concluded

that the trialability variables will influence the professional librarians' decision to adopt Linked Data technologies.

6.5 Perceived benefits of adopting Linked Data in university libraries

This section discusses the research findings in terms of the third research question, namely, the perceived benefits of adopting Linked Data in the university libraries that were presented in Chapter Five.

It is evident that several benefits can accrue to libraries that adopt Linked Data. Studies have shown that the interest of LAMs in Linked Data is becoming widespread and has gained acceptance to the extent that the term Linked Data is now finding its way into the vocabulary of librarianship (Miller and Westfall, 2011; Guerrini and Possemato, 2013; Heitmann et al., 2014). Unterstraßer (2023) noted that although Linked Data is still in its beginning stages of implementation in the library community, librarians are confident that it will bring transformative benefits. Currently, Linked Data is significantly impacting library practice in different ways including knowledge and information organisation in the digital age. Libraries have now started investing resources in Linked Data (Faith and Chrzanowski, 2015:122). The study's results indicate that the majority of the respondents (from all four groups) agreed that Linked Data will reduce the unnecessary duplication of data and improve users' overall search experiences. The linking of data from university libraries to the Web will be useful for library patrons to find content on the Web and assist them in discovering relevant information and data. Furthermore, the potential to interlink and publish libraries on the Web will increase the exposure of IR collections, enrich research discovery, and create a model that other universities can use.

The UTAUT model predicts technology acceptance and elucidates the actual use of such technologies and systems in organisational settings. The performance expectancy of the system plays a significant role in this process (Venkatesh et al., 2003; Chang, 2012; Chao, 2019). Performance expectancy thus has a significant effect on user adoption. For instance, if librarians believe that adopting Linked Data will improve their job performance and provide better output in data sharing among the university libraries, they are more likely to

adopt it for their university libraries. Mohideen (2017) applied the UTAUT to study the adoption of open-source library information systems among librarians in Malaysia and found that performance expectancy was a significant predictor. A study by Andrews et al. (2021), applied the UTAUT to understand the intention to adopt AI and related technologies among librarians in North America. Their study confirmed that the UTAUT can partially predict the likelihood of AI and other related technology adoption among librarians. The model showed that performance expectancy and attitude to use AI and related technologies had a significant effect on librarians' intention to adopt AI and related technologies. The UTAUT construct of performance expectancy thus represents a critical factor in enhancing or hindering the adoption of Linked Data by university libraries. Based on the study findings, the professional librarians (and the other respondents) are aware of the benefits of adopting Linked Data and therefore are more likely to adopt and use it. This implies that the UTAUT's performance expectancy construct is likely to influence the university libraries to adopt Linked Data. The benefits of Linked Data adoption, as revealed by the study's findings, are discussed in more detail below.

6.5.1 Linked Data reduces duplication of data

Instead of duplicating data that another university library already has, Linked Data will enable other libraries to use the already existing data. This was evident from the responses of 111 (90.9%) professional librarians who agreed that Linked Data would reduce the unnecessary duplication of data that is already available elsewhere while only 11 (9%) of the librarians were unsure or disagreed. This finding was confirmed by the heads of library technical services. In addition, the interviews with the university Librarians and heads of IT confirmed that adopting Linked Data would reduce or eliminate the duplication of data, research, and other information resources among the university libraries. Respondent UL-4 indicated during the interview that currently, each university has its own IR with its own data; however, if these repositories were linked to one central repository into which each university library would be required to deposit its data, this would eliminate the duplication of research and library data. Since libraries collect similar things, they should be able to share data and reuse the descriptions collected by other libraries. This would enable the data to be shared globally

and made available in a Linked Data environment. Thus, libraries would not have to replicate the same data but would share it on the Web.

6.5.2 Linked Data improving users' overall search experience

Linked Data has the capability to open and share materials that are held in the LAMs in ways that are restricted by many existing metadata standards (McKenna et al., 2022). The responses from the professional librarians who took part in the study revealed that the vast majority, 115 (95.2%), believed that the adoption of Linked Data would enable users to search from a wealth of data shared by the various university libraries. This is one of the main goals of Linked Data, that is, to improve accessibility and satisfy the needs of users (Faith and Chrzanowski, 2015; Abdelaziz and Kaffas, 2018).

The finding corroborates with a study by Warraich (2016:1) which found that information professionals believed that Linked Data would improve users' overall search experiences with existing library data. The conversion of bibliographic data into Linked Data will enhance searching and discovery capabilities and make metadata available and authentic datasets accessible through Linked Data technologies (Deliot, 2014; Debruyne et al, 2016; Jalia, 2023). This will enable users to interpret and navigate seamlessly between related entities held in internal and external datasets and hence empower them in complex searches (Haslhofer and Isaac, 2011; Faith and Chrzanowski, 2015; McKenna et al., 2022).

6.5.3 Linked Data increasing richness in overall data

The responses from the professional librarians revealed that the vast majority of the respondents, 115 (95.2%), indicated that linking data from university libraries to the Web will allow for increased richness in overall data. This finding concurs with a study by McKenna et al. (2018) which noted that Linked Data technologies in libraries are significant in making their rich data available on the Web because they make information available in a format easily understood by the common user. For example, Luxembourg, Portugal, Germany, and the Netherlands implemented Linked Data for the enrichment and quality enhancement of their data by establishing links to external resources, thereby improving the

usability of existing datasets. Through the rich linkages with data from trusted sources, libraries can increase the value of their own data.

6.5.4 Linked Data improving library patrons' capabilities to find content on the Web

Using LOD, libraries can create an open, global pool of shared data that can be used and reused to describe resources (Keller et al., 2011). Again, a significant majority of respondents, 93.4%, indicated that Linked Data will be useful for library patrons to find content on the Web. This is because it will enable library patrons to access different kinds of data and content from the Web, which they may not have been able to do while accessing an IR. This finding corroborates with Warraich (2016) who noted that informational professionals were of the view that Linked Data will be useful for library patrons to find content on the Web and it will supplement the library's records from online sources. For example, the University of Victoria Libraries host a wide variety of digital content from its special collections and university archives in addition to content from the faculty, community, and institutional partners (Seeman, Chan and Dykes, 2023). Similarly, Hyku, a turnkey, open-source digital repository offers several features that may appeal to libraries and other cultural institutions, including in-built support for Linked Data and other open standards such as the International Image Interoperability Framework (IIF); viewers for files of different types (images, PDF documents, audio/video); and the ability to serve multiple stakeholders or tenants (Seeman et al., 2023:2). The University of Victoria Libraries' use of Faceted Application of Subject Terminology (FAST) as a faceted Linked Data vocabulary in the vault digital collections platform results, in the author's view, in an intuitive and trustworthy digital collections platform. It has created a data-driven interface that offers browsing and post-search filtering on discrete features of the digital resources that are present in the faceted metadata (Seeman et al., 2023:21).

6.5.5 Linked Data improving the discovery of relevant information

Linked Data allows for the possibility of serendipity in information searching, that is, finding information one did not even know they were looking for, something akin to browsing the library shelves (Gonzales, 2014). The responses from the professional librarians who took part in the study revealed that 118 (96.7%) believed that Linked Data would assist patrons in

discovering relevant information by enabling users to search from a wealth of data shared by the various university libraries. The university librarians agreed, pointing out that Linked Data will help researchers discover more information in their field of research, and hence increase the visibility of the university's research output. Similarly, the study by Warraich and Rorissa (2020:13) found that Pakistani academic librarians believe that Linked Data has the potential to assist library patrons in discovering relevant information through links to repositories. This is one of the basic assumptions of Linked Data technology, namely, to link machine-readable data on the Web. Linked Data is an effective tool for increasing the visibility of resources and collections held by libraries. It allows the Web searcher to refine their search and even suggest new directions or related resources they may also like to see (Debattista et al., 2018; Mandal and Saha, 2022; Warraich and Rorissa, 2022). Hence, this results in improved findability and discoverability of library data online (Hallo et al., 2014; Warraich and Rorissa, 2018a; Gaitanou et al., 2022). Linked Data is an apt solution for exposing library cataloguing data via the Web, for example, publishing the library catalogue will make the data available for discovery on the Web (Williams, 2021).

6.5.6 Linked Data improving the interlinking and publishing of libraries

One of the principles of Linked Data is to interlink data from different libraries or sources and publish it on the Web for accessibility. It was evident from the responses of the professional librarians that the majority, 106 (86.9%), indicated that Linked Data has the potential to interlink and publish libraries on the web. This finding corroborates with Warraich (2016:1) who found that information professionals perceived Linked Data as having the potential to interlink and publish library data on the Web and being able to assist patrons in discovering relevant information through links to other repositories. However, the information professionals in the study by McKenna et al. (2022) found the process of Linked Data interlinking to be particularly challenging because they have to first describe and justify the links required to publish interlink provenance data. Thus, the lack of interlinking across Linked Data projects in LAMs affects the discoverability of their information resources (McKenna et al., 2022). One of the main benefits of Semantic Web/Linked Data is the ability to interlink related entities across datasets. However, such interlinks can only be meaningfully used if their origin and creation processes are exposed to the users (McKenna et al.,

2019:958). Linked Data technologies allow libraries and other cultural heritage institutions to publish their content in an interoperable, machine-understandable way to make it more accessible to both humans and computers (Rousidis, Garoufallou, Balatsoukas and Sicilllia, 2014).

6.5.7 Linked Data increasing exposure of IR collections

LOD provides libraries with an open, global pool of shared data that can be used and reused to describe resources, with a limited amount of redundant effort compared with current cataloguing processes (Keller et al., 2011:12). Instead of requiring data to be accessed using library centric protocols (for example, Z39.50), Linked Data uses well known standard Web protocols such as HTTP and widely used publishing mechanisms and protocols to expose data on the Web (Keller et al., 2011). This is evident from the responses of the professional librarians, 114 (93.5%) of whom were in agreement that Linked Data will increase the exposure of their IR collections to Web search engines. This is because Linked Data allows the LAMs to expose their physical and digital resources to a larger community of potential users (McKenna et al., 2022). With LOD, libraries can increase their presence on the Web, where most information seekers may be found. The openness of data is more an opportunity than a threat. For example, exposed data will be put to unexpected use by someone else (Keller et al., 2011:11). Therefore, linking data for more relevant and empowered searching helps open libraries to a wider world of connected possibilities (Faith and Chrzanowski, 2015). Respondents in the study by Warraich et al. (2021) opined that the visibility of library resources and services should be increased on the Web for a wider audience.

6.5.8 Linked Data enriching research and discovery

LOD is shareable, extensible, and easily re-usable and supports multilingual functionality for data and user services (Keller et al., 2011). Linked Data allows anyone to contribute unique expertise in a form that can be reused and recombined with the expertise of others (Keller et al., 2011). The majority of the professional librarians, 112 (91.3%), agreed that Linked Data should be of benefit to research and discovery, and create a model another university can use. This corroborates with the studies by Wang and Yang (2018) and McKenna et al. (2022) which found that linking data in different parts of the university benefits research, enriches

discovery, and creates a model that can be used by other institutions. This will improve the sharing and reuse of related resources across datasets and institutions. McKenna et al. (2022), however, argued that currently, there is a lack of interlinking across the Linked Data projects in LAMs, which affects the discoverability of their information resources.

Omitola et al. (2010) noted that some universities in developed countries, for example, Queen's University in Australia and North Carolina State Libraries in the USA, have adopted Linked Data for interlibrary exchange and reuse of data to make it available to the general public. Cagnazzo (2017:18) pointed to some national libraries having adopted Schema.org which is a standard for marking up pages with semantic data for better discoverability of their data through search engines. The Library of Congress (2010) acknowledges the benefit of increasing discoverability on the Web; however, their BIBFRAME primer does not directly address how the BIBFRAME model will assist in discoverability in the library. Publishing LOD through visual interfaces maximises information enrichment, contextualisation and discovery, in addition to improving user experience, because of both increased navigation capabilities and interrelationships between data (Alvite-Díez, 2021).

6.6 Factors that influence the behaviour of professional librarians towards the adoption of Linked Data

The fourth research question of the study sought to determine the factors that influence the behaviour of professional librarians towards the adoption of Linked Data in the university libraries. In addressing this question, the researcher was guided by two constructs, namely, effort expectancy and social influence derived from the UTAUT. Effort expectancy is posited in the UTAUT as it indirectly affects technology acceptance and usage, and social influence affects individual consideration for technology use.

6.6.1 Effort expectancy and the adoption of Linked Data

Effort expectancy (EE) is defined as the degree to which an individual believes that using the system will be free of effort (Venkatesh et al., 2003). In the context of this study, effort expectancy was defined as the degree of ease related to the professional librarians' adoption of Linked Data. Findings from the study revealed that many respondents agreed that prior knowledge, fear of change from traditional tools to new technologically innovative tools, age and gender would influence their adoption of Linked Data. However, a majority of the respondents disagreed or were unsure about the fear of using Linked Data technologies influencing their behaviour. These findings suggest that the adoption of Linked Data is not likely to be influenced by effort expectancy on the part of the respondents. This finding corroborates with Owolabi et al. (2021) who applied the UTAUT model to examine the librarians' behavioural intentions to adopt big data technology in Nigerian universities. Their study revealed that effort expectancy does not influence behavioural intention to adopt big data technology.

6.6.1.1 Prior knowledge and fear of using Linked Data technologies

The UTAUT model elucidates that the more complex a technology is, the lower its intention to use it. Findings revealed that the majority of professional librarians, 89 (73%), indicated that having prior knowledge of Linked Data will increase the acceptance of the use of Linked Data in their universities. Niu (2020b) noted that many libraries, before adopting the Linked Data technologies, first attempt to gain knowledge of them before deciding whether and how to adopt them or not. In addition, 81 (66.4%) respondents indicated that fear of using Linked

Data technologies would influence their adoption. However, just over half of the respondents, 63 (51.6%), indicated that the fear of change from traditional to innovative tools would not influence their adoption of Linked Data. Since these librarians are not involved with the library's technical work, which requires the use of various systems to enter metadata or upload information resources. These findings are in line with that of Ramzan and Singh (2010:342) who asserted that librarians' fear of handling technologies and involvement in IT-related decision-making impacts their level of adoption. To reduce or eliminate this fear, librarians need to be trained prior to using these new technologies.

6.6.1.2 Perceived availability of training and skills

According to Saleem et al. (2018), knowledge and awareness of Linked Data are issues that require an institutional willingness to share data and therefore, require staff to be provided with the necessary training and skills. The responses from 87 (71.3%) of the professional librarians indicated that the availability of training and skills may influence their behaviour towards the adoption of Linked Data. Before adopting a new system, it very important to train the staff on how to use it and gain the skills to use it, otherwise, the librarians will find challenges using it. So, it is not surprising that training and skills are one of the factors that may influence their adoption of Linked Data. This finding corroborates a study by Zengenene (2013:86) who recommended that librarians need to transform their expertise in working with metadata into expertise in working with ontologies or models of knowledge so that their libraries can fully participate as information providers in the digital age. The Ugandan Library and Information Association (ULIA) is encouraged to promote the participation of all academic librarians in CPD to keep themselves abreast of the new trends that will support new library innovations.

6.6.2 Social influence and the adoption of Linked Data

Venkatesh et al., (2003) defined social influence as "the degree to which an individual perceives that important others believe he or she should use the new system". Social influence represents the interpersonal considerations of technology use. Social influence has always been an important factor when it comes to technology adoption studies (Masrek and Hussein, 2021:41). Many previous studies focusing on librarians have shown that social influence

plays an important role in shaping the intention of librarians to adopt technology (Masrek and Hussein, 2021:41). For instance, Dowdy (2020) surveyed 202 public librarians from two South-Eastern states in the USA and found that social influence, along with other constructs from the UTAUT, were significant in determining intention to adopt new technology. The findings of the current study showed that the majority of the respondents agreed that top management buy-in and support, support from the IT staff, and benchmarking with other institutional libraries will influence their adoption of Linked Data. This implies that the adoption of Linked Data will be influenced by the social influence construct.

6.6.2.1 Top management buy-in

One of the major challenges that librarians face is gaining management buy-in for library initiatives and Linked Data is not an exception in this regard. The findings from the study revealed that 92 (75.4%) of the professional librarians indicated that one of the major factors that will influence the adoption of Linked Data is top management buy-in. Without such buy-in, it will be very difficult for an innovation such as Linked Data to be approved for adoption and implementation. The heads of library technical services, the university librarians and the heads of IT also confirmed this. The finding corroborates with the study by Neish (2015) which found that a majority of the respondents in the study were struggling to obtain management buy-in for their project approval. Neish (2015) asserted that high-level management must see tangible proof of Linked Data's benefits to justify the substantial investment required. Similarly, European national libraries have had difficulties obtaining management buy-in because they are required to show tangible proof in terms of for whom and how their data is being used (Zhang, 2022). The study by Okoroma (2023:34) revealed that institutions in Nigeria have not adopted Linked Data because they believe it is not their decision but rather that of management to automate the system. The National Library of Germany, however, had the buy-in of senior management from the beginning, built knowledge networks as part of their long-term strategy, and refined the Linked Data service as part of their strategic priorities (Zhang, 2022).

6.6.2.2 Technical skills required for Linked Data technologies

According to Saleem, et al (2018), knowledge and awareness of Linked Data is still an issue and requires an institutional willingness to share data. Librarians lack knowledge, experience and success stories that may be used to motivate for the adoption of Linked Data for their libraries. The findings of the study revealed that 99 (81%) professional librarians indicated that technical skills will be required to adapt to using Linked Data. The primary challenge in adopting Linked Data or any new technology is the lack of knowledge and expertise (Cagnazzo, 2017; Rasmussen Pennington and Cagnazzo, 2019; Zhang, 2022). The studies by Warraich et al. (2021) and Ashiq and Warraich (2022) identified a lack of technical skills among professional librarians and proposed that LIS professionals should acquire advanced technical skills to enable them to adopt Linked Data technology in their libraries. Miyakita, Leskinen and Hyvonen (2018), however, noted that there are several tools, user interfaces, and Web services being used to adopt and implement Linked Data from multiple sources without the need for advanced technical expertise. As alluded to earlier, Zengenene (2013:86) recommended that librarians transform their expertise in working with metadata into expertise in working with ontologies or models of knowledge so that their libraries can fully participate as information providers in the digital age.

6.6.2.3 Benchmarking with other institutional libraries

Another factor that respondents noted would influence the adoption of Linked Data was benchmarking with other institutional libraries that have adopted and implemented Linked Data. This was revealed by 113 (92.6%) respondents who either agreed or strongly agreed with this view. Librarians from developed countries need to transfer their expertise in working with metadata and ontologies or models of knowledge to the librarians in developing countries to enable the latter to fully participate as information providers in the digital age (Zengenene, 2013:86). Libraries may adopt processes and learn how other libraries and organisations are sharing their knowledge resources with the world at large (Faith and Chrzanowski, 2015). However, as an early Linked Data adopter, the British Library did not have existing examples against which to benchmark but rather had to do most of the work from scratch (Zhang, 2022).

6.7 Strategies that can be used by university libraries to promote Linked Data adoption

Many studies involving librarians have shown that the lack of organisational and technical infrastructure results in a low adoption rate of an innovation (Saravani and Haddow, 2011; Lwoga and Questier, 2015). The fifth research question of the study sought to determine the strategies that university libraries can use to promote the adoption of Linked Data. In addressing this question, the researcher was guided by the facilitating conditions construct derived from the UTAUT model. Venkatesh et al. (2003) defined the construct of facilitating conditions as "the degree to which an individual believes that an organisation and technical infrastructure exists to support the system."

The majority of the study's respondents agreed that there is a need to be proactive in gaining administrative support; include research assignments in librarians' workload; collaborate with other professionals and universities; benchmark with other institutions; lobby for budget allocation; establish a policy on data management; adopt the minimum requirements of the Linked Data principles; develop courses in Linked Data application in libraries; and ensure that librarians keep themselves up-to-date. Based on the results, it can be concluded that the facilitating conditions construct influences respondents' decision to adopt Linked Data.

6.7.1 Be proactive in gaining administrative support

One of the key aspects that may affect the adoption of Linked Data is not having the support of the university administration. This requires the librarians to devise ways of bringing management on board for them to appreciate the Linked Data initiative and how it will be beneficial to their institutions. The vast majority of professional librarians, 116 (95%), recognised the need to be proactive in gaining administrative support instead of passively waiting for administrative decisions. The heads of library technical services also confirmed this. The interviews with the heads of IT corroborated that librarians need to lobby for support from the top management specifically to facilitate IT infrastructure and innovations that the libraries require to adopt Linked Data. The respondent HIT-4 indicated during the interviews that Linked Data technologies require improved IT infrastructure which is currently not available. A study by Ashiq and Warraich (2022) noted that there is a lack of organisational

support for the initiation of data-driven services in libraries. This is similar to Ugandan university libraries, whose management doesn't seem to prioritise data-driven services and any innovations within the libraries. Ali and Warraich (2018) recommended that libraries and information centres should motivate and inform their concerned authorities about the benefits of Linked Data, making it easier for them to adopt and implement the technology in their libraries.

6.7.2 Inclusion of research assignments in employees' workloads

For librarians to appreciate new emerging technologies in the field, they need to be encouraged to conduct research to keep them abreast of the innovations. One hundred and four (85.3%) of the professional librarians in the study proposed the inclusion of research assignments in some of the employees' workload for them to conduct research, especially during the exploratory stages of innovation adoption. Through research, professional librarians will be able to gain knowledge and be exposed to the different emerging technologies in the library field. This was also confirmed by the heads of library technical services. The university librarians recommended the need for the librarians to seek knowledge about the linked Data concept and to keep abreast of any new developments in the library sector.

These findings corroborate the study by Niu (2020b) that early adoption of innovation involves much learning of the innovation and requires that libraries which strive to be early adopters, hire employees who are willing to conduct original research. He recommended that these libraries should include research assignments for some of the employees to give them time for learning and the research needed during the exploratory stage of innovation adoption.

A Linked Data survey by the OCLC found that most of the institutions that have implemented or are implementing Linked Data projects/services have had to include the responsibilities of the current librarians to enable them to understand and appreciate Linked Data (Smith-Yoshimura, 2018). A study by Ali and Warraich (2018) recommended that LIS academicians in developing countries should focus on Linked Data technology in their research activities.

6.7.3 Collaboration with professionals in and out of the library community

Librarians cannot work alone to promote the adoption of Linked Data in their university libraries – they need to forge collaborations and partnerships with other communities in and out of their field. A study by Pennington and Cagnazzo (2019) recommended collaboration between libraries and non-library services such as Wikipedia, GeoNames, MusicBrainz, and the BBC to connect local collections into the larger universe of information on the Web. Miller and Westfall (2011) asserted that libraries can start developing relations and initiate discussions with other groups such as the W3C. This will enable different libraries and communities to share their expertise. This was evident in the responses of most professional librarians in that 116 (95.1%) respondents proposed effective collaboration with professionals in and out of the library community. A similar response was received from the heads of library technical services. This may be due to the numerous positive collaborations that these university libraries have had, especially with CUUL, RENU, and other communities. These findings are in agreement with Niu (2019) who in his study found that librarians need to collaborate effectively with professionals in and out of the library community.

Information professionals also need to collaborate with IT professionals to help them develop vocabularies according to their library needs (Park and Tosaka, 2017; Warraich and Rorissa, 2018a; Gaitanou et al., 2022). Gaitanou et al. (2022:16) recommended that libraries need to participate in larger communities (like Linked Data and the Semantic Web) to enable them to transform their library data into Linked Data. Linked Data enables the use of external datasets which might encourage collaboration with communities of practice (Pace, 2018). Therefore, a more widely used data model such as Functional Requirements for Bibliographic Records (FRBR) will create opportunities for library professionals to engage with other professionals outside the library community (Gaitanou et al., 2022; Unterstraßer, 2023).

6.7.4 Collaboration with other university libraries

According to Abdelaziz and Kaffas (2018), efforts to implement Linked Data require collaborations that focus on creating links between concepts and their definitions in global datasets, to form an Open Linked Data cloud such as Wikipedia and DBpedia among others.

It is important that university libraries, especially those that have adopted and implemented Linked Data, collaborate with others to increase data sharing among their institutions. Most of the professional librarians, 115 (94.3%) indicated that there was a need to collaborate with other university libraries through the CUUL and establish a central data repository. The university librarians also highlighted the need for collaboration and networking with university libraries in Uganda and with those abroad who have already implemented Linked Data.

This study is in alignment with Niu (2020) who found that top research libraries or library consortia take on the responsibilities of leading research, and standards and technologies needed for the adoption of innovation. There is a need to promote partnerships and cooperation to advance the Semantic Web for libraries among the various institutions (Zengenene, 2013; Abdelaziz and Kaffas, 2018).

Steele (2019) asserted that multi-institutional collaboration is very common, especially during research and exploratory stages. He noted that the Library of Congress collaborated with Zepheria in developing BIBFRAME which was tested by many other libraries. Also, Purdue University Libraries collaborated with the Graduate School of Library and Information Science at the University of Illinois, Urbana-Champaign in Data Curation Profile projects (Witt, Carlson and Brandt, 2009). Cornell University Library (CUL) has collaborated with Harvard Library Innovation Lab and Stanford University Libraries on the Linked Data for Libraries (LD4L) project since 2014 (Kovan, 2016). The three institutions have been looking at ways to gather context and relationships about their library resources beyond the traditional metadata approaches (Krafft, 2015; Kovan, 2016). The study by Niu (2020b) recommended collaboration with other libraries and technology partners because a single library might not have all the necessary infrastructure and expertise to develop widely useful adoption solutions.

6.7.5 Benchmark with other institutions

Linked Data is increasingly becoming a reality and, therefore, libraries are encouraged to learn from others and publish their data so that they benefit from "being of the Web" and

reach out to as many users as possible (Niu, 2020b). Responses from the professional librarians revealed that 118 (96.7%) indicated that benchmarking with other institutions already implementing Linked Data could be one of the strategies that university libraries can use to promote the adoption of Linked Data. This was confirmed by four of the university librarians during the interviews. They indicated that benchmarking with other institutions will enable them to decide what is best for their libraries, and also enable them to identify champions to promote these initiatives. This will enable the university libraries to share their experiences and to learn from each other. As noted, librarians from developed countries need to transfer their expertise and knowledge to librarians in developing countries to enable the latter to fully participate in Linked Data initiatives. Niu (2020b) asserted that given the high costs of early adoption, it is wise that libraries with fewer resources should be late adopters and enjoy the benefits of benchmarking and learning from the experiences of the early adopters.

6.7.6 Lobby for a budget allocation

To foster research and set Linked Data practices in libraries and other cultural heritage institutions, there is a need to invest in this area in terms of financial and social capital (Warraich, 2016). This was evident from most of the professional librarians' responses with 115 (94.3%) agreeing that there is a need to lobby for a budget allocation. This finding was confirmed by the heads of library technical services and interviews with the university librarians and heads of IT who indicated the need to lobby for a budget allocation for infrastructure and training to facilitate the adoption and implementation of Linked Data in their universities. The university librarians indicated that the libraries have limited funding and recommended that the university libraries should seek funding elsewhere through writing grant proposals. Respondent HIT-2 made the point that even if the innovation is a good one, if there are no resources, implementing it will not be possible. Libraries, therefore, need to seek funding and benchmark with other institutions already implementing Linked Data by writing proposals justifying its importance. A finding by Okoroma (2023:35) revealed that one of the major challenges in the adoption of Linked Data in Nigeria is inadequate funding of academic institutions and this limits the adoption of technological initiatives in libraries.

A study by the OCLC (2022) found that most respondents received grant funding to implement Linked Data projects. Other institutions' funding was covered by either the library/archive or the parent institution. or partner institutions. Private funding was also received by some institutions. Mulumba(2022) asserts that universities should dedicate a budget to support data-linking activities and any associated initiatives, lobby for budget allocation, and the institutions should prioritise the library and its initiatives by increasing its budget allocation. The university should, therefore, dedicate a budget to support data-linking activities and associated initiatives (Mulumba, 2022).

6.7.7 Establish a policy to govern Linked Data management

To ensure the adoption of Linked Data among university libraries and encourage them to share their data, there is a need to have a legal framework which mandates university libraries to share and link their data on the Web. This requires establishing a policy that governs Linked Data management. The findings revealed that 116 (95%) respondents indicated that university libraries need to establish a policy governing data management and linking, requiring research submissions to be accompanied with data files, and the creation of Linked Data. This was also confirmed by the heads of library technical services, university librarians, and heads of IT. Three university librarians stressed the urgent need for a data management policy which should be enacted at the national level and then implemented in institutions. This will enable the librarians to advocate for Linked Data, the deposit of sharing and reuse of the research data. Respondent HIT-1 indicated there was a need to strengthen the CUUL so that they can advocate for a Linked Data management policy. The respondent pointed out that the CUUL advocates for institutional libraries' research and development and, therefore, they can lobby the VCs to facilitate Linked Data initiatives. In addition, there is a need to lobby for a national linked data policy that can mandate researchers to deposit their research data in addition to theses in the university libraries. A study conducted by Okoroma (2023:34) revealed that Nigerian institutions lacked a policy that would require them to adopt Linked Data. In addition, most of the institutions do not have a written policy to cover all aspects of Linked Data implementation and use (Zhang, 2022).

Mulumba (2022) recommended the development of data management awareness plans for the staff and student communities. He further asserted that the university administration should implement a policy that will govern data management and linking. This policy should require research submissions to be accompanied by the data files. Roth and Luczak-Roesch (2020) asserted that doing so will depend on the type of data generated because the management of big data differs from subject-specific conventional data. Studies by Gaitanou et al. (2022) and Unterstraßer (2023) revealed that there are no common policies or guidelines to facilitate the reuse of data, making it difficult for the libraries to decide which datasets to use and trust. Therefore, Gaitanou et al. (2022) recommended the need for developing several guidelines and tools for opening library data, in accordance with Linked Data principles. The development of a Linked Data policy will help create more clarity and trust when it comes to incorporating external datasets into the catalogue (Unterstraßer, 2023:52).

6.7.8 Adoption of minimum requirements of Linked Data principles

Institutions that intend to adopt Linked Data are required to either adopt all the requirements or, at least, adopt the minimum requirements of Linked Data principles; this, however, will depend on their circumstances. The study revealed that 111 (91%) respondents indicated that to adopt Linked Data, an institution may start with the minimum requirements. This finding corroborates with Alemu et al. (2012) who asserted that libraries need to adopt the minimum requirements of Linked Data principles and adopt a mixed metadata approach so that they can become part of the Linked Data Web. Therefore, instead of librarians sticking to models and resources over which they have complete control, they should also explore publicly editable user-centred tools.

In addition to making Linked Data creation and usage more accessible for information professionals, there is a need to understand the benefits of Linked Data which will help reduce the technological barriers (McKenna et al., 2018). There is a lack of documented Linked Data procedural activities for models in the region (Okoroma, 2023:35). Gaitanou et al. (2022) recommend the production of guidelines and tools for opening library data, in accordance with Linked Data principles.

6.7.9 Develop courses on Linked Data applications in libraries

There are various education and training opportunities that the library and information science schools offer; unfortunately, Linked Data applications are not among them. The results revealed that 113 (92.7%) respondents agreed that there is a need to develop courses on Linked Data applications in libraries. The heads of library technical services and the university librarians also confirmed this. This finding corroborates with Ali and Warraich (2018) who found that the library schools in developing countries have not yet included Linked Data courses in their curricula at the master's and PhD levels and recommended that this should be done particularly given that the Web is evolving around Linked Data. Niu (2020b) asserted that the Educational Curriculum for the Usage of Linked Data (EUCLID) project published a comprehensive textbook that is being used to assist users in Linked Data creation and use. This textbook also can be adopted and used by institutions.

6.7.10 Librarians need to keep themselves up-to-date

According to Gorrety, Nakaziba and Holmner (2021), there are numerous changes that academic libraries are encountering due to emerging technologies and their users' ever-changing information-seeking behaviour. This requires that librarians need to respond in new ways to meet their users' needs. The study findings revealed that 119 (97.5%) respondents indicated that there was a need to encourage library staff to keep themselves up-to-date and explore the potential of Linked Data technologies in libraries. This finding was confirmed by the heads of library technical services and the university librarians. Two of the latter said that the librarians cannot promote what they are not sure of and, therefore, recommended that university librarians acquire knowledge of and understand the Linked Data concept clearly so that they can sell it to researchers and management. Librarians can gain knowledge about Linked Data through participating in CPD programmes, webinars, and conferences, among others. Gorrety et al., (2021) recommended that the Uganda Library and Information Association (ULIA) should formulate policies and procedures to promote the participation of all academic librarians in CPD programmes. This will promote knowledge sharing among librarians, keep them abreast of new trends, and support new library innovations such as Linked Data.

With the current low levels of awareness among the community and librarians about Linked Data there is a need to have more conferences, seminars and workshops related to Linked Data in library centres. This is especially the case for librarians in developing countries where they need to be provided with the necessary skills to implement Linked Data technologies themselves (Ali and Warraich, 2018:935; Raza et al., 2019). A study by Warraich and Rorissa (2018) found that librarians are eager to attend events about Linked Data applications in their libraries and are willing to explore ways to incorporate Linked Data standards in bibliographic records management as well as library Linked Data. There is a need for more education as well as the sharing of experiences regarding Linked Data in libraries (Unterstraßer, 2023).

The findings revealed the most significant support in terms of strategies that libraries can use to promote the adoption of Linked Data was to encourage staff to keep themselves up-to-date and explore the potential of Linked Data technologies in their libraries. Very few respondents disagreed or gave neutral responses regarding the effort expectancy variables regarding the strategies to promote the adoption of Linked Data technologies. Based on these results, it can be concluded that the effort expectancy variables influence the promotion of the adoption of Linked Data technologies.

6.8 Summary

This chapter discussed and interpreted the findings of the study. The discussion was done in a comprehensive manner that followed the research findings and literature review and aligned them with the theoretical framework employed. In terms of the latter, the UTAUT constructs of performance expectancy, effort expectancy, facilitating conditions, and social influence and the two constructs of the DOI theory, namely, observability and trialability were used to direct the discussion of the findings. The five research questions underpinning the study provided the overall structure for the discussion.

The study found that the majority of the respondents were aware of the Linked Data concept. While a small majority of the respondents believed that Linked Data does not require much effort, a slightly larger (but still small) majority had not acquired any training in Linked Data

technologies. The respondents believed that Linked Data would benefit research, enrich discovery, and create a model that other university libraries could use. The respondents were aware that technical knowledge and IT skills are needed to use Linked Data. They were also acutely aware of the need for top management buy-in and support in terms of human and financial resources, as well as technological infrastructure to enable the successful adoption and implementation of Linked Data in their university libraries.

Chapter Seven follows; it summarises the major findings, outlines the implications of the study, makes recommendations, and provides suggestions for further research.

CHAPTER SEVEN
SUMMARY OF FINDINGS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

7.1 Introduction

This study's findings were presented in Chapter Five, and their interpretation and discussion were presented in Chapter Six. The study explored the adoption of Linked Data among university libraries in Uganda. The summary of the main findings of the study, in light of the research questions posed, is presented in this chapter. This is followed by the contribution and originality of the study, and its implications for theory in terms of the UTAUT model developed by Venkatesh et al. (2003) and Roger's (1995) DOI theory. The implications of the study's findings for policy and practice are presented, as are the study's recommendations. The limitations of the study are outlined, suggestions for future research are given, and the chapter ends with a summary.

The study adopted a mixed-methods approach and the findings were thus derived from research data generated from multiple sources. The data collection methods employed, and the population samples were as follows:

- An online questionnaire involving 122 professional librarians
- An online questionnaire involving 14 heads of library technical services
- A semi-structured interview conducted telephonically with 10 heads of IT
- A semi-structured interview conducted either telephonically or face-to-face with 14 university librarians.

The study aimed to explore the adoption of Linked Data among the university libraries in Uganda. The summary of the main findings responds comprehensively to the five research questions that underpinned the study. The research questions were developed from the aim and are repeated below:

1. What is the level of awareness of Linked Data among professional librarians in Ugandan university libraries?

2. What is the extent of Linked Data adoption in Ugandan university libraries?
3. What are the benefits of Linked Data adoption in Ugandan university libraries?
4. What factors influence the behaviour of professional librarians towards the adoption of Linked Data in Ugandan university libraries?
5. What strategies can be used to promote the adoption and use of Linked Data in Ugandan university libraries?

7.2 Summary of the main findings

The summary of the findings is drawn from the study's aim which was to explore the adoption of Linked Data among the university libraries in Uganda. The findings of the study were gathered from the questionnaires involving the professional librarians and heads of library technical services and the interviews conducted with the university librarians and heads of IT. These findings were systematically presented in Chapter Five. They were then interpreted and discussed in Chapter Six using themes that were developed from the findings and in light of the literature review, the theoretical framework, and the research questions underpinning the study. As noted above, the summary of the findings is presented in terms of the five research questions posed.

7.2.1 What is the level of awareness of Linked Data among professional librarians in Ugandan university libraries?

The first research question sought to determine the level of awareness of Linked Data among the professional librarians. Findings revealed that the majority of the professional librarians were aware of the Linked Data concept. However, this contradicts the findings by the university librarians who indicated that they were not sure that the professional librarians were aware of Linked Data because they had not shared with them any knowledge regarding the concept. Furthermore, the respondents indicated that they were aware that Linked Data offers best practices for publishing, sharing and interlinking data. The findings revealed that the professional librarians were aware that some university libraries had adopted and implemented Linked Data. The findings also revealed that respondents were influenced in terms of awareness by observing the benefits of using Linked Data. On the other hand, it was

apparent from the findings that the professional librarians were not aware of their institutions having acquired the necessary infrastructure to facilitate data sharing among the universities.

7.2.2 What is the extent of Linked Data adoption in Ugandan university libraries?

The second research question sought to determine the extent of Linked Data adoption among the selected university libraries. It was established that only one university had adopted Linked Data while the other universities had yet to do so. The findings revealed that a majority of the professional librarians believed that Linked Data technologies were easy to use. They were, however, unsure or disagreed whether a lot of effort was required to use Linked Data. Similarly, several respondents believed that Linked Data requires technical knowledge and, therefore, requires a trial for them to be convinced to use it. The respondents believed that using Linked Data is better than traditional library methodologies.

In terms of the findings, the majority of the respondents have not been provided with the required training to adapt to using Linked Data; however, there were several training opportunities they could participate in. It was evident that the institutions had not provided the university libraries with the technological infrastructure needed to facilitate the adoption of Linked Data. However, the institutions had acquired specialised IT personnel to provide technical assistance to the library staff regarding the use of Linked Data technologies. The respondents were unsure or disagreed that the university libraries have a library technical team to ensure data sharing and its reuse. The findings also revealed that some professional librarians were unsure whether there was a financial budget allocated to facilitate data sharing and its reuse in their libraries, while others indicated that they did not have a financial budget to facilitate the adoption of Linked Data.

The respondents also believed that Linked Data may require staff with technical knowledge and IT skills and were unsure whether Linked Data tools were complicated to use. Therefore, they expressed a preference for first experimenting with how Linked Data worked before adopting and implementing it, especially after ascertaining that other institutions have successfully implemented it. Furthermore, a majority of the respondents were unsure as to

whether transitioning to Linked Data technologies in the library was a challenge, while others indicated otherwise.

7.2.3 What are the benefits of Linked Data adoption in Ugandan university libraries?

The third research question sought to ascertain the benefits of adopting Linked Data among the university libraries. The following benefits were identified by the professional librarians:

i) Reduction in unnecessary duplication of data that is already available elsewhere, through several reliable sources.
ii) Enable the users to search from a wealth of data shared by the various university libraries.
iii) Increase richness in overall data when data is linked from the university libraries to the Web.
iv) Enable library patrons to find content on the Web instead of being restricted to the library repositories.
v) Assist researchers in discovering relevant information and data through links to other data repositories.
vi) Interlink and publish libraries on the Web and assist patrons in discovering relevant information through links to resources in other repositories.
vii) Increase exposure of IR collections to Web search engines where users can easily access them.
viii) Benefit research, enrich discovery and create a model other university libraries can use.

7.2.4 What factors influence the behaviour of professional librarians towards the adoption of Linked Data in Ugandan university libraries?

The fourth research question sought to identify the factors that influence the adoption of Linked Data among the professional librarians.

i) The majority of respondents indicated that having prior knowledge of Linked Data would increase librarians' acceptance of the use of Linked Data in their universities.
ii) In addition, they indicated that the fear of using Linked Data technologies would influence the adoption of Linked Data among university librarians.

iii) On the other hand, the findings revealed that the fear of changing from traditional to innovative tools would not influence the adoption of Linked Data. However, the availability of training and skills may influence the behaviour of professional librarians towards the adoption of Linked Data.

iv) One of the major challenges that librarians face is gaining management buy-in for library initiatives and a Linked Data initiative is not an exception in this regard.

v) A majority of the respondents pointed to top management buy-in as a crucial factor influencing the adoption of Linked Data in university libraries. Without such buy-in, it will be very difficult for Linked Data (and other innovations) to be approved for adoption and implementation.

vi) A further factor influencing the adoption of Linked Data identified by respondents was benchmarking with other institutional libraries that have adopted and implemented Linked Data. University libraries may learn how other libraries and organisations share their knowledge resources with the world and adopt the processes used.

7.2.5 What strategies can be used to promote the adoption and use of Linked Data in Ugandan university libraries?

The final research question sought to establish the strategies the university libraries can use to promote the adoption and use of Linked Data. The study found that there were several strategies that the Ugandan university libraries could use, namely:

i) Be proactive in gaining administrative support instead of passively waiting for administrative decisions.

ii) Include research assignments in some of the employees' workload for them to conduct research, especially during the exploratory stages of innovation adoption.

iii) Collaborate effectively with professionals in and out of the library community.

iv) University libraries need to collaborate to increase Linked Data adoption.

v) University libraries must benchmark with other institutions that have already adopted or implemented Linked Data for their best experiences.

vi) Lobby for an adequate budget allocation to cover the costs of the innovation adoption.

vii) Establish a policy governing data management and sharing.

viii) Consider adoption but start with the minimum requirements of the Linked Data principles.

ix) Library training institutions should develop courses on Linked Data applications in libraries to inculcate skills.

xi) Librarians need to take the initiative in keeping abreast of the profession's emerging technologies.

7.3 Contribution and originality of the study

The study explored the adoption of Linked Data and is the first to be carried out in multiple universities in Uganda. This was confirmed when identifying relevant materials for the literature review. Searches were done on various databases including the UKZN's iCatalogue and OCLC systems. However, a related study identified was that of Mulumba (2022). His study focused on library services and Linked Data at Uganda's Makerere University. Findings were that researchers at the university archive their data in external repositories despite Makerere's IR having the potential to host Linked Data. The distinctions between his study and the current study are explained below:

i) Mulumba's study aimed to establish the status of Linked Data at Makerere University and the prospect of linking the data through the Makerere IR. The current study aimed to explore the adoption of Linked Data among university libraries in Uganda.

ii) Mulumba's study focused on only one university library (Makerere) while the current study focused on 14 university libraries (one of which was Makerere).

iii) Mulumba used secondary data from existing situations, and primary data from key informants, especially from the information management and digitization team, and from his own experience as an expert in information science. The current study used primary data collected through online questionnaires and telephonic interviews with key stakeholders.

iv) Finally, Mulumba used an exploratory research methodology to generate key findings from existing literature, personal experience, and experts. The current study generated key findings from primary data collected from a wider range of stakeholders – professional librarians, the heads of library technical services, the heads of IT and the university librarians comprised the respondents.

A second related Ugandan study was conducted earlier by Mulumba, Kinengyere and Akullo (2017). It also focused on Makerere University and explored the level of data sharing at the institution, focusing on the multimedia collection. Their study found that although most of the library staff were involved in data processing, this data was not linked to the Open Data Cloud. In addition, most of the university librarians were unaware of the LOD concept and Semantic Web functionality and lacked the necessary skills. Their study is not conclusive because it focused on only one university library.

Other studies outside of the African context include that of Warraich and Rorissa (2018) who conducted a study on the "Adoption of linked data technologies among university librarians in Pakistan: Challenges and prospects." The study aimed to explore librarians' perspectives concerning the adoption of Linked Data technologies in Pakistani university libraries. Their study found that the librarians believed in the effective adoption of Linked Data technologies in libraries and how they may enhance navigation between traditional online tools to access library resources. They also believed that Linked Data would soon be the standard for creating metadata and records for information resources. The librarians were willing to explore Linked Data technologies in their institutions; however, there was a general lack of awareness of basic Linked Data concepts and best practices for this emerging technology.

A later study conducted by Warraich and Rorissa (2019) on the "Readiness for and barriers to implementation of linked data by Pakistani libraries" assessed the willingness and level of interest in applying Linked Data by librarians in Pakistan and determine their perceptions of the barriers to Linked Data applications in their respective libraries. The study found that librarians were interested in implementing Linked Data in their libraries, and were willing to participate in events to learn more about the potential of Linked Data technologies and how to integrate them into their library services.

A study conducted by Cagnazzo (2017) aimed at delivering a comprehensive picture of the current state of Linked Data implementation in Europe. The study found that although various institutions had applied Linked Data to their resources, they were still in the minority and a

considerable lack of expertise concerning the technology was also identified. The study concluded that there was a strong need to spread awareness of the potential of the Semantic Web within the library environment.

Pennington and Cagnazzo (2019) conducted a study on "Connecting the silos: Implementation and perceptions of Linked Data across the European libraries". The authors aimed to determine how information professionals in Scotland and European national libraries perceived Linked Data and how they were implementing it. According to their findings, some of the projects demonstrated Linked Data's potential to improve the visibility and discoverability of library data, overcome linguistic barriers, and promote interoperability. The essential need to demonstrate the Semantic Web's potential in libraries was highlighted. One of the major challenges faced by libraries was obtaining management buy-in for Linked Data initiatives despite open data being mandated by the government. The study proposed collaboration between information professionals and vendors to develop implementation tools. Also proposed was the need for advocacy through the dissemination and review of successful Linked Data implementations to solve practical difficulties and obtain management buy-in.

Niu (2020b) conducted a study on the diffusion and adoption of Linked Data among libraries in the USA. The study found that the diffusion of linked Data among libraries was a decentralised and continuous process comprising multiple stages (which could last for many years) and with a high degree of reinvention. It also found that the diffusion of Linked Data among libraries involved the diffusion of knowledge about Linked Data adoption experiences and three related innovations, namely, software tools, Linked Data vocabularies, and datasets. Leading libraries, professional organisations, vendors, and external funders played an important role in facilitating the diffusion. The study proposed that the library community should reuse existing tools and resources as much as possible to develop standards that pave the way for commercial vendors and service providers to lower the barriers to adoption.

Results from the current study have highlighted the urgent need for a policy to govern data management and sharing, the training of librarians and IT staff, the development of a Linked

Data curriculum in library schools, benchmarking and creating more awareness of Linked Data in the universities.

7.4 Implications for theory

The purpose of the study was not to construct a theory but rather to explore the adoption of Linked Data among university libraries in Uganda. This study is important as it shows the gaps in the literature, particularly between studies done in developed and developing countries. The study employed both the UTAUT and DOI theory as its theoretical framework, and these models guided the study. This section summarises the study findings related to the four constructs of the UTAUT model (facilitating conditions, performance expectancy, effort expectancy, and social influence), and this is followed by the findings related to the constructs of the DOI theory (trialability and observability).

7.4.1 Findings related to the UTAUT model

The current study employed the UTAUT model as a theoretical framework. The applicability of this model for the study was discussed in Chapter Two and the findings of the study that were linked with the model were interpreted and discussed in Chapter Six. As noted above, the study adopted all four constructs of the UTAUT model to explore the behavioural intention of university libraries in Uganda to adopt Linked Data to enable data sharing and reuse. This section provides a summary of the findings related to the use of the UTAUT model as a theoretical framework for the study to predict technology acceptance and elucidate the actual use of technologies and systems in organisational settings. In addition, the literature review, the presentation of the findings, and the discussion of the results also followed the trend provided by the model. The UTAUT model was considered appropriate for the study because Linked Data is an innovative initiative.

The study findings indicated that the respondents in the Ugandan university libraries were aware of the Linked Data concept and they have library technical teams established to ensure data sharing and its reuse. In addition, the institutions have provided the libraries with the technological infrastructure support to facilitate the adoption of Linked Data. The study also revealed that the respondents agreed that Linked Data technologies will be easy to use

although it requires a lot of technical knowledge. The majority of respondents also indicated prior knowledge of using Linked Data and that the perceived availability of training and skills enhancement opportunities will influence its adoption. They suggested that the university libraries start with the adoption of minimum requirements of Linked Data principles.

Furthermore, the study revealed that a majority of the respondents indicated that benchmarking with other institutional libraries implementing Linked Data, support from the IT staff and top management buy-in would be required. Linking data from university libraries to the Web will allow for increased richness in overall data and benefit research, enrich discovery and create a model other universities can use. It is apparent from the findings that performance expectancy, effort expectancy, social influence and facilitating conditions can explain the behavioural intention of professional librarians in the 14 university libraries to adopt Linked Data for data sharing and reuse. However, the facilitating conditions were found to not have any significant contribution since some of the professional librarians disagreed with its attributes. The study findings suggest that behavioural intention is influenced by effort expectancy, performance expectancy, and social influence.

7.4.2 Findings related to the DOI theory

The DOI theory is considered one of the most appropriate theories that can be used to investigate the adoption or non-adoption of technology in higher education and other educational environments (Ismail, 2006; Sahin, 2006; Nazari, Khosravi and Babalhavaeji, 2017).

The trialability construct is the extent to which an innovation may be experimented with on a limited basis (Rogers, 2003). Rogers (2003) posits that trialability is fundamental to the adoption and use of a technology because it provides librarians with the opportunity to learn and practice before they adopt it. Trialability can be determined by the extent to which a librarian determines the level of technical knowledge and IT skills required, experimenting with Linked Data, the complexity of the Linked Data tools, and challenges in the transition from traditional tools to Linked Data in the library. Since Linked Data is still an emerging

innovation in the library field, university libraries may need to first experiment with it to determine its practicability before adopting it.

The study revealed that using Linked Data technologies would require someone with technical knowledge and IT skills. The respondents preferred that they first experiment with Linked Data before it is adopted and implemented so that they can determine its practicability. This was due to them being unsure as to whether Linked Data tools are complicated to use or not, and whether the transition to Linked Data technologies in the library may be a significant challenge.

Another construct of the DOI theory is observability, which indicates that librarians would only support the diffusion of an innovation that they find valuable, and which does not threaten their jobs. The findings revealed that a majority of the respondents agreed with all four observability attributes, and this implies that observability influences the adoption of Linked Data by the professional librarians.

7.5 Implications for policy and practice

The study contributes substantively towards the adoption of Linked Data in university libraries and, in doing so, may influence policy and practice. The study's findings have significant implications for policymakers and stakeholders who are responsible for promoting data sharing and its reuse and providing the necessary infrastructure needed for the university libraries to adopt Linked Data. The study is of importance to university libraries in Uganda, as it provides insight into what Linked Data is and how it will benefit the libraries and their institutions if adopted. This will assist in policy decision-making regarding data sharing and management in the university libraries.

The findings will assist university libraries and their stakeholders in developing a Linked data management policy that will enable them to address the challenges experienced in data sharing and reuse. The study reveals the need for librarians to acquire training in Linked Data technologies, the need for university top management support, and the need for required infrastructure to enable the adoption and use of Linked Data in university libraries. When

Linked Data is taken seriously, it will, as pointed out, benefit research, enrich discovery, and create a model that other universities can use.

7.6 Recommendations

The study explored the adoption of Linked Data among selected university libraries in Uganda. One hundred and twenty-two professional librarians, 14 heads of library technical services, 14 university librarians, and 10 heads of IT participated in the study. Based on the findings of the study, the following recommendations are made:

i) The study highlighted that universities do not have the necessary infrastructure in place that would be needed for the adoption of Linked Data. The study recommends that university libraries lobby for budget allocations or seek grants to facilitate acquiring the infrastructure which is needed for the adoption and implementation of Linked Data in the universities.

ii) In addition, there is also a need to train the workforce by professional organisations such as the International Association of Social Science and Information Services Technology (IASSIST) which supports professionals in IT and data services in terms of research and teaching; the African library and information associations and Institutions which provide support to informational professionals in learning how to use Wikidata for connecting their collections through linking their local metadata with a network of global metadata; IFLA which supports Linked Data activities; and DataCite which makes research more effective by connecting research outputs and resources from data.

iii) Findings revealed that almost half of the respondents had not been provided with the required training to enable them to adapt to the use of Linked Data. Furthermore, they believed that using Linked Data may require people with technical knowledge and an IT background. Given this, the study recommends that courses on Linked Data applications in libraries be developed by the various library and information training institutions; the East Africa School of Library and Information Science (EASLIS);

the universities of Kyambogo, Kabale, and Ndejje; and other educational institutions with data related courses such as the Uganda Institution of Information and Communication Technology, and the Uganda Christian University, among others. In addition, it is recommended that librarians keep themselves up-to-date with and explore the potential of Linked Data technologies in libraries.

iv) It is evident from the study findings that a majority of the professional librarians believe that Linked Data is easy to use and does not require a lot of effort and, therefore, does not require much technical knowledge. However, the findings revealed that the universities have not yet acquired specialised IT personnel to provide the technical assistance required. Similarly, the respondents were unsure about establishing a library technical team that would ensure data sharing and its reuse. It is recommended that the technical skills required to adapt to using Linked Data are acquired. In addition, benchmarking with other institutions that have already adopted or implemented Linked Data is needed. Zengenene (2013:86) recommends that librarians from developed countries transfer their expertise in working with metadata and ontologies or models of knowledge to their counterparts in developing countries. This study, in turn, recommends that Zengenene's recommendation be considered and acted upon.

v) The study highlighted that no data management policy mandates the various institutions to share their data with other institutions for reuse. To ensure the adoption of Linked Data is implemented, it is recommended that a legal framework be developed which will mandate the university libraries to share and link their data on the Web. The institutions, therefore, need to establish a policy that will govern data management.

vi) The findings revealed that there is no collaboration among the university libraries regarding data sharing. In addition, there is also no collaboration between the IT staff and library staff when it comes to providing technical assistance. The study recommends collaboration with other university libraries through the Consortium of

Uganda University Libraries (CUUL) and the establishment of a central data repository.

vii) Finally, collaboration and partnerships need to be forged with other communities and organisations both in and out of the library and information field. These would include institutions such as the National Council of Science and Technology which is mandated to coordinate and guide national research and development in Uganda; the Research and Education Network for Uganda (RENU) which enables research and education collaboration; the National Council of Higher Education which accredits courses taught by higher education institutions and, therefore, will ensure that Linked Data is included in the LIS curriculum; the Science, Technology and Innovation Secretariat at the Office of the President (STI-OP) which develops customised technology solutions to support Ugandan citizens; and the National Information Technology Authority (NITA-Uganda) which is the provider of IT in the country, among others. Miller and Westfall (2011) recommended that libraries start by developing relations and initiating discussions with other groups like the W3C community. This will enable the different libraries and communities to share their expertise with each other. Zengenene et al. (2014) also emphasised the need to promote partnerships and cooperation to advance the Semantic Web. Again, this study recommends that the recommendation of the above authors be taken cognisance of and acted upon.

7.7 Limitations and suggestions for future studies

As earlier indicated, this study was limited to 14 university libraries in Uganda. The findings, therefore, cannot be generalised to all the university libraries in Uganda. However, it can be argued that important insights have been revealed that will be of benefit to university libraries not only in Uganda but those in other countries in Africa and developing countries in general. Moreover, 25 professional librarians did not respond to the online questionnaire. However, 122 professional librarians did respond, thus overcoming this limitation of the study.

The study suggests the following future studies be conducted:

i) The study focused on the adoption of Linked Data in university libraries. It is therefore, suggested, that further similar research be conducted in other types of libraries, such as government and research libraries. This will enable a more holistic understanding of Linked Data adoption in the Ugandan library and information sector and help ensure that there is a coherent approach to its adoption and implementation. In addition, findings from these studies may well assist the university library sector in its endeavours to adopt linked data.

ii) The study also highlighted that one of the challenges university librarians may face in the adoption of Linked Data is the transition from existing traditional library technologies to Linked Data technologies. Therefore, there is a need for a study to be conducted on how existing library technologies can be integrated into the Linked Data technologies to ascertain the challenges in doing so. Aspects such as the technical training and infrastructural support needed could also be investigated.

iii) Elaborating on the final point in the suggestion above, the study highlighted that there is inadequate IT infrastructure which is key for the adoption of Linked Data in university libraries. It is suggested that further research be conducted on the available infrastructure existing in university libraries that may support the adoption of Linked Data in a context of limited resources, both financial and human, and how this challenge can be responded to.

7.8 Summary

The study explored the adoption of Linked Data among university libraries in Uganda by determining the level of awareness of Linked Data among the university librarians; establishing the extent of Linked Data adoption in the university libraries; determining the potential benefits of adopting Linked Data by the libraries; investigating the factors that influence the behaviour of professional librarians towards the adoption of Linked Data; and, finally, strategies that can be used to promote the adoption and use of Linked Data.

The summary of the findings was grounded on the five research questions underpinning the study. The findings of the study were linked with the related literature reviewed and the various constructs of the UTAUT model and the DOI theory. The implications of the study for policy and practice were briefly outlined, recommendations given and suggestions for further research provided. The study aimed to explore the adoption of Linked Data among university libraries in Uganda and it is considered that the aim was accomplished.

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APPENDICES

Appendix I: Covering Letter for the Interview Schedule for University Librarians and Heads, Information Technology

Dear Respondent

My name is Winny N Akullo a Ph.D. in Information Studies Candidate at the University of KwaZulu-Natal, South Africa, I kindly invite you to participate in the research project entitled **Adoption of Linked Data among University Libraries in Uganda.**

The aim of the study is to explore the adoption of Linked Data among the University libraries in Uganda. It is hoped the findings of the study will bridge the gap in sharing and re-use of data among the Ugandan university libraries. The research will gather data on the level of awareness of Linked Data among the professional librarians; the extent of adopting Linked Data in the University libraries; identify the potential benefits of adoption of Linked Data among the university libraries; investigate the factors that influence the behaviour of professional librarians towards the adoption of Linked Data; and strategies that the university libraries can use to adopt the use of Linked Data.

Fourteen (14) university libraries have been selected in the country for this study. Your university library is among the selected ones for data collection. Participation in this research project is voluntary. You may refuse to participate or withdraw from the research project at any stage and for any reason without any form of disadvantage. There will be no monetary gain from participating in this research project. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Information Studies programme, at the University of KwaZulu-Natal.

I would greatly appreciate if you can spare 20 minutes of your time to complete the questionnaire. Please answer every question as honestly as you can. Your response will be strictly kept confidential. Any information provided would be used for academic purposes only.

I can be contacted at: School of Social Sciences, University of KwaZulu-Natal, Pietermaritzburg Campus,
Email: [redacted]
Phone number: [redacted]
My supervisor is **Dr. Zawedde Nsibirwa** who is located at the School of Social Sciences, Pietermaritzburg Campus of the University of KwaZulu-Natal, South Africa
Email: nsibirwaz@ukzn.ac.za
Phone number: +27 33 260 5685
The Humanities and Social Sciences Research Ethics Committee contact details; Email: HSSREC@ukzn.ac.za and Phone number +2731 260 4557/8350/3587

Thank you for your contribution to this research

DECLARATION

I…… *(full name of participant*) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire. I understand the intention of the research. I hereby agree to participate.

I consent/do not consent to have this interview recorded (if applicable)

SIGNATURE OF PARTICIPANT **DATE**

……

Appendix II: Interview Schedule for University Librarians

Demographic Information:

1. University of affiliation: _____
2. Gender: Female ☐ Male ☐ Prefer not to say☐
3. Age Category

   i) 31-40☐ ii) 41-50 ☐ iii) 51-60☐ iv) 61 and above☐
4. Qualification: Masters☐ PhD☐ Other *(Please specify)*

   …….

A. Level of awareness of linked data among university librarians

5. In your opinion, what is your understanding of Linked Data?.....
6. When were you introduced to Linked Data technologies?.....
7. How did you come to know about Linked Data technologies?.....
8. What facilitating conditions are available to create awareness of Linked Data among the university librarians?.....
9. What social influence is needed to promote the adoption of Linked Data at the university library?.....
10. From your observation, do you think the library staff are aware and can easily adapt to Linked Data?

    If yes, why?.....

    If No, why not?.....

B. Extent of use of linked data in the university libraries?

11. Has the University library adopted any Linked Data technologies to share data with the users?
12. If yes, what type of Linked Data technologies are being used in your institutional library? (For example: Mendeley Data, Figshare, Zenodo, Open science framework, UK data service, Harvard Dataverse among others)
13. How would you describe the extent of adoption of data sharing among university libraries in the country?.....

14. Which section is responsible for ensuring that research data is uploaded to the data repository and shared with users?.....
15. What facilitating conditions are available to support data sharing and reuse among the university libraries? ……...

D Benefits of adopting linked data in University libraries

16. What benefits do you think Linked Data provides to the university libraries in the country?

E. Factors that influence the behaviour of University librarians towards the adoption of Linked Data.

17. In your opinion, what factors influence the adoption of Linked Data among the university librarians?.....
18. What do you think are some of the challenges that hinder university librarians to adopt and implement Linked Data?.....
19. How can these challenges mentioned in question 18 above be addressed?.....

F. Strategies required to promote the adoption and the use of linked data among university libraries.

20. What policies are in place to facilitate data sharing among the university libraries?
21. What strategies do you think university libraries should use to adopt the use of Linked Data in their institutions?

Thank you for accepting to be part of this study.

Appendix III: Interview Schedule for Heads of Information Technology

Demographic Information:

1. University of affiliation:_____
2. Gender: Female ☐ Male ☐ Prefer not to say ☐
3. **Age Category**

i) 31-40 ☐ ii) 41-50 ☐ iii) 51-60 ☐ iv) 60-above☐

4. **Qualification:** Masters ☐ PhD Other *(Please specify)*……

A. Level of awareness of linked data among university librarians

B. In your opinion, what is your understanding of Linked Data?.....

5. Are you aware of any Linked Data technologies used in libraries?.....
   If yes, how did you come to know about these Linked Data technologies?.....
   If yes, what Linked Data technologies are being used by the libraries?…….....
6. What facilitating conditions are available for the IT section to create awareness of Linked Data among the university librarians?.....
7. In your opinion, what social influence do you think the University library needs in order to successfully adopt and use Linked Data?.....
8. From your observation, do you think the IT Staff are aware and have the skills to adapt to the Linked Data technologies easily?

If yes, why?.....

If no, why not?.....

C. Extent of use of linked data in the university libraries?

9. Has the IT department developed any in-house linked data technologies used by the library to share data among users and other university libraries?
10. If yes to question 9, what type of in-house linked data technologies have been developed?
11. How have they improved data sharing in the university and other university libraries?
12. In your opinion, how would you describe the extent of adoption of data sharing among the university libraries?
13. In your opinion, is there any IT infrastructure to support the adoption of Linked Data among the university libraries?

14. If yes to question 13, what kind of IT infrastructure is available to support data sharing and reuse among the university libraries?

C Benefits of adopting linked data in University libraries.

15. In your opinion, what do you think are the benefits of adopting and implementing Linked Data in the university library?

D. Factors that influence the behaviour of University librarians towards the adoption of Linked Data.

16. What do you think are the factors that influence the behaviour of university librarians towards the adoption of Linked Data?
17. What challenges does the IT section face in providing support to the university library regarding adopting Linked Data technologies?

E. Strategies required by University libraries to promote the adoption of linked data

18. What policies are in place to facilitate data sharing among the university libraries?
19. What strategies do you think you need to promote the adoption and use of Linked Data in the university library?

Thank you for accepting to be part of this study.

Appendix IV: Informed Consent Form for the Professional Librarians and Heads, Library Technical Services

Dear Respondent

My name is Winny N Akullo a Ph.D. in Information Studies Candidate at the University of KwaZulu-Natal, South Africa, I kindly invite you to participate in the research project entitled **Adoption of Linked Data among University Libraries in Uganda.**

The aim of the study is to explore the adoption of Linked Data among the University libraries in Uganda. It is hoped the findings of the study will bridge the gap in sharing and re-use of data among the Ugandan university libraries. The research will gather data on the level of awareness of Linked Data among the professional librarians; the extent of adopting Linked Data in the University libraries; identify the potential benefits of adoption of Linked Data among the university libraries; investigate the factors that influence the behaviour of professional librarians towards the adoption of Linked Data; and strategies that the university libraries can use to adopt the use of Linked Data.

Fourteen (14) university libraries have been selected in the country for this study. Your university library is among the selected ones for data collection. Participation in this research project is voluntary. You may refuse to participate or withdraw from the research project at any stage and for any reason without any form of disadvantage. There will be no monetary gain from participating in this research project. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Information Studies programme, at the University of KwaZulu-Natal.

I would greatly appreciate if you can spare 20 minutes of your time to complete the questionnaire. Please answer every question as honestly as you can. Your response will be strictly kept confidential. Any information provided would be used for academic purposes only.

I can be contacted at: School of Social Sciences, University of KwaZulu-Natal, Pietermaritzburg Campus,
Email: [redacted]
Phone number: [redacted]

My supervisor is **Dr Zawedde Nsibirwa** who is located at the School of Social Sciences, Pietermaritzburg Campus of the University of KwaZulu-Natal, South Africa
Email: nsibirwaz@ukzn.ac.za
Phone number: +27 33 260 5685

The Humanities and Social Sciences Research Ethics Committee contact details; Email: HSSREC@ukzn.ac.za and Phone number +2731 260 4557/8350/3587

Thank you for your contribution to this research.

DECLARATION

I…… *(full name of participant*) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participate in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire. I understand the intention of the research. I hereby agree to participate.

I consent/do not consent to have this interview recorded (if applicable)

SIGNATURE OF PARTICIPANT **DATE**

…… ……

Appendix V: Questionnaire for the Professional Librarians

Please provide the most suitable response by putting a tick (✓) in the appropriate box (☐). Use the spaces provided to write your answers to the open-ended questions.

A. Demographic and affiliate university information:

A1. University affiliation:……...

A2. Current designation:……..…….....

A3. Gender 1) Male☐ 2) Female☐ 3) Prefer not to say☐

A4. Age range:

1) 21-25 ☐ 2) 26-30 ☐ 3) 31-35☐ 4) 36-40 ☐ 5)41-45 ☐ 6) 46-49 ☐ 7)50-above ☐

A5. Please indicate how long you have worked at the university library.

1) Less than 1 year ☐ 2) 1-5 years ☐ 3)5-10 years ☐ 4) 10-above ☐

A6. What is your highest academic qualification?

1) Bachelor's degree ☐ 2) Master's Degree ☐ 3) PhD☐ 4) other (*please specify)*……

A7. What is the primary role of your section in the University library?

…….…..

B. Level of awareness of linked data.

Linked Data has emerged as an innovation among libraries. Linked Data is defined as a set of principles for sharing data and building relationships between data on the Web. It is therefore a publishing paradigm for making data fully accessible and interlinked anywhere in the world.

The purpose of this section is to find out your level of awareness about Linked Data

B1. Are you aware of any research data in your institution linked on the Web?

1) Yes ☐ 2) No ☐

B1.1. If yes to question B1, please tick the appropriate data repository where the data is linked.

1) Mendeley Data☐
2) Zenodo☐
3) UK Data Service.☐
4) Figshare☐

5) Harvard Data verse☐

6) Others (*Please specify)*……

B2.Were you introduced to Linked Data in your current institution or had prior knowledge of Linked Data before you joined the university library?

1) I was introduced to Linked Data in my current university library☐
2) I had prior knowledge before I joined this university library ☐
3) I don't have knowledge about Linked Data ☐
4) Other (*Please specify)*……

B3. If you were introduced to Linked Data Technologies, approximately when were you first introduced to these technologies?

1) Less than 6 months ago ☐
2) months to 2 years ago ☐
3) 2 to 3 years ago ☐
4) to 5 years ago ☐
5) 5 to 10 years ago ☐

B4. How did you come to know about Linked Data?

1) At an international conference☐
2) Told by a colleague☐
3) At a library workshop☐
4) By accident☐
5) Other (*Please specify*)……

B5. Below are the statements that express the level of awareness of the adoption of Linked Data. For each item, please tick (✓) as it applies to you. 1=Strongly disagree, 2=Disagree,3=Neither agree nor disagree, 4= Agree,5=Strongly agree

S/N	Item 1: Facilitating Conditions	1	2	3	4	5
B5.1	I am aware of the Linked Data concept					
B5.2	I am aware Linked Data offers best practices for publishing structured data on the Web					

B5.3	I am aware Linked Data offers best practices for sharing structured data on the Web					
B5.4	I am aware Linked Data offers best practices for interlinking structured data on the Web					
B5.5	I am aware Linked Data offers best practices for publishing, sharing and interlinking structured data on the Web.					
B5.6	I am aware some university libraries have adopted Linked Data for their data sharing and re-use					
	Item 2: Social Influence					
B5.7	I am aware the university has acquired the necessary infrastructure to facilitate the data sharing among other universities					
B5.8	I am aware of the university library's use of URIs to link data to explore the information referenced and interconnected on the Web.					
B5.9	I am aware of the university library's use of the web interface to enable patrons find and search published datasets.					
B5.10	I am aware the university library needs to use the Web of Data to enable access and sharing of data with users without barriers.					
B5.11	I am aware my institution needs to support global efforts to make data available, accessible, and usable for unrestricted use worldwide.					
	Item 3: Observability					
B5.12	I was influenced by what I observed as the benefits of using Linked Data					
B5.13	I observed colleagues from other institutions using Linked Data technologies and appreciated the advantages of using it					
B5.14	I have seen how my colleagues use Linked Data technologies before I could use it.					

B5.15	I have the opportunity to try out how I can make use of Linked Data					
B5.16	It didn't take me a lot of time before I started using it					

C. Extent of adopting Linked Data in the University libraries.

Below are the statements that express the extent of the adoption of Linked Data. For each item, please tick (✓) as it applies to you. 1=Strongly Disagree, 2=Disagree, 3=Undecided 4=Agree 5=Strongly Agree.

S/N	Item 4: Effort Expectancy	1	2	3	4	5
C1	Linked Data technologies are easy to use for me					
C2	The use of Linked Data does not need a lot of effort					
C3	The use of Linked Data requires a lot of technical knowledge					
C4	I don't need a trial to be convinced to use Linked Data					
C5	It did not take me much time to try Linked Data technologies before I finally accepted it.					
C6	A trial convinced me that using Linked Data is better than using the library traditional methodologies					
	Item 5: Facilitating Conditions					
C8	My institution has provided me with the required training to enable me to adapt to use of Linked Data.					
C9	My institution has provided the library with the technological infrastructure support to facilitate the adoption of Linked Data					
C10	My institution has acquired specialised IT personnel to provide technical assistance to the library staff regarding the use of Linked Data technologies					
C11	My institution has allocated a financial budget to facilitate data sharing and its use in my library					
C12	There is a library technical team established to ensure data sharing and its re-use.					
C13	My institution has a policy that requires research datasets to be deposited in the library					

	Item 6:Trialability					
C14	Using Linked Data technology may need someone with technical knowledge and an IT background.					
C15	It is better to experiment with how Linked Data works before adopting and implementing it.					
C16	It is better and easier to use Linked Data technologies after ascertaining that other institutions have successfully implemented it.					
C17	Linked Data tools may be complicated to use					
C18	Transition to Linked Data technologies in the library may be a big challenge					
C19	I am willing to learn about Linked Data technologies to improve data sharing and reuse in my institutional library.					

D. Benefits of adopting Linked Data in University libraries.

Below are the statements that express the benefits of the adoption of Linked Data in university libraries. For each item, please tick (✓) as it applies to you. 1=Strongly Disagree, 2=Disagree, 3=Undecided 4=Agree 5=Strongly Agree.

S/N	Item 7: Performance Expectancy	1	2	3	4	5
D1	Linked data shall reduce the unnecessary duplication of data that is already available elsewhere					
D2	Linked data shall improve users' overall search experiences with the existing library data once it's integrated into the Web.					
D3	The linking of data from university libraries to the Web will allow for an increased richness in overall data					
D4	Linked Data will be useful for library patrons to find content on the Web.					
D5	Linked Data will assist patrons to discover relevant information and data through links to other data repositories					
D6	Linked Data has the potential to interlink and publish libraries on the Web.					

D7	Increased exposure of institutional repository collection to web search engines					
D8	Traditional institutional repository software shall facilitate the integration of vocabularies published as Linked Open Data.					
D9	Benefit research, discovery, and enrich discovery and create a model other universities can use.					

E. Factors that influence the behaviour of professional librarians towards the adoption of Linked Data in University libraries.

Using a five-point Likert Scale, indicate how the behaviour of professional librarians influences the adoption of Linked Data. Please tick (✓) as follows: 1=Strongly Disagree, 2=Disagree, 3=Undecided 4=Agree 5=Strongly Agree.

S/N	**Item 8: Effort Expectancy**	1	2	3	4	5
E1	Prior knowledge with using Linked Data					
E2	Fear of using Linked Data technologies					
E3	Fear of change from traditional tools to new technologically innovative tools					
E4	Perceived threats to job security					
E5	Age and Gender to adapt to the Linked Data technologies					
E6	Perceived availability of training and skills enhancement opportunities					
	Item 9: Social influence					
E7	Top management buy-in and support					
E8	Technical skills will be required to adapt to using Linked Data					
E9	Benchmarking with other institutional libraries using Linked Data					
E10	Human resources with the expertise will be required					
E11	Researchers 'will be able to access datasets on the Web					
E12	Support from the IT staff shall be required					

F. Strategies that can be used by university libraries to adopt the use of Linked Data.

Linked Data in University libraries.

Using a five-point Likert Scale, indicate how university libraries can strategize to promote the adoption of Linked Data. Please tick (✓) as follows: 1=Strongly Disagree, 2=Disagree, 3=Undecided 4=Agree 5=Strongly Agree.

S/N	Item 10: Effort Expectancy	1	2	3	4	5
F1	Be proactive in gaining administrative support instead of passively waiting for administrative decisions.					
F2	Include research assignments in some of the employees' workload for them to conduct research during the exploratory stages of innovation adoption					
F3	Collaborate effectively with professionals in and out of the library community					
F4	Benchmark with other institutions already implementing Linked Data					
F5	Lobby for budget allocation to facilitate the adoption and implementation of Linked Data at the university library in addition to infrastructure and training of workforce					
F6	Establish a policy governing data management and linking. Requiring research submissions to be accompanied with data files and creation of Linked Data.					
F7	Collaborate with other university libraries through the Consortium of Uganda University Libraries and establish a central data repository					
F8	Develop data management awareness plans for staff and users					
F9	Start with adoption of minimum requirements of Linked Data principles					
F10	Develop courses on Linked Data applications in libraries by professional organisations.					
F11	Encourage staff to keep themselves up-to-date and explore the potential of Linked Data technologies in libraries					

Any other comments or remarks……

…….....

Thank you very much for your time.

Appendix VI: Questionnaire for the Head, Library Technical Services

Please provide the most suitable response by putting a tick (✓) in the appropriate box (☐).
Use the spaces provided to write your answers to the open-ended questions.

A. Demographic and affiliate university information

A1. University affiliation:……...

A2. Current designation:……..…….....

A3. Gender: 1) Male ☐ 2) Female ☐) Prefer not to say ☐

A4. Age range:

1) 21-25 ☐ 2) 26-30 ☐ 3) 31-35☐ 4) 36-40 ☐ 5) 41-45 ☐ 6)46-49 ☐ 7)50-above ☐

A5. Please indicate how long you have worked as Head of Library Technical Services.

1) Less than 1 year ☐
2) 1-5 years ☐
3) 5-10 years ☐
4) Above 10years ☐

A6. What is your highest academic qualification?

1) Bachelor's degree ☐
2) Master's Degree ☐
3) PhD. ☐
4) 4. Other (*please specify*)

B. Level of awareness of linked data among professional librarians in University libraries.

Linked Data has emerged as an innovation among libraries. Linked Data is defined as a set of principles for sharing data and building relationships between data on the Web. It is therefore a publishing paradigm for making data fully accessible and interlinked anywhere in the world.

The purpose of this section is to find out your level of awareness of Linked Data.

B1. Are you aware of any research data linked on the Web?

1) Yes ☐
2) No ☐

B1.1. if yes to question B1, please tick the appropriate linked data technology you have used or are using.

1) Mendeley Data☐
2) Zenodo☐
3) UK Data Service.☐

4) Figshare☐
5) Harvard Data verse☐
6) Others (*Please specify)*……

B2. Were you introduced to Linked Data in your current institution or had prior knowledge of Linked Data before you joined the university library?

1) I was introduced to Linked Data in my current university library ☐
2) I had prior knowledge before I joined this university library ☐
3) I do not have knowledge about Linked Data ☐

B3. If you were introduced to Linked Data Technologies, approximately when were you first introduced to these technologies?

1) Less than 6 months ago ☐
2) 6 months to 2 years ago ☐
3) 2 to 3 years ago ☐
4) 3 to 5 years ago ☐
5) 5 to 10 years ago ☐

B4. How did you come to know about Linked Data?

1) At an international Conference ☐
2) Told by a colleague ☐
3) At library workshop ☐
4) By accident ☐
5) Other (*Please specify*)……

B5. Below are the statements that express the level of awareness of the adoption of Linked

Data. For each item, please tick (✓) as it applies to you. 1= Low, 2= Below average, 3-Average, 4=Above Average, 5=High

S/N	Item 1: Facilitating Conditions	1	2	3	4	5
B5.1	I have the knowledge necessary to use Linked Data					
B5.2	Linked Data technologies are not compatible with other systems I use					
B5.3	IT staff are available for assistance in case I experience difficulties					
B5.4	I am aware Linked Data offers best practices for publishing, sharing and interlinking structured data on the Web.					
B5.5	It would be good to use Linked Data in my work even if it is not compulsory					
	Item 2: Social Influence					
B5.6	I am aware of the university library's use of URIs to link data to explore the information referenced and interconnected on the Web.					
B5.7	I am aware the university library needs to use the Web of Data to enable access and sharing of data with users without barriers.					
B5.8	I am aware my institution needs to support global efforts to make data available, accessible, and usable for unrestricted use worldwide.					
	Item 3: Observability					
B5.9	I observed colleagues from other institutions using Linked Data technologies and appreciated the advantages of using it					
B5.10	I have seen how my colleagues use Linked Data technologies before I could use it.					
B5.11	I have the opportunity to try out how I can make use of Linked Data					
B5.12	It did not take me a lot of time before I started using Linked Data					

C. Extent of adopting Linked Data in the University libraries.

Below are the statements that express the extent of the adoption of Linked Data. For each item, please tick (✓) as it applies to you. 1=Strongly Disagree, 2=Disagree, 3=Undecided 4=Agree 5=Strongly Agree.

S/N	Item 4: Effort Expectancy	1	2	3	4	5
C1	My interaction with the Linked Data technologies would be clear and understandable					
C2	It would be easy for me to easily adapt to using Linked Data					
C3	I would find the Linked Data technologies easy to use					
C4	Learning to use Linked Data will be easy for me					
	Item 5: Facilitating Conditions					
C5	I have the resources necessary to use the Linked Data technologies.					
C6	I have the technical expertise to use Linked Data					
C7	I have support from my team to adopt and use Linked Data					
	Item 6:Trialability					
C8	Using Linked Data technologies needs an IT technical background.					
C9	It is better to experiment with how Linked Data works before adopting and implementing it in the library.					
C10	It is better to adopt Linked Data after ascertaining that other institutions have successfully used it.					
C11	Linked Data tools may be complicated to incorporate in the current library tools					
C12	The transition from Machine Read Catalogue (MARC) to Resource Description Framework or BIBLIOFRAME is a big challenge					
C13	I am willing to learn about Linked Data technologies to improve data sharing and discovery of data on the Web.					

D. Benefits of adopting Linked Data in University libraries.

Below are the statements that express the benefits of the adoption of Linked Data in university libraries. For each item, please tick (✓) as it applies to you. 1=Strongly Disagree, 2=Disagree, 3=Undecided 4=Agree 5=Strongly Agree.

S/N	Item 7: Performance Expectancy	1	2	3	4	5
D1	I would find Linked Data useful in my job					
D2	Using Linked Data enables me to accomplish tasks more quickly					
D3	Using Linked Data increases my productivity					
D4	If I use Linked Data I would have more chances to improve data sharing					
D5	Using Linked Data enables me to accomplish tasks more quickly					

E. Factors that influence the behaviour of professional librarians towards the adoption of Linked Data in University libraries.

Using a five-point Likert Scale, indicate how the behaviour of professional librarians influences the adoption of Linked Data. Please tick (✓) as follows: 1=Strongly Disagree, 2=Disagree, 3=Undecided 4=Agree 5=Strongly Agree.

S/N	Item 8: Effort Expectancy	1	2	3	4	5
E1	Prior knowledge with using Linked Data					
E2	Fear of using Linked Data technologies					
E3	Fear of change from traditional tools to new technologically innovative tools					
E4	Perceived threats to job security					
E5	Age and Gender to adapt to the Linked Data					
E6	Perceived availability of training and skills enhancement opportunities					
	Item 9: Social influence					
E7	Top management buy-in and support					
E8	People who influence my work think that using Linked Data will improve our services in the library.					

E9	Technical skills will be required to adapt to using Linked Data					
E10	Benchmarking with other institutional libraries using Linked Data					
E11	Management would motivate me to use the system					
E12	Human resources with the expertise will be required					
E13	I shall require external training in Linked Data technologies for me to integrate with the library systems we currently have					
E14	Researchers will be able to access datasets on the Web					
E15	Support from the IT staff shall be required					

F. Strategies that can be used by university libraries to adopt the use of Linked Data.

Using a five-point Likert Scale, indicate how university libraries can strategise to promote the adoption of Linked Data in their libraries. Please tick (✓) as follows: 1=Strongly Disagree, 2=Disagree, 3=Undecided 4=Agree 5=Strongly Agree.

S/N	Item 10: Effort Expectancy	1	2	3	4	5
F1	Be proactive in gaining administrative support instead of passively waiting for administrative decisions.					
F2	Include research assignments in some of the employees' workload for them to conduct research during the exploratory stages of innovation adoption					
F3	Collaborate effectively with professionals in and out of the library community					
F4	Benchmark with other institutions already implementing Linked Data					
F5	Lobby for budget allocation to facilitate the adoption and implementation of Linked Data at the university library in addition to infrastructure and training of the workforce					

F6	Establish a policy governing data management and linking, requiring research submissions to be accompanied with data files and creation of Linked Data.					
F7	Collaborate with other university libraries through the Consortium of Uganda University Libraries and establish a central data repository					
F8	Develop data management awareness plans for staff and users					
F9	Start with adoption of minimum requirements of Linked Data principles					
F10	Develop courses on Linked Data applications in libraries by professional organisations.					
F11	Encourage staff to keep themselves up-to-date and explore the potential of Linked Data technologies in libraries					

Any other comments or remarks……

Thank you very much for your time

Appendix VII: Research Approval by Uganda National Council for Science and Technology

Uganda National Council for Science and Technology

(Established by Act of Parliament of the Republic of Uganda)

Our Ref: SS1338ES **21 July 2022**

Winny Akullo
Public Procurement and Disposal of Public Assets Authority
Kampala

Re: Research Approval: Adoption of Linked Data among University libraries in Uganda

I am pleased to inform you that on **21/07/2022**, the Uganda National Council for Science and Technology (UNCST) approved the above referenced research project. The Approval of the research project is for the period of **21/07/2022** to **21/07/2023**.

Your research registration number with the UNCST is **SS1338ES**. Please, cite this number in all your future correspondences with UNCST in respect of the above research project. As the Principal Investigator of the research project, you are responsible for fulfilling the following requirements of approval:

1. Keeping all co-investigators informed of the status of the research.
2. Submitting all changes, amendments, and addenda to the research protocol or the consent form (where applicable) to the designated Research Ethics Committee (REC) or Lead Agency for re-review and approval **prior** to the activation of the changes. UNCST must be notified of the approved changes within five working days.
3. For clinical trials, all serious adverse events must be reported promptly to the designated local REC for review with copies to the National Drug Authority and a notification to the UNCST.
4. Unanticipated problems involving risks to research participants or other must be reported promptly to the UNCST. New information that becomes available which could change the risk/benefit ratio must be submitted promptly for UNCST notification after review by the REC.
5. Only approved study procedures are to be implemented. The UNCST may conduct impromptu audits of all study records.
6. An annual progress report and approval letter of continuation from the REC must be submitted electronically to UNCST. Failure to do so may result in termination of the research project.

Appendix VIII: Research Approval by Humanities and Social Sciences Research Ethics Committee

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

27 July 2022

Winny Akullo (221116843)
School Of Social Sciences
Pietermaritzburg Campus

Dear Winny Akullo,

Protocol reference number: HSSREC/00004317/2022
Project title: Adoption of linked data among university libraries in Uganda
Degree: PhD

Approval Notification – Expedited Application

This letter serves to notify you that your application received on 30 May 2022 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid until 27 July 2023.
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

HSSREC is registered with the South African National Research Ethics Council (REC-040414-040).

Yours sincerely,

[redacted]

Professor Dipane Hlalele (Chair)

/dd

Appendix IX: Gatekeepers Letters

BUSITEMA UNIVERSITY
Pursuing Excellence

P.O. Box 236, Tororo, Uganda
Gen: +256 - 45 444 8838
Fax: +256 - 45 4436517
Email: info@adm.busitema.ac.ug
www.busitema.ac.ug

OUR REF: BU/LIB/Akullo/01

August 27, 2021

Dr. Zawedde Nsibirwa
Supervisor/ Senior Lecturer
Information Studies Programme
University of KwaZulu-Natal
nsibirwaz@ukzn.ac.za
+27 33 260 5685

RE: MS. WINNY NEKESA AKULLO - PHD STUDENT AT UNIVERSITY OF KWAZULU-NATAL

Greetings from Uganda!

I take note of your request to grant Ms. Winny Nekesa Akullo permission to carry out research at Busitema University Library. I wish to confirm that this permission is granted and we pledge to give all the necessary support that Ms. Akullo will require through her research at Busitema University Library.

Ms. Akullo's research on linking data is timely as there is widespread campaigns on Open Science among libraries and research institutions.

We look forward to supporting Ms. Akullo and we hope to benefit from her research.

Yours sincerely,

[redacted]

Dr. Fredrick Kiwuwa Lugya
University Librarian
BUSITEMA UNIVERSITY

CAVENDISH UNIVERSITY UGANDA

Dr. Zawedde Nsibirwa

Supervisor / Senior Lecturer

Information Studies Programme

University of KwaZulu-Natal

Private Bag X01 Scottsville 3209

Pietermaritzburg

23rd August 2021

Dear Dr. Zawedde,

RE: Ms. Winny Nekesa Akullo – PhD Student at the University of KwaZulu-Natal

This is to acknowledge receipt of the introductory letter from your office and to confirm that Ms. Winny Nekesa Akullo – PhD Student at the University of KwaZulu-Natal has been accepted to conduct part of her research from Cavendish University Uganda Library.

Thank you for expressing interest in doing your research in our University.

Kind regards.

[redacted]

Ms. Alice Akiteng Okure

University Librarian

Cavendish University Uganda
Plot 1469, Ggaba Road, Nsambya (opp. American Embassy)
P.O.Box 33145, Kampala, Tel: +256 414 531700
info@cavendish.ac.ug, www.cavendish.ac.ug

CLARKE INTERNATIONAL UNIVERSITY
LEAD • INNOVATE • TRANSFORM
LIBRARY DEPARTMENT

(+256) 0750 000600
library@ciu.ac.ug
www.ciu.ac.ug

August 25th 2021

Dr. Zawedde Nsibirwa

Supervisor/Senior Lecturer

Information Studies Programme

University of KwaZul-Natal

Dear Dr. Zawedde,

RE: Approval Letter for Ms. Winny Nekesa Akullo - PhD Student at the University of KwaZulu-Natal

This is to acknowledge receipt of the introductory letter from your office and to confirm that Ms. Akullo has been granted permission to conduct her research from the Clarke International University libraries situated at Bukasa, Muyenga and Kisugu, Namuwongo. She will be free to engage with any of the library staff and other University staff at any time depending on her research questions.

I hope Ms. Akullo will find the best data for her research.

Thank you.

[redacted]

Mubiru Steven

University Librarian

Email: smubiru@ciu.ac.ug

+256784770247

GULU UNIVERSITY
P.O. Box 166
Gulu, Uganda
Tel: +256-471-32924
Fax: +256 471343095
Emails: ul@gu.ac.ug
URL: www.gu.ac.ug

OFFICE OF THE UNIVERSITY LIBRARIAN

September 7, 2021

Dr Zawedde Nsibirwa
University of Kwazulu-Natal,
Private Bag X01 Scottsville 3209,
Pietermaritzburg,
South Africa

Dear Madam,

RE: INTRODUCTION OF MS. WINNY NEKESA AKELLO - PHD STUDENT UNIVERSITY OF KWAZULU-NATAL

We have received your letter dated 17th August 2021 from the University of KwaZulu-Natal introducing Ms Winny and her research titled "**Adoption of Linked Data among University Libraries in Uganda**" in Gulu University.

This is to inform you that permission is granted for Ms Winny to carry research in Gulu University Library.

By this letter, all Library staff required in the research are requested to kindly accord Ms Winny the necessary support.

Thank you.

[redacted]

Mr. Kizito Ongaya

FOR: UNIVERSITY LIBRARIAN

Copy Vice Chancellor

,, Deputy Vice Chancellor - Academics

KABALE UNIVERSITY

P.O. Box 317
Kabale - Uganda
Email: us@kab.ac.ug

Tel: +256-392-848355/4864-26463
Mob: +256-782-860259
Website: www.kab.ac.ug

OFFICE OF UNIVERSITY SECRETARY

25/08/2021

Dr Zawedw Nsibirwa,
Supervisor/Senior Lecturer
Information studies Programme
University of KwaZulu- Natal
Private Bag X01, Scottsville 3209
Pietermaritzburg

Dear Dooctor,

Re: **Ms Winny Akullo- PHD student at University of KwaZulu-Natal**

This is to confirm that Ms Winny Akullo has been granted permission to carry out her PhD research in Kabale University for her study entitled: *Adoption of Linked Data among University Libraries in Uganda.*

By copy of this letter, all Kabale University staff are requested to give her the necessary support required to enable her carry out and complete her studies in time.

[redacted]

Tindyebwa Peace Tushabeomwe
For: **University Secretary**

KABALE UNIVERSITY
P.O. BOX 317 KABALE
25 AUG 2021
UNIVERSITY SECRETARY

cc: Ms Winny Akullo

KYAMBOGO UNIVERSITY

P. O. BOX 1 KYAMBOGO
Tel: 041 -286237, 285001/2 Fax: 041 -220464, 222643
Email: uskyu@kyu/www.kyu.ac.ug

Office of the University Secretary

In any correspondence on this subject please, quote No: **KYU/R/03**

Date: 31st August 2021

Winny Nekesa Akullo
PhD Student
University of KwaZulu-Natal
P. O. Box 3209
South Africa

KYAMBOGO UNIVERSITY
RECEIVED
03 SEP 2021
OFFICE OF THE UNIVERSITY SECRETARY

PERMISSION TO CONDUCT RESEARCH

Reference is made to the letter dated, 17th August 2021 on the above requesting for authority to conduct research on: ***"Adoption of Linked Data among University Libraries in Uganda",*** as a partial fulfillment for the award of Doctorate (PhD) in ***Information Studies*** at the University of KwaZulu-Natal.

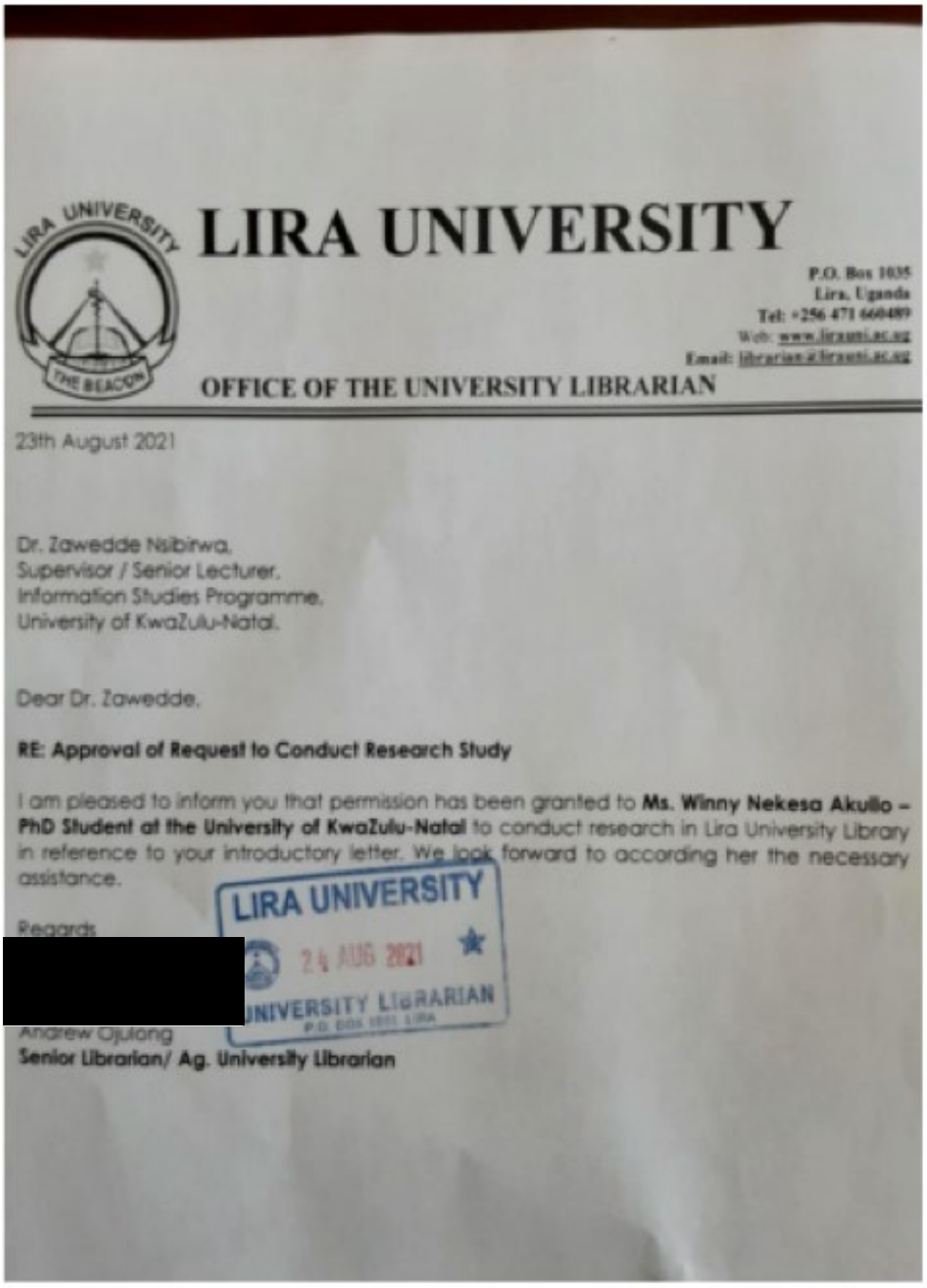
This is to inform you that permission is **granted** to you to conduct the above research at the University. Liaise with the Academic Registrar or relevant Faculty Dean and Head of Departments to guide you on the way forward.

Regards

[redacted]

Arthur Katongole
FOR UNIVERSITY SECRETARY

CC: The Academic Registrar
" The Dean of Students
" The University Librarian
" The Dean Faculty of Engineering
" The Head of Departments



LIRA UNIVERSITY

P.O. Box 1035
Lira, Uganda
Tel: +256 471 660489
Web: www.lirauni.ac.ug
Email: librarian@lirauni.ac.ug

OFFICE OF THE UNIVERSITY LIBRARIAN

23th August 2021

Dr. Zawedde Nsibirwa,
Supervisor / Senior Lecturer,
Information Studies Programme,
University of KwaZulu-Natal.

Dear Dr. Zawedde,

RE: Approval of Request to Conduct Research Study

I am pleased to inform you that permission has been granted to **Ms. Winny Nekesa Akullo – PhD Student at the University of KwaZulu-Natal** to conduct research in Lira University Library in reference to your introductory letter. We look forward to according her the necessary assistance.

LIRA UNIVERSITY
24 AUG 2021
UNIVERSITY LIBRARIAN
P.O. BOX 1035, LIRA

Regards

[redacted]

Andrew Ojulong
Senior Librarian/ Ag. University Librarian

MAKERERE UNIVERSITY

P.O. Box 7062 Kampala Uganda
P.O. Box 16002 Kampala Uganda
Email: universitylibrarian@mulib.mak.ac.ug

Tel: Gen line 256-41-531041
Fax: 256-41-540374
Web: mulib.mak.ac.ug

THE LIBRARY

26th August 2021

Dr. Zawedde Nsibirwa
Senior Lecturer, Information Studies Programme
University of KwaZulu - Natal

RE: PERMISIION FOR MS WINNY AKULLO TO CARRY OUT RESEARCH IN MAKERERE UNIVERSITY LIBRARY

Dear Dr. Zawedde Nsibirwa,

Reference is made to your letter of 17th August 2021 in which you requested me to allow Ms Winny Akullo carry out research for her doctoral studies on: ***Adoption of linked data among University libraries in Uganda.***

The purpose of this letter is to inform you that permission is granted for Ms Akullo to carry out her research in Makerere University Library.

Yours sincerely,

[redacted]

Helen M. Byamugisha (PhD)
Assoc. Library Professor and
UNIVERSITY LIBRARIAN
Makerere University
P. O. Box 7062
Kampala- Uganda

MUNI UNIVERSITY

OFFICE OF THE UNIVERSITY SECRETARY
P.O. Box 725, Arua, Uganda
Tel: +256 476 420312/3/4; Fax +256 476 420316
Email: info@muni.ac.ug/inquiries@muni.ac.ug
www.muni.ac.ug

Our Ref: **MU/CR/150/164/3**
Your Ref:.....

14 September 2021

Winny Akullo
School of Social Sciences
University of KwaZulu-Natal
Private Bag X10, Scottsville
3209, SOUTH AFRICA

Dear Madam,

RE: PERMISSION TO UNDERTAKE ACADEMIC RESEARCH STUDY AT MUNI UNIVERSITY FOR YOUR PhD (DOCTORAL) PROGRAMME

The above in caption refers.

I am in receipt of your letter dated 24th August 2021, regarding carrying out academic research to explore the "Adoption of Linked Data among University Libraries in Uganda".

The purpose of this communication, is therefore, to inform you that, permission has been granted for you to conduct research from Muni University for academic purposes.

By copy of the same, Mr. Adoma Philliam, our Ag. University Librarian is assigned to help you to access the information required to enable you successfully complete your research undertaking.

I wish to thank you for showing interest in identifying Muni University as your yard stick for academic growth.

Thank you.

[redacted]

MUNI UNIVERSITY
P. O. BOX 725 ARUA
14 SEP 2021
OFFICE OF THE
UNIVERSITY SECRETARY

Rev. Fr. Professor Odubuker Picho Epiphany, MIDM
UNIVERSITY SECRETARY/ACCOUNTING OFFICER

Copy: Vice Chancellor, Muni University
- Deputy Vice Chancellor (AA), Muni University
- Dr. Zawedde Nsibirwa, University of KwaZulu-Natal South Africa
- Ag. University Librarian, Muni University
- Senior Human Resource Officer, Muni University
- File

In Any Future Correspondence Please Quote the Above in Reference

NDEJJE UNIVERSITY
Fear of God brings Knowledge and Wisdom

Directorate of Research and Innovations
P. O. Box 7088, Kampala – UGANDA
Tel: +256 414 663 680
Email: @ndejjeuniversity.ac.ug
Website: www.ndejjeuniversity.ac.ug

Date : 1st September, 2021

To : Winnie Akullo
University KwaZulu-Natal

Dear Ms. Akullo

RE : PERMISSION TO CONDUCT RESEARCH AT NDEJJE UNIVERSITY

This letter responds to yours dated 17th August 2021 requesting for permission to collect data for your PhD study "Adoption of Linked data among University Libraries in Uganda" at Ndejje University.

This is to inform you that permission is hereby granted to you as per your request. However, you will be expected to follow the Uganda National Council for Science and Technology COVID-19 and human ethical guidelines. Therefore, you are expected to report for data collection with a clearance from National Council for Science and Technology.

By the copy of this letter, the University Librarian and University Security is hereby informed and requested to accord you the necessary support.

Yours Sincerely,

[redacted]

.....

Dr. Primrose Nakazibwe (PhD)

Director

Nkumba University

CHARTERED SINCE 2006 BY THE GOVERNMENT OF UGANDA

OFFICE OF THE VICE-CHANCELLOR

The mission of the University is to provide an environment that enables the cultivation of Competence, Confidence, Creativity, and Character, in the academic, professional and social interactions.

27th August, 2021

Dr. Zawedde Nsibirwa
Supervisor/Senior Lecturer
Information Studies Programme
University of KwaZulu-Natal
Private Bag X01 Scottsville 3209
Pietermaritzburg

RE: **PERMISSION FOR MS. WINNY NEKESA AKULLO TO CARRY OUT RESEARCH IN NKUMBA UNIVERSITY**

I refer to your letter of 17th August, 2021.

Permission is hereby granted to Ms. Winny Nekesa Akullo to carry out research in Nkumba University Library.

However, I request her to get in touch with the University Librarian and the Director, Directorate of Postgraduate Studies and Research for any assistance.

Yours sincerely

[redacted]

NKUMBA UNIVERSITY
27 AUG 2021
I OWE YOU
OFFICE OF THE VICE CHANCELLOR

Prof. Jude T. Lubaga
Ag. VICE CHANCELLOR
Tel (mob)+256 774 600 884
Email: vc@nkumbauniversity.ac.ug

Cc: Ms. Winny Nekesa Akullo - PhD Student, University of KwaZulu-Natal

Entebbe Highway • P. O. Box 237, Entebbe, Uganda • Tel: +256 (0)41 437 4996 • E-mail: vc@nkumbauniversity.ac.ug

Vice-Chancellor: +256 (0)41 437 4996 • University Secretary: +256 (0)41 432 0134 • Academic Registrar: +256 (0)41 432 0283 • University Bursar: +256 (0)41 437 4991 • Dean of Students: +256 (0)41 437 4998
School of Postgraduate Studies & Research: +256 (0)41 432 0283 • School of Business & Information Technology: +256 (0)77 259 4457 • School of Education: +256 (0)41 437 0999
School of Social Sciences: +256 (0)41 432 0268 • School of Sciences: +256 (0)41 437 4989 • School of Commercial, Industrial Art & Design: +256 (0)41 432 0269 • School of Law: +256 (0)41 437 0997
University Library: +256 (0)41 437 6113 • Directorate of Quality Assurance: +256 (0)41 469 0120 • General Inquiry: +256 (0)41 432 1448
General Tel / Fax Lines: +256 (0)41 432 1448/437 4288
Website: www.nkumbauniversity.ac.ug

UGANDA CHRISTIAN UNIVERSITY

A Centre of Excellence in the Heart of Africa

University Library and Information Services

Dr. Zawedde Nsibirwa
Information Studies Programme
University of KwaZulu-Natal
Private Bag X01 Scottsville 3209
Pietermaritzburg
Email: Nsibirwaz@ukzn.ac_za
Tel: +27 33 260 5685

25th August 2021

Dear Dr. Nsibirwa,

Re Acceptance to Conduct Research in the UCU Library

This is to acknowledge receipt of your request, dated 17th August 2021, to permit Ms Winny N. Akullo, your PhD (Information Studies) student at the University of KwaZulu-Natal, who is conducting a research titled, "Adoption of Linked Data among University Libraries in Uganda".

We hereby duly accept her request to perform the context of research as stated above; in the Uganda Christian University Library setting. This also serves to request the investigator to comply with the necessary requirements of the relevant research ethics committee(s) and ensure that these requirements are followed in the conduct of this research. Please revert with any queries you may have in this regard. Wishing her all the best in her intellectual endeavours.

Sincerely,

[redacted]

David Bukenya
Ag. University Librarian
Email: dbukenya@ucu.ac.ug
Cell phone: +256776777522

UGANDA CHRISTIAN UNIVERSITY
25 AUG 2021
UNIVERSITY LIBRARIAN

Uganda Martyrs University

Making a difference

School of Postgraduate Studies and Research
spgs@umu.ac.ug

19th August, 2021

Dr. Zawedde Nsibirwa,
Supervisor/ Senior Lecturer
Information Studies Programme
University of KwaZulu-Natal
Private Bag X01 Scottsville 3209
Pietermaritzburg – South Africa.

Dear Zawedde Nsibirwa,

Re: Your request for Ms. Winny Nekesa Akullo to carry out her Research at Uganda Martyrs University

I am glad to inform you that your request for Ms. Winny Nekesa Akullo to carry out her study titled "Adoption of linked data among University Libraries in Uganda" at Uganda Martyrs University has been approved. We shall accord her the assistance required.

As COVID-19 continues to spread Winny is urged to maximally observe the SOPs without compromising the rights, welfare and safety of the participants. Also, she should ensure to emphasize to the participants as mandatory the wearing of face masks, washing of hands with soap and water or hand sanitizer and that physical distancing must be adhered to throughout the implementation of the research activities.

In case of focus group discussions or some form of workshops, she will ensure a distance of at least two meters between persons to avoid person-to-person spread of Corona virus.

On behalf of the School of Postgraduate Studies and Research at Uganda Martyrs University, I welcome Winny and wish her a successful data collection process.

Yours sincerely,

[redacted]

Dr. Elizabeth Namazzi
Dean

c.c Ms. Judith Nannozi, Head Librarian, Uganda Martyrs University.

KAMPALA INTERNATIONAL UNIVERSITY

Ggaba Road, Kansanga * PO BOX 20000 Kampala, Uganda
Tel: +256700654732/+256773395791 Fax: +256 (0) 41 – 501974
E-mail: [illegible] * Website: http://www.kiu.ac.ug

Directorate of Higher Degrees and Research
Office of the Director

CONFIDENTIALITY AGREEMENT (The Agreement dated this ..22.... day of .Sept, 2021
BETWEEN
Akullo N. Winny ....of .University of KwaZulu-Natal
(The Researcher)

AND

.... of KAMPALA INTERNATIONAL UNIVERSITY
(The representative of the University/Site)

Background
The researcher is currently or may be allowed to conduct the study in this institution and may be granted access to .... In addition to this activity, this agreement covers the researcher's responsibility to keep all information attained from this institution confidential and use it for Academic purposes ONLY. The researcher at the end of the study shall share the findings of this study with the institution.

STRICTLY, information on .... is too private and will be handled with anonymity strategies.

SIGNED

Researcher's Signature: [redacted]
Name : Winny Nekesa Akullo
Institution : University of KwaZulu-Natal
Telephone and Email Address: +256 782422047, winny-nekesa@yahoo.com or 221116843@stu.ukzn.ac.za

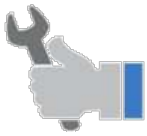
Permission Granted By:

Name : Janice Bwagye
Signature : [redacted]
Designation : University Secretary

"Exploring the Heights"

Appendix X: Proof of editing letter

Athol Leach (Proofreading and Editing)



31 Park Rd
Fisherhaven
Hermanus 7200
Email: atholleach@gmail.com Cell: 0846667799

10 January 2024

To Whom It May Concern

This letter serves to confirm that I have edited the following DPhil (Information Studies) thesis by Winny N Akullo:

"Adoption of Linked Data Among the University Libraries in Uganda"

The thesis was edited in terms of grammar, spelling, punctuation and overall style. In doing so, use was made of MS Word's "Track changes" facility thus providing the student with the opportunity to reject or accept the changes made on a chapter-by-chapter basis.

Please note that while I have, as far as possible, checked the in-text references and those appearing in the list of references for consistency in terms of format and bibliographic detail, I have not checked the veracity of the sources themselves.

Both the tracked and final documents are on file.

Sincerely

[redacted]

Athol Leach
(MIS, Natal)