# PREPAREDNESS OF ACADEMIC LIBRARIES FOR THE ADOPTION OF RESEARCH DATA MANAGEMENT; A CASE OF SELECTED UNIVERSITY LIBRARIES IN KENYA

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## DECLARATION

I hereby declare this is my original work and has not been considered for certification by been presented in any other University/institution.

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## DEDICATION

The Lord God my rock and salvation, it is true it pays to wait upon you, Lord God you are a promise keeper. My mouth shall forever proceed with songs of praise for the mighty and gracious work in my life. What could I have achieved without your help. King of all glory…May praises and adoration come back to you. Thank you, Father. Also, I dedicate the work to my Adorable Husband Anderson Murage and Children Hope Wambura, Precious Nyakio, Lemuel Kamina, Israel Baraka, and Jeremiah Zig. Indeed, your patience and continuous encouragement made the education journey successful. Lastly My Dad Elijah Njagi and Bancy Thirikwa, and In-love Lydiah Wambura and Kenway Patrick Ndwigah. Thank you.

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## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| **ANDS** | Australian National Data Services |
| **ASCIL** | Adaptive Support for Collaborative and Individual Learning. |
| **CARL** | Canadian Association of Research Libraries |
| **CSV** | Comma-Separated Values |
| **DC** | Dublin Core |
| **DCC** | Data Curation Lifecycle |
| **DDI** | Data Documentation Initiative |
| **DIF** | Directory Interchange Format |
| **DMP** | Data Management Plan |
| **EML** | Ecological Metadata Language |
| **F.A.I.R** | Find, Access, Interoperate, and Reuse Data |
| **JISC** | Joint Information Committee |
| **KENET** | Kenya Education Network |
| **LIASA** | Library and Information Association of South Africa |
| **MySQL** | Relational Database Management System (RDBMS) developed by Oracle that is based on Structured Query Language (SQL) |
| **NDS** | National Data Service |
| **NETCDF** | Network Common Data Form |
| **NHRMC** | Australian Government National Health and Medical Research Council |
| **RDF** | Resource Description Format |
| **RDM** | Research Data Management |
| **SADA** | South Africa Data Archive |
| **TELOS** | Economical, Legal, Organizational, Schedule |
| **XML** | Extensible markup language |

## ABSTRACT

Research data entail information gathered during a research project. Research data management is a distinct data lifecycle-related tasks and activities, including metadata creation and design, storage, security, preservation, retrieval, sharing, and reuse. The activities take into account technical capabilities, ethical considerations, legal ramifications, governance frameworks, and technical know-how. Evidence indicates that lack of adopted strategies to manage research data has led to duplication of efforts, unverifiable study findings, and waste of public fund in undocumented research data. Therefore, the study sought to assess the knowledge and key competencies of librarians in the context research data management; collaborative partnerships; structure that drives research data management; policy and legal framework; and data architecture model which academic libraries could adopt to support RDM activities. The study used the technology, economic, legal, organizational, and schedule (TELOS) feasibility model coined by Hall (2007). The study used descriptive quantitative design. The total population was 73 and a sample size was determined using the Slovin's sample size determination method which led to a sample of 62 participants including academic librarians, directors of research, and graduate school board staff selected purposively. Also, structured closed-ended were used. The study used content validity to establish the degree to which the measure represented the paradigm of interest. Cronbach Alpha test was employed to measure questionnaire's reliability which confirmed reliability at 0.78. The descriptive statistical analysis was used to analyze data gathered quantitively and finding presented using tables, graphs, and pie-chart. The study reveals RDM knowledge, skills, and competencies in libraries which have integrated RDM services in the library role. The collaboration exists at interdisciplinary level. The study reveals availability of standards for metadata creation, security for metadata data and responsibility, strategies to make metadata available and when, understanding on cost implication, and who the target for the managed research data. The policies help in handling process and legal framework on ethical issues and concerns. On data architecture the majority preferred the repository model citing practically, flexible functions and utility, giving a foundation for coordinated planning and collaborative activities in academic libraries. In relations to preparedness the participants had high level of knowledge, skills, and competencies particularly Egerton though Kenyatta university have knowledge on RDM but lack the skills and competencies to handle RDM role effectively. On technical preparedness Egerton is more prepared compared to Kenyatta university though diverse understanding of data standards, security, how to make data globally available and when, cost implication and target users for the managed data. The studied libraries were prepared with policies to handle RDM though there were varied views on what the policy should cover and legal framework to handle ethical issues. The study concluded that low level of knowledge, skill and competencies in Kenyatta university could be attributed to lack of integration of RDM service in librarian's role. The interdisciplinary collaboration could be sufficient to handle RDM process. The technical structure should be well defined to handle all phases of research data for a seamless process. On policy there should be evidence-based policies to match with open science methods. The study recommends continuous education on RDM through formal training, seminars, and workshop for successful RDM. Also, extension of interdisciplinary collaboration to partnership with stakeholders. On policy and data architecture institutions should come together in drafting RDM policy for best practice and agree on architecture which could allow widely sharing of research data.

# CHAPTER ONE

# INTRODUCTION AND BACKGROUND TO THE STUDY

## Introduction

The chapter focuses on the importance of research data management and how it has revolutionized the role played by academic libraries across the globe, in the region, and locally. The problem that informed the study follows after background information. The purpose is stated, objectives articulated, and research question provided to guide the study.

The significance is also covered to signal who benefits from the study finding and how. The study's limitations, delimitations, and assumptions are presented. The researcher adopted the technological, economic, legal, organizational, and schedule model to provide direction impetus to the research problem and to inform the conceptual framework. The chapter ends with the operational definition of terms.

## 1.1 Background to the Study

Research data management is an evolving field in scientific inquiry that provides a framework for managing research data from the start to the completion of the research process (Ngeno,2018). Research data is the collected, observed, generated or created raw materials by the researchers during research endeavors suitable for communication, interpretation, or processing. Data can be primary generated data or collected from secondary sources as part of research activity helpful in validating research finding

though, the research philosophy dictates the type of research data gathered either qualitative or quantitative. Also, research data can have many forms including notes (paper-based or digital), spreadsheet, stemmata, videos, images, specimen, samples, interview coding, content of an application, focus group documentation, questionnaires survey, and transcripts among others. The logically complete set of data commonly known as dataset can be used as data package including a database containing population data, analyzed images during a research project, numeric spreadsheet data, and survey data in a database.

Research data management is a collection of various data lifecycle activities and procedures that take into account technical capabilities, legal constraints, ethical principles, and governance frameworks while collecting, storing, protecting, retrieving, sharing, and reusing data (Hess, 2019). RDM is associated with several activities and processes within the data lifecycle including design, and creation of data, storage, security, preservation, retrieval, sharing, and reuse, taking into consideration the governing framework, technical capabilities, legal issues, and ethical aspect (Xiaofeng & Xiang, 2013).

The essence of managing research data in library is to allow harvesting by researchers for knowledge advancement and meet funding and regulatory requirements. Suppressing data generated with public funds is viewed as undemocratic, and restricting access to a public asset is unacceptable. Also, without sharing data, it is hard to verify study findings, which is a core principle of good science. RDM guarantees the accuracy

and validity of the research, allowing new and innovative research to be built on existing information for research continuity (Amorim *et al.,* 2017). Sharing well-managed research data and making it available to others help to avoid duplication of effort, organizing files and data for access leading to research efficiency, and minimizing risks of data loss through enhanced data security (Cox & Pinfield, 2014).

Data sharing can boost a researcher's citation rate, whether through direct citations of the data or the linked article. The ease of online sharing is arguably the most frequent justification for keeping and managing research data. Research data, as well as publication based on that data, is an essential component of a researcher's output thanks to initiatives like Data Cite, a registry that assigns distinctive digital object identities (DOIs) to research data (Cox & Tam, 2018).

The library role in RDM is to acquire raw research data, organize, upload in data repositories and guide researchers on data management plans and metadata standards. The library offers reference assistance for locating and citing data sets, web guides, finding aids for data sets, technical support for data repositories, preparation of data sets for a repository, deaccessioning of data sets from a repository, and meta data creation. The metadata is data about data instrumental in the understanding and processing of data using standards and convection to promote use and reuse by data owners or other researchers. The metadata field describes the dataset including information about the author, content, date of creation, place of capture, why the generated data exist and how the data was created. The librarians classify the metadata

following guideline from provided by the Australian National Data Service (ANDS) to help identify whether metadata is either descriptive, technical, provenance, right of access, or citation metadata in adherence to standard. Standards help to meet the description need in the context of metadata production (Cox & Tam, 2018).

The librarians create awareness on formalized standards adapted for the user community needs such as use and reuse of research data. Some of the standards often used is Dublin Core, Darwin Core, Data Documentation Initiative (DDI), digital imaging and communication in medicine (DICOM). It within the mandate of librarians to guide researchers on how to create metadata and timelines for sharing for reuse by other researchers (Sanjeeva, 2018).

The United States is where the research data management plan first appeared to facilitated sharing and dissemination of funded research findings. The National Science Foundation (NSF) introduced a clause requiring all grant applicants to include the project's data management plan (DMP) in their application documents in 2010. Data management plan is a requirement in RDM which formally describe how data is managed both throughout research period and after the project is finished (Sanjeeva, 2018).

Funding for research institutions such as the National Institutes of Health and the National Science Foundation have made it mandatory to include data management plans in proposals submitted for funding (Sanjeeva, 2018). Before a project starts, it is

important to think about all the different facets of data management, metadata creation, data preservation, and analysis to ensure that data will be properly managed today and preserved in the future.

Most academic institution conducting research on data management are working on policy development. With one-third of its universities participating, Australia has the greatest degree of participation in the creation of research data management policies globally, according to a poll conducted in the middle of 2012. It also ranks among the best in the world when it comes to looking at the history of data management policy and the maturity of the content, with Ireland ranking in third (12.5%) and the UK in second (17.3%). An empirical review of universities in the United States academic libraries with international standards enlightened that research data management success is attributed to adopting functional approaches that guide RDM activities. The libraries began by planning data management services and integrating data management in the librarian role in 2008 (Yoon & Schultz's, 2017).

In 2013 the then-sitting USA president administration, in partnership with the office for Science and Technology Policy, led to the adoption of the data management plan to enhance research data access for universities with high research activity and projects funded by the federal government (Brint & Clotfelter, 2016). The academic libraries were influenced by funding bodies to implement infrastructure that could support RDM activities and training of librarians in readiness to offer RDM support to the research community (Henderson & Knott, 2015).

The research data management can be examined in several angles related to data integration and discovery including datasets availability, location, and search engine to locate the data. Further, metadata in the repository storage formats, searchability, and if it can be downloaded in a format which allow integration with community data repositories, third-party data publications, and private in-house data (the local dataset). Also, automation of the integration process to save time and prevent copy-paste mistakes, license terms for researcher to use data from these third-party researchers, and who gets credit for reusing a data point (Wilkinson, 2016).

The European Commission partially incorporated data management and planning as part of the H2020 grant funding program application procedure. The applicants are required to submit data management plans (DMP) including technological standards intended for use (storage, backup, and software) and proposed ways for data preservation, sharing, and resources for data management for their research project (Lefebvre, Bakhtiari & Spruit, 2020). The Joint Information Committee (JISC) a UK organization invests in research data management practices, including improved RDM practices, piloting essential RDM infrastructure within the institution, encouraging and demonstrating benefits of improved citing methods, and linking and integrating research data Further, JISC funds digital curation to promote good research data management through a repository that supports open learning and teaching resources (Lefebvre, Bakhtiari & Spruit, 2020).

The University of Adelaide library in Australia and the Australia National Data service in a research data project influenced an upsurge in research data and requirements by funding bodies and publishers on open access. The partnership led to the implementation of three significant projects, including open data collection, high-value collection, and showcasing research data projects to grow the University of Adelaide's international reputation. Creating a post for a research data librarian fostered the University of Adelaide library to develop a researcher's training module that prepared research stakeholders on publishing impressions and metrics. Notably, the institution conferred credibility and authority to the graduate center to manage, direct, and provide research education (Morgan, Duffield & Walkley Hall, 2017).

In examining the academic libraries staff preparedness to adopt RDM in US and Canadian academic libraries, the study established the library's role has changed from conventional classifying and cataloging to a new role in research data management, which requires thorough adaptation and preparation of policies, infrastructure and human competencies (Tenopir *et al*.,2014). The three leading south Australia university libraries (Flinders, Adelaide, and UNISA) tailored approaches to serve research community needs.

The hosting of a workshop by the library and Information Association of South Africa (LIASA) in 2014 in cooperation with the UK digital curation center allowed librarians to evaluate the changing shift in the research data management landscape. The move led the government to improve the South Africa Data Archive (SADA) to host large-

scale data collected from national, regional, and international arenas, particularly in areas of humanities and social sciences (Morgan, Duffield & Walkley, 2017). Some South African universities in 2015 started offering master's degrees by course work in digital curation in staff preparation for the adoption of RDM though, most libraries still struggle with skill and knowledge gap on open data sharing (Kahn *et al.,* 2014).

A study on RDM literacy among lecturer at Strathmore University informed that lecturers possess literacy skills to manage research data. However, the study noted weaknesses in the lecturers' ability to manage research data in areas like sharing research data on open-access publications, data regulation, and data security. A study was done to establish technical preparedness by Horizon 2020 European Union by analyzing 24 American websites. The study established that most academic libraries had developed protocols, standards/and best practices to cover broader data services (Yoon & Schultz, 2017). However, libraries cannot effectively store data sets in a form that can be managed considering the fragility, vulnerability, and sensitivity associated with data sets. Technical preparedness entails strategies that guarantees robust data management from the initialization of research to completion. (Spichtinger & Blumesberger's, 2020).

In Africa, RDM technical preparedness is evident in South Africa particularly signing of the Berlin declaration on openness to make scholarly output visible, accessible, searchable, and useable by a potential community of researchers. The metadata direction, distribution, enactment of guidelines, and data best practices, are some of the

SADA's mandates and responsibilities (Kahn *et al.*,2014). In Ghanaian university libraries there is wide establishment of data repositories to allow the creation and storage of metadata for research development and data management support (Frederick, 2019).

In Ethiopia there lacked policies, and strategies, infrastructure to enhance research data management in the first-generation universities including science and technology universities fueling researchers to use spreadsheets and structured scientific and statistical research data formats (Kinde, Addis & Abebe (2021). A study done in the agricultural research institute in Kenya observed that some developing states have adopted strategies to enhance RDM services though, the study noted inadequacies in technical structures ethical deliberations, legal framework, data standard, and procedure as significant contributors to incomplete, inaccurate, and loss of data hindering important activities such as wide data distribution and reuse (Ng'eno, 2018). While, developed states such as the United States, United Kingdom, and China have made tremendous milestones in RDM support services, African countries particularly Kenya (Masinde *et al*., 2021).

The Egerton university one of the oldest institutions founded in 1939 presently has sustained research initiative continuously contributing to the creation of research data. Some of the notable research data hub is Tegemeo Institute of agricultural policy and development which deals with research policy, analysis, and outreach for sustainable agricultural system, natural resources, and environment. Egerton university Tegemeo

institute has led to the exposer of staff to knowledge on how to handle research data, technical structures, adoption of policy to allow storage of raw research data into the repository making the institution ideal place for the study.

Kenyatta university started in 1965 as teachers training college has grown evidenced by the academic programmes and research activities. The National Phototherapeutics Research Centre has operated for a while exposing staff to proficiencies in research data management. The university has the largest library in Africa with a functional repository hosting thesis and dissertation hence, making the institution appropriate for the study. In Kenya KENET has the mandate to host data for member institutions and individuals for a certain period, often not facilitating sharing and reuse. Despite the great initiative by KENET, Masenya, Tlou & Maggie (2021) observe that research data management in Kenya academic libraries remains a mirage.

**1.2 Statement of the Problem**

The present era is characterized by massive research data production in the institution of higher learning, amidst increased emphasis on the return on the government's investment in research projects. It is obvious that as the nature of research in our institution changes, so must the library's role in supporting research. It may be difficult to translate librarians' expertise in information management into scenarios involving research data, such as metadata production or excellent data housekeeping. Poor research data management practice evidenced by lack of raw data management policy

in Egerton and Kenyatta university is a significant contributor to data loss which threatens future knowledge advancement and data sharing outside the research team which could lead to valuable discoveries. There is evidence libraries in developed states are actively implementing policies for seamless research data management process. Consequently, some African countries have shown progress in research data management while in Kenya, KENET is the only platform hosting research data though not to facilitate reuse by sharing. The selected universities have functional institutional repositories which host post graduate dissertation and scholarly publication for research advancement. Consequently, RDM is an activity associated with creation of datasets such as reformatting for analysis in various software packages, transporting between sites, and processing. This undertaking requires an architecture that allow storage, use and reuse, technical know-how of the metadata standards and technological infrastructure. Also, data storage in a format that can be easily accessed, processed, and analyzed is challenging, as datasets are often fragile and susceptible to storage malfunctions and advances in technology. Hence, it necessary to carry out the study and establish what libraries in the selected university are doing and preparedness for successful adoption of research data management process.

## 1.3 Objectives

### 1.3.1 Generyal Objective

The objective of this study is to establish academic libraries' level of preparedness in adopting research data management to allow improved identification and reuse of research data.

### 1.3.2 Specific Objectives

1. To assess the level of staff preparedness to support research data management (RDM) activities
2. To assess the collaboration drivers for effective research data management process.
3. To establish the level of technical preparedness for the adoption of research data management
4. To assess library policy and legal framework preparedness towards the adoption of research data management
5. To establish the data architecture that could support RDM activities in academic libraries

## 1.4 Research Questions

1. Are the staff prepared to support the adoption of research data management RDM?
2. What collaboration drivers are appropriate for effective research data management?
3. What is the level of technical preparedness for the adoption of research data management process?
4. Are libraries prepared with policies and legal framework that could support research data management?
5. What data architecture could support RDM activities?

### 1.5 Significance of the Study

The research has instrumental value to knowledge managers concerning technical standards and database model architecture for research data management.The findings proposed various regulatory aspects that could facilitate the seamless distribution of research data, whether on an inter-university basis or a cross-national border and within the universities. Policymakers in various fields stand to benefit from the study as it informs on the importance of ethics in the data management process. The study proposes how libraries can maximize the benefits of massive research data generated while safeguarding the privacy and integrity of citizens and society.

The study findings provide crucial information on strategies to adopt to support academic libraries for effective implementation of RDM activities, particularly in promoting knowledge advancement through verifiable findings and reproducibility. Finally, it is projected that the study would contribute to the knowledge on academic libraries' preparedness to implement RDM, and identify gaps for further research.

### 1.6 Limitations and De-limitations of the Study

The study limitations and de-limitations are discussed below;

#### 1.6.1 Limitations of the Study

Although the research data management is a concept that has gained popularity globally, few institutions, particularly in developing countries, understand ways to

adopt the process. Further, minimal literature is available in Kenya, particularly on academic libraries' adoption of research data management.

### 1.6.2 De-limitations of the Study

Research data management is a series of activities that involve the arrangement of data from its entrance through the research cycle to the dissemination and archiving of useful outcomes. Since it is not possible to study the entire RDM lifecycle, the study focused on curated, published, and metadata stored in libraries database to assess preparedness towards the adoption of RDM. The research data contributors though, valuable in research data management were not studied as the researcher focused on academic libraries' preparedness towards the adoption of RDM.

The participants in the study were sought from two institutions of higher learning that is Kenyatta University and Egerton University. Despite different approaches which could be employed to collect data, the researcher used quantitative method to gather quantifiable data.

## 1.7 Assumptions of the Study

The selected university libraries are prepared, have implemented, or have plans in place to facilitate the adoption of research data management.

## 1.8 Theoretical and Conceptual Frameworks

### 1.8.1 Theoretical Framework

The study adopted the Technology, Economic, Legal, Organizational, and Schedule (TELOS) feasibility model coined by Hall (2007), as it provides guideline on research data management concerning technical, economic, legal, organizational, and scheduling feasibility studies. The developed states with functional research data management have invested in robust technical infrastructure which are diverse and flexible for dynamics in RDM (Ssegawa & Muzinda, 2021). Adequate RDM access and sharing is supported by a wide range of technologies, including systems, records, social platforms, verification structures, and computer software. The RDM activities are linked using a web platform and another system in a distributed institutional repository, supported by electronic documentation, digitized storage, and housed research datasets in various systems (Ng'eno & Mutula, 2022). Therefore, making data comprehensible, findable, accessible, and safe require considerable investment in technical infrastructure and providing even and equivalent access to a comprehensive diversity of outputs (Nhendodzashe & Pasipamire, 2017).

Also, research data management requires careful consideration of legal, policy, regulatory, and ethical issues to guide data service activities, including research data construction, evaluation, accounting, conservation, intellectual property, sharing, reuse, and removal (Ssegawa & Muzinda, 2022). The legal framework guide research data custodians on data types and formats that should be considered for archiving (Nhendodzashe & Pasipamire, 2017). Further, policy on research data management

guides metadata and data repository for data file storage, use, and data sharing procedures.

Morgan *et al* (2017) identified various research data policies which institutions preparing to adopt RDM should consider, including curation of data, administration, publication, and distribution. Hess (2019) observed that knowledge managers as key support of RDM activities and processes lack appropriate skills and comprehensive plans to foster RDM activities. Research data management requires collaborative partnership to enhance research data roadmaps and discernibility of results widely and reinforce the research community (Drljaca & Latinovic, 2018).

More importantly, RDM partnership range from different levels starting with research hubs such as academic institutions, regional, and global (Nhendodzashe & Pasipamire, 2017). Also, shared documentation such as the enactment of RDM policy, DMP, and human and financial resources are some of the benefits accrued by developed states with practical collaborative efforts in RDM implementing (Machimbidza, Mutula, & Ndiweni, 2022). In addition, the personnel involved in data creation, assigning of persistent identifiers, metadata creation and linking, indexing, legal and ethical issues on metadata collected, and procedures related to quality assurance, appraisal, disposal, and transfer to storage media should possess exceptional technological knowledge (Elsayed & Saleh, 2018).

RDM custodians should possess specific core competencies to support open access fueled by research data management including skills to analyze, detect data manipulation, and essential requirements to maintain data credibility. Further, knowledge managers need to be knowledgeable about issues such as the funder's policy requirement, data management plan, metadata, and format for both data and Meta data and articulate the benefits of data sharing, audit, assessment tools, and data reuse (Nhendodzashe & Pasipamire, 2017). Data collection is instrumental as individuals can develop metadata standards and schemas, database designs, structures, data repositories, and appropriate storage formats (Machimbidza, Mutula & Ndiweni, 2022). Therefore, the stakeholders should identify individuals with skills, knowledge, and training to carry out various RDM activities.

Research data management discoverability relies on technical infrastructure to promote open access to research data critical for reinforcing open scientific inquiry and encouraging diversity of analysis and opinion (Tripathi, Shukla, & Sonkar, 2017). Further, Ng'eno & Mutula (2022) point out that proper scheduling of RDM activities allows compiling of a fresh set of data through compounding, enhancing the teaching of novel researchers and promoting scholarly work. Open access advances science and research reuse in future research through the creation, processing, authentication, preservation, and sharing of research data (Machimbidza, Mutula & Ndiweni, 2022).

Presently, academic institution made it mandatory for a postgraduate student to deposit research output as a way of promoting discoverability and knowledge advancement

(Drljaca & Latinovic, 2018). Further, open access is a widely recognized platform where a researcher can benefit through diverse contributions to their research work from experienced researchers and enjoy more citations as other researchers consult their work (Machimbidza, Mutula, & Ndiweni, 2022).

The Open access movement continues to advocate for the implementation of technological infrastructure, specific competencies and skills, partnership, and collaboration to enhance the visibility of research data through open access (Drljaca & Latinovic, 2018). However, research data management that facilitates open access requires careful consideration of requirements and risks which could promote or impend open access (Machimbidza, Mutula & Ndiweni, 2022).

Sharing of research data in technological platforms impacts research during metric analysis, though there are cost implications and risks that should be evaluated to maintain research for continued open access. Consequently, personnel support and infrastructure are critical aspects of RDM services as they foster data share-ability and long-term stewardship. Therefore, there is a need to put parameters in place to prevent issues that could conflict with researchers' intellectual property rights as their output is being accessed widely.

Further, institutions should adopt a rigorous and conscientious culture of citation and acknowledgment among all practitioners and infrastructure to promote seamless research data management activities, stored data security, and quality (Machimbidza,

Mutula, & Ndiweni, 2022). The model enlightens on aspects to consider for a successful RMD process and services. RDM requires staff with technical skills to offer valuable input in the data lifecycle particularly if the organization wishes for research data openness. Further, skills and competencies in handling RDM technical aspects as well as legal and policy concerns, often lead to success implementation of RDM services. The TELOS model provides detailed requirements to enhance effective and efficient RDM services. The model focuses on components that could facilitate functional research data management in academic and research institutions.

### 1.8.2 Conceptual Framework

The organization of data from entry in research lifecycle through dissemination and archiving of valuable results entails research data management. The academic libraries' preparedness is the independent variable depicted by staff knowledge and competencies, collaborative partnership, and structure to allow data reprocessing, and analysis for wider dissemination and reuse. Further, preparedness is demonstrated by the availability of a data architecture and governance framework to enhance data integrity, privacy, accuracy, and reliability.

Consequently, the technological economical legal, organizational, and schedule feasibility model provides a guideline on technological infrastructure that could help support RDM, though academic libraries need to consider the economic implication including the cost of staff training and acquisition of equipment such as software and hardware and technological infrastructure such as telecommunication network. Also,

RDM success as demonstrated in developed countries requires collaboration to bring different expert on board.

Since RDM involves a series of activities, it is important to carefully schedule what should be adopted as a priority to avoid malfunction and data loss. The research data management is the dependent variable. Although data management is beneficial in different ways including error prevention to increase analyzed data quality, validation of data, and replication of finding for valuable discoveries, the activities require careful consideration of legal aspects and cost implications.

Although academic libraries may be prepared to adopt research data management, research data contributors may be skeptical to allow their curated data manipulated to create metadata and allow knowledge advancement and valuable discoverability of research through wider dissemination and sharing. As outlined by the TELOS model RDM involves a series of activities that require parent institutions to allocate a budget which could be challenging as most universities are struggling with a constrained budget

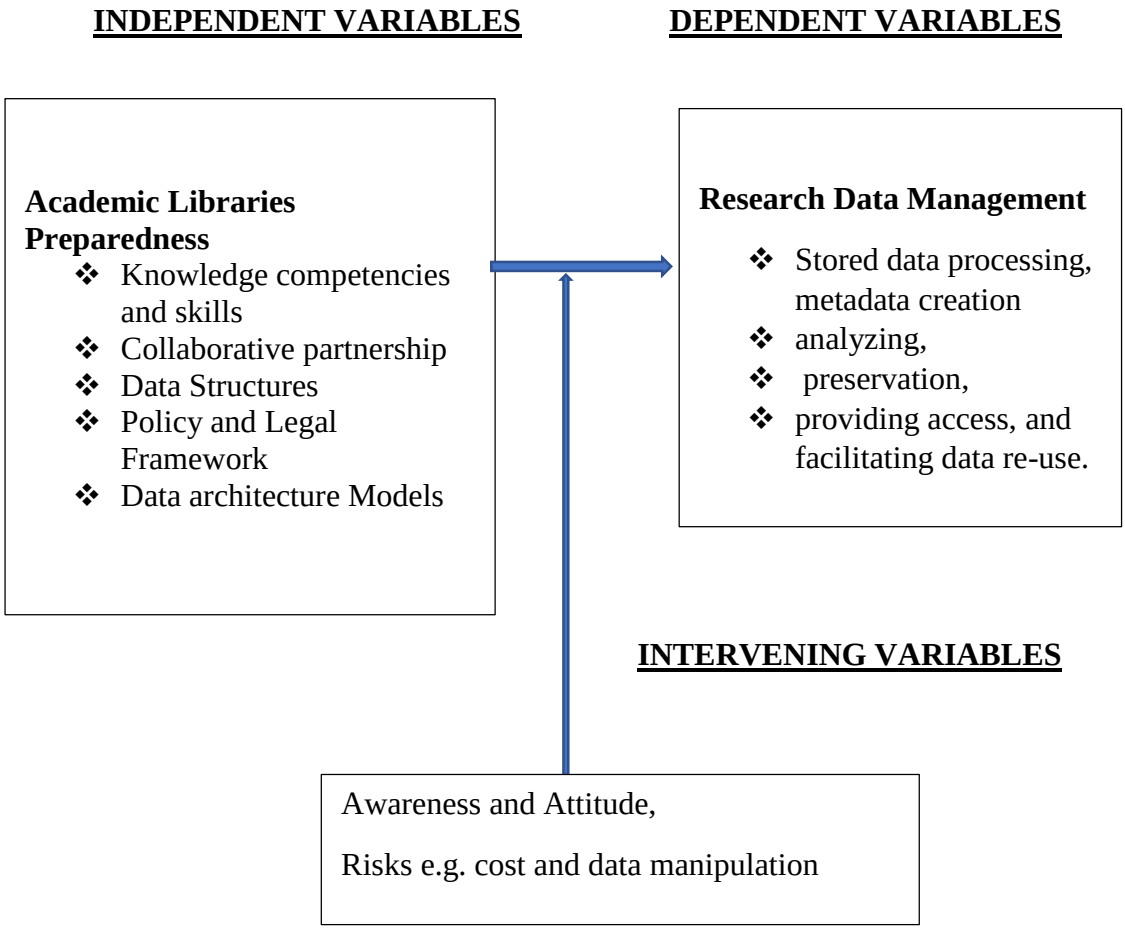


**Figure 1.1: Conceptual Framework.**
**Source: Researcher; 2025.**

# CHAPTER TWO

# REVIEW OF RELATED LITERATURE

## 2.1 Introduction

The chapter is organized around themes guided by the study objectives, including; knowledge and key competencies that knowledge managers should possess to support RDM activities; collaborative partnerships for effective research data management; the technical structure that drives research data management; policy and legal framework that could support research data management; and data architecture for mapping scholarly activities in institution of higher learning research.

This section allowed the researcher to gain insight into the broad study context by systematically identifying documents with information related to the studied problem. Khan (2014) pointed that literature review helps to identify trends and debates in the existing literature by evaluating connections among the contemporary studies conducted in the same area. According to Beins (2017), literature review is an essential aspect of research as it allows the interpretation of selected documents demarcating information that is not within the study scope.

As put to perspective by Snyder (2019), literature review allows researchers to pursue notions that back anticipated views and present opinions posited to solve the research phenomenon. The study aim is to establish academic libraries' preparedness for the adoption of research data management to propose an intervention that could allow

implementation or improvement of the process, including creation, processing, analysis, preservation, discovery, and reuse.

## 2.2 Staff Preparedness

The library staff are supposed be versed with the entire concept of research data management to better engage with research community and tailor services accordingly.

### 2.2.1 Knowledge and Skills

Pasipamire & Mhone (2025) discusses libraries preparedness in the context of research data management. The authors assessed how libraries integrate research data management services with traditional librarians' role. The study established that libraries are key players in providing RDM services for scholarly advancement through good research practices. Consequently, the study shed light on different level of RDM knowledge among librarians. The study emphasizes on focused awareness creation on RDM to equip librarians with instrumental knowledge to effectively support researchers and focused RDM skills development training instrumental in confidence building to RDM activities. Also, the need to explore librarians' attitudes toward offering RDM services in order to better understand the problems they face when delivering these services to researchers which could help to scale up the knowledge and skill from just awareness to expertise in research data management.

Corti & Van den Eynden (2015) discusses the importance of acquisition of skills for librarians in light of the growing significance of research data and interaction with the

research community. The article used a qualitative approach to explore the pedagogical tactic for effective data handling. The authors point the importance of training researcher to effectively deal with digital data sources as research data form the cornerstone of empirical research. Strategies such as integrating research data management as part of research methods training to researchers and research data librarians. Further, the study noted RDM is a complex undertaking that requires professional skills and often left to researchers leading to the loss of valuable data. The article emphasized the need to train librarians, novice researchers at the undergraduate or postgraduate level in the institution of higher learning and the importance of integrating research data skills in narratives of standard methodological approaches. Also, a need to adopt strategies to lump gaps in current knowledge or update skills in response to legislation governing research data and rapid changes in technology.

Consequently, the study noted challenges and skill gap in librarians' data handling in areas such as arithmetical logical methods in social science, thus proposing research method curricula pedagogy as part of cultural change in training for data management and distribution skills. Also, Corti & Van den Eynden proposed an RDM managing and sharing pedagogical approach in a modular structure based on embedding grounded learning activities within the research design and implementation narrative. The method allows active learning for librarians and researchers making the RDM process visible allowing critical reflection on practice entrenched in grounded learning that creates solid empirically-based knowledge (Corti & Van den Eynden (2015). The pedagogy's success has been demonstrated in practical activities in the Economic and Social Research Development Council ESRC in UK.

Buckley *et al* (2015) case studies in Manchester noted skill gap in librarians to effectively handle research data management role. The article proposed upskilling particularly on research strategy, fact-finding, and scrutiny entwining integrated practice-based training in research data management with outmoded approaches. To bridge the skills and knowledge gap, the study emphasized that guidance and training should form part of instructional literature since dynamics in the data landscape often fail to satisfactorily cater for the necessary skill required in RDM activities.

A study on research data management by Henderson & Knott (2015) in Virginia Commonwealth University Library, the University of Pretoria, and witwaterland university pointed to the need of up-skilling by liaison librarians in readiness to take up the new role and responsibility on research data management. Concurring Koltay (2016) review of current literature on RDM informed of skills and resource challenges which could derail adoption of research data management process. The article findings shed light on the importance of outfitting academic libraries with resources in readiness for research data services including digital data curation, data quality, data citation. Also, the need for upskilling librarians or hiring librarians with cutting-edge and sufficient RDM knowledge and abilities.

### 2.2.2 Competencies

Koltay (2016) study of institutions of higher learning on functionality of RMD services address the need for the senior librarian to champion in updating their RDM knowledge. The study highlight that research data management requires technical knowledge and

competency to handle metadata creation instead of the usual extension of interpersonal relationship skills. Further, a literature review by Matteson, Anderson & Boyden (2016) concur with Koltay (2016) who examined what is meant by soft skills, and compared such skills to similar ideas and proposed that, librarians should develop both technical and soft skills. Although soft skills are not easily described, they are depicted by demonstrative competence and intellect instrumental in identifying research data needed to make decisions.

Cox (2017) study in the United Kingdom on research council policies on open access observed that, RDM success is pegged on substantial investment in advance data-related skills, particularly alignment around shareable data by focusing on the collection, management, and analysis of long-term data resources. The above view by Cox (2017) is consistence with Cannon's (2017) review of professionalism within the library and information science. The author emphasized that librarian should consistently nurture competency in RDM by using Green and Gutman (2006) research data lifecycle as a guide.

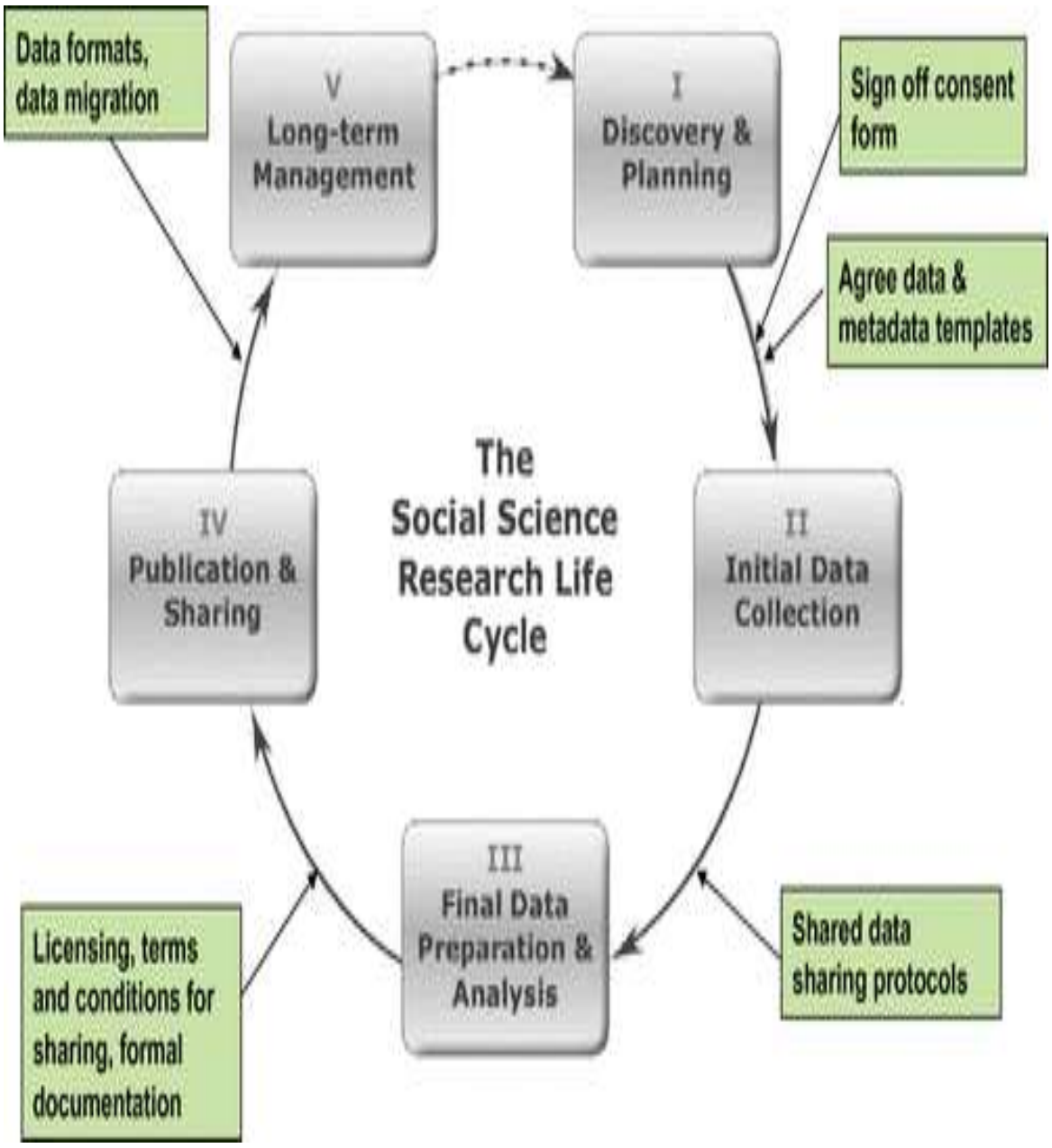


**Figure 2.1: Research Data Management Activities.**
**Source: Green and Gutman, (2006).**

In their article Morgan, Duffield & Walkley (2017) study on RDM support done at the University of Adelaide, UNISA, and Flinders university observed that library staff were entrusted with the responsibility of populating the institutional repositories, a database that hosts electronic resources, metadata creation, and work closely with the researcher. A repeat study in South Australia academic institutions to establish librarian role in

RDM noted gaps in competencies instrumental to support RDM process. The article proposed the need to incorporate various initiatives to increase understanding of the research process, including seminars, workshops, virtual and group training. In their follow-up literature review involving the senior and new professional librarians observed improvement in RDM skills and competencies. Consequently, the article suggested an examination of the institution's research policies to allow inclusion of librarians as part of research team. The researcher adopted the research data lifecycle visual created by Hellen Morgan and Nadine Davinson-wall to emphasize the role of librarians in RDM.

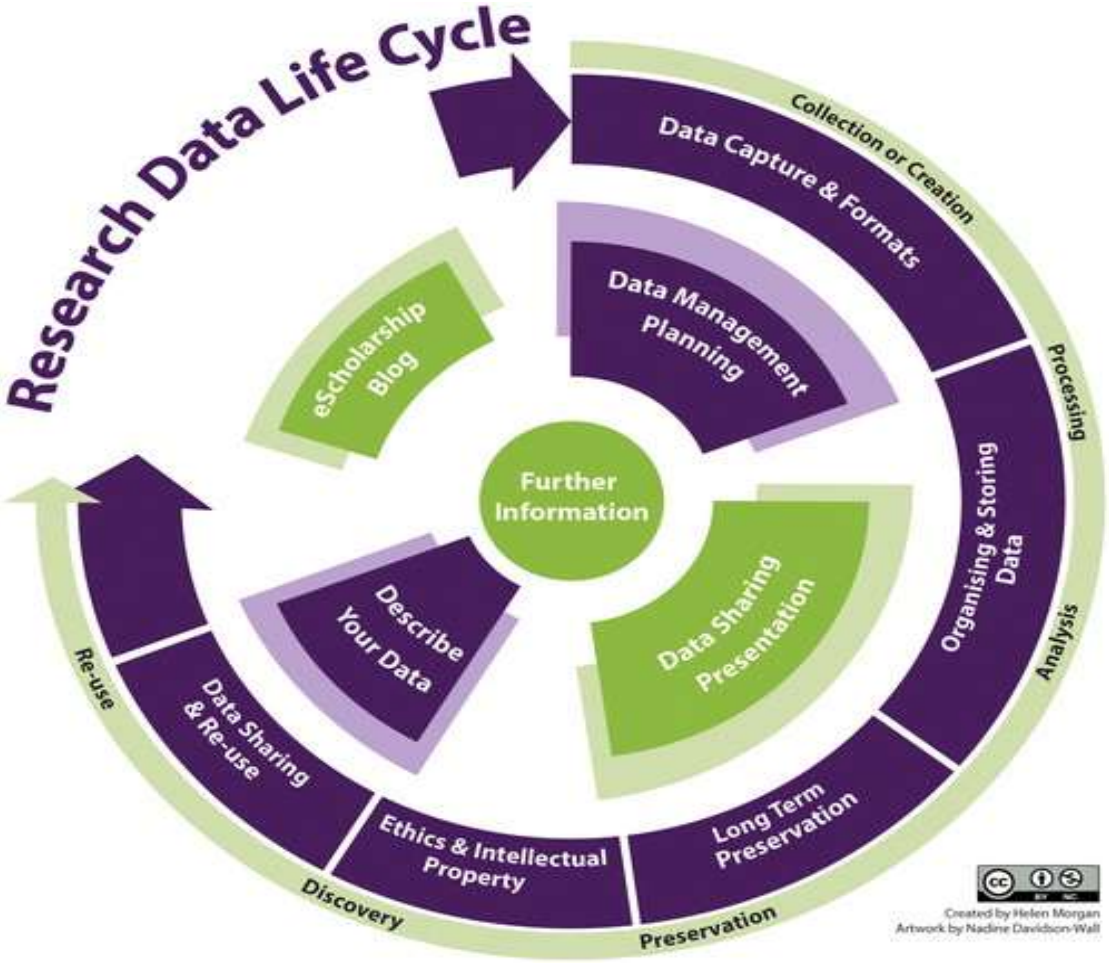


**Figure 2.2; Infographic model created by the University of Queensland**
**Source: Hellen Morgan and Nadine Davinson-wall.**

In their case studies Morgan, Duffield & Walkley (2017) presented an infographic from researchers co-authored by a team from the University College Dublin school of information and communication studies which investigated the literature available on RDM and data management planning envisaged to serve as a valuable resource for library and information professionals. The creative commons in the infographic highlighted the importance of competent and highly qualified librarian bearing their active role in the creation phase, particularly materials for background study and literature review. Also, Librarians are involved in compiling data in the processing phase, such as reading, selecting, and reporting, drawing a conclusion from data after analysis, identifying the format, location, and length of time data is available in preservation phase.

Concurring the Digital Curation Centre presented an infographic that highlighted the importance of librarian's specialized qualification in RDM. The librarians should be versed with discovery phase, which ensures data availability, access rights, where, how, and for how long, and future research reuse which require high level of competency. Further, the Digital Curation Centre came up with the Data lifecycle model (DCC) to define the role and responsibility of the information and technology specialist, librarians, and RMD stakeholders (Digital Curation Centre, 2017b).

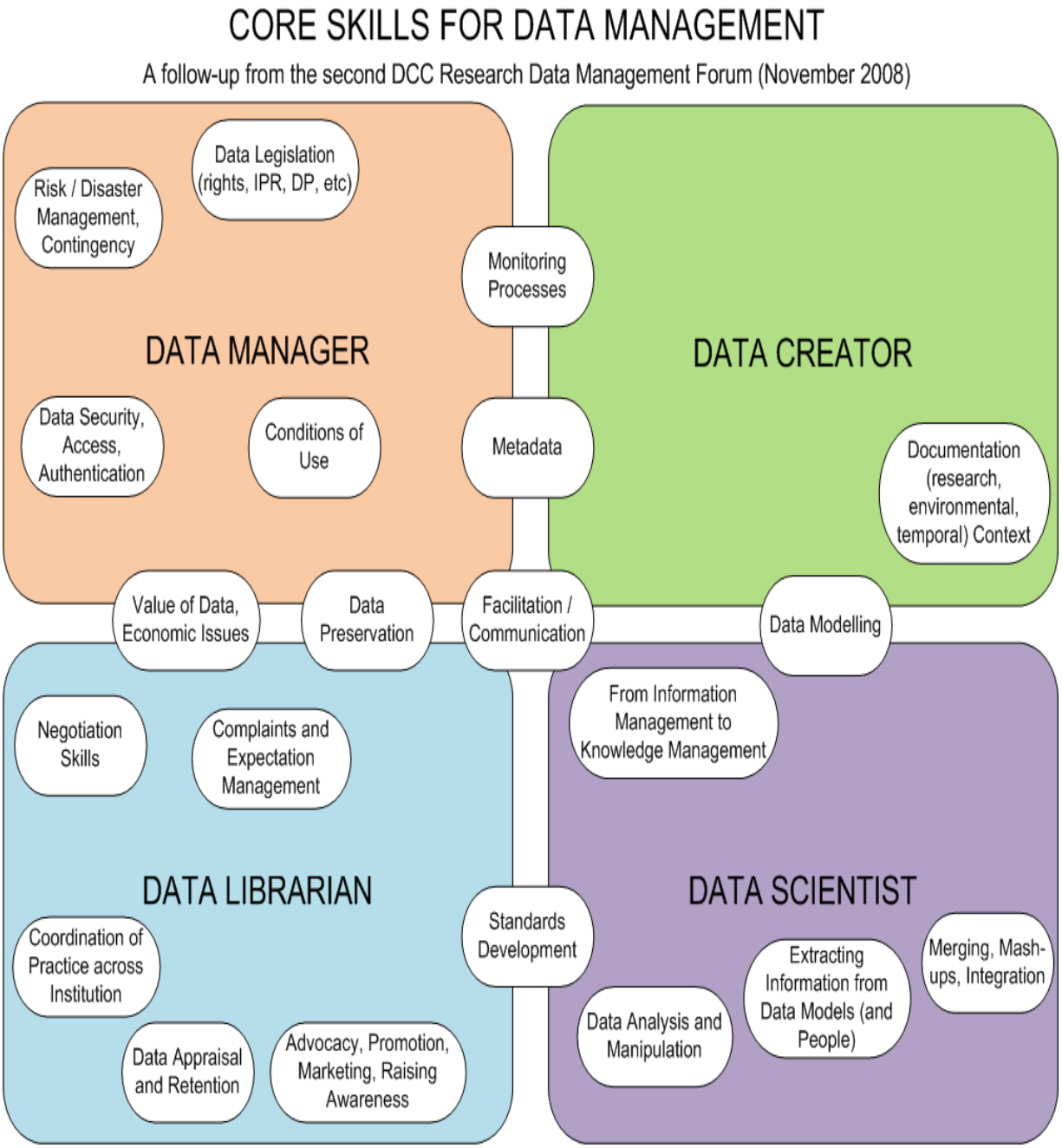


**Figure 2.3; The RDM Core Skills and Competency.**
**Source: http://www.dcc.ac.uk/resources/rolesDCC.ac.UK.**

In their discussion, the Data Curation Centre highlighted RMD skills could help to support the reproducibility of results, reuse, and adding value to the data, long-term accessibility, preservation, and research data authenticity and integrity (DCC, 2017). The research data creation process encompasses a series of activities; hence the need for policies that advocate for RMD qualification including custodian roles and responsibilities.

In their case studies, Carter (2017) using the quantitative electronic survey in UK and Matteson *et al* (2016) concurred with Digital Curation Centre by emphasizing the importance of leadership abilities, strategic understanding, and influencing skills which are part of soft skills and competence critical in individuals supporting RDM activities. Cannon (2017) observed that failure to support librarians to acquire RDM competence and skills could significantly limit their contribution in the research data cycle and curtail importance RDM process including data curation, sharing, and reuse. The author insists librarians' input in the research process is critical as they possess knowledge on scholarly work preservation in the institution repositories.

Carter (2017) discusses the importance of skills upgrades in preparation for the new role of managing the research process from initiation to completion. In their studies Carter (2017) and Matterson (2016) emphasized the importance of nurturing librarian soft and hard skills through training, seminars and workshops help librarians build confidence and demonstrate competence in handling various RDM needs for the research community. Further, the authors highlighted the important of gaining the hard

skills depicted by technical competencies which could help the library staff manage electronic data.

Cox, Pinfield & Rutter (2018) investigated the role of librarians in academic libraries in readiness to adopt research data management process. In their framework analysis of the literature on research data management, it was observed that academic libraries are confronted with the consulting role of developing new and advanced services to deal with changes in technology and scholarly communication, implicating on information professionals' identity and educational level. The study finding proposed the need for advancing RDM competencies in librarians through formal or informal training approaches. Read & Cox (2020) concurred with Cox, Pinfield & Rutter in their thematic analysis that used in-depth semi-structured interview with Uk librarians. The study noted gaps in librarians' competencies to handle RDM propelled by scarcity in training opportunities are scarce particularly in developing nations as most universities concentrate on information technology expertise disregarding growing interest in areas such as RDM.

Andrikopoulou, Rowley & Walton (2021) conducted a literature review to establish the academic librarians' evolving identity in the era of research data management. The authors observed limited discussion on the academic librarian's role in RDM. Consequently, a follow-up study through empirical review disclosed librarian's contribution in research data management process. Consequently, less acknowledged by the teaching fraternity, academic libraries were recognized by research funding

agencies as important entities to drive and develop RDM services such as data management and data sharing requirements hence need for competency (Rowley & Walton, 2021).

Ng'eno & Mutula (2022) survey of Kenya's agricultural research institute identified gaps in RDM handling suggesting advanced training for effective management of web and holding research data. The awareness creation and capacity building influenced digital object management and knowledge growth in the area (Kahn *et al.*, 2014). Some South African universities in 2015 started offering master's degrees by course work in digital curation to prepare librarians take up research data management role.

### 2.3 Collaboration Drivers

Andrikopoulou, Rowley & Walton (2021) conducted a literature review to establish the librarian evolving identity amidst advocacy for research data management. The finding showed that globally libraries are actively involved in supporting teaching and learning impacting floor space re-arrangement to accommodate growing scholarly activities. The platform academic libraries operate has been expanded to feature structure, partnership, and strategy instrumental in the implementation of RDM services. Concurring Steel, Thompson & Wright (2019); Ng'eno & Mutula (2022) in their study emphasizes the need for institutions to share data widely to create and sustain public-private partnerships among organizations and associates.

Chiware & Mathe (2016) in their study on academic libraries role in research data management, a South African perspective shed light on the extension of academic libraries' traditional activity. Also, the study highlighted the importance of strong collaborative endeavor driven by rapid technological change and a competitive environment contributing to both library and institution of higher learning prestige. The article informs that RMD activities require joint efforts such as consenting agreements, actions to share resources, and support services.

The study finding enlightened that, successful implementation of RDM requires stakeholders to have common interests and professional skills in information literacy training and repository management. The skills are exemplified by individuals' ability to effectively carry out collection development role, metadata management, and resource discovery to accomplish mutual goals and promote broader interest for community benefit.

The authors shed light that in a collaborative partnership there is a wide distribution of obligations, extensive cooperation, communication, and interpersonal context. Collaboration reduces effort duplication and data loss, as evidenced in the developed countries' enriched research data repositories. The study shed light on what international agencies, including the National Science Foundation in the United States and Australia National data Services are doing in regard to collaboration.

One of the adopted strategies is advocate for collaboration with concerned partners as research data is pervasive and potentially long-term lived assets for society. Consequently, the study cited challenges that hinder collaboration in research data management, including different layers of complexity such as confidential information, data variation, contamination of the dataset, varied opinions on the data retention period, and differing views on best practices for RDM.

The study finding proposed solutions that may arise from collaboration, such as the development of a common research portal for secure access and the implementation of a data management plan. A data management plan enables widespread access, reuse, and longevity of research data due to different measures employed to address legal and regulatory control for data generated by a research project. The authors explain that data management plan help to minimize challenges by providing guidelines to define appropriate quality and metadata standards.

Also, data plan helps in data sharing procedures, restrictions, ethical and legal issues, copyright, intellectual property, and ownership, storage, backup and security, preservation, sharing, and access, roles and responsibility for RDM, and cost implication for RDM activities. Ng'eno & Mutula (2022) inform that collaboration within an institution, particularly between the library and IT department, helps in role and responsibility allocation leading to well-structured and synchronized research data services. The IT department support RDM by providing technical assistance related to metadata standards and data management plan, authors support, and other complex

issues which may arise such as deselecting data, preparing data sets, and metadata production.

Ng'eno and Mutula (2022) illuminate that the development and implementation of RDM policies require multiple collaboration actors, including researchers, librarians and IT specialists. However, Cox & Tam (2018) study done in the USA observe that though collaboration with other stakeholders in RDM could positively impact an institution of higher learning, the approach may gradually eliminate professional information distinctiveness and the library's ability to maintain its identity. Every step of the RDM process requires the development of policies and laws that address data curation, quality, and security in addition to ethical considerations, human resource capacity, technical infrastructure, and cooperative collaborations (Ng'eno & Mutula, 2022).

### 2.4 Technical Preparedness

In the 21st century, research activities have gained significant momentum, partly driven by publisher’s advocate for electronic supplementary information. This shift brings several benefits, including enabling the scientific community to share research data, facilitate the creation of new research hypotheses through aggregated data, and allow reproducibility to refine original findings (Cox *et al.*, Pinfield, 2017). Scientific data is used interchangeably in international literature to describe research data. Research data can be in any digital file format, including text, video, photos, numbers, and seismic simulation data, laboratory data, derived and compiled data for text mining or testing procedures, and observation variables like investigation data for forecasting, airstream rapidity, and liquid eminence.

### 2.4.1 Technical Standards and Structure that Drives Research Data Management

The University of Yale provides an overview of what research data entails. Research data is the information gathered, observed, or created for analysis and which could be expressed in various data formats including spreadsheets, database data, text, SPSS/XML, experimental data, digital images, and document reports. The data format determines the processing strategy and storage (Zhou, 2018). In their studies Cox *et al* (2017) discusses the importance of research data such as sharing for reuse by the scientific community, creating of new research hypotheses by aggregating data to allow reproducibility of novel data which may improve on original data. Concurring De Silva & Vance (2017) in their analysis of historical and technological development observed that appropriately compiled and content-rich research data is often sought by publishers, though most publishing firms have guidelines that help to enforce procedures impacting knowledge advancement. The study point that policies should be implemented to define research data, author instruction, and other guidelines on different research sections.

Wilkinson (2016) studied the scientific principles for research data management and stewardship adopted by stakeholders including academia, industry, funding agencies and scholarly publishers. The researcher noted that metadata is always public, even if data is restricted or removed for privacy considerations (F.A.I.R Principle). Three tiers of this metadata is available, fully supporting the 'I' and 'R' FAIR principles including domain-specific metadata which map metadata standards used in a scientific domain; data citation metadata. The study results highlight the importance of mapping data to

Data Cite schema or Dublin Core terms and file-level metadata, which can be deep and comprehensive for tabular data files including column-level metadata. In the conclusion the study suggested that data should be shared all the time as large data repositories are available where researchers can post data files for usage by other researchers.

In their article Tripathi, Shukla & Sonkar (2017) studied research data management practices in 20 universities libraries in India. The authors noted existing funding bodies and many international publishers are mandating researchers to submit their raw data generated and used to report the research findings. Further, the strict advocacy by research funders that research data should be deposited to open access data repositories for others to access, browse, use and validate the reported research fuels the need for an appropriate data standard that could allow finding authentication. Concurring Yu, Deuble & Morgan (2017) in their study on designing research data management services based on a lifecycle emphasized the need to adopt structures allowing dataset repositories to use specialized metadata for describing research data to facilitate easy discovery, access, and use.

The United States Geological Survey (2017) shed light on the underdeveloped state of research data management standards and the need for adopting control measures to enhance correctness and exactness in the collection, management, and utilization of research data. The importance of quality assurance through research project audits and process checklists to achieve verifiable research outputs. Quality assurance in the research data management process focuses on building quality and preventing defects

that could curtail process authentication. To resolve issues surrounding research data quality, the institution insists the importance of subjecting RDM products to rigorous testing to ensure the personnel handling research data and researcher have followed the mandatory procedures mostly stipulated in the data management plan.

Since quality control and quality assurance are an integral part of research activities, the research data custodian should ensure the principles are implemented at the onset of data collection and end at archiving stage when data is built into the RDM system (Yu, 2017). Concurring Hamad, Al-Fadel & Al-Soub (2021) study on research data management services in Jordan highlighted the necessity of metadata creation and how it should be presented to the research community. The authors suggested that librarians should connect with researchers and learn about their behavior and approach to RDS.

A meta-driven comprehensive study by Grunzke *et al* (2019) on MASI repository service provide an overview of how technology has led to the data explosion hence call for higher-quality scientific findings. The study highlights the importance of standards and structure as the amount and complexity of data increases. An appropriate and specific data description becomes critical. The study observes that current data handling systems are frequently hitting their limits. Newer and more complicated data require the use of cutting-edge data management solutions.

Improved data definitions, sustainable storage, findability, pre-processing for future purposes, and exploitation of current data are particularly crucial. Metadata (data about

data) play an important role in making data available in the long run. It is required for data understanding, storage, preservation, curation, and discovery for later use. Metadata facilitates the implementation of complex tasks on data by allowing the search for input data based on its content and context. Aside from improved discovery, additional data management features, such as controlling and leveraging commonalities between data sets is encouraged.

Metadata standards and data management approaches vary greatly across scientific groups, with each embracing community-specific data property. Concurring Wilkinson (2016) emphasized the need for university libraries to develop software enabling infrastructure that are end-to-end FAIR compliant and can be deployed over current repositories. These code modules have a special emphasis on metadata publication and searchability, compatibility in circumstances of severe privacy considerations, and the exceedingly challenging issue of data and metadata interoperability (manuscript in process).

The UK Data Archive (2017) provided a report on what standards and structure in research data should seek to achieve. First there is need for data custodian to ascertain accuracy and extensiveness of data through quality assurance and control measures. The data supervisory team should have the capacity to ensure accountability, complete tracking of the process, rigorous verifying mechanism, a vibrant approach to reply to challenges, and sufficient resources. Rigorous documentation during data collection provides a platform for evidence verification.

The report placed emphasis continuous checking while editing and cleaning through confirmation, cross-checking, and authentication. Consequently, the report highlighted challenges encountered by academic institutions such as gaps in policies, regulations, and strategies. Although the institutions are mostly guided by the ISO standards and procedures which could strengthen the quality of research activities, challenges are often observed in leveraging research data standards with institution adopted procedures.

In their study Shelly & Jackson (2018) discusses the importance of data curation an activity often explained using the Data Curation Centre (DCC) Lifecycle. Also, Ng'eno & Mutula (2022) in their study of agricultural institution in Kenya established research data management is a rigorous and complex undertaking that requires stewards with the ability to develop unified standards for data privacy and ownership policy, switching data sets, and professional educational standards for RDM guided by data-driven research agenda. In the data curation lifecycle, it is critical to employ quality measures during the capture or creation stage to ensure metadata can expedite data sharing, publishing, and citation.

Concurring Kinde, Addis & Abebe (2021) concurring refer to Australian National Data Service (2017) that provide a blue print on how to gather authentic data by the use of quality data capture tools. Also, the study emphasizes the use of platform to fosters processing, organizing, structuring of data files, and validation to ensure data is within the required range. The study insists on good conversion standards with flexible and

open tools, and transfer of data to the intended destination. Supporting the above view Andrikopoulou, Rowley & Walton (2021) in their study observed that the data curation process entails selection, digitizing and transcribing, confirming and cleaning, anonymizing data, managing, and data storage.

Although it is important to adhere to policy and legal requirements and documented guidelines while selecting research data for long-term preservation, consistency, transparency, and accountability decisions are easily made when data is subjected to appraisal and selection policy. Mani *et al* (2021) presented ten appraisal criteria often popular in preservation and digitization including properties available, use, societal implication, authority, presentation matters, strategies to deal with electronic data, and certification.

Shaanika, Maletzky & Iyamu (2018) in their Namibian case study presented a model for research data management. The authors looked at the entity technical preparedness in addressing parallelism of systems in the management of data. First the authors explored the data evaluation standards and procedures including data disposal guidelines such as permanent archiving, redeployment, ownership, or custody transfer. The study concluded that employing the DCC lifecycle model researchers are responsible for disposing securely and safely of research data that has exhausted the retention period by documentation policies, guidance, and legal requirements. Also, with a modest set of community-agreed guiding principles and practices, all stakeholders may readily

locate, access, appropriately integrate and re-use, and adequately cite, the massive quantities of data generated by contemporary data-intensive science.

In their study Ng'eno & Mutula (2022) survey of the agricultural institute in Kenya established gaps in data naming, an important activity in technical preparedness that entails preparation for data storage such as data interpretation, production of research output, author publication, data anonymization, and visualization. The authors propose flexible metadata standards that provide homogenous naming to allow users comprehend and trail important details, describe metadata facilities, search, and retravel in data repositories. Also, the study suggested putting in place appropriate procedures and eminence controller on scholarly work when RDM supporters are naming dataset.

Concurring with Ng'eno & Mutula (2022); Birkbeck, Nagle & Sammon (2022) case studies in Manchester alluded that research data preservation should involve activities including the authentication of metadata tailoring data standards and structure for data to remain authentic and reliable while maintaining its integrity. Equally, stakeholders such as researchers, and scholars' confidentiality should be built by making data available, accessible, and timely distribution of research content if the institution preserves research data in repositories which are accredited or certified to appropriate standards to ensure data quality through assurance and control process.

The study prosed transforming datasets with information exchange standards such as XML for bulk movement, and data integration such as transform, extract, and load standards. This is to allow verification and validation of results obtained when raw data

is analyzed, forming an appropriate base for further experiment and the creation of new hypothesis.

Further, Ng'eno & Mutula (2022) inform that developing intellectual capability ratings standards for data repositories led to the opening of research output to the wider community, maximizing visibility and impact, collecting, curating digital outputs, and providing access and workspace for collaborative research. Also, enhancing data access, use, and reuse make research data available in a convenient and modifiable form and redistributing under terms/ standards that permit reuse.

In their article Hamad, Al-Fadel & Al-Soub (2021) study on research data management awareness in Jordan disclosed that no single discipline can cover all the necessary concepts. Instead, numerous layers of analysis must be used. Concurring Tammaro *et al* (2019) discuss the importance of sharing, distributing, and reusing research data. Consequently, the researcher established the need to create multi-layered knowledge infrastructures and engaging multiple institutional stockholders.

Wilkinson (2019) shed light that Dataverse is an open-source data repository software that supports institutional research data repositories as well as public community repositories installed in dozens of universities worldwide. For example, Harvard university has the largest Dataverse repository to date, which is made available to academics across all disciplines and contains over 60,000 datasets. Every deposit is given a formal citation by Dataverse, which follows the standards and guidelines set

forth by Altman and King13. When the dataset is released, Dataverse makes the Digital Object Identifier (DOI) or other persistent identifiers (Handles) publicly available.

However, the above is possible if data repositories adhere to policy, legal, and technical dimension that render physical and semantic barriers irrelevant and supplant outdated illegal jurisdictions, and boundaries. In their study Birkbeck, Nagle & Sammon (2022) support by alluding that the Australian Data Service provides guidelines on ways to ensure technical preparedness is appropriate to facilitate data use and reuse, including planning, recognition through citation, straightforward and clear data accrediting methods. The adequate metadata recitation and use of standard vocabularies in the metadata could allow prevailing data post-analysis, results corroboration to reduce effort repetition.

Similarly, Ng'eno & Mutula (2022) study supports the above view by pointing that data transformation is a critical aspect that allows examining large databases to generate new knowledge. The transformed datasets allow verification and validation of results obtained when raw data is analyzed, forming an appropriate base for further experiments and creating new hypotheses.

Davies & Mosdell (2022) pilot study discuss the importance of value in research investment through research openness and visibility using cutting-edge computational tools fostered by adhering to control measures and standards in the research lifecycle. Consequently, Wilkinson *et al* (2016) study on FAIR guiding principle for scientific

data management and awareness point to issues often associated with data standards. The study finding shed light on the importance of overcoming data standard challenges which could benefit a wide range of stakeholders, including: funding agencies (public and private).

The study noted stakeholders are becoming more concerned with long-term data stewardship; researchers who want to share, credit, and reuse each other's data and interpretations; professional data publishers offering their services; software and tool-builders providing data analysis and processing services like reusable workflows; and the data science community, which mines, integrates, and analyzes new and existing data to advance discovery.

In their study Hamad, Al-Fadel & Al-Soub (2021) point that libraries are responsible for providing advice on funding sources, supporting roles in literature review, bibliometrics and impact measurement, bibliographic software training, support for open access/institutional repositories, advice on copyright issues, data analysis support, and finally, research record archiving support. The paper highlights that academic libraries in the United States and Canada have demonstrated preparedness in regard to standard and structures for research data management services though, majority of the libraries are in planning stages. Unfortunately, (RDM/RDS) standards in most developed countries are often treated as ISO standards and procedures hence the need to carry out the study.

## 2.5 Policy and Legal Framework Preparedness

Policies are adopted or proposed statements that guide decisions, plan to tackle certain issues, and achievement of a rational outcome.

### 2.5.1 Policy that Support Research Data Management

In their study Cox, Pinfield & Smith (2016) used a semi-structured interview with librarians in the UK to establish how librarians are preparing to adopt research data management process. The study observed that institutional guideline in research governance, preservation and managing, and rapid data increase to influence the slow implementation of RDM policies in the Uk compared to the United States. Entities including local, regional, and international have appreciated research data is critical in knowledge advancement and education.

Cox *et al* (2017) in their follow-up study towards understanding the research data management maturity in UK noted a common principle on access to research output policy to facilitate data sharing. Although libraries play a special role in the research process, in the UK library associations influenced the enactment and implementation of the RDM policy. At the institutional level, as observed by Cox & Verbaan (2018) some constructs could impact RDM such as present inclinations, particularities, adopted institution strategies, and wider state standpoints. Concurring Wiley (2018) exploration of 850 journals for dissemination of research data noted that though publishers play a critical role in the RDM process the study revealed that only 132 had

identifiable policies; hence, the existence of journal data policies positively correlates with data-sharing practices among authors.

Wiley (2018) discusses the importance of policy preparedness to help in data validation, preservation, and indexing to facilitate discoverability and reuse by other journal publishers. Consequently, the study noted the need to revise data-handling policies, publication, and data-sharing requirements. Concurring Shelly & Jackson (2018) literature review of Australia universities informs of wider adoption of strategies in most institution of higher learning for functional scholarly activities and open access initiatives in compliance with government funding body requirements.

In a study done in 2007 to evaluate research data management policy by assessing the Australian Code for Responsible Research and National Statement on Ethical Behavior in Human Research established a wider distribution and verification of data compiled by researchers. Consequently, the study enlightened on the great assumption by researchers that depositing articles in institutional repositories equal publishing. Also, describing data in publications and the use of accompanying resources allow for analysis and successful RDM process.

In a survey done by Nhendodzashe (2017) discusses the importance of exploring the feasibility of offering research data management services in Zimbabwe mine schools. The study established that successful RDM activities, data gathering, preservation, and distribution is determined by policy preparedness. Further, the institutions seeking

funding for RDM implementation use policies to spell out critical issues which promote RDM success and prevent loopholes that could implicate research adversely.

The study finding enlightened that RDM policies are essential as they stipulate whether members can make a formal request to withdraw their shared research, compensation through and safeguarding of research data to avoid manipulation by unauthorized personnel. However, study identified issues that curtail RDM policy implementation, particularly in developing states, including policy treatment as a statement of aspiration as opposed to intent and changes in institutional culture. The study highlights those institutions in developed states such as Australia often operate without policies to guide data management.

A follow-up study by Nhendodzashe (2017) in European countries observed that less than (40.9%) have not adopted policies to guide research data management. Consequently, the policy has been replaced by a new Australia Code for the Responsible Behavior of Research with eight principles for responsible research behavior, including responsibilities for research institutions and transparency in reporting. Further, the policy stipulates the facilities should have infrastructure built with security aspects to safeguard data from unauthorized manipulation.

Equally, the policy guide that the researchers allow access and reference to raw data by interested parties, and disseminate findings responsibly, accurately, and broadly by maintaining clear, precise, and comprehensive records. However, Shelly & Jackson

(2018) in their studies observed that lack of collaboration in the adoption of research data management within universities acts as a challenge to implementation of RDM policies and procedures. The study enlightens that O.E.C.D. members, including Australia with signed Declaration on Open Access to research Data, have championed in RDM policy implementation adapted by a Public Funding Organization.

In their study Ng'eno & Mutula (2022) exploration of agricultural research institutions examined the National Health Medical Research Council (2018) policy statement to establish how the policy leverage with F.A.I.R. policy. The study established that the policy is significant in providing access, which allows research data created in Australia easily found, metadata to be available in repositories, and data to be unified by linking with international standards, format, and language that adhere to the F.A.I.R. principle.

On contrary Shelly& Jackson (2018) challenged the F.A.I.R. policy enacted by National Health Medical Research Council (2018) by alluding that it challenging to implement the policy in repositories developed using discipline-based practices and protocols on how data should be shared. Further, adoption and compliance with the F.A.I.R principle requires an institution with open guidelines rather than rules to cater for facets including linking and reuse, often subjective to open interpretation. The study finding enlighten that implementing and publishing policies on identifiers, metadata, licensing, and protocol can be a good way for repositories to adhere to the fair principle.

In their study Lefebvre, Bakhtiari & Spruit (2020) explanatory case in Netherlands revealed that RDM guidelines adopted in preparation for the implementation of RDM services should stipulate a series of activities, including data collection, integration, preservation, sharing, and reuse which influence the importance of a policy document to support the development of cases for information technology infrastructure funding, clarification of institutional position, and outline of stakeholder's roles and responsibilities.

### 2.5.2 Legal and Governance Framework

Wong & Chan (2021) discusses the importance of policy, regulatory framework, and ethical issues as critical variables that enhance effective RDM practice. Further, Kinde, Addis, & Abebe (2021) multi-stage sampling in Ethiopia higher education institutions identified challenges often observed in policies to manage data and educate stakeholders and support open access activities. In their studies Birkbeck, Nagl & Sammon (2022) literature analysis on the challenges in research data management practice revealed that the solution to challenges associated with research data management is to develop infrastructure and service that conform to specific legal and policy framework and responds to storage, security, conservation, quality, compliance, and shared drives.

Andrikopoulou, Rowley & Walton (2021) studied the legal environment surrounding research data management. The article highlighted on the rules, principles, procedures, and plans to enhance data eminence in academic institutions. It was observed that, the

adopted policy and legal framework should enhance the implementation of architecture that fosters the management and distribution of scholarly work. Concurring Machimbidza, Mutula & Ndiweni (2022) study highlited that regulatory framework needs inclusivity, comprehensiveness, and details by including critical facets such as patent protection, patents, moral rights, privacy, agreement, internal guiding principle, and procedures.

Moreover, Chiarelli *et al* (2022) case study at the university of oxford informs that a functional RDM legal and policy framework should spell out purpose, scope, applicability, contributors' guidelines, copyright agreements, terms, metadata, data classification, security breaches, and intellectual property concerns. The policy should help to spell out research data ownership to minimize disputes, thus promoting accountability. Equally, the participant's contribution to the construction, formation, certification, application, preservation, and assertion of RDM policy led to rigorous research data in academic institutions. In support Ng'eno & Mutula (2022) emphasize that the RDM policy should stipulate players' roles and responsibilities, which leverage the researcher's needs and accommodate technological dynamics as exemplified in a table below.

**Table: 2.1: Proposed Research Data Management Policy**

| **Proposed Research Data Management Policy** | |
|---|---|
| Stakeholders | Roles and responsibility |
| Librarians | Facilitate data access and reuse<br>Curation and preservation, both long/short term<br>Metadata and data security<br>Data accessibility and availability<br>Research data subject to legitimate protection<br>Provide a mechanism for storage, backup, and registration<br>Training and support<br>Copyright and intellectual property support<br>Guidelines for record disposal |
| I.T. professionals | Research data security<br>Training and support<br>Sharing guidelines and restrictions<br>Removal and data transport<br>Preferred data licenses |

**Source: Ng'eno & Mutula (2022**)

## 2.6 Data Architecture for Supporting Research Data Management

In their study Cox & Pinfield (2014) highlighted that research takes various dimensions, including statistical, investigational results, consultation recording, transcriptions, physical records or files, and terabytes of data on shared servers. The authors discussed the need for domain-specific expertise to enhance adoption of data- model to help in the translation of research data into metadata, disseminate, and archive valuable results. Also, gathering, sorting, analyzing, classifying, and storing research data requires integration within the framework of scientific research.

In their study Yoon & Schultz (2017) discussed research data management services in academic libraries. The evaluated the data architecture adopted to provide researchers access to processed, high-value data, individualized guidance, and support across the whole data life cycle. The study established the purpose of architecture in metadata services such as helping researchers in producing metadata that complies with standards, enhancing dataset interoperability, raising the possibility of data discovery, and providing more comprehensive and in-depth descriptions of the data. Metadata services can be approached in two ways.

The first is developing customized training programs that concentrate on particular metadata standards and architecture. These programs are labor-intensive but flexible. The second strategy makes use of metadata tools or systems (like Morpho) that produce metadata records automatically or that progressively assist users in accordance with project or discipline-specific requirements. In the their finding the study emphasized the that specialized metadata can be made accessible through adoption of models/architecture that allow storage of dataset in repositories.

Yu, Deuble & Morgan (2017) introduces a model for research data management in their consultative leadership study. Their analysis majored on the design of architecture model based on research data management lifecycle. The authors established that that RDM products should be stored in appropriate model to allow subjection to rigorous testing to ascertain adherence to the mandatory procedures mostly stipulated in the data management plan.

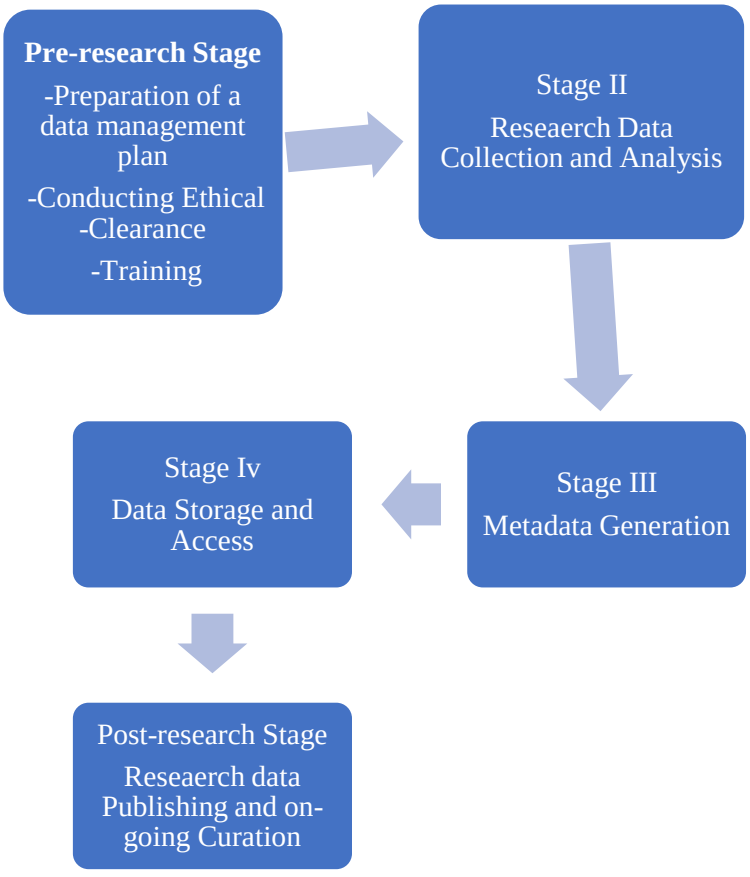


**Figure 2.4: Research Data Model**
**Source: Yu, Deuble & Morgan (2017).**

In their studies Morgan, Duffield & Walkley Hall (2017) share their experiences on research data management. The study exploration established that RDM requires adoption of a models that allow quality data capture for processing, organizing, and structuring

of data files, validation to enhance flexible conversion, and transfer to intended destination. Concurring Andrikopoulou, Rowley & Walton (2021) point that data curation process depends on adopted model to enhance appraisal including selection, digitizing and transcribing, validating and cleaning, anonymizing data, describing, managing, and data storage.

In their study Ng'eno & Mutula (2022) support by highlighting that functional RDM model helps in quality control and assurance measures to provide consistent naming of data, search, and retrieval in data repositories. Zhou (2018) study provides an overview of what academic libraries to successful implement research data management process. A number of academic storage systems are operating at high levels, such as the DSpace at the MIT Library, the Dataspace at Princeton academic, the DataStar at Cornell University, the E-Data at Purdue University, and the HMDC at Harvard University.

These RDM architecture provide scientific researchers with storage and sharing services for research data Oxford University has a two-tier data management storage system that helps scientific establishments manage and maintain their data while also satisfying the needs of researchers for local data management. The Fudan University social science data platform was introduced in 2014 by Harvard University's Dataverse Network to provide tools for online analysis and sharing, services for universities, research institutes, and government organizations to store, publish, and exchange research data. It was founded on the open-source software DSpace with set standards for data submission, organization, preservation, sharing, and utilization.

The study finding proposes the need to comprehend and assess external storage solutions that are appropriate for scientific researchers in addition to creating and promoting an internal storage system that satisfies user needs. The author insist that the importance of research data management is to gather, compile, and assess the data that has been saved in order to find connections with other relevant information. Equally, carry out secondary development to increase the value of the data and make it easier for other scientists to utilize by providing channels for sharing that have been specified.

Cox & Pinfield (2014) studied the lewis-Corrall archetypal to explain RDM activities hierarchically including policy-making, training, and mapping of the potential role of information professionals which should be considered in choosing RDM model. The study identified gaps in lewis-Corrall hence proposes use of DCC Lifecycle Curation Model, often associated with record administration to guide the adoption of RDM model though, to some extent fails to solve challenges associated with RDM scale complexity.

The Professional Information Researchers in their study to established an appropriate research data model proposed a nine-area pyramid to map RDM activities, which is more implicit and strategic as compared to Lewis model. The nine-level pyramid archetypal is significant due to the incorporation of national policy and partnership with educational providers. However, the archetypal fails to address intra-organizational collaboration and librarians' roles which need a multi-professional approach.

In their study Pinfield, Cox & Smith (2014) proposed an RDM data-centric architecture with drivers such as storage, jurisdiction, and technologies drives. Concurring Tripathi, Shukla & Sonkar (2017) emphasize that institutions need to consider functional RDM model that allow seamless access, browsing, consulting, and built-in for future academic work and research activities. In a study of research data model Alhussain (2017) proposes blackboard architecture citing the model possibility of information exchange, effective communication, and comprehensive framework for comparing success across multiple information systems or usage of a single system, given its multidimensional and interrelated nature.

On the contrary, some studies often promote blackboard as a Learning Management System (LMS) that supports thousands of institutions worldwide in addressing educational challenges and driving innovation rather than adopted to support research data management (Alhussain (2017). Concurring Zhou (2018) point that data warehousing and technology platforms are included in the category of RDM architecture, which also includes storage systems for managing and storing research data. The efficient handling of research  dfatdata, especially for academic and data-intensiv companies, depends on this architecture. It is imposible to organize , preserve, and secure data effectively without a specialized platform.

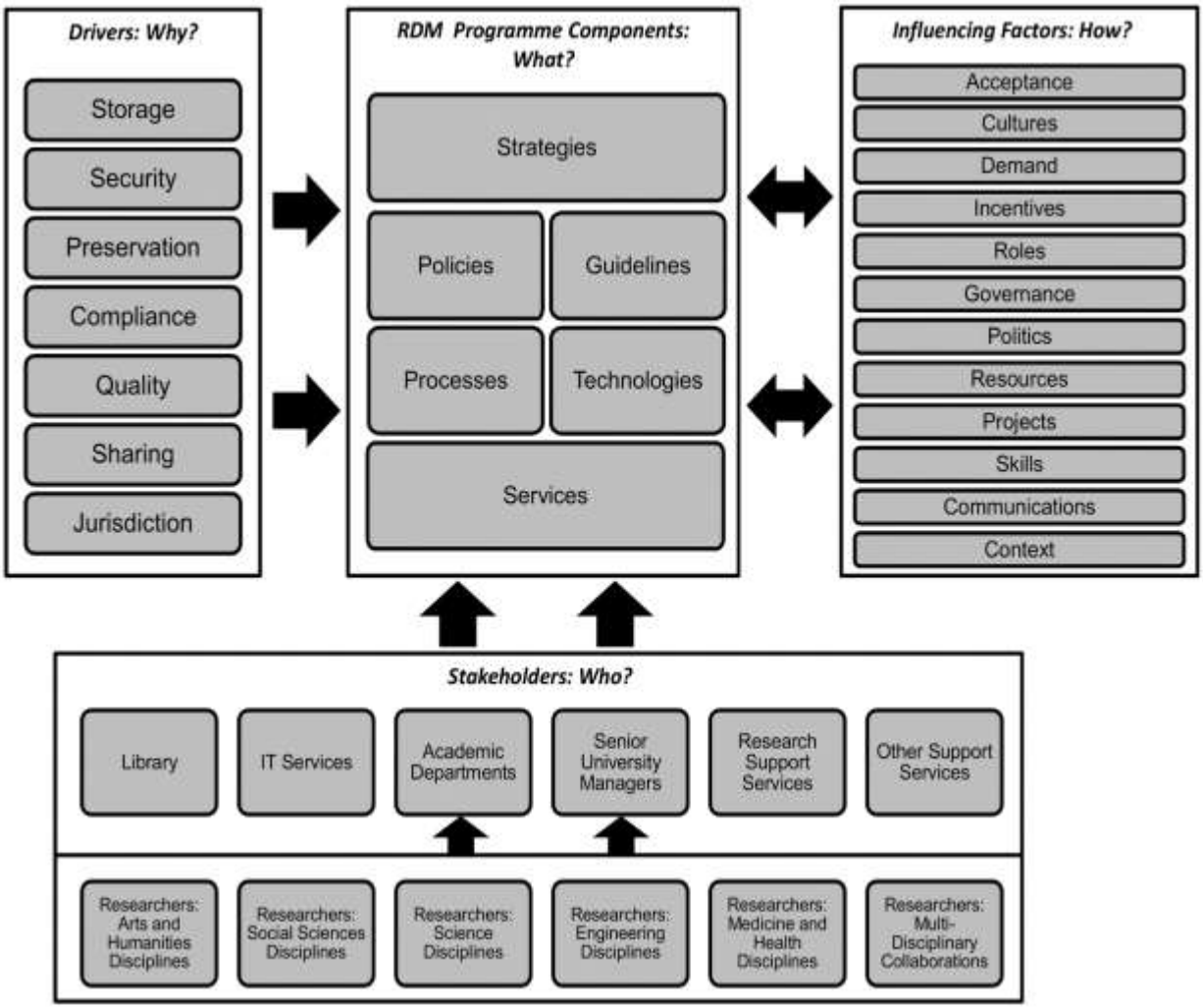


**Figure 2.6: Library-oriented institutional RDM model**
**Source: Pinfield, Cox, and Smith (2014).**

In their study Tripathi, Shukla & Sonkar (2017) used the National Data Service (N.D.S.) a U.S. initiative and data providers association computing infrastructure providers and publishers to map up research activities including deposit, use, reuse, data analysis, to describe an RDM model that enhance support, promote, and strengthen research endeavors while allowing analysis of research data policies formulated and implemented in India. Yu, Deuble & Morgan (2017) in their discussion used a consultative leadership approach to explain RDM prototype that could support library services based on the research lifecycle including Vaughan *et al* (2013) five-stage

architecture comprising of constructs including; ideas development, funding, proposal, conducting, and dissemination of metadata. The study concluded that the proposed guide supports a few RDM activities such as locating data sources, preparing a data management plan, describing data, and navigating repository options for a comprehensive RDM model. Further, the authors suggest the adoption of research lifecycle structure with listed RDM related activities across three research project phases.

The structure has several stages stipulating activity including preparation of a data management plan, conducting ethical clearance, and training in the pre- research location. The structure guide on procedures for research data collection and analysis; metadata generation; data storage and access during the research; publishing research data, and on- going curation in the post-research stage.

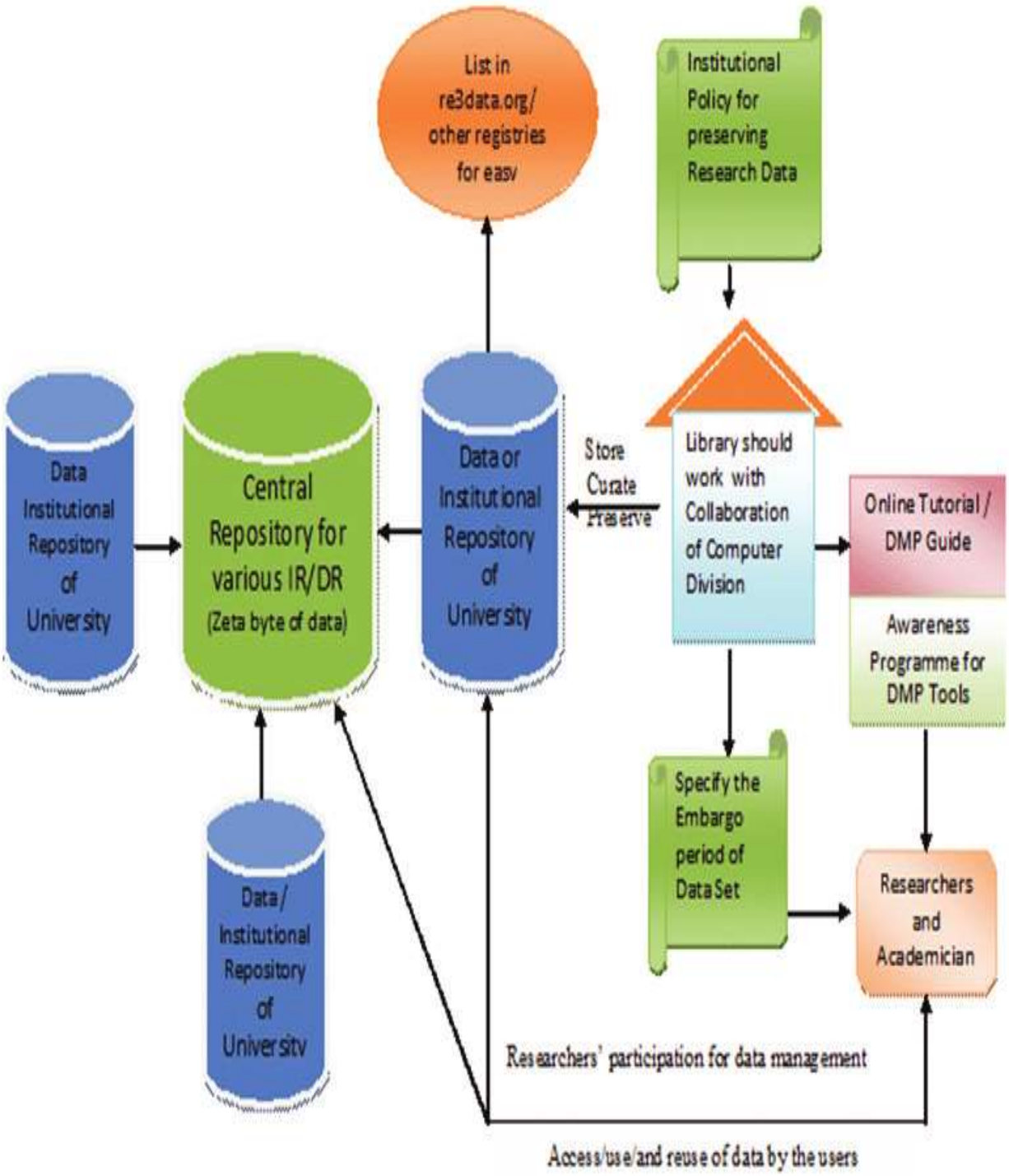


**Figure 2.7 Model for Research Data Management**
**Source: Tripathi, Shukla & Sonkar, (2017).**

Gries *et al* (2018) studied the repository model and established that it is an open access data repository that share a standard framework for data deposition, discovery, and reuse by offering a consistent experience for both producers and users across repositories. Also, the model uses multiple metadata standards or export metadata in multiple specifications as employ the specification that best fits its data entities and curation procedures. The repository model is automated hence increase the quality and complexity of metadata making it easier to codify and incorporate minute details of the

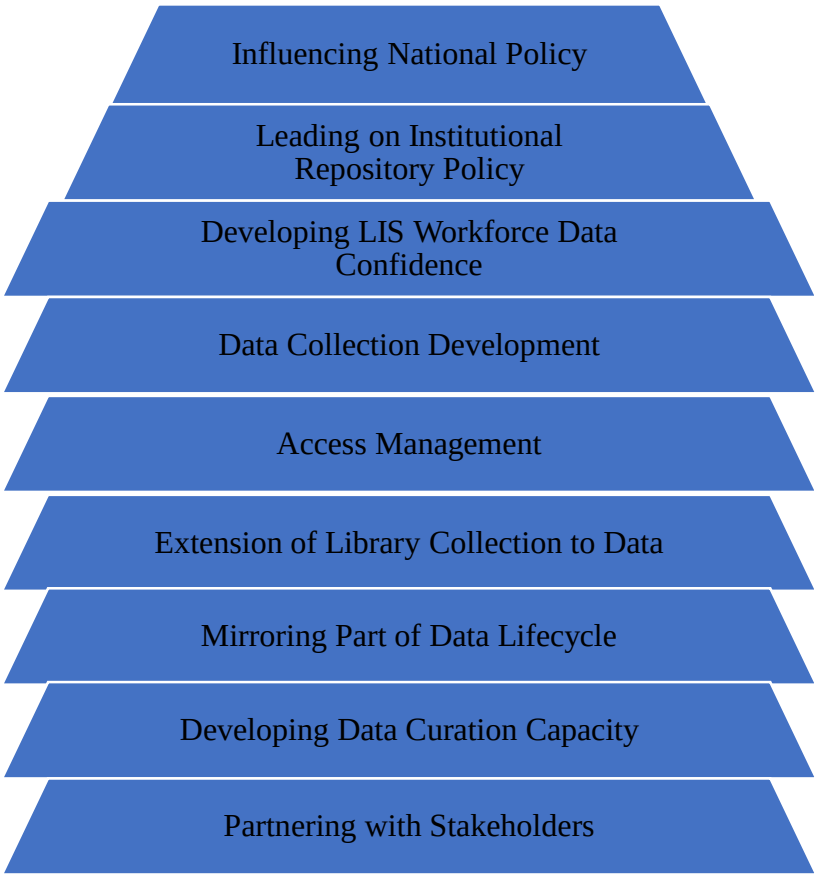


**Figure 2.8; Nine pyramid data-centric model for R.D.M.**
**Source: Researcher: 2025**

data that might be missed or ignored during manual compilation. Also, it has explicitly described and regulated vocabularies, authoritative definitions, resolvable URIs, and unique identifiers attached. In several universities, research data management systems have recently merged tailored discipline management platforms and a variety of collaboration platforms as demand increases. As a result, hierarchical or cooperative system structure like the DATA-PASS platform group of the US Data Management Alliance have been developed that guides different types of RDM functional activities, including policy-making, training, and mapping of the potential role of information professionals in the research lifecycle.

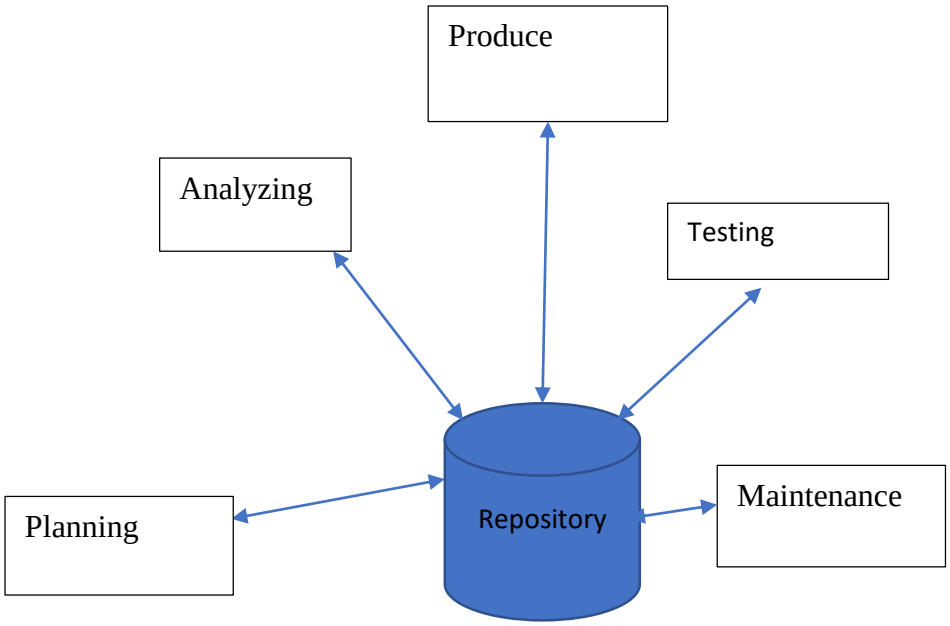


**Figure 2.9.: Repository Architecture Style**
**Source: Researcher, 2025**

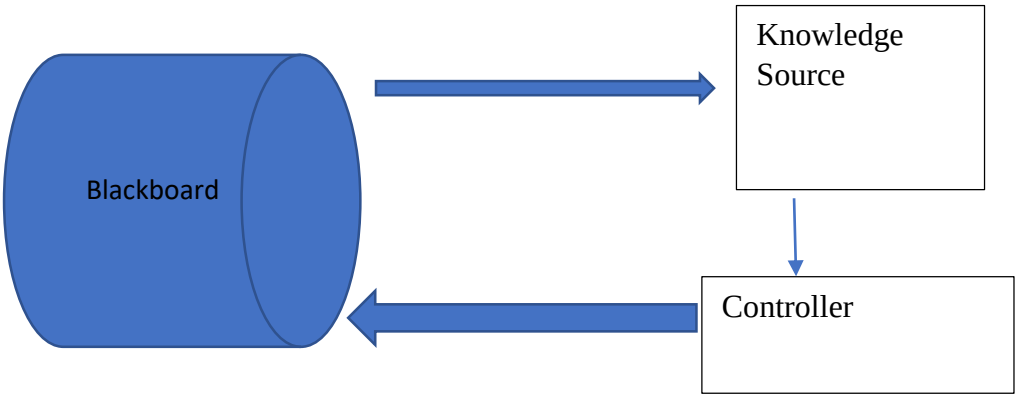


**Figure 2.10; Blackboard Architecture Style**
**Source: Researcher; 2025**

## 2.7 Literature Summary

The reviewed literature revealed libraries level of preparedness by assessing the key skills, knowledge, and competencies. The literature highlight that for library staff to support RDM activities they need training to nurture soft and hard skills. However, studies lacked criteria to identify personnel for upskilling or whether the skills and competencies could be acquired through seminars, workshop or formal training. Collaboration strengthens library epistemological boundaries, allow data exchange, promote university profile, citations, and researchers' collaboration. However, some studies inform that collaboration may gradually eliminate information professional distinctiveness, best practices for RDM and library ability to maintain its identity. Further, the studies are done in developed states hence, need for exploration to ascertain issues that could foster collaborative partnership.

In technical structure emphasis is on data standards for quality data capture processing, organizing, and structuring of data files, validation, good conversion, flexible transfer and metadata. Consequently, most studies are done in developed countries. Further, comprehensive information lacked on standard for data sets such as XML and DUBLIN Core, guidelines on metadata standards. In policies F.A.I.R. principle was proposed to allow research data to be easily findable, However, some studies pointed to difficulties in implementing F.A.I.R. policy hence need to carry out this research to establish what elements should be incorporated in the RDM policy framework.

In data architecture, the lewis-Corall model was common due to the underlying hierarchical conception to guide RDM activities in place of a nine-level pyramid model that fails to address intra-organizational collaboration. However, some studies proposed an RDM model with three research project phases with every stage stipulating RDM activity. Consequently, it is not clear whether the models are either a blackboard or a repository model. Therefore, it is vital to carry out this study and establish appropriate data architecture for functional research data management.

# CHAPTER THREE

# RESEARCH DESIGN AND METHODOLOGY

## 3.1 Introduction

The section presents the study methodology. It discusses the research design, study variables, study location, target population, sampling technique, and sample size. It also confers on the instruments used to collect data, the piloting study, and the cogency, consistency, and techniques used to collect data. Finally, it describes how the data was analyzed and the ethical considerations observed, and the study summary

## 3.2 Research Design

The research design entails the researcher's decision on appropriate means of inquiry for collecting and analyzing data to solve the study phenomenon. The study adopted the positivism research design which is strongly related with quantitative data collection methods. Positivism paradigm is based on measurement and reason, with knowledge provided by neutral and quantitative (quantifiable) observation of activity, action, or reaction. Positivism holds that if something is not measured in this way, it cannot be known with certainty. Scientific knowledge is formed from the collection of theory free and value free evidence gathered via observation. This implies that anything that cannot be observed and hence measured (quantified) is of little or no significance.

The researcher used quantitative design which is a statistical approach that helps in organizing, analyzing, interpreting, and presenting numerical data collected through

questionnaires. The design offers more convincing evidence and increases researcher trust in their conclusions and more precise results. The approach enables a researcher to formulates focused research questions, and gathers from participants' measurable data and examines these figures using statistics and carry investigation in a fair and impartial manner. Also, quantitative research involves data, reasoning, and an impartial viewpoint by prioritizing on precise, convergent thinking over divergent reasoning. The design was considered as it helped in the creation of ideas regarding a research subject in an unstructured and free-flowing manner.

### 3.2.1 Variables

The independent and dependent variables are described below:

#### 3.2.1.1 Independent Variables

Independent and dependent variables guide the study though intervening variables come into play. The independent variable is academic library preparedness depicted by staff knowledge and skill, collaborative partnership, research data validation, and verification structures, policies and legal framework, and RDM architecture.

#### 3.2.1.2 Dependent Variable

The ability to implement RDM is the dependent variable. However, academic libraries' preparedness for the adoption of research data management may be hindered by extraneous variables, including stakeholders' awareness, attitude, and data manipulation.

#### 3.2.1.3 Scope

The research data management process is a lifecycle including activities such as data creation, processing, data analyzing, preservation, providing data access, and facilitating data use- and reuse. Although the processes have been reviewed and discussed widely, the study concentrated on metadata creation, preservation/storage in data repositories, data access, and reuse.

### 3.2.2 Research Methodology

Since the study used descriptive quantitative design, the data collection tools were questionnaires to measure the opinion and offer broad representation of target population.

### 3.2.3 Location of the Study

The study was carried out in two academic institutions: Kenyatta University and Egerton University. The institutions were considered due to the extent of their mandate including promoting teaching, research, and innovation which led to the creation of data. Further, the institution has different department that could offer collaborative support for the successful adoption of research data management. Also, the institution has the authority to develop policies that govern their undertaking; hence it could be possible to incorporate policies that allow the adoption of research data management. Kenyatta and Egerton University are pioneering institutions that often access higher funding from the Kenyan government and research grants from local, regional, and international sponsors and whose growth is remarkable.

### 3.3 Target Population

The study sought to establish academic libraries' preparedness for the adoption of research data management; hence the population sample was drawn from academic library staff, director of research, and graduate school board.

**Table 3.1: Participants, Location, And Sampling Technique**

| **Respondent** | **Location** | | **Sampling Technique** |
|---|---|---|---|
| | **Kenyatta University** | **Egerton University** | |
| Chief Librarians | 1 | 1 | **Purposive** |
| Deputy Librarian | 1 | 1 | Purposive |
| Section heads | 10 | 10 | Purposive |
| Senior Library Assistant | 12 | 13 | Purposive |
| Director of Research | 5 | 5 | Purposive |
| Graduate School Board | 6 | 6 | Purposive |
| Total | 36 | 37 | |

**Source: Researcher, 2025.**

### 3.4 Sampling Techniques and Sample Size

#### 3.4.1 Sampling Technique

Purposive sampling was used to obtain cases deemed rich in information for data saturation. Purposive sampling gives the researcher freedom of choice for the object of the study as long as they meet specific characteristics. Further, the technique allows

better control of significant variables and matching sampled data from the selected group. A total of 73 participants were expected to participate in the study. The researcher visited the study location to discuss with the university librarians on the topic and booked appointment to collect data. Since the targeted participants were sampled purposively based on knowledge of the study topic, the university librarians were requested to guide in identifying eligible participants. Also, the researcher explained exhaustively the study topic, sought consent, and maintained ethical standard.

### 3.4.2 Sample Size

**Table 3.2: Sample Size**

| **Respondent** | **Population N** | **Sample (n)** | **Percentages %** | **Sampling Technique** |
|---|---|---|---|---|
| Chief Librarian | 2 | 2 | 100% | Purposive Sampling |
| Deputy librarian | 2 | 2 | 100% | Purposive Sampling |
| Section Head | 22 | 20 | 90.9% | Purposive Sampling |
| Senior Library Assistant | 25 | 23 | 92% | Purposive Sampling |
| Director of Research Staff | 10 | 7 | 70% | Purposive Sampling |
| Graduate School Staff | 12 | 8 | 66.70% | Purposive Sampling |
| Total | N=73 | n=62 | | |

**Researcher, 2025.**

The above sample size was arrived at using the Slovin's sample size determination method. The is applicable in scenario where the population size is known. The method allows a margin error of a certain percentage. Using a population of N=73 and a margin error of 5% resulted to a sample size of n=62 as illustrated below.

The Slovin's sample determination method;

n=Sample size

N=population size

E=Margin of error (in decimal form)

Where N=73

e=0.05

$$n=1+\frac{73}{1+73(0.05)2}=\frac{73}{1+73(0.0025)}=\frac{73}{1+0.1825}=\frac{73}{1.1825}$$

n=61.73

n=62

### 3.5 Research Instruments

The research instruments are tools used to collect, measure, and analyze data, respond to research queries, and prove or disapprove the study hypothesis. Self-constructed research instruments were utilized in this study. Since the study used quantitative research design, the structured closed-ended questionnaires were used to collect data. The instruments allowed participants to respond based on their complete knowledge, feeling, and understanding of the subject (Doyle *et al*., 2020).

### 3.6 Pre-Testing/Piloting

The feasibility of a research design was examined by testing the method chosen for gathering data and guiding methodology for the initial large-scale investigation (Majid

*et al*., 2017). Piloting was instrumental in establishing issues that could negatively affect the study design, process, and mitigate strategies to reduce the chance of failure in the larger project (Davies & Mosdell, 2022). Therefore, piloting tested the feasibility of structured closed-ended questionnaires in establishing academic libraries' preparedness for the adoption of the research data management according to the research questions. Piloting before the actual study was done in University of Nairobi. The institution choice was based on specific characteristics that almost matched the actual study's location. The participants in pre-testing were selected purposively, which helped to identify design flaws and foster improvement during the initial research.

### 3.6.1 Validity

The study used content validity to establish the degree to which the measure represented the paradigm of interest. The research instrument's content validity was established by involving subject experts to evaluate the questionnaires. The researcher further assessed the validity of the questionnaires against each of the constructs and modified the instrument based on expert guidance.

### 3.6.2 Reliability

The study used Cronbach Alpha reliability approach to measure construct consistency. The information supplied shows the outcomes of a reliability test for a collection of items using Cronbach's Alpha.

**Table 3.3: Case Processing Summary**

| | | N | % |
|---|---|---|---|
| Cases | Valid | 19 | 61.3 |
| | Excluded[a] | 12 | 38.7 |
| | Total | 31 | 100.0 |

**Source: Researcher, 2025**

**Table 3.4: Reliability Statistics Test Results**

| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
|---|---|---|
| .785 | .883 | 58 |

**Source; Researcher, 2025**

A total of 58 products were tested for reliability. The Cronbach's Alpha coefficient of 0.785 indicates the reliability of internal consistency. A scale of 0 to 1, with higher numbers indicate greater dependability. A rating of 0.785 indicates a moderate to good level of internal consistency among the elements in this scenario. Based on standardized items, the Cronbach's Alpha was 0.883. This coefficient is frequently greater than the usual Cronbach's Alpha since it took into account the variance of each item as well as the covariance between items. When examining standardized items, the higher score (0.883) suggests increased reliability.

### 3.6.3 Internal Consistency

Cronbach's Alpha levels (both standard and non-standard) are more than the usually accepted cut off of 0.7. This implies that the set's components are internally consistent, which means they measure the same underlying construct or notion.

### 3.6.4 Item Homogeneity

The strong Cronbach's Alpha values show that the items are connected with one another, lending credence to the notion that they are assessing a single, related construct. When working with scales or assessments, this is preferable.

### 3.6.5 Strength of Reliability

A Cronbach's Alpha of 0.785 is generally regarded as adequate for many research applications. The higher score (0.883) based on standardized items adds to the measurement's reliability. The reliability test findings show that the set of 58 items has strong internal consistency, indicating that they are reliable for measuring a common underlying concept. Based on these Cronbach's Alpha values, researchers have trust in the consistency and stability of the measurement apparatus.

## 3.7 Data Collection Techniques

The researcher used structured questionnaires with same questions on specific topics and wording to avoid ambiguity or specified undesired connotations.

### 3.8 Data Analysis

The study used quantitative approach to collect data informing the use of statistical package for social sciences to analyze data, and result presented using percentages, tables, charts, pie charts, and graphs for the purpose of interpretation.

### 3.9 Logistical and Ethical Consideration

#### 3.9.1 Logistical Considerations

The researcher developed a comprehensive work plan and budget that stipulated activities to be carried out during the research period. A grant chart was prepared to specify specific actions, milestones that ought to have been covered, and the anticipated period.

#### 3.9.2 Ethical Considerations

Ethics was observed to guide the researcher’s action when dealing with participants in the study, handle privileges, and maintain confidentiality and respondents' privacy. Equally, the researcher ensured the graduate school and NACOSTI were fully aware of the researcher’s intention to carry out the study. A consent form addressing issues such as privacy, confidentially, and anonymity was availed to participants. Also, withdrawal from participation was granted.

### 3.9.3 Confidentiality

The respondent's confidentiality was ensured by maintaining privacy and anonymity. The researcher anonymized data to ensure information gathered didn’t identify the individual respondent. Further, the researcher adopted an appropriate strategy grounded on the study aim, contents, approaches, and findings reported in strict adherence to ethical values

### 3.9.4 Community Considerations.

Data was collected in strict adherence and respect to institution local culture and tradition. The ethical standards and guidelines were maintained; including voluntary participation, informed consent, anonymity, potential for harm, and result communicated.

### 3.9.5 Care and Protection

The researcher avoided breach of confidentiality by ensuring the information disclosed in a relationship of trust was not divulged without their permission.

# CHAPTER FOUR

# DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

## 4.1 Introduction

The section presents analyzed data and findings on academic libraries preparedness towards the adoption of research data management. The chapter begin with questionnaires response rate. Further, the findings are based on study objective organized in sections for ease of interpretation and understanding.

## 4.2. Response Rate

The response rate as observed by Frey (2018) is arrived at by calculating the completed data collection instruments against the administered in the sampled population.

**Table 4.1: Response Rate on Administered Questionnaires**

| Respondent | Population N | Sample (n) | Percentages % | Sampling Technique |
|---|---|---|---|---|
| Chief Librarian | 2 | 2 | 100% | Purposive Sampling |
| Deputy librarian | 2 | 2 | 100% | Purposive Sampling |
| Section Head | 22 | 20 | 90.9% | Purposive Sampling |
| Senior Library Assistant | 25 | 23 | 92% | Purposive Sampling |
| Director of Research Staff | 10 | 6 | 70% | Purposive Sampling |
| Graduate School Staff | 12 | 8 | 66.7% | Purposive Sampling |
| Total | N=73 | n=62 | | |

**Source: Researcher, 2025**

**Table 4.2: Questionnaire Response Rate**

| Name of Institution | Number of Copies Administered | Number of Copies Returned | |
|---|---|---|---|
| | | | % |
| Kenyatta University | 31 | 18 | 83% |
| Egerton University | 31 | 17 | 88% |
| Total | 62 | 35 | 85% |

**Source: Researcher, 2025**

A sample of 62 participants was drawn from a target population of 73 in the two selected universities. A total of 62 questionnaires were prepared and 31 administered in every university. According to the table the return rate was commendable with the selected institutions reporting 83% and 88% which is an above average response rate. Although, the two institutions have large population of staff, the study targeted section which often interact with research data including libraries, graduate school, and research directorate hence a smaller sample. Consequently, the response rate of above 70% in the two institutions with Kenyatta university registering 83% and Egerton university 88% with the average of 85% make the collected data valid for analysis as observed by Mugenda (2012) for generalization to be made from a study survey.

### 4.3 Staff Preparedness

#### 4.3.1 Knowledge and Skills

The academic libraries should invest in resources and librarians' skills in readiness to provide research data management services including digital data curation, data quality, and data citation (Koltay,2016).

In order to establish librarians' knowledge on research data management the participants were asked to indicate their level of knowledge which could help to establish the level of preparedness. The four categories of knowledge level in which the participants were rated was poor, average, good, and excellent. The results are interpreted as follows;

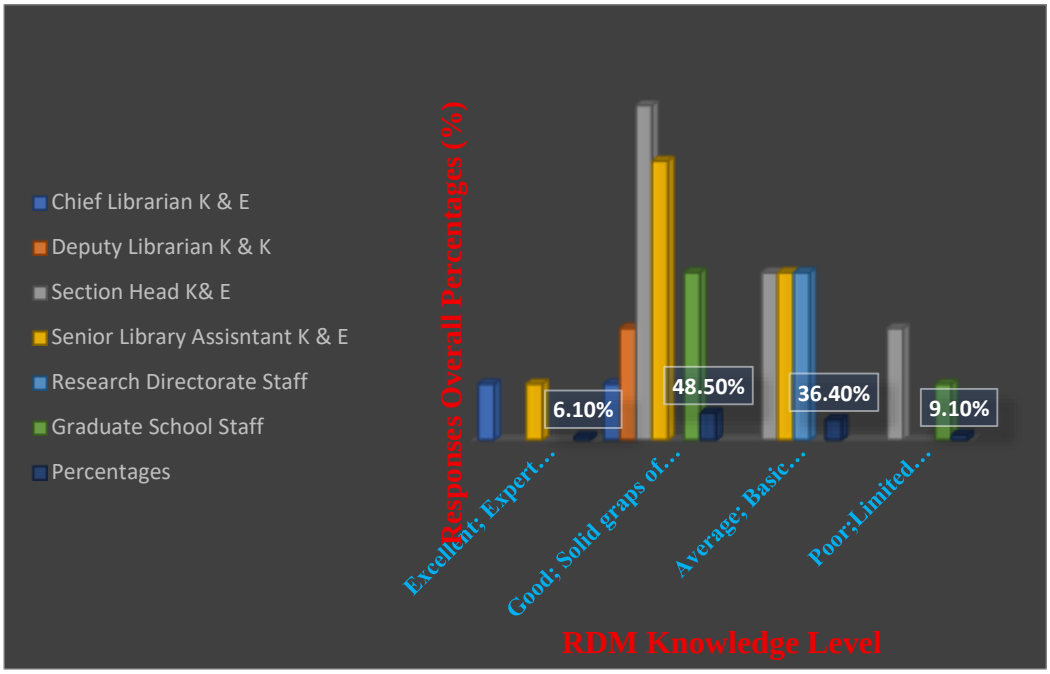


**Figure: 4.1 RDM Participants Knowledge Level**

**Source: Researcher, 2025**

The majority of participants reported their RDM knowledge level as good at 48.50% implying a generally favorable understanding of metadata standards and knowledge of legal and ethical aspect in documentation and sharing of research data. The average response at 36.4% imply awareness of research data management principles in data organization and documentation though, with possible inefficiencies. The poor response at 9.1% implies limited understanding instrumental in data documentation and organization. Lastly, the 6.1% excellent response depicts expertise knowledge to implement comprehensive data management plans and adhere to RDM principles and standards for data storage and sharing.

This study agrees with Pasipamire & Mhone (2025) the exposer of librarians to RDM services through the integration of research data management services in librarian traditional role could led to some bit of preparedness though, the level varies for scholarly advancement through good research practices. The university with lower level of knowledge as alluded by Pasipamire & Mhone (2025) need to invest in awareness creation on RDM to equip librarians with instrumental knowledge to effectively support researchers focusing on RDM skills development training to build confidence in RDM activities.

Also, the need to explore librarians' attitudes toward offering RDM services could better understand the problems faced by librarians when delivering the service to researchers which could help to scale up the knowledge and skill from just awareness to expertise in research data management. Concurring Koltay (2016) highlight of skills

challenge which could derail adoption of research data management process emphasizing on the importance of upskilling librarians or hiring librarians with cutting-edge and sufficient RDM knowledge and skills.

### 4.4 Strategies for Acquiring RDM Competencies

The research data management requires technical knowledge and competency to handle metadata creation. Also, librarians should develop both soft and technical skills described as demonstrative competence and intellect instrumental in identifying research data needed to make decisions (Matteson, Anderson & Boyden, 2016). Nurturing librarian soft and hard skills through training, seminars and workshops help librarians build confidence and demonstrate competence in handling various RDM needs for the research community. RDM is a complex undertaking that requires professional skills and a high level of competencies (Corti & Van den Eynden, 2015). Also, Buckley et al (2015) propose upskilling concentrating on research strategy, fact-finding, and scrutiny entwining integrated practice-based training in research data management with outmoded approaches. Equally, training should form part of instructional literature since dynamics in the data landscape often fail to satisfactorily cater to the necessary skill required in RDM activities.

In determining participants preparedness demonstrated by competency to discharge research data management role, the study explored different strategies as tabulated below;

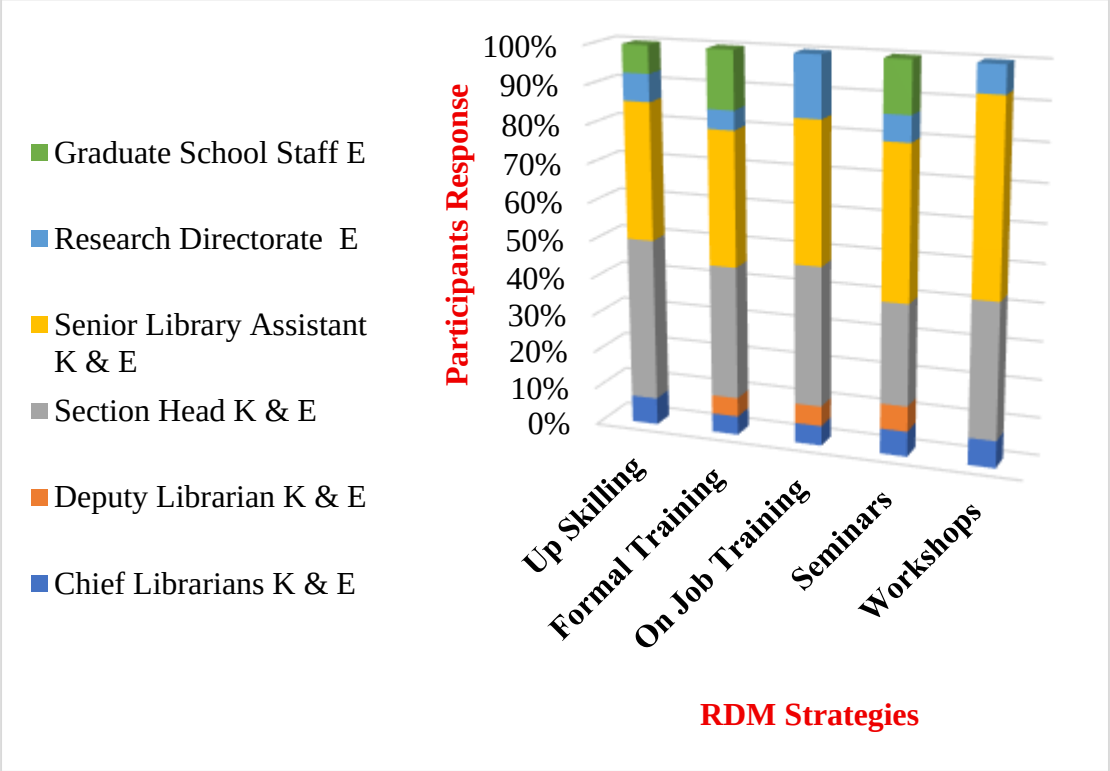


**Figure 4.2; Strategies for acquiring RDM Knowledge and Skills**
**Source: Researcher, 2025**

The finding reveals equal support for all strategies at 100 % implying that all are applicable in acquiring RDM knowledge and skills. The upskilling is supported by Kenyatta university at 35.7%, Egerton at 64.8%, formal training K 45%, E 55%, on job training K 45%, E 55%, seminars K 31.4%, E 68.9%, and workshop at K 37.6%, and E 62.7%. The support for various approaches to acquire RDM competencies is supported by Morgan, Duffield & Walkley (2017) by alluding that there is need to incorporate various initiatives to increase understanding of the research data management process, including seminars, workshops, and virtual and group training.

### 4.5 Collaboration Drivers

The findings reflect participants' reactions to crucial areas of collaboration in the context of university libraries' readiness to implement research data management (RDM). Collaboration drivers include areas such as definition of RDM data repository criteria, research data reuse with legal considerations, data repository platform selection, data sharing inside and beyond disciplines, and data rental duration.

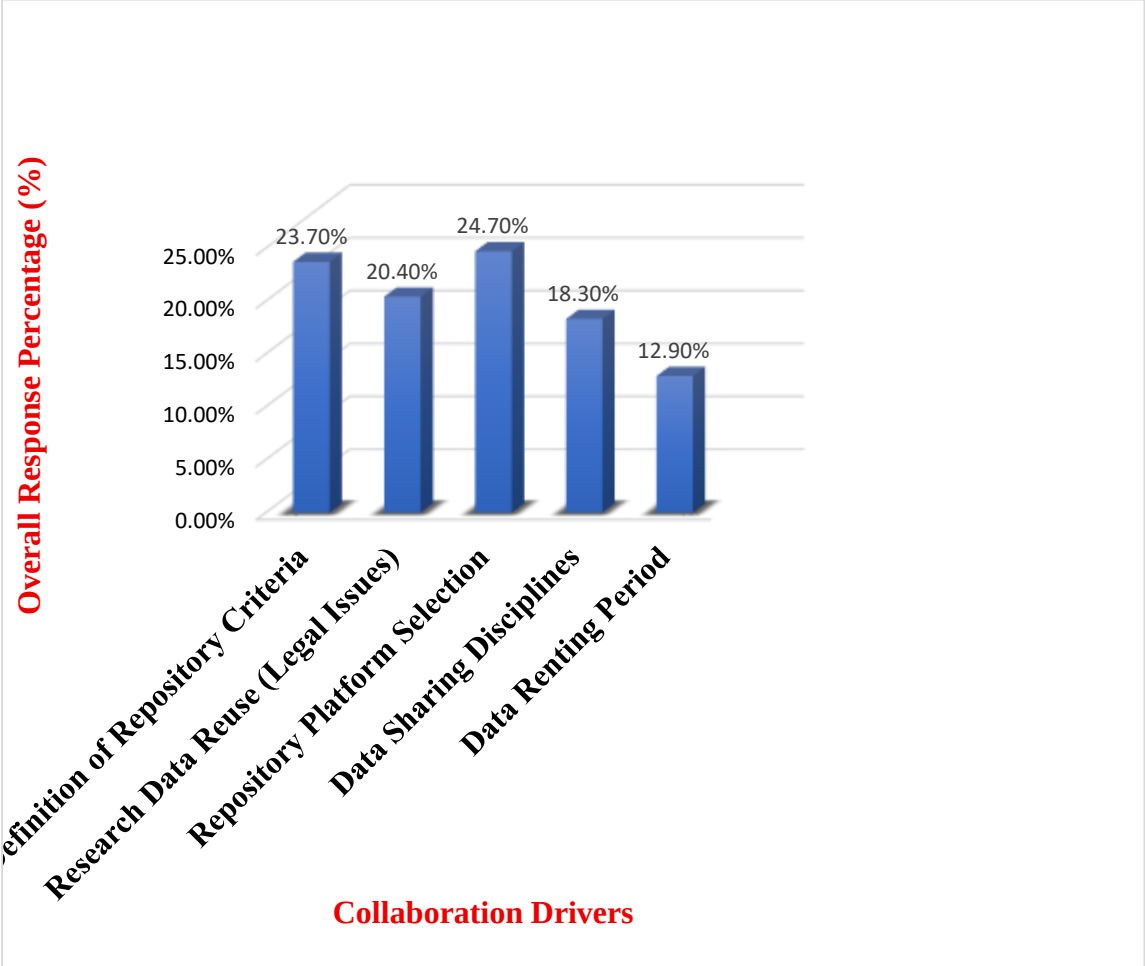


**Figure 4.3; Collaboration Drivers**
**Source: Researcher, 2025**

The result reveals varied preference for different collaboration drivers with repository platform selection being preferred by the majority at 24.7%. The definition of the repository criteria follows at 23.7% with participants feeling research data reuse in light of legal issues at 20.4% need a bit of collaboration. The definition of data repository criteria and the selection of an appropriate data repository platform are seen as essential cooperation areas. This implies that there is a shared understanding that setting defined criteria for data repositories and selecting appropriate platforms are essential for good research data management.

Equally, data sharing disciplines and data renting period were fairly considered for collaboration at 18.3% and 12.9% respectively. Ng'eno & Mutula (2022) in support allude that every step of the RDM process requires the development of policies and laws that address data curation, quality, and security in addition to ethical considerations, human resource capacity, technical infrastructure, and cooperative collaborations. The emphasis on research data reuse and sharing within and between disciplines implies appreciation of the significance of such collaboration as supported by Ng'eno & Mutula (2022) that sharing research data and establishing and maintaining public-private partnerships between research institutes and partners need collaboration both inside and between institutions. Also, RDM full potential won't be realized unless the several parties involved in data generation, management, and use can work together to create shared infrastructure, develop optimal RDM, and put it into practice.

### 4.6 Technical Structure Preparedness

Technical preparedness entail standard for research data as data is often created as digital file format, including text, video, photos, numbers, and seismic simulation data, laboratory data, derived and compiled data for text mining or testing procedures, and observation variables like investigation data for forecasting, airstream rapidity, and liquid eminence. Standard is important as it help to determines the processing strategy, storage of metadata and sharing for reuse by the scientific community, creating of new research hypotheses by aggregating data to allow reproducibility of novel data which may improve on original data.

Standards help in mapping data to Data Cite schema or Dublin Core terms and file-level metadata, which can be deep and comprehensive for tabular data files including column-level metadata. Research data management standards help in adopting control measures to enhance correctness and exactness in the collection, management, and utilization of research data (Zhou, 2018).

The data supplied reflects participants' replies regarding the technical frameworks approved for research data storage, exchange, and reuse in the context of academic libraries' readiness for RDM adoption. Text documents, structured text, spreadsheets, databases, graphical images, software application source code, data configuration, and software applications are examples of technical structures.

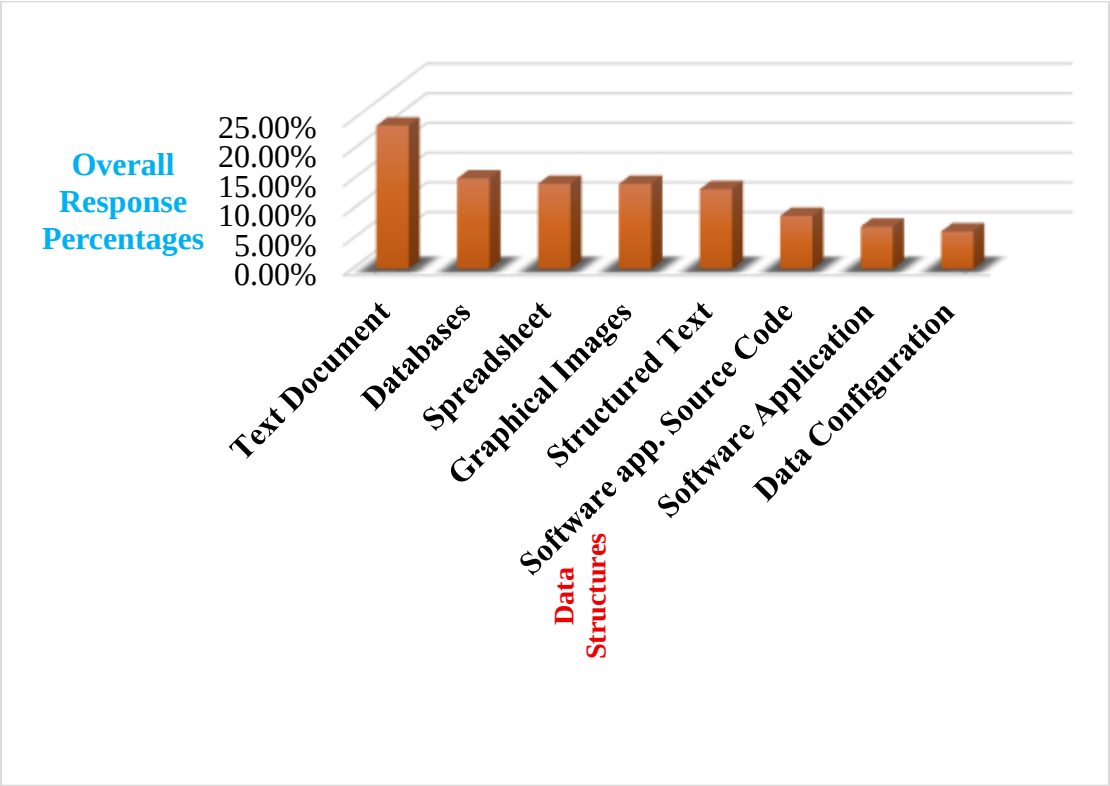


**Figure 4.4; Data Structures**
**Source: Researcher, 2025**

The finding reveals majority acceptance of the range of technical structures, suggesting an understanding of the various formats in which research data may exist with text perceived as best at 24.1%**.** The other structures were fairly preferred including database 15.2%, spreadsheet 14.3%, graphical images 14.3%, structured text 13.4%, software app. Source code 8.9%, software application, and data configuration at 6.3%. The acceptance of different technical frameworks by this category reveal that libraries may need to invest in resources and skills to handle various technical structures accommodate a wide variety of data formats., with a focus on software-related data.

The findings are supported by Ng'eno & Mutula (2022) that flexible metadata standards provide homogenous naming to allow users to comprehend and trail important details,

describe metadata facilities, search, and retravel in data repositories. Ng'eno & Mutula (2022) support the finding by alluding that to enhance data access, use, and reuse entails making research data available in a convenient and modifiable form and redistributing under terms that permit reuse.

The findings are supported by Yu (2017) that there is need to adopt structures allowing dataset repositories to use specialized metadata for describing research data to facilitate easy discovery, access, and use. The overall percentages are text document E 23.19%, K 23.40, structured text E 11.59%, K14.89%, spreadsheet E 11.59%, K 17.02%, graphical images E 13.04%, K 14.89%, software application source code E 10.14%, K 6.38%, data configuration E 8.07%, K 2.13%, software application E 8.70%, K4.26%.

### 4.6.1 Responsibility for Metadata Creation (data about data).

The metadata creation is a complex undertaking that need collaborative effort among stakeholders such as librarians, researchers, and scholars should collaborate to build confidentiality by making data available, accessible, and timely distribution of research content if the institution preserves research data in repositories which are accredited or certified to appropriate standards to ensure data quality through assurance and control process. (Ng'eno & Mutula, 2022).

The information supplied shows the participants' opinions about who should be in charge of developing metadata in relation to academic libraries' readiness to implement research data management. Data owners and librarians are two of the categories. The data are interpreted as follows:

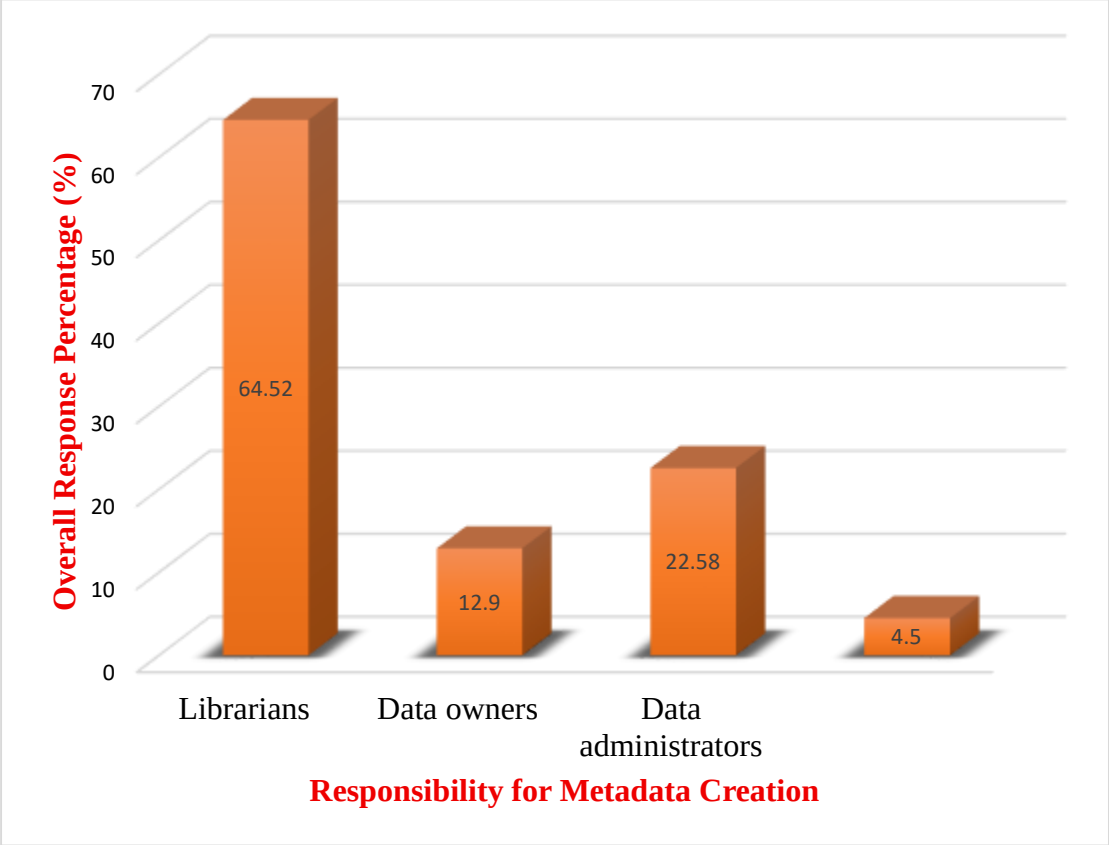


**Figure 4.5: Responsibility for Metadata Creation**
**Source: Researcher, 2025.**

The participant provided different views on who should be responsible for metadata creation. The majority at 64.52% perceived librarians should be entrusted with metadata creation responsibility. This emphasizes how crucial librarians are in the description of research material, guaranteeing its discoverability, accessibility, and usability by providing domain-specific information about the research data. The data administrators

were averagely preferred to handle metadata at 22.58%. Lastly, the data owners were less preferred at 12.9%.

The above information highlight the need to engage all categories as they have a role to play which is consistence with Ng'eno & Mutula (2022); Birkbeck, Nagle, & Sammon (2022), that stakeholders such as librarians, researchers, and scholars should collaborate to build confidentiality by making data available, accessible, and timely distribution of research content if the institution preserves research data in repositories which are accredited or certified to appropriate standards to ensure data quality through assurance and control process. Also, Hamad, Al-Fadel, & Al-Soub (2021), allude that to comprehend RDM and metadata creation, and how it should be presented to the research community, librarians must connect with researchers and learn about their behavior and approach to RDM.

### 4.6.2 Responsibility for Metadata Security and Standards

The findings present participants' reactions to the responsibility for ensuring metadata security and standard adherence in the context of university libraries' readiness to implement research data management. Librarians, IT professionals, and research administrators.

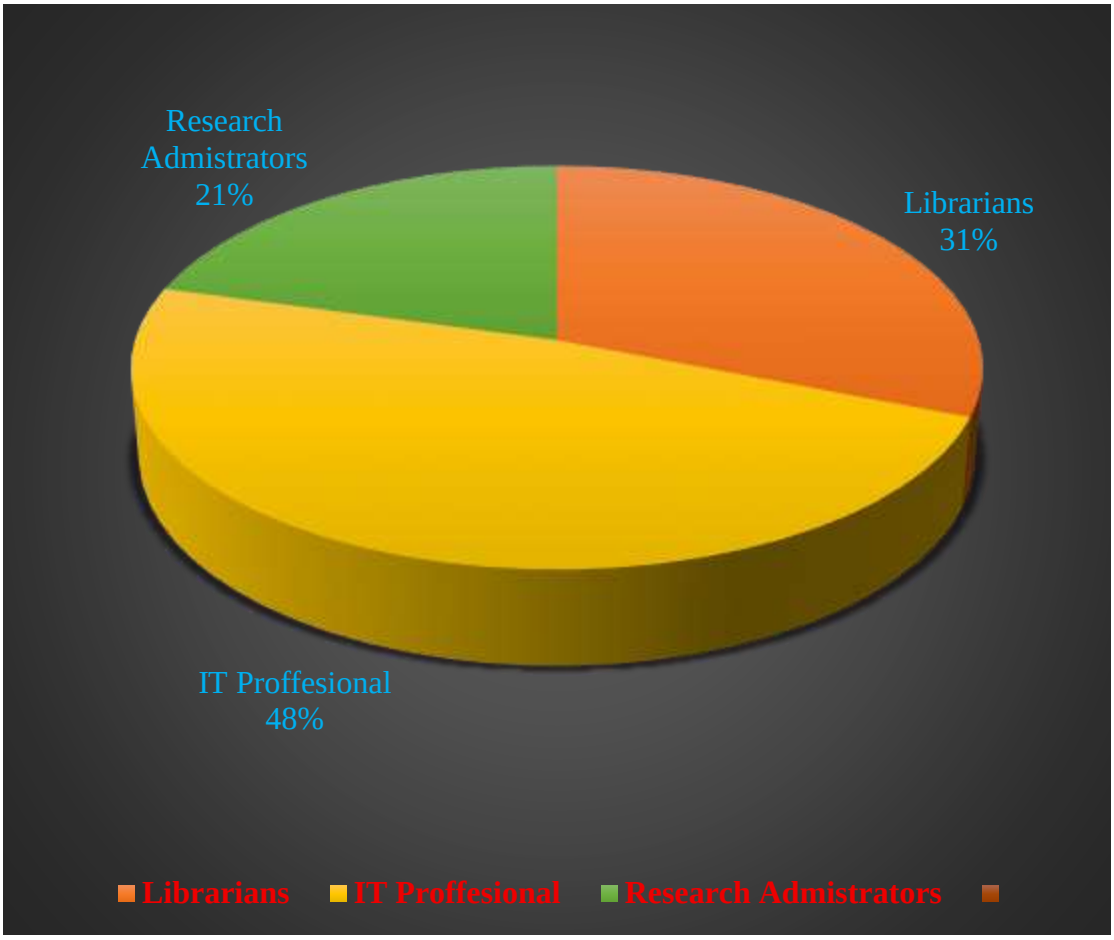


**Figure 4.6: Responsibility for Metadata Security and Standards**
**Source: Researcher, 2025.**

The finding reveals varied perceptions on who should be responsible for metadata security. Each category received a degree of support with IT professionals having the majority support at 48%. The librarians were fairly preferred at 31% and research administrators less preferred at 21%. Supporting the finding Hamad, Al-Fadel & Al-Soub (2021) allude that no single party can support all of the necessary concepts, instead, numerous different groups should be involved. Also, Tammaro, Matusiak, Sposito & Casarosa (2019) inform that sharing, distributing, and reusing research data necessitates creating multi-layered knowledge infrastructures and engaging multiple institutional stockholders.

Steel, Thompson & Wright (2019) support the finding by informing that encouraging collaboration between the librarians, I.T. professionals, and research offices could foster a cordial working relationship with funding agencies' requirements and university-adopted policies on research data management. The overall institution scores with Egerton at 62.07% and Kenyatta university at 37.93% implies that Egerton understand the importance of metadata security possibly due to exposer to digital data infrastructure and organized data stewardship procedures.

### 4.6.3 Steps Taken in Metadata Creation

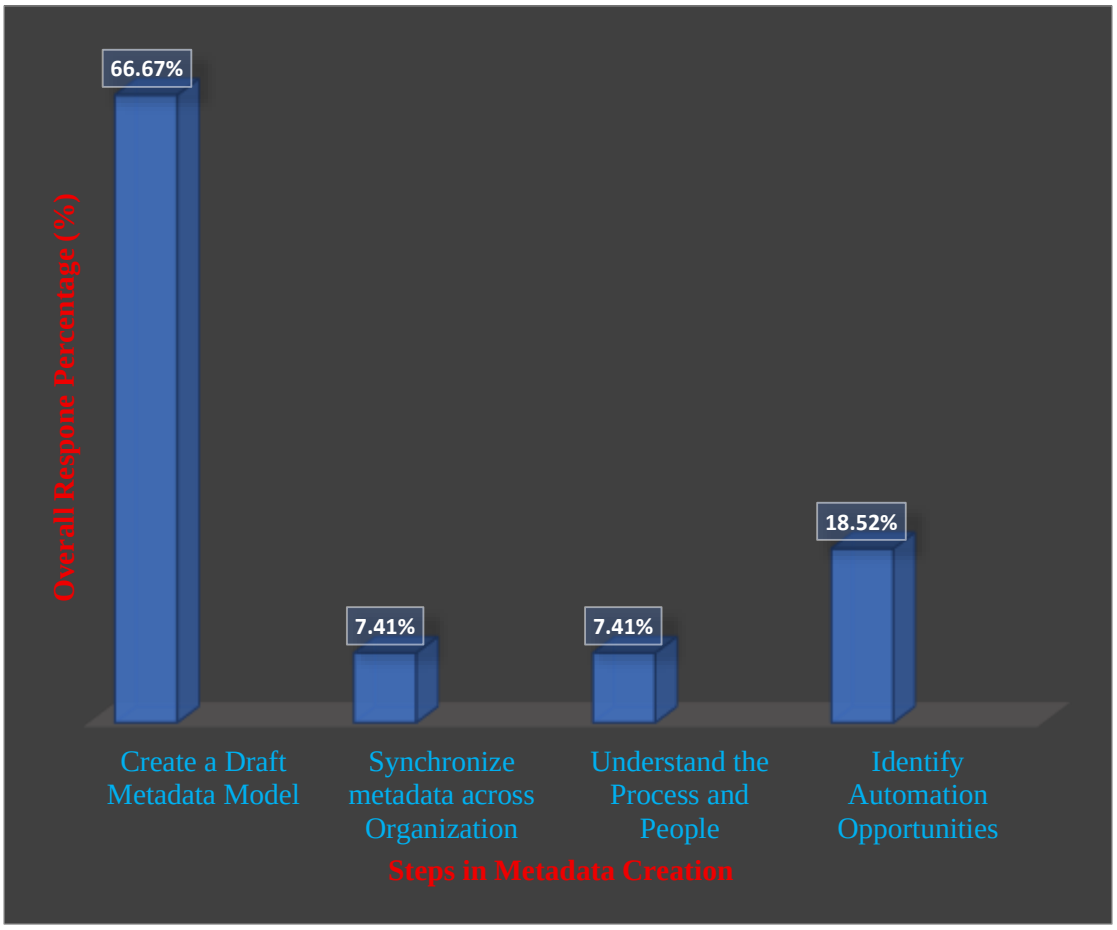


**Figure 4.7; Metadata Creation Steps**
**Source: Researcher, 2025**

The finding on participants responses concerning the metadata creation steps provide varied perceptions. The establishment of a draft metadata model is strongly supported by the majority of the participant at 77.9% including deputy librarian K/E 5.6%, section head K/E 16.7%, senior library assistant 11.1%, 22.2%, research directorate 16.7% and graduate school staff at 5.6%. Grunzke *et al* (2019) support the finding by informing that metadata ("data about data") play an important role in making data available in the long run. It is required for data understanding, storage, preservation, curation, and discovery for later use.

Metadata facilitates the implementation of complex tasks on data by allowing the search for input data based on its content and context. Synchronizing the metadata across the organization was averagely supported by chief librarians at 50% and section head E a 50% implying it a fundamental stage in the metadata development process. Also, understanding the process and people, the section head E 50% and senior library assistant K 50% suggesting that participants appreciate how important it is to have a thorough awareness of the processes, methods, and stakeholders involved in the development of metadata.

Similarly identifying opportunities for automation or auto-classification step was fairly supported by section head K/E 20% and graduate school staff at 40% implying the importance of identifying places where technology can be used to streamline and improve the efficiency of metadata development. The studies support the finding by informing that it important to prepare RDM draft with appropriate procedures and

eminence controller on scholarly work when RDM supporters are naming dataset stage. Concurring with Ng'eno & Mutula (2022); Birkbeck, Nagle & Sammon (2022), case studies from Manchester alluded that research data preservation should involve activities including the authentication of metadata tailoring data structure for data to remain authentic and reliable while maintaining its integrity.

The overall percentage with Egerton 63.0% and Kenyatta university at 37.0% implies that Egerton has previously engage staff in metadata creation hence a higher awareness for metadata security as compared to Kenyatta university.

### 4.6.4 Metadata Global Availability

In the context of university libraries' readiness for the implementation of research data management, the data supplied highlights participants' preferences for global metadata availability solutions. Providing a permanent web address (URL) and assigning a Document Object Identifier (DOI) are two of the solutions that are being examined.

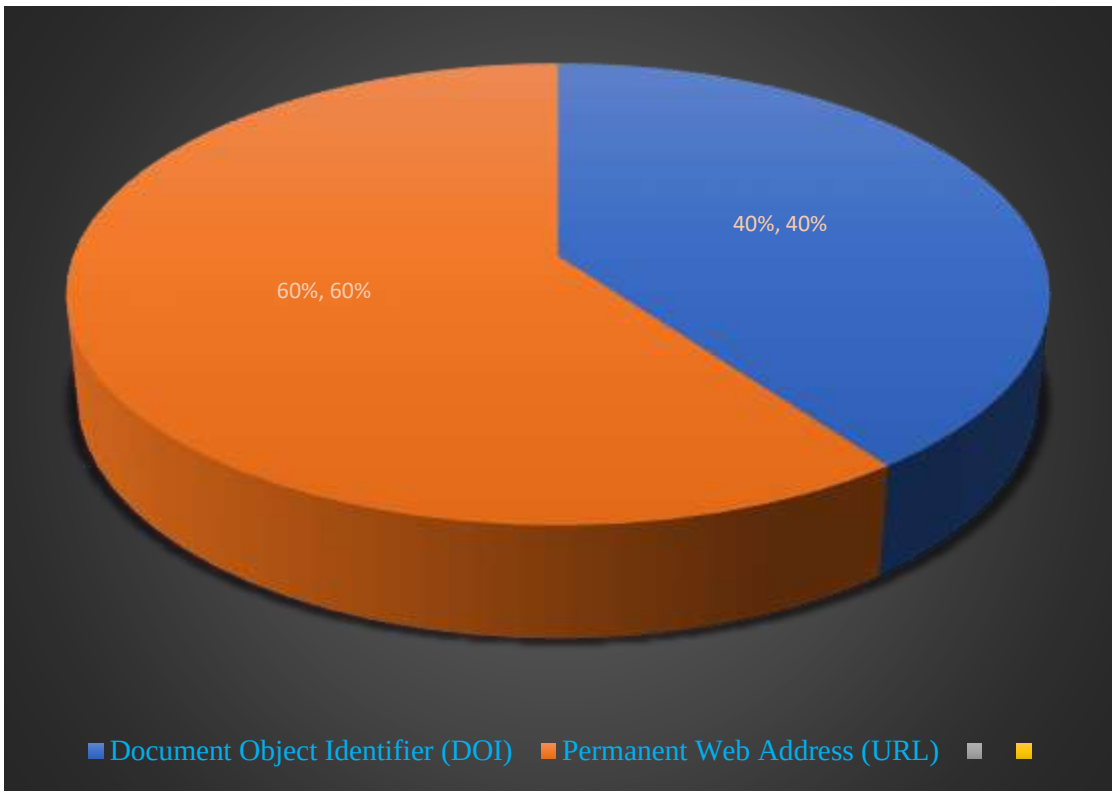


**Figure 4.8; Ways to Make Metadata Globally Available**
**Source: Researcher, 2025**

The finding reveals majority support for permanent web address at 60% to make document discoverable and metadata publicly accessible. The Document object identifier is fairly supported at 40% (DOI) as it regarded critical for metadata availability. The above support for the two approaches in making metadata globally available is supported by Wilkinson *et al* (2016) alluding that with a modest set of community-agreed guiding principles and practices, all stakeholders may more readily locate, access, appropriately integrate and re-use, and adequately cite, the massive quantities of material generated by contemporary data-intensive science. Wilkinson (2019) point that when the dataset is released, Dataverse makes the Digital Object Identifier (DOI) or other persistent identifiers (Handles) publicly available (Wilkinson, 2016).

### 4.6.5 Metadata Elements to Describe and Document Research Data

The data presented depicts participants' perception to the metadata elements used to characterize and document research data in the context of academic libraries' readiness to adopt research data management. The metadata elements under consideration are history, Dspace, and ecological.

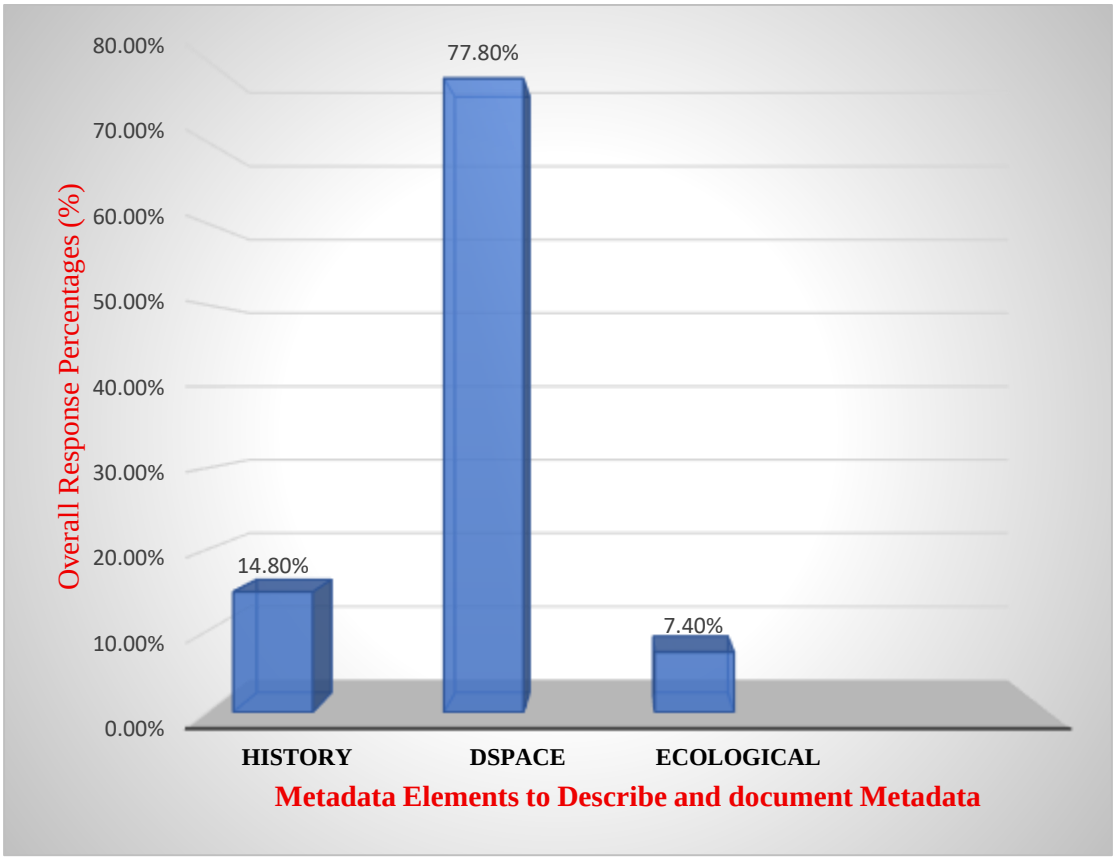


**Figure 4.9: Metadata Element to Describe and Document Metadata**
**Source: Researcher, 2025**

The finding on metadata element to describe and document metadata reveal majority preference for Dspace at 77.8% as a crucial component for managing metadata. The ecological 7.4% and history 14.8% metadata feature were less preferred. The findings are supported by Kinde, Addis & Abebe (2021) by informing that in data curation lifecycle, it is critical to employ quality measures during the capture or create a stage

to ensure metadata can expedite data sharing, publishing, and citation. Concurring with Australian National Data Service (2017) inform that adopting quality data capture creation tools and platform fosters processing, organizing, and structuring of data files, and validation to ensure data is within the required range, good conversion with flexible and open tools, and transfer of data to the intended destination. Also, Wilkinson (2016) point that developing software enabling infrastructure with end-to-end FAIR compliant and can be deployed over current repositories. These code modules have a special emphasis on metadata publication and searchability, compatibility in circumstances of severe privacy considerations, and the exceedingly challenging challenge of data and metadata interoperability (manuscript in process).

### 4.6.6 The Library Target for Generated Data

The finding reveals participants perception on the intended recipients for data sharing in the framework of academic libraries' readiness to implement research data management. Researchers from various fields, researchers from outside the field, practitioners, and policy makers are among the categories taken into consideration.

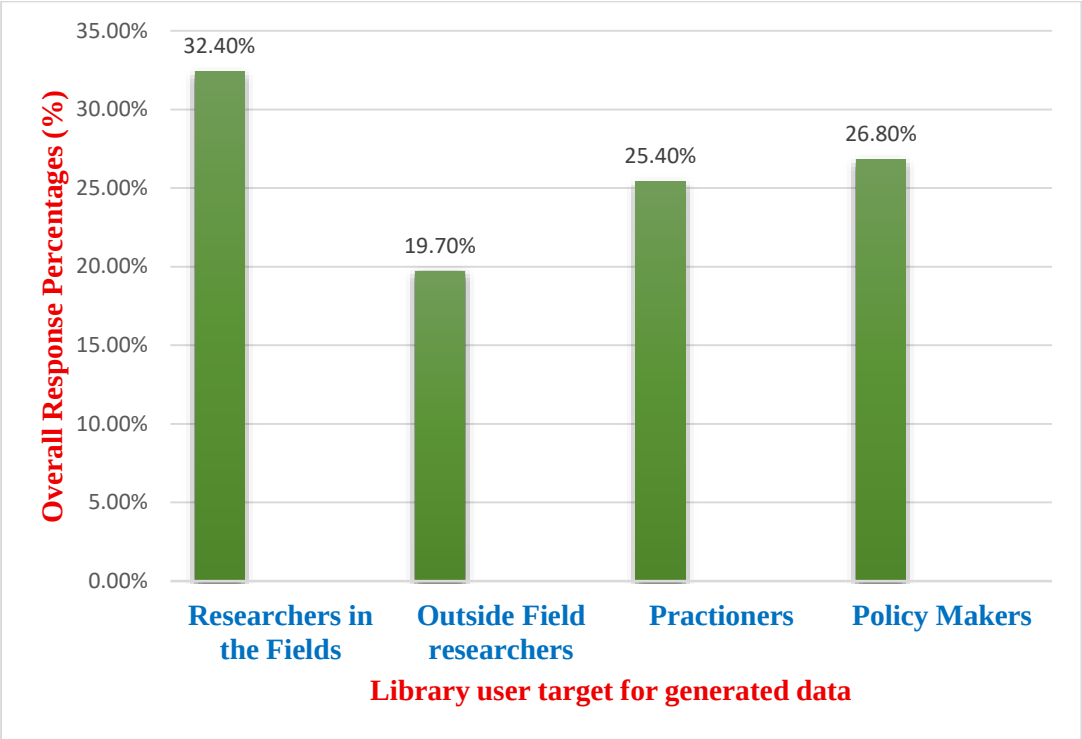


**Figure 4.10; Research Data Target**
**Source: Researcher, 2025**

The majority of participants across all categories strongly agreed that researchers in the field at 32.4% could be a great target to avoid duplication of effort in researches already done. The rest of the proposed target were fairly preferred with policy maker receiving 26.8%, practitioners 25.4% and less preferred were outside field researchers at 19.7%. This acknowledgement is significant because research data may have practical uses in a variety of industries, and sharing data with practitioners can contribute to real-world impact and innovation. The findings are consistence with Wilkinson (2016) who point that sharing research data would benefit a wide range of stakeholders, including: funding agencies (public and private), which are becoming more concerned with long-term data stewardship; researchers who want to share, credit, and reuse each other's data and interpretations.

Also, Wilkinson inform that sharing data is impactful to professional data publishers offering their data services; software and tool-builders providing data analysis and processing services like reusable workflows; and data science community, who mines, integrates, and analyzes new and existing data to advance discovery.

### 4.6.7 Point at Which Data Sets is Shared

Perspectives on the best times to share research datasets within the context of academic libraries' readiness to adopt research data management.

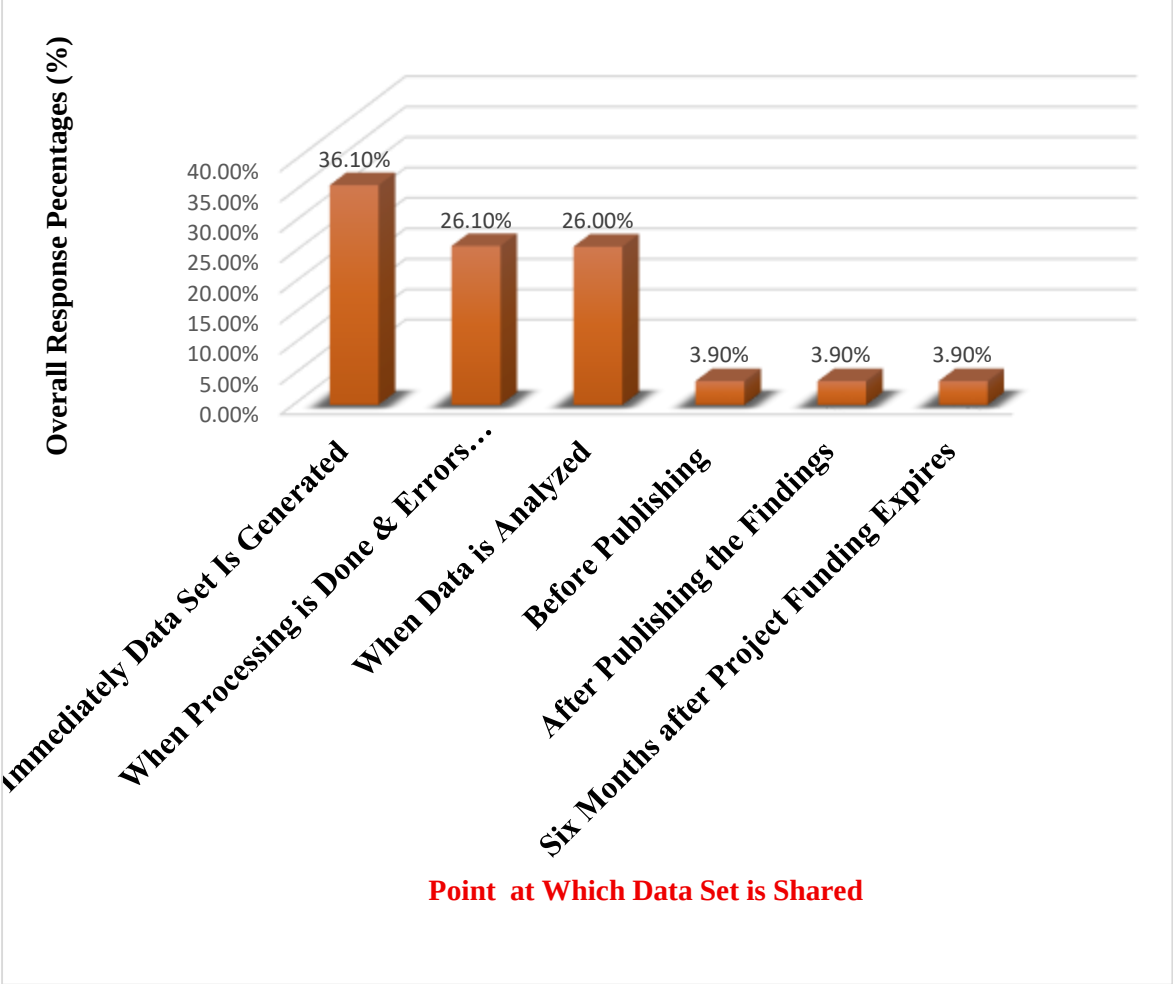


**Figure 4.11; Data Sharing Point**
**Source: Researcher, 2025**

The finding reveals a majority preference sharing immediately at 36.1% and average preference for sharing when processing is done and errors corrected at 26.1%. and when data is analyzed at 26.0%. Consequently, participant less supported sharing of data before publishing 3.9%, after publishing the findings 3.9%, and after project funding expires at 3.9%. The majority support for data sharing immediately data sets is generated is supported by DuBois, Strait & Walsh (2018) that metadata should be made public, shared all the time in online data repository and researchers provided platform to post data files for usage by other researchers.

### 4.6.8 Measure to Enhance Data Security

The finding reveals participant responses on the kinds of security measures university libraries have implemented or plan to implement in relation to research data management.


**Figure 4.12: Security Measures when Providing Data**
**Source: Researcher, 2025.**

The finding reveals majority support for embargoes as a security measure to safeguarding research at 38.3% implying the need to strike a balance between openness and control of research data. Embargoes security measure entails withholding the publication of research data for a specified period. This demonstrates an understanding of the need to balance openness with factors such as publication timelines and sensitive data issues. Restriction as security measure was averagely preferred at 35% followed by permission-based access at 26.8% to ensure ethical and legal compliance when sharing research data while, encouraging a culture of responsible and transparent data sharing.

The almost average support for the three types of measures is supported by Ng'eno & Mutula (2022) that data curation is a rigorous and complex undertaking that requires stewards with the ability to develop unified standards for data privacy and ownership policy, switching data sets, and professional educational standards for RDM guided by data-driven research agenda. Concurring Wilkinson (2016) pointed that contemporary e-Science requires measures to ensure data is Findable, Accessible, Interoperable, and Reusable throughout time.

### 4.6.9 Catering for Data Set Cost

Interpretation of the percentages cost implications and perceived responsibility for data sets

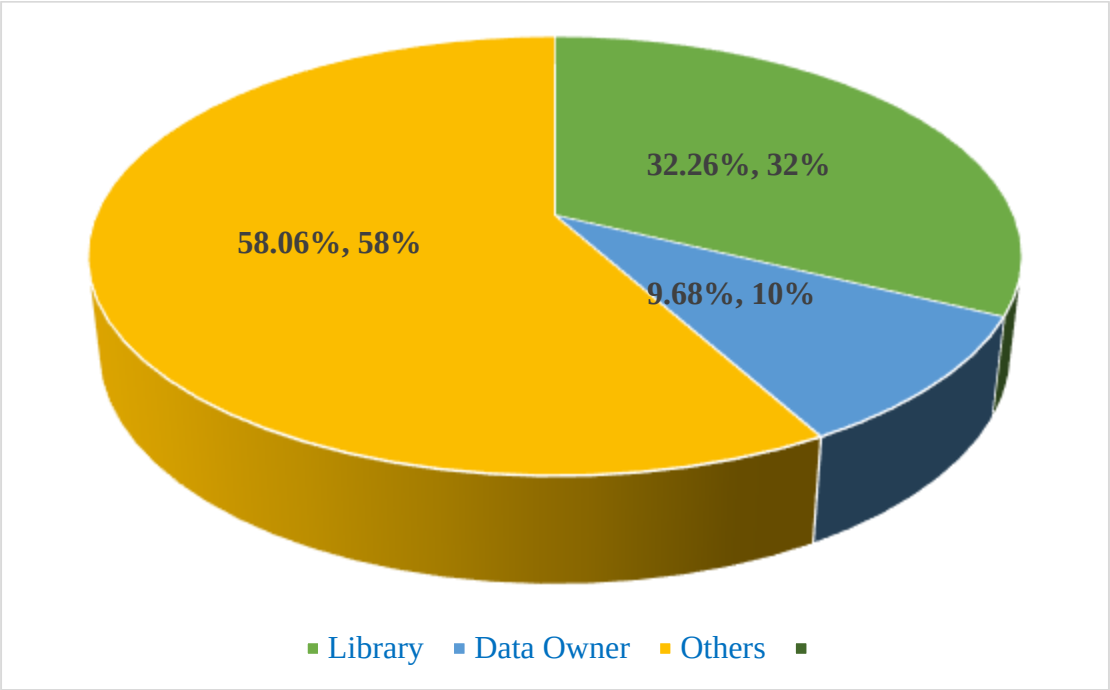


**Figure 4.13 Cost Responsibility for Data Set**
**Source: Researcher, 2025.**

The majority perceived that other stakeholders should cater for cost associated with research data management at 58.06%, while libraries at 32.26% were fairly perceived they should cater for the cost. Consequently, the data owners at 9.68% were less preferred to handle the cost associated with their generated research data. This reflects a widespread belief that stakeholders and libraries as central repositories of knowledge and resources should take the lead in bearing the financial burden of data management and sharing. Hamad, Al-Fadel & Al-Soub (2021), affirm the finding that stakeholders and libraries are responsible for providing advice on funding sources, supporting roles

in literature review, bibliometrics and impact measurement, bibliographic software training, support for open access/institutional repositories, advice on copyright issues, data analysis support, and finally, research record archiving support.

The findings are supported by Hamad, Al-Fadel & Al-Soub (2021) by informing that academic libraries in the United States and Canada have demonstrated that while many services are still in the planning stages, research data management/services (RDM/RDS) are not widely used in libraries at this time.

**4.7 Policy Prepareness**

There is wider adoption of strategies in most institution of higher learning for functional scholarly activities and open access initiatives in compliance with government funding body requirements (Shelly & Jackson, 2018). Having policy in place help in data validation, preservation, and indexing to facilitate discoverability and reuse by other journal publishers (Wiley, 2018).

Several significant implications arise from the participants' responses, which show that 74.19% confirm the presence of an established policy on research data management whereas 25.81% indicate otherwise.

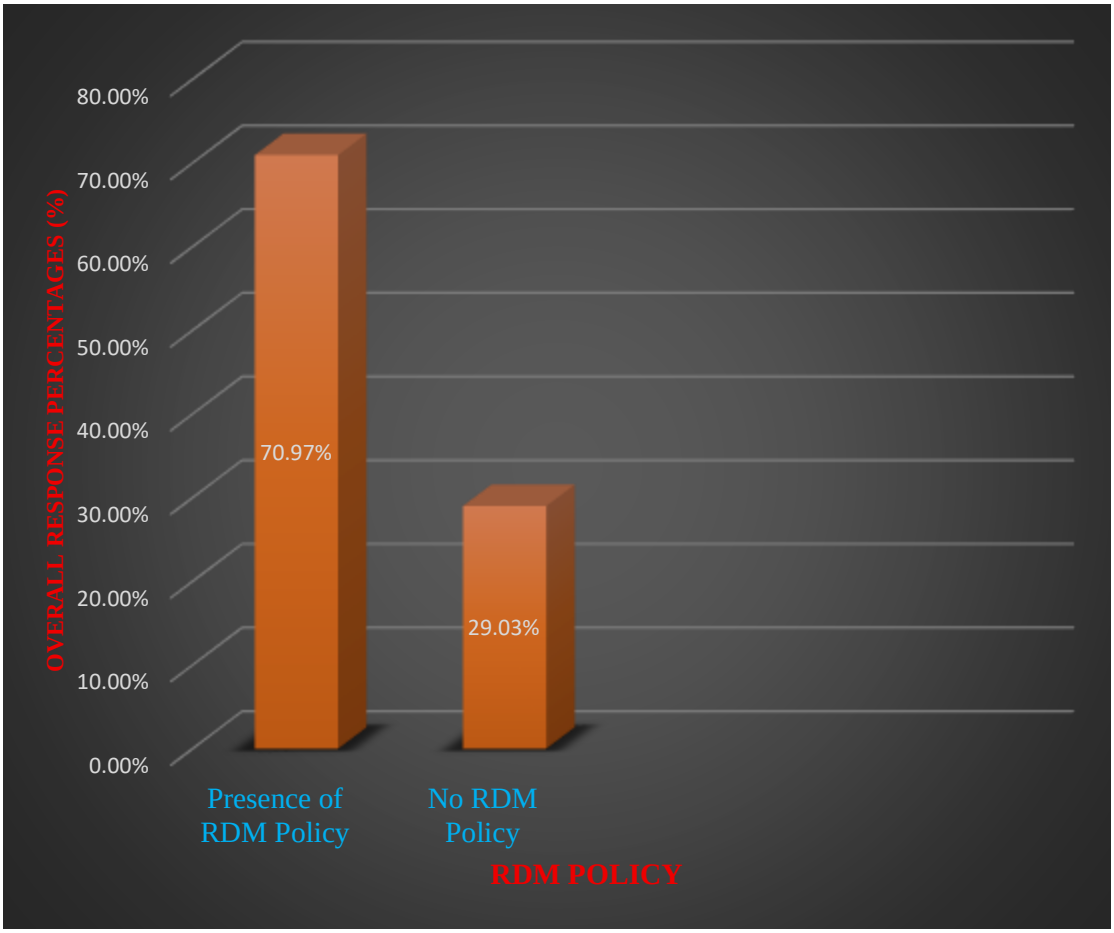


**Figure 4.14: Research Data Management Policy**
**Source: Researcher, 2025.**

The study revealed a majority support for a RDM policy at 70.97% to spell out purpose, scope, applicability, contributors' guidelines, copyright agreements, terms, metadata, data classification, security breaches, and intellectual property concerns in RDM. This is supported by Shelly & Jackson (2018) that there is wider adoption of strategies for RDM policy implementation in most institution of higher learning to support scholarly activities and open access initiatives in compliance with research funding body requirements. Concurring Chiarelli et al (2022), informs that a functional RDM policy should help to spell out research data ownership to minimize disputes, thus promoting

accountability. Equally, a policy contributes to the construction, certification, application, preservation, and assertion of RDM in academic institutions. The fair response on lack of RDM at 29.03% is supported by Nhendodzashe & Pasipamire (2017) who identified issues that curtail RDM policy implementation, particularly in developing states, including policy treatment as a statement of aspiration as opposed to intent and changes in institutional culture.

### 4.7.1 Legal Framework/ Issues Supported by Policy

The participants' "yes" responses to the availability of a policy to control research data management reflect the emphasis placed on the policy's many issues. The percentages for each concern category are as follows;

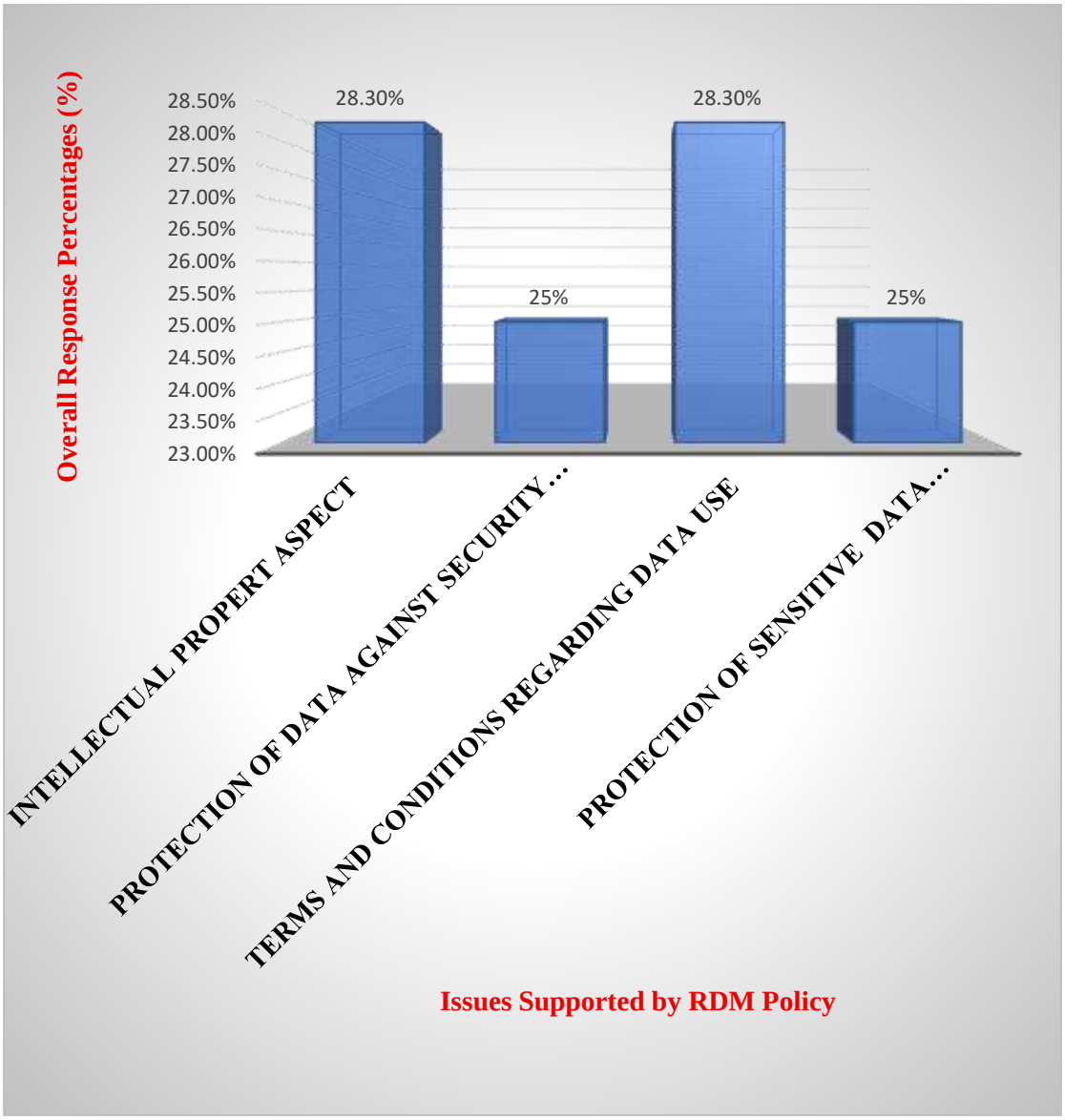


**Figure 4.15; RDM Policy**
**Source: Researcher, 2025.**

The finding reveals an above average support for issues which should be included in the research data management policy including intellectual property aspect and term and condition regarding data use at 28.3%. Also, data protection against security breaches and data protection for confidentiality was fairly supported at 25%. Ssegawa & Muzinda (2021) support participants perception on issues which should be covered by RDM policy by alluding that research data management requires careful

consideration of legal, policy, regulatory, and ethical issues to guide data service activities, including research data construction, evaluation, accounting, conservation, intellectual property, sharing, reuse, and removal. The above responses are supported by Nhendodzashe & Pasipamir (2017) that policies are essential as they stipulate whether members can make a formal request to withdraw their shared research, compensation and safeguarding of research data to avoid manipulation by unauthorized personnel.

### 4.7.2 Legal Concerns on Research Data Management Process

The responses of participants to legal concerns in the research data management process show a deep awareness of the numerous legal elements related with handling research data. The following are key interpretations

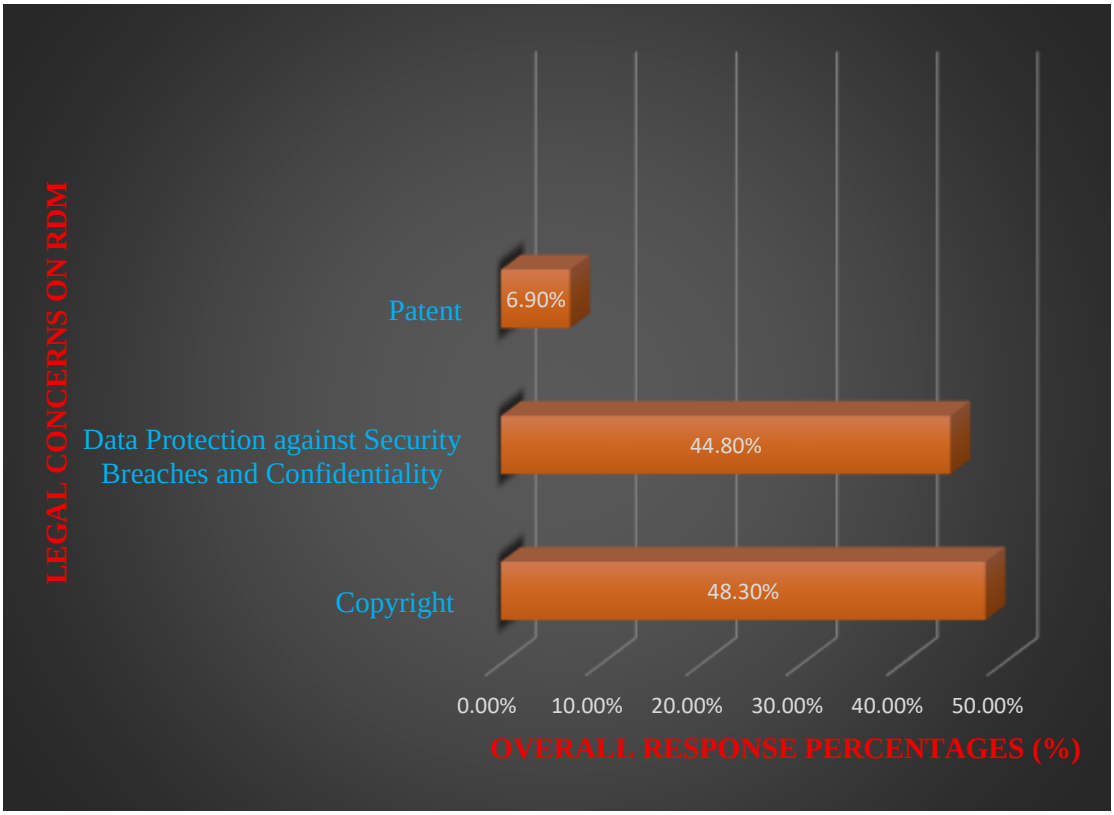


**Figure 4.16; Legal Concerns on RDM Process**
**Source: Researcher, 2025**

The findings reveal average support for legal concern which should be addressed by the research data management policy including data protection against security breaches and confidentiality at 44.8% and copyright slightly higher at 48.3%. Consequently, all participant perceived patent as a lesser issue for inclusion as a legal concern in RDM process, though fairly important at 6.9%. The finding is supported by Machimbidza *et al* (2022) that policy framework needs inclusivity, comprehensiveness, by including critical facets such as patent protection, patents, moral rights, privacy, agreement, internal guiding principle, and procedures

Institutions that have a legal framework are better positioned to ensure that data protection rules and ethical standards are followed. This reduces the potential of legal complications while also demonstrating a dedication to appropriate and accountable research data management. Abraham *et al* (2019) support by informing that data governance is the exercise of authority and control over the data management processes. It attempts to achieve a corporate-wide data agenda, maximize the value of an organization's data assets, and manage data-related risks.

### 4.8 Data Architecture

The study sought to establish the type of model libraries have adopted or intend to implement for effective research data management. The findings show participants responses concerning architecture style to support RDM activities. The Architecture in consideration is the repository model and the blackboard.

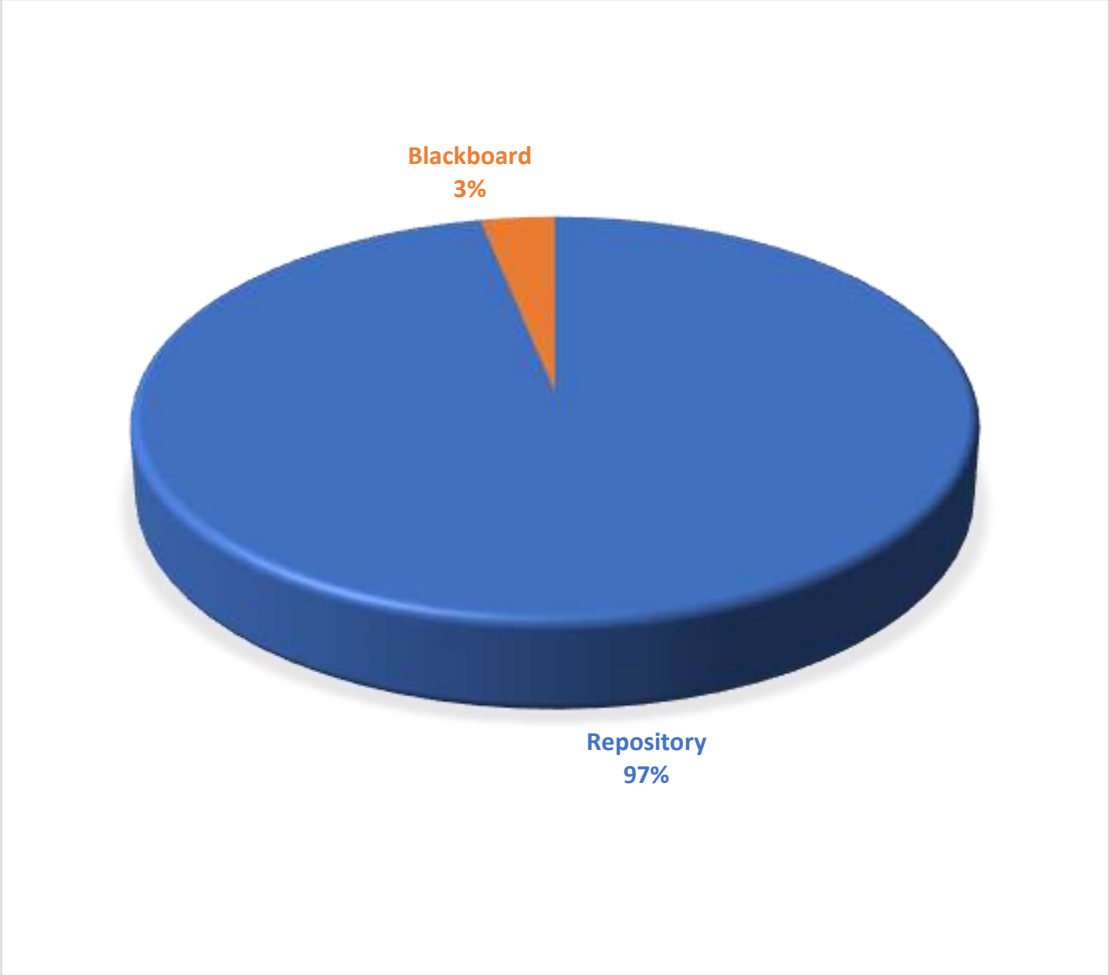


**Figure 4.17: Research Data Architecture Style**
**Source: Researcher; 2025**

The study findings reveal majority preference for repository demonstrating that university libraries recognize and respect the repository-based architecture for hosting research data. A repository architecture is a centralized and structured system for storing, organizing, and distributing digital content, including research data. The repository concept is adaptable and can house a wide range of research data, including datasets, articles, multimedia files, and other digital artifacts (Gries et al, 2018). Repository has version control, metadata standards, and permanent identifiers are common elements of repositories, ensuring the long-term preservation of research data.

Concurring Pinfield, Cox & Smith (2014); and Tripathi, Shukla & Sonkar (2017), proposed a model that allow seamless access, browsing, consulting, and built-in for future academic work and research activities. Also, Gries et al (2018), support the finding by informing that the repository model is an open access data architecture that share a standard framework for data deposition, discovery, and reuse by offering a consistent experience for both producers and users across repositories. Also, the model uses multiple metadata standards or export metadata in multiple specifications as employ the specification that best fits its data entities and curation procedures.

The blackboard was less preferred at 3% as participant viewed it as a collaborative and interactive educational platform where users can share material and engage in debates. The blackboard paradigm is seen as less suitable for thorough and methodical handling of research data and commonly linked with learning management systems thus less capable of handling the complexities of research data, metadata, and the different requirements of academic research workflows. As a result, academic libraries may prefer models created expressly for research data curation. Concurring Alhussain (2017), point that blackboard is not popular in hosting research data management practices as it often promoted as a Learning Management System (LMS) used by thousands of institutions worldwide in addressing educational challenges and to drive innovation.

# CHAPTER FIVE

# SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

## 5.1 Introduction

The chapter focuses on summary of the findings and conclusion presented. The information flows according to the study objectives and gap for further research identified.

## 5.2 Summary of Study Findings

The study aim was to assess university libraries preparedness towards the adoption of research data management process. On the basis of knowledge, skills and competencies, collaboration, technical preparedness, policy and legal framework, and data architecture the preparedness level was determined differently.

### 5. 2.1 Staff Preparedness

### 5.2.2 Knowledge and Skills Preparedness

The finding reveals a growing awareness and shifting academic library's culture toward an appreciation of the value of research data management. The findings reaved knowledge level as good a generally favorable understanding of metadata standards and knowledge of legal and ethical aspect in documentation and sharing of research data. Consequently, the finding point to possible skill gaps to adequately handle RDM process plan that considers the training and experience of personnel at various levels. Training programs should be designed to satisfy role-specific demands and duties

within the academic library setting, taking into account the diversity of perceptions among various roles (e.g., section heads, senior library assistants).

### 5.2.3 Strategies for Research Data Management Competencies

The finding revealed balanced preference for various kinds strategies to acquire research data management skills and competencies. This implies that different approaches maybe used or are used depending on roles and preferences, and that there is no one-size-fits-all method for gaining competence in research data management. The participant agreed training strategies including conferences and workshops, on-the-job training, and upskilling could work as research data management practice is a dynamic sector where best practices and technologies are always changing.

## 5.3 Collaborative Drivers

The findings point to a collaborative approach to research data management within an academic library. Libraries, scholars, and other stakeholders should be encouraged and supported to work together. Collaboration with research administrators highlights the administrative aspects of research data management to streamlining research-related activities.

The findings reveal preference for libraries to prioritize collaboration in defining precise criteria and choosing appropriate platforms because there is a constant emphasis on platform selection and data repository requirements. Consequently, there are areas that received less attention such as the data rental period. This gives academic libraries

the opportunity to raise awareness and knowledge of the significance of this component in the context of RDM. It's important to understand that a comprehensive strategy is needed for the successful implementation of RDM, even though some areas may receive more attention than others. In order to develop a thorough RDM strategy, institutions should strive to promote collaboration across all identified drivers. A recognition of the significance of ethical and legal matters in RDM is suggested by the emphasis on research data reuse in light of legal concerns.

## 5.4 Technical Preparedness

### 5.4.1 Technical Standards

The findings revealed varied levels of technical preparedness in light of technological standards, including text being widely used and the rest being used depending on data custodian technical knowledge such as spreadsheets, databases, graphical images, structured text, software applications, data configuration, and software applications, a recognition of the diversity of research data. The finding emphasizes the importance of keeping up with technological advances, particularly in the context of software-related data.

### 5.4.2 Responsibility for Creating the Metadata (Data about Data).

The finding clearly revealed librarians have the knowledge and abilities needed to create metadata in the context of managing research. This acknowledgement emphasizes how crucial librarians are to the efficient classification and arrangement of research data. The comparatively low percentage allocated to Data Owners implied that

participants do not believe data owners bear significant responsibility for metadata production. This could indicate a lack of understanding or awareness of the role data owners can play in providing domain-specific knowledge to metadata generation. Although the primary responsible group is designated as librarians, there exists a possibility for collaboration with data owners. By acknowledging the unique expertise that data owners have on the study data, joint efforts can improve the accuracy and comprehensiveness of metadata.

### 5.4.3 Responsibility for Metadata Security and Standards

The finding revealed strong sharing of responsibility for metadata security and standards between librarians, IT professionals, and research administrators. This demonstrates an understanding of the multidimensional nature of metadata management. Consequently, there is some disagreement among roles on who should be primarily responsible for metadata security. This variation could be attributed to disparities in knowledge, roles, and institutional environments. It is widely acknowledged that librarians play a critical role in maintaining metadata security in various contexts. This demonstrates how crucial it is for librarians to have the know-how to manage, organize, and secure metadata in the setting of university libraries.

IT professionals have been highlighted as major contributors to metadata security, indicating their technical ability in developing and maintaining safe information systems. Research administrators, while not universally acknowledged, are recognized in specific categories. This shows that administrators are becoming more conscious of

the role they may play in maintaining metadata security, particularly in situations such as graduate schools.

### 5.4.4 Steps in Meta-data Creation

The finding reveals greater emphasis on developing a draft metadata model suggesting that academic libraries should take a more systematic approach to metadata development. The development of standardized models can aid in the uniformity and efficiency of describing and arranging research data. Understanding the process and people is the routinely preferred stage, which suggests that academic libraries should invest in ongoing training programs. The reduced emphasis on syncing metadata across the enterprise could indicate that participants believe existing synchronization processes are appropriate, or that there is a need to evaluate and improve these processes as part of overall metadata management plans.

### 5.4.5 Strategy to Make Metadata Globally Available

The finding reveals a higher preference of DOIs as a strategy indicating university libraries should use DOIs for all research data. This entails working with publishers and data repositories to provide DOIs to datasets in order to ensure their long-term accessibility and cutability. Given the importance of having a permanent web address (URL), libraries ought to concentrate on establishing and managing persistent URLs for metadata. This guarantees that metadata availability in the event of platform or data repository change.

### 5.4.6 Metadata Elements to Describe and Document Research Data

The finding reveals a diversity in metadata element selection with participants across categories selecting different items based on their perceived importance to their individual fields of work. Because of this variety, academic libraries may need to accommodate a variety of metadata items to fulfill the diverse needs of different study disciplines. This entails recognizing the unique requirements of many professions and adapting metadata techniques accordingly. To guarantee that all library employees, particularly those in positions like section heads and senior library assistants, have a shared knowledge of the chosen metadata elements and their significance for efficient research data management.

The frequency with which Dspace was selected as a metadata element implied that academic libraries that use Dspace as a platform for repositories may already have a metadata schema in place. To guarantee that information creation and retrieval is efficient, libraries should make sure that the metadata elements they have selected interface seamlessly with current systems. Specific metadata items chosen may indicate a need for close collaboration between library workers and researchers from other fields. Libraries should work with scholars to understand their data documentation needs and include those needs into the metadata schema. Flexible metadata standards that provide the incorporation of different features according to the desires of diverse research communities should be adopted by libraries. This flexibility guarantees that the metadata format will continue to be applicable and valuable in a variety of academic fields.

### 5.4.7 User Groups Targeted for Sharing Generated Data

The finding reveals a higher preference for scholars from other fields and outside field researchers as important targets. In order to promote cooperation and creativity, academic libraries ought to make it easier for researchers from other fields to share research data. Identifying practitioners as a target audience for data sharing suggests that academic knowledge can be transferred to a variety of professional domains. Libraries should look into ways to make research data more accessible and useful to practitioners by bridging the gap between academic research and real-world applications.

### 5.4.8 Point at Which Data Sets is Shared

The finding reveals varying stakeholder's opinions on when to share research data, which reflects different objectives for guaranteeing data value, accuracy, and accessibility. Many people support early data dissemination, highlighting the need for timely access to promote openness and cooperative research. Some participants, however, place a higher priority on sharing following processing and error correction, indicating worries about the accuracy and dependability of the data. Concerns regarding premature dissemination and possible misunderstanding are emphasized by the lack of support for sharing during analysis or before publishing. The desire for post-publication data sharing and adherence to established criteria point to a chance to improve metadata accessibility and repository usage procedures in order to strike a balance.

### 5.4.9 Data Sets Sharing

The finding reveals a majority preference for timeliness and data quality though, data sharing should be done immediately when data is processed and error corrected, as well as before publication. Before sharing data, academic libraries should assist researchers in verifying data integrity. Preferential data sharing prior to publication is consistent with open research ideals, which place a strong emphasis on cooperation and transparency. Libraries ought to encourage researchers to share their datasets and promote open data policies. The choice "Or after six months after the project funding has expired" raises the possibility of delaying data sharing and taking into account the project lifetime. To support delayed sharing, libraries might need to make data management and storage available for longer than project durations.

Academic libraries and researchers must work closely together to understand researchers' preferences for when to share data. Libraries ought to offer advice on best practices while taking project schedules and researcher workflows into account. Academic libraries should make investments in platforms and infrastructure that allow researchers to share datasets effectively and in accordance with best practices for data management, in order to facilitate immediate or timely data sharing.

### 5..4.10 Security Measures for Providing Data

The finding reveals a majority preference for constraints and permission-based access indicating a commitment to reconciling open data principles with the requirement for regulated access. Libraries should provide advice on data sharing ethical issues and

legal constraints. The interest in permission-based access suggests the requirement for adaptable and customized access restrictions.

### 5.4.11 Cost for Making dataset Accessible

The finding reveals majority awareness of the potential financial consequences of making datasets available. This implies that when planning and implementing data management it critical to budget and allocate resources. The contrary opinion by some participant reveals a believe that making datasets available does not always necessitate large financial effort. However, it is critical to analyze if this perception corresponds to the actual expenses involved, or if it reflects a potential miscalculation of the resources required for efficient data exchange.

## 5.5 Policy on Research Data Management

### 5.5.1 Policy

The finding reveals a majority affirmation on the presence of an established policy for research data management. This implies that data governance is likely to be more developed in institutions with defined policies. Defining roles and duties, establishing protocols for data collection, storage, sharing, and assuring compliance with ethical and legal norms are all part of this maturity.

The fraction of academic libraries that do not have a policy implies that there is still room for improvement in some of them. Without a policy, institutions may need to assess existing data management processes, identify gaps, and consider drafting and

adopting their own policies. Institutions with well-defined policies can serve as models for others. Collaboration between institutions that have policies in place and those that are in the process of drafting policies can promote information exchange and mutual progress in research data management procedures.

### 5.5.2 Legal Framework to Govern Research Data Management

The study indicates the availability of legal framework demonstrating a dedication to appropriate and accountable research data management. Institutions with a legal framework are better positioned to ensure data protection, rules, and ethical standards are followed. This reduces the potential of legal complications in an era when data breaches and privacy concerns are common, this guarantee is critical for fostering trust among researchers, participants, and stakeholders. Researchers and collaborators are more inclined to trust an institution that has developed legal norms for data handling, which contributes to the institution's positive image.

### 5.5.3 Type of Issues Supported by RDM Policy

The study reveals of a majority support indicating a thorough awareness of the multifaceted difficulties that research data management policy should address. Intellectual property, security, terms of use, and confidentiality have all been identified as key issues that necessitate policy direction. The findings also show a collective understanding of the issues and risks involved with research data, emphasizing the importance of a well-defined policy framework. This mutual acknowledgement implies

a commitment to fostering appropriate, secure, and ethical research data practices within the academic library setting.

Security and confidentiality policies help to mitigate the risks associated with data breaches and unauthorized access. Policies on intellectual property elements clarify ownership and usage rights, eliminating potential disputes. Clear terms and conditions promote transparency in data use, which contributes to responsible research. Policies on intellectual property issues clarify ownership and usage rights, decreasing potential disputes. Policies ensuring the confidentiality of sensitive data assist research involving personal or sensitive information, supporting ethical data handling.

### 5.5.4 The Intellectual Property Rights Adopted in Reference to University Policy

The findings reveal a recognition for the value of intellectual property rights suggesting a dedication to safeguarding and controlling the creative works produced during research projects. Participant awareness of the value of intellectual property rights helps to reduce the possibility of disagreements over who owns and uses research data.

### 5.5.5 Legal Concerns Regarding Research Data Management Process

The findings reveal of a deep grasp of legal considerations in the research data management process within academic libraries. The key emphasis is on data protection and secrecy, a relative lack of concern about copyright issues, and a diverse perspective across different professions. The increased percentage of participants who expressed worries about data protection and confidentiality reflects a significant emphasis on

protecting research data. This demonstrates a dedication to data integrity and security, which is typically motivated by ethical concerns and regulatory constraints. The decreased proportion of participants who expressed copyright concerns shows that academic libraries may prioritize original research data above copyrighted goods. This could indicate a discrepancy in the sorts of data managed and a focus on copyright compliance in research techniques.

The mentioned legal problems can help to shape or revise institutional policies on research data handling. Participants' individual legal challenges should be addressed in policies, as should clear rules for ethical and legal data handling. Academic libraries should encourage legal professionals to collaborate with them or involve legal counsel in the formulation and evaluation of research data management policies. This partnership guarantees that policies are in accordance with legal requirements as well as best practices. Given the fluidity of legal landscapes, institutions should build systems for continual monitoring of legal needs and adjust policies accordingly. This ensures that academic libraries comply with changing legal norms.

### 5.6 Research Data Architecture

The finding reveal of majority agreement regarding the best data architecture for research data management (RDM) activities in academic libraries, as evidenced by the overwhelming preference for the repository model (96.77%) and the small percentage of participants who expressed interest in the blackboard model (3.23%). A repository is a centralized and structured system for storing, organizing, and distributing digital

content, including research data, version control, metadata management, access control, and preservation capabilities critical for protecting the integrity, accessibility, and lifespan of research data. The minority (3.23%) expressing interest in the blackboard paradigm suggests contemplation for an alternative method. The blackboard approach refers to a collaborative and interactive educational platform where users can share material and engage in debates. This decision may indicate a desire for a more engaged and dynamic atmosphere for research collaboration. Given the overwhelming preference for the repository model, academic libraries should invest in solid repository infrastructure. Implementing or improving systems that support metadata standards, version control, and persistent identification for effective research data management.

## 5.7 Conclusions

### 5.7.1 Staff Preparedness (Knowledge, Skills, and Competencies)

The study concluded libraries should integrate research data management in library process and strategically plan for focused training and development to equip librarians with RDM knowledge, skills and competences. While the RDM knowledge, skills and competency is good, the study appreciates the general awareness of RDM process, emphasizing the need for more RDM formal training, organized workshops, and seminars targeting personnel handling research data.

### 5.7.2 Collaboration

The finding reveals existence of collaboration between different parties for academic success and appreciates the participants knowledge on the importance of inter-

discipline collaboration in all RDM phases. This could bring together parties including librarians, research directorate staff, IT experts, Legal team, librarians, and data owner for a seamless implementation of RDM. This is a realization of the importance of interdisciplinary collaboration, knowledge transmission to practitioners, and data sharing in contributing to evidence-based policies. The academic libraries' strategy should be aligned with these highlighted goals, encouraging open science practices, facilitating collaboration, and providing data accessibility to a wide range of stakeholders.

### 5.7.3 Technical Preparedness

The finding reveals availability of standards for metadata creation, security for data and greater understanding on cost implication for making metadata data available. However, the findings highlighted infrastructure investment, ongoing technological adaptation, role-specific initiatives to improve metadata security and standards adherence in academic libraries. The different perspectives of making datasets available the data suggest institutions and libraries could establish practical and long-term methods to support research data accessibility and exchange.

### 5.7.4 Policy Preparedness

The finding reveals availability of research data management policies in to govern, compliance, and overall research output quality. The study encourages constant evaluation and policy improvement as a way to align with changing research data management issues and possibilities. Consequently, there was relatively low support

for lack of policy to support RDM services. The availability of legal framework is instrumental in assuring compliance and ethical behavior when handling research data and institution's dedication to responsible and transparent research procedures, which contributes to a healthy research ecosystem.

### 5.7.5 Data Architecture

The finding reveals availability of repository architecture which could be applicable in research data management. The study reveal plan to adopt the repository data architecture for institution lacking one in place reflecting a widespread understanding among participants of its applicability for enabling research data management in academic libraries.

## 5.8 Recommendations

Based on the issues raised from the study outcome, the following recommendations were made.

I. To improve staff preparedness the institution of higher learning should consider conducting a comprehensive assessment on stakeholders that handle research data to establish the exact areas in which participants lack confidence to inform the design of formal RDM training programs. Also, the academic libraries leadership should proactively advocate for staff members opportunity to stay current on changing research data management techniques through continuous training, workshops, and seminars.

II. The academic libraries as the custodian of research data should to strengthen collaborations with the relevant stakeholders, including data owners, IT experts, research directorate, legal experts' inter-discipline and extra-discipline for a flowless research data management implementation process.

III. Based on various issues on technical preparedness including, data standards, security, steps in metadata creation, strategies for making metadata available, ways to host the data, cost implication users targeted for data, and when is the appropriate time to share research data, the study recommend the creation of a technical task force to look into the issues, identify challenges, and propose solution for seamless adoption of RDM process.

IV. Based on diverse views on research data management policies preparedness, the

study recommends that libraries with well-defined policies can serve as models for others and collaborate in the process of drafting policies to promote information exchange, experiences, insight, and mutual progress in research data management procedures.

V. To establish the data architecture that could be effective for research data management more research into the precise characteristics, functionalities, or use cases that participants connect with each model is needed.

### 5.9 Suggestion for Further Studies

In the following areas further studies is suggested.

1. The researcher suggests that since there exist a variety of authorized technical structures/standards for research data, further studies should be carried out to explore university libraries adaptable data administration techniques in handling a wide range of data kinds and formats, processes and infrastructure to can keep up with the constantly changing nature of research data.
2. The researcher further suggests an investigation into the connection between repository model with metadata creation, sharing and reuse in the context of open science.

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# APPENDICES

## APPENDIX I: Informed Consent Form

I'm Pauline Njagi, a Kenyatta University PhD candidate. I'm working on a research project called: Academic Libraries' Preparedness Towards the Adoption of Research Data Management: A Study of Selected University Libraries in Kenya.

### Procedures to be followed

To participate in this study, I will ask you some questions and record your responses in a questionnaire.

### Voluntarism

You have the freedom to refuse participation in this study. You will receive the same services and care whether you agree to participate in the study or not, and your decision will have no impact on the treatment you receive. Please keep in mind that your participation in this survey is completely voluntary. You may ask questions about the study at any time. You may refuse to answer any questions and end an interview at any time. You may also withdraw from the study at any time without affecting the services you receive from this or any other organization, now or in the future.

### Discomforts and Risks

You may feel uncomfortable or embarrassed by some of the questions that may be asked about personal matters. If this occurs, you have the option to decline to respond to these questions. Additionally, you can end the interview whenever you choose.

**Benefits**

By taking part in this study, you will assist us in learning how to manage research data for better sharing and reuse.

**Reward**

Please be aware that participation has no benefits.

**Confidentiality**

The interview will take place in a confidential environment. The questionnaire won't contain your name. The surveys will be securely stored at Kenyatta University in a secured cabinet. All information will be kept confidential and shared solely with the research team.

**Contact Information**

For inquiries regarding the study, contact Miss Pauline Njagi at 0725230029. Alternatively, supervisors Dr. Ronald Bituka at 0728606273 or Dr. Gitau Njoroge at 0724246872.

However, you can email the Kenyatta University Ethical Review Committee Secretariat at chairman.kuerc@ku.ac.ke with any queries you may have regarding your rights as a study participant.

**Participant's statement**

I understand the information above about my involvement in the study. I was given an explanation of the study and given the opportunity to ask questions, all of which were well addressed. My involvement in this research is completely voluntary. I am aware that I can withdraw from the study at any moment and that my information will be kept confidential. I am aware that whether or not I choose to withdraw from the study, I will still receive the same medical care, and that my choice will not affect the care I receive from the clinic today or from any other clinic at any point in the future

Name of Participant: _____

Signature or Thumbprint_____ Date_____

Name of Representative/Witness (where necessary) Relationship to Subject

**Investigators statement**

I, the undersigned, have explained to the volunteer in a language s/he understands, the procedures to be followed in the study and the risks and benefits involved

Pauline Njagi

Name of Interviewer _____27/6/23_____

Signature_____ Date_____

**APPENDIX II: Research Instruments**

**Structured Open-Ended Questionnaire**

I am Pauline Ruguru Njagi, a doctoral student in philosophy at Kenyatta University, studying in the library and information science department of the School of Education and Lifelong Learning. I'm doing a study to find out how ready academic libraries are to implement research data management. The creation, preservation, analysis, description, sharing, and reuse of research data are all included in research data management. I will discuss library responsibilities in the research process in the context of this study, including sharing, preserving, and reusing information in the scientific community. I respectfully ask that you take part in the study in order to investigate the methods used or plans implemented for functional research data management services.

The results of the study will only be utilized for scholarly purposes, and the responses of the participants will remain anonymous. Please allow around half an hour to answer the questions, and don't be afraid to ask for clarification or more information if necessary.

## SECTION A:

## KNOWLEDGE, KEY COMPETENCIES AND SKILLS

Research data management is a series of activities from the commencement of the research project to the dissemination of verifiable findings to facilitate data reuse.

1. How do you rate your knowledge of research data management?

| **Knowledge of Research Data Management** | **Tick all that apply** |
|---|---|
| Poor | |
| Average | |
| Good | |
| Excellent | |

2. What is your take on strategies which should be employed to acquire knowledge, skills, and competencies to effectively participate in the research data management process?

| **Strategies to acquire Knowledge and Skill** | **Tick all that apply** |
|---|---|
| Up skilling | |
| Formal Training | |
| On Job Training | |
| Seminars | |
| Workshops | |

## SECTION B:

## COLLABORATIVE PARTNERSHIPS FOR EFFECTIVE RESEARCH DATA

3. What areas of collaboration are critical to support research data management and who should drive collaboration?

| **Collaboration Drivers** | **Tick all that apply** |
|---|---|
| Definition of data repository criteria for RDM | |
| Research data reuse in light of legal issues | |
| Data repository platform selection | |
| Data sharing within and outside disciplines | |
| Data renting period | |

## SECTION C:

## TECHNICAL STRUCTURE FOR RESEARCH DATA STORAGE, SHARING, AND REUSE

4. What type of data structure does the institution approve to allow research data storage, sharing, and reuse?

| | **Tick all that apply** |
|---|---|
| Text Document (Doc, ODF, PDF, TXT, etc | |
| Structured Text (HTML, JSON, TEX, XML, etc. | |
| Spreadsheet (XLS, ODS, CSV, SAS, STATA, SPSS, etc. | |
| Databases (MS Access, Oracle | |
| Graphical Images (SVG, JPEG, PNG, GIF, etc. | |
| Software application source code (JavaScript, JAVA, CSS | |
| Data configuration (INI, CONF, etc. | |
| Software applications/others specify | |

5. Who is responsible for creating the Metadata (data about data).

| **Creation Of Metadata** | **Tick all that apply** |
|---|---|
| Librarians | |
| Data Owners | |
| Data Administrators | |

6. (a) In your research section, who has the responsibility for ensuring metadata security and standards are adhered to

| **Responsibility for Metadata Security** | **Tick all that apply** |
|---|---|
| Librarians | |
| IT Professional | |
| Research Administrators | |

7. What steps are taken in metadata creation?

| **Steps in Metadata Creation** | **Tick all that apply** |
|---|---|
| Create a draft metadata model | |
| Synchronize the metadata across the organization | |
| Understand the process and people | |
| Design with an eye for continuous improvement | |
| Identify opportunities for automation or auto-classification | |

8. Which of the following ways do you use to make metadata globally available?

| **Metadata Availability** | **Tick all that apply** |
|---|---|
| Document Object Identifier ( DOI) | |
| Provide a permanent web address (URL | |

9. What metadata elements are used to describe and document research data?

| **Metadata Elements** | **Tick all that apply** |
|---|---|
| History | |
| Dspace | |
| Ecological | |

10. Which of the following user groups does the library has a target for sharing data generated

| **Target for Data Sharing** | **Tick all that apply** |
|---|---|
| Researchers in other fields | |
| Outside field researchers | |
| Practitioners | |
| Policy makers | |

11. At what point do you share data sets.

| **Data Sharing** | **Tick all that apply** |
|---|---|
| When data sets are generated immediately | |
| When processing is done and errors corrected | |
| When analyzing is done | |
| Before publication | |
| After publishing the finding derived from the data | |
| After the funding period has expired if it a funded project | |
| Or after six months after the project funding has expired | |
| Or a year after the project funding has expired | |
| Or others, | |

12. What types of security measure has the library adopted when providing data

| **Security Measures when Providing Data** | **Tick all that apply** |
|---|---|
| Restrictions | |
| Permission | |
| Embargoes | |

13. Do you have somebody responsible for the security of data set?

Yes ☐ No ☐

14. If yes in question 17 who cater for the cost?

| Cost | Tick all that apply |
|---|---|
| Library | |
| Data Owner | |

**SECTION D:**

**POLICY AND LEGAL FRAMEWORK**

15. Do you have a policy on research data management?

Yes ☐ No ☐

16. Does the policy have legal framework to govern research data management?

Yes ☐ No ☐

17. If yes, in question 20 above, what type of issues does the policy support?

Tick all that applies

| **Issues Policy Supported** | **Tick all that apply** |
|---|---|
| Intellectual property aspects | |
| Protection of data against security breaches | |
| Terms and conditions regarding data use | |
| Protection of sensitive data confidentiality | |

18. What does the intellectual property rights adopted in reference to university policy applies to?

| Intellectual Property Right | Tick all that apply |
|---|---|
| datasets owner and stakeholders | |
| Conditions to permit reuse of the dataset | |
| Conditions to permit re-distribution of the dataset | |
| Permission to create and publish derivatives from datasets | |
| Development of data for commercial gain | |
| Data generators to receive attribution for their work | |

19. Do you have any legal concerns regarding the research data management process?

| Legal Concerns | Tick all that apply |
|---|---|
| Copyright | |
| Data protection against security breaches and confidentiality | |
| Patent | |

## SECTION E:

## DATA ARCHITECTURE MODELS/STYLE

20. What type of data architecture model/style have the academic libraries adopted or intend to adapt to support RDM activities? There are two types of models that include and why

| **Data Architecture Model** | **Tick all that apply** |
|---|---|
| Blackboard | |
| Repository | |

**Thank you**

**APPENDIX: III: Research Approval Letter**

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 13th April, 2023

TO: Pauline R. Njagi
C/o Dept. of Library & Information Science
KENYATTA UNIVERSITY

REF: E83/CTY/20037/2020

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the Graduate School Board at its meeting 5th April, 2023 approved your Ph.D. Research Proposal entitled "Academic Libraries Preparedness towards the Adoption of Research Data Management; A Study of Selected University Libraries in Kenya".

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking and Progress Report Forms. The Forms are available at the University's Website under Graduate School webpage downloads.

By copy of this letter, the Registrar (Academic) is hereby requested to grant you substantive registration for your Ph.D. studies.

Thank you.

JOHN M. ODONGI
FOR: EXECUTIVE DEAN, GRADUATE SCHOOL

c.c. Chairman, Department of Library & Information Science
Registrar (Academic) Att; Mr. Richard Chweya

Supervisors:

1. Dr. Gitau Njoroge
   C/o Department of Library & Information Science
   KENYATTA UNIVERSITY

2. Dr. Ronald Bituka
   C/o Dept. of Library & Information Science
   KENYATTA UNIVERSITY

JMO/cao

## APPENDIX IV: Research Authorization

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: E83/CTY/20037/2020 Date: 13th April, 2023

The Director General,
National Commission for Science, Technology & Innovation,
P.O. Box 30623-00100,
NAIROBI

Dear Sir/Madam,

RE:RESEARCH AUTHORIZATION FOR PAULINE R., NJAGI REG. NO. E83/CTY/20037/2020

I write to introduce Njagi who is a Postgraduate Student of this University. The student is registered for a Ph.D. degree programme in the **Department of Library & Information Science in the School of Education & Lifelong Learning.**

Njagi intends to conduct research for Ph.D. thesis entitled, **"Academic Libraries Preparedness towards the Adoption of Research Data Management; A Study of Selected University Libraries in Kenya".**

Any assistance given will be highly appreciated.

Yours faithfully,

PROF. ELISHIBA KIMANI
EXECUTIVE DEAN, GRADUATE SCHOOL

JMO/cao

**APPENDIX V: Research Permit (NACOSTI)**

**PPENDIX VI: Research Ethics And Safety**

**KENYATTA UNIVERSITY**
**CENTRE FOR RESEARCH ETHICS AND SAFETY**

**Fax: 8711242/8711575** **P. O. Box 43844,**
**Email: chairman.kuerc@ku.ac.ke**
**Nairobi, 00100**

Tel: 8710901/12

Website: www.ku.ac.ke
Our Ref: **KU/ERC/APPROVAL/VOL.1** Date: 18th July, 2023

Pauline R.Njagi
P.O Box 43844, 00100
Nairobi.

Dear Ms. Njagi,

**APPLICATION NUMBER: PKU/2769/I1894- ACADEMIC LIBRARIES PREPAREDNESS TOWARDS THE ADOPTION OF RESEARCH DATA MANAGEMENT :A STUDY OF SELECTED UNIVERSITY LIBRARIES IN KENYA**

This is to inform you that ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*** has reviewed and approved your above research proposal. Your application approval number is **PKU/2769/I1894.** The approval period is **18th *07/2023 to 18th /07/2024***

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE***
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE*** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the

approval period. Attach a comprehensive progress report to support the renewal.

vii. Submission of an executive summary report within 90 days upon completion of the study to ***KENYATTA UNIVERSITY ETHICS REVIEW COMMITTEE***

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

To serve you better, researchers are kindly requested to access and complete a customer feedback form and sent it back online as you continue with research and upon completion of data collection found on the following website link; ;(https://docs.google.com/forms/d/1ytWefDwvyz5h1oz_VIn0xbxg3uGdlDzMXFWNDsMrRPQ/edit?usp=sharing

Yours sincerely


**Prof. Judith Kimiywe**

**Director: Centre for Research Ethics and Safety**

**APPENDIX VII: Egerton Resrarch Permission**


**EGERTON UNIVERSITY**

P. O. Box 536 – 20115
Egerton, Kenya
director.reserch@egerton.ac.ke

Cell: 0775015388
Email:


**OFFICE OF DIRECTOR (RESEARCH AND EXTENSION)**

**EU/DVC/RE/089** **21st July, 2023**

Pauline Ruguru Njagi
P. O. Box 75 - 10200
**Murang'a**

**RE: PERMISSION TO CONDUCT RESEARCH AT EGERTON UNIVERSITY**

Reference is made to a letter dated 22nd June, 2023 requesting for authority to collect data for your Ph.D.thesis titled: **"Academic Libraries Preparedness Towards Data Management; A Study of Selected Universities Libraries in Kenya"**. It is noted that the data will be collected from Library staff in Egerton University.

Authority is hereby granted for you to collect data. Please liaise with the office of the University Librarian.

You will be required to strictly adhere to the regulation by various research regulatory bodies in Kenya for your research and handle the data with the highest level of confidentiality in line with the Data Protection Act, 2019. This is also to request you to deposit a copy of your thesis with Egerton University Repository.

Thank you.

DIRECTOR EGERTON UNIVERSITY P.O. Box 536 EGERTON NJORO RESEARCH & EXTENSION

Prof. Nancy W. Mungai, PhD
**AG. DIRECTOR (RESEARCH & EXTENSION)**

cc: DVC (AA)
University Librarian

**NWM/nw**

*"Transforming Lives through Quality Education"*

**APPENDIX VIII: Nairobi University Permit**

**UNIVERSITY OF NAIROBI**
**OFFICE OF DEPUTY VICE-CHANCELLOR**
(Research, Innovation and Enterprise)

P.O. Box 30197-00100
Nairobi, Kenya
Website: uonresearch.uonbi.ac.ke

Tel No: +254-020-4913164
Email: dvcric@uonbi.ac.ke

**UON/RIE/3/5/Vol.XX /** **June 21, 2023**

Ms. Pauline Ruguru Njagi
Reg. No. E83/CTY/20037/2020
P.O Box 75 – 10200
Murang'a
Email: rugurupauline@gmail.com

Dear Ms. Njagi,

**RE: PERMISSION TO COLLECT DATA**

I refer to your request to conduct research at the University of Nairobi for your research project titled: ***"Academic Libraries Preparedness towards the Adoption of Research Data Management; A study of Selected University Libraries in Kenya".***

I write to inform you that your request has been approved.

You are however required to share the findings of your study with the University of Nairobi by depositing a copy of your findings with the Director Library & Information Services upon completion of your study.

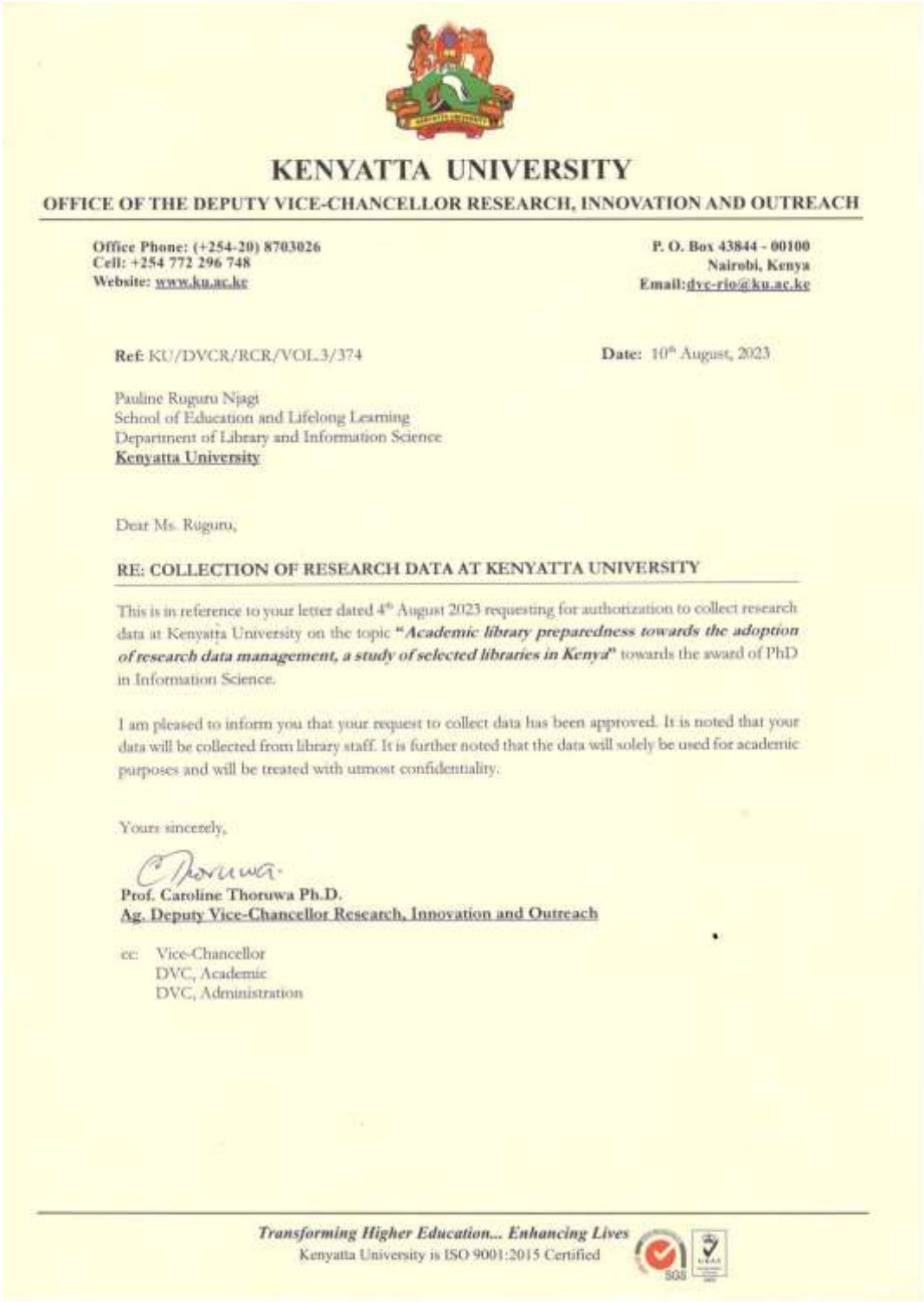
Yours sincerely,

**PROF. M. JESANG HUTCHINSON**
**DEPUTY VICE-CHANCELLOR (AG.)**
**(RESEARCH, INNOVATION AND ENTERPRISE)**
**AND**
**PROFESSOR OF HORTICULTURE**

Copy to: Director, Library and Information Services

...../jks

**APPENDIX IX: Kenyatta Authorization**



KENYATTA UNIVERSITY

OFFICE OF THE DEPUTY VICE-CHANCELLOR RESEARCH, INNOVATION AND OUTREACH

Office Phone: (+254-20) 8703026
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Website: www.ku.ac.ke

P. O. Box 43844 - 00100
Nairobi, Kenya
Email:dvc-rio@ku.ac.ke

Ref: KU/DVCR/RCR/VOL.3/374

Date: 10th August, 2023

Pauline Ruguru Njagi
School of Education and Lifelong Learning
Department of Library and Information Science
Kenyatta University

Dear Ms. Ruguru,

RE: COLLECTION OF RESEARCH DATA AT KENYATTA UNIVERSITY

This is in reference to your letter dated 4th August 2023 requesting for authorization to collect research data at Kenyatta University on the topic ***"Academic library preparedness towards the adoption of research data management, a study of selected libraries in Kenya"*** towards the award of PhD in Information Science.

I am pleased to inform you that your request to collect data has been approved. It is noted that your data will be collected from library staff. It is further noted that the data will solely be used for academic purposes and will be treated with utmost confidentiality.

Yours sincerely,

Prof. Caroline Thoruwa Ph.D.
Ag. Deputy Vice-Chancellor Research, Innovation and Outreach

cc: Vice-Chancellor
DVC, Academic
DVC, Administration

*Transforming Higher Education... Enhancing Lives*
Kenyatta University is ISO 9001:2015 Certified