Research Data Management Practices in Sir Kashim Ibrahim Library, Ahmadu Bello University, Zaria

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Abstract:
The evolution of digital and communication technology has resulted in significant amounts of digital data, necessitating effective RDM services. This study investigated research data management (RDM) practices at Sir Kashim Ibrahim Library, Ahmadu Bello University (ABU), Zaria. The study sought to identify how research data are collected in the library and examined the types of research data collected as well as services provided to promote data use and reuse. A descriptive survey research design was employed, collecting data from 35 respondents via a Google form disseminated through WhatsApp. The findings revealed amongst others that the library has no data repository and research data collected are embedded inside materials ingested into the library's institutional repository. The most popular RDM service provided by the library was hosting data through the Institutional repository. Recommendations for the installation and deployment of the Data repository and for creating awareness of and highlighting the importance of data management planning services were postulated.

Keywords: *Research Data Management, Ahmadu Bello University, Data Collection, Academic Library, Research Data Infrastructure, Kashim Ibrahim Library, Data Re-use, Data Repository*

Introduction

The evolution of digital and communication technology as well as its adoption in scholarly activities has resulted in an enormous amount of digital research data. Research activities in the digital age have integrated digital tools, large data sets, simulation, visualizations, and even virtual environments thereby extending the sources of information beyond the written words (Wolski & Richardson, 2014 Mulligan, 2016).

Supporting this assertion, Frederick and Run (2019) posited that the enormous data being generated in 21st-century research has pushed academic research into the "fourth paradigm," where it has become more collaborative, more computational, and more data intensive. Academic libraries now have a greater demand for research data management (RDM) services due to the growth of technology-enabled research and data-sharing requirements set out by international research funding agencies for researchers (Marlina & Purwandari, 2019).

Library and librarians must support research activities by collecting, managing, and facilitating access to research data for discovery, sharing, and reuse. Ohaji (2016), posited that data are invaluable knowledge assets in an electronic or non-digitized form generated by the scholarly community in the course of their research process. Research data may be created directly by researchers through a research process while conducting experiments in laboratories, social investigations, field observations, and mining on the internet. Borgman (2012) asserted that research data produced by researchers take a wide range of forms, from statistics and experimental results to interview recordings and transcripts.

Chawinga and Zinn (2020) posited that the generation of large volumes of research data and the subsequent demand by research stakeholders for proper data management have spurred the conceptualization, awareness, adoption, implementation, and promulgation of research data management. Collecting and managing research data among academic libraries in Universities is important for optimizing scholarly research, ensuring efficient utilization of resources, and encouraging a culture of data stewardship crucial for advancing knowledge dissemination and academic excellence.

Research Data Management according to Whyte and Tedds (2011) is about the organization of data, from its entry to the research cycle through to the dissemination and archiving of valuable results. Supporting this assertion Cox and Pinfield (2014) asserted that RDM consists of several different activities and processes associated with the data lifecycle, involving the design and creation of data, storage, security, preservation, retrieval, sharing, and reuse. Similarly, Rouse (2019) posited that research data management is the process of ingesting, storing, organizing, and maintaining the data created and collected by researchers or an organization. RDM is all about managing research data; embracing all the services, activities, tools, and infrastructure to organize, document, store, and share data for future re-use (Sheikh et. al., 2023). This suggests that the procedures for research data archiving and preservation in all forms should incorporate all procedures required for effective research data production and management as well as the capability to add value to data produced from new sources of information and expertise. Andrikopoulou et al. (2022) noted that RDM is a transformational force for academic libraries and librarians and, as such, is impacting the evolution of policies, processes, and technologies. The academic community requires a collection of research data services (RDS) in response to the rise in data-intensive research, the evolving functions of libraries, and the realization of the necessity of research data management (Tenopir, Hughes & Allard, 2015). Research data management (RDM) is an essential component of the research lifecycle, encompassing

the organization, storage, preservation, and sharing of data collected during research activities. Effective RDM ensures that data is accessible, reliable, and reusable, which is crucial for advancing scientific knowledge and maintaining the integrity of research (Whyte & Tedds, 2011). The increasing volume and complexity of research data, driven by technological advancements and the proliferation of digital tools, have underscored the importance of robust RDM practices (Tenopir et al., 2011).

RDM covers all aspects of data generation and design, storage, security, preservation, retrieval, sharing, and reuse. Technical capabilities, ethical issues, potential legal repercussions, and governance structures are all taken into account in these actions and processes. When RDM is implemented and the proper data management plan and tools are used, interoperability and accessibility, are followed by storing and dissemination of data (Soundarya & Sukhdev, 2023).

RDM also aims at ensuring that research data is well preserved, accessed, and used as long as it remains relevant and of value to the societies. Singh et al. (2018) enumerated the benefits of Research Data Management to include:

i. providing authentication of data and a trusted repository for long-time curation.
ii. Providing authenticity of data and validating research findings
iii. application of Research Data in various contexts by other researchers and it can also be re-used by the same researcher to extend the use of such data.
iv. saving a lot of time for the researcher, hence investing his time in other avenues of research instead of collecting data from scratch.
v. research data management enhances data sharing, brings transparency, and improves the quality of research.
vi. providing security by keeping data safe and ensuring that the data is not accessible to unauthorized parties.
vii. It enhances the data citation and is useful for training new researchers.

Academic libraries traditionally have a role in providing access to scholarly materials in many forms, hence scholars have argued that management of research data is an extended service of academic libraries (Tenopir et al., 2017). By providing infrastructure like (data repositories) and services like data management, and plan consultations, academic libraries are becoming more involved in research data management. This is because they make it easier for researchers to access and re-use research data. Understanding the RDM practices at ABU involves examining the policies, infrastructure, and support mechanisms in place to assist researchers. It also requires an evaluation of the awareness and attitudes of researchers towards RDM, as these factors significantly influence the adoption of best practices (Cox & Pinfield, 2014). Sir Kashim Ibrahim Library (KIL) Ahmadu Bello University (ABU), Zaria, one of Africa's biggest academic libraries, offers a valuable context for examining RDM practices. As one of the first-generation universities, Researchers at Ahmadu Bello University, generate a vast array of data across diverse disciplines, making the effective management of this data a critical concern in academic institutions.

Statement of the Research Problem

Academic libraries traditionally provide access to scholarly materials in many forms to scholars in their research activities, hence it has been argued that research data management is an extended service of academic libraries. Research Data Management ensures that data is accessible, reliable, and reusable, which is crucial for advancing scientific knowledge and maintaining the integrity of research. Despite the growing recognition of the importance of research data management (RDM), many academic institutions, particularly in developing countries, struggle to implement effective RDM practices. The researcher observed that Sir Kashim Ibrahim Library, A.B.U. Zaria faces significant challenges in collecting and managing the vast amounts of research data generated across its numerous disciplines. This can result in hindering the reproducibility and reliability of research, limits data sharing and reuse, and ultimately undermines the institution's research output and impact. Moreover, the inefficiencies in data management can lead to data loss, increased research costs, and missed opportunities for collaboration. This study aims to explore the current state of RDM practices at KIL, ABU, identifying the types of data collected and shared and areas for improvement, to contribute to the broader discourse on enhancing research data management Through this study, we aim to provide insights into the types of data they collect, how they share data and effective implementation of RDM in a university setting, thereby offering recommendations that could benefit similar institutions globally.

Therefore, this study aims to address the following research questions:

i. What infrastructure is available for research data collection?
ii. What types of research data do academic librarians collect for scholarly purposes in Ahmadu Bello University Library?
iii. What are Research Data Management services provided to promote the use and reuse of research data at Ahmadu Bello University Library?

By answering these questions, this study seeks to identify the gaps in RDM practices at KIL, ABU Zaria, and provide recommendations for improvement. This will not only enhance the quality and impact of research at ABU, Zaria but also contribute to the broader understanding of RDM.

Adekoya et. al. (2024), investigated Research data management services among librarians in public universities in south-west, Nigeria, they concluded that the librarians encounter challenges such as a lack of data management plans and limited grants from research funding agencies in contributing to RDM. This study however will focus on research data management practices for scholarly purposes by academic librarians in Sir Kashim Ibrahim Library, Ahmadu Bello University Library Zaria, Nigeria.

Research Data Infrastructure

Research data infrastructure refers to the comprehensive systems and frameworks that support the collection, storage, management, sharing, and analysis of research data. It includes physical hardware like servers and storage devices, software tools for data management and analysis, and policies and procedures for data governance and security.

Research data infrastructure ensures data is accessible, reliable, and reusable, facilitating collaboration and innovation. It encompasses elements such as data repositories, metadata standards, data integration platforms, and user support services. Robust infrastructure is needed for advancing scientific research, enhancing data-driven decision-making, and promoting open science principles.

The research paper "Research Data Management Services in Academic Libraries: A Comparative Study of South Asia and Southeast Asia" by Sinha *et al.* (2023) investigated the current state of research data management (RDM) services in academic libraries in South Asian and Southeast Asian countries. The quantitative method was used for the study. The study used a survey method with purposive sampling to collect data on the types of RDM services offered, required RDM skills, and challenges library professionals face. The findings revealed that while data repository, data management training, and maintaining web resources are standard RDM services, advisory services on data analysis and supporting reproducibility are given less attention. The study emphasized the need for more competent and dedicated staff for effective RDM services. It also highlighted the importance of awareness and infrastructure to overcome challenges in implementing RDM services in these regions.

Alex-Nmecha and Onifade (2023) investigated research data management (RDM) practices, the level of preparedness, and the challenges being faced by librarians in Nigeria. The study adopted a survey research design of quantitative methodology. The questionnaire developed using Google Forms and administered electronically on LIS platforms, was used for data collection from librarians across the six geopolitical zones in Nigeria. The data collected was presented in charts and analyzed descriptively. Findings from the study showed that there is a lack of awareness about RDM policy, and skills to organize research data among librarians. The study recommended the formulation of comprehensive RDM policies, awareness campaigns, and professional development initiatives to address these challenges, fostering a culture of effective RDM in Nigeria.

Tunmibi and Ajokotola (2024) investigated research data management services among University libraries in Lagos State, Nigeria. Research data management was measured using data creation, data processing, data analysis, data preservation, and data reuse as adapted from the research data life cycle. The study adopted a descriptive survey and structured questionnaire administered to librarians from selected University libraries in Lagos State, Nigeria. For the analysis, the study adopted descriptive statistics using frequency and percentage distribution. The findings of this study revealed that the level of research data management services among the respondents is high with data indicating that they scored high on all the metrics of research data management services such as data creation, data analysis, data preservation, data sharing, and data reuse. However, the study was contextualized in the sense that the librarians provide data management services based on the limited needs of the researchers they serve. The study recommended that stakeholders should focus on the development of research management service policies and training of university librarians on relevant skills.

Martin-Melon et al. (2023) examined research data services (RDS) in Spanish academic libraries. Quantitative content analysis (QCA) was used for the study. Of 48 public universities, only 9 (18.75%) offered RDS, while 11 (22.9%) did not provide any. Advising on data management was available in 58% of libraries, with preservation and data management plans being the most common areas. About 75% of libraries offered guides on RDS, covering topics like data preservation, open research data, and legal aspects. 67% recommended using institutional repositories for data preservation. Training courses on data management were conducted by 23% of libraries, mainly for teaching and research staff. Only five universities (10.42%) had a data management plan, and 16 (33.33%) had open research data policies. The study suggests further exploration to understand users' needs and enhance RDS implementation.

Yidavalapati et al. (2021) examined research data management (RDM) and related services in South Asian academic libraries. The research used a quantitative approach and a survey research design, distributing a questionnaire to library professionals in Afghanistan, Bangladesh, India, Pakistan, and Sri Lanka. The sample population consisted of 67 library professionals from various institutes in these countries. The findings revealed that 83.6% of institute libraries provided RDM services such as data management training and/or data literacy instruction and data repositories/ institutional repositories. The study recommended supporting staff attendance at conferences and workshops on RDM, conducting in-house staff workshops, and addressing compliance with funder requirements and preservation as major issues. The study highlighted the importance of skill development in data description, documentation, curation, metadata, visualization, and technical and ICT skills. The respondents expressed the need for support from institutes or funding organizations to enhance staff skills through conferences, workshops, courses, and collaborations with academic programs. The study also identified various challenges in RDM, including compliance, infrastructure, limited awareness, legal issues, and budget constraints

Methodology

The study was conducted utilizing the quantitative research method using a descriptive survey research design, with data collected using Google Forms. The researcher used WhatsApp to disseminate the Google form link to the university library WhatsApp group. The study's population is the entire academic librarians in the university library. Thus, the entire population will be used for the study because the size of the population is manageable. This is consistent with Umar's (2015) assertion that a researcher can investigate an entire population if it is relatively small. The population used for the study was based on the number of questionnaires responded to at the end of three weeks of which the questionnaire was opened to be responded to.

Data generated from the questionnaire will be analyzed descriptively using frequency tables, and percentages.

Results

The researchers noted that at the end of the three weeks that the questionnaire was opened to be responded to, 35 respondents participated in the study.

Demographic Information

A total of 35 responses were collected from Academic Librarians of Sir Kashim Ibrahim Library Out of the 35 respondents who participated in the study, 85.71% are Masters holders while 14.29% are Ph.D holders. This is an indication that more Masters holders participated in the study. On the years of experience as academic librarians, 71.43% of the respondents had 8 years and above while 14.29% of the respondents indicated 4-5 years and 6-7 years respectively.

Table 1: Infrastructure Provided by the Library for Managing and Organizing Research Data

Infrastructures Provided	Frequency	Percentage
Institutional Repositories	30	85.71
Cloud Storage Services	10	28.57
Data Processing Software	25	71.43
Data Citation Manager	20	57.14
Data repositories	0	0.00
Research Data Sharing	20	57.14
Data Management Plan	10	28.57
Research Data Management Policy	15	42.86

Data collected from the respondents indicated that Kashim Ibrahim Library, Ahmadu Bello University Zaria does not have a data repository, where research data only is collected. However, the Library has an institutional repository where researchers submit their research works in the form of a thesis, dissertation, conference papers, and , pre-print and post-print articles.

The library offers several infrastructures to support the management and organization of research data. Analyzing the provided data gives insights into the availability and utilization of these services. Table 1 shows the infrastructure provided by the library for managing and organizing research data to support scholarly works. Institutional repositories are the most commonly provided infrastructure by the library,

with 85.71% availability. This indicates a strong emphasis on the importance of centralized storage locations where researchers can deposit their data for long-term preservation and access. The high percentage reflects the library's commitment to ensuring that research data is safely stored and easily retrievable, facilitating better data management practices and compliance with institutional and funding agency requirements. On the other hand, Cloud storage services were found to be less commonly provided, with only 28.57% availability. This suggests that while the library does recognize the advantages of scalable and flexible storage solutions offered by cloud services, it may still rely more heavily on traditional data repositories. The lower percentage might indicate potential areas for growth, as cloud storage can provide additional benefits such as easier data sharing and collaboration, as well as enhanced data security and disaster recovery options. The finding aligns with that of Chen (2022) posited that cloud storage services have the potential to reduce costs, improve efficiency, enhance data storage and security, and offer flexibility.

Types of Research Data Collected by Academic Librarians for Scholarly Purposes

The types of research data collected by academic librarians at Kashim Ibrahim Library, Ahmadu Bello University, for scholarly purposes, are presented in Table 2.

Table 2: Types of Research Data Embedded in Materials Collected by Academic Librarians at Kashim Ibrahim Library, Ahmadu Bello University, for Scholarly Purposes

S/N	Types of Research Data Collected	Frequency	Percentage
1	Numerical Data (Experimental data generated by lab equipment)	5	14.29
2	Numerical Data (survey response, experimental results)	35	100.00
3	Audiovisual data (recording, videos)	15	42.86
4	Computational/simulation data generated from computational models	15	42.86
5	Biological and Environmental data observational data of specific phenomena at a specific time or location	10	28.57
6	Derived data produced via the processing or combining of other data (data mining)	10	28.57
7	Social media data (tweets, Facebook posts)	25	71.43
8	Canonical data extracted from reference data sets	10	28.57

Table 1 provides a summary of the types of research data collected by academic librarians at Kashim Ibrahim Library, Ahmadu Bello University, for scholarly purposes. These types of data are embedded alongside, conference papers, post-print and pre-print articles, theses, and dissertations in an institutional repository. The table revealed that the most collected data type by academic librarians in KIL is Numerical Data (Survey Response, Experimental Results) which accounted for 100% of responses. This type of data, which includes survey responses and experimental results, is universally collected. It is foundational for many types of research as it provides quantitative evidence that can be analyzed to conclude. The high percentage indicates its critical status and widespread use across various academic disciplines. On the other hand, Numerical Data (Experimental Data Generated by Lab Equipment) is the least type of data collected by academic librarians as indicated by 14.29%. This is not unconnected with the fact that this data type generated directly from laboratory equipment, is less frequently collected. The lower percentage could be due to its specialized nature, requiring specific equipment and expertise, and possibly being more relevant to specific fields like physical sciences or engineering. The findings underscore the library's strong focus on supporting quantitative research by providing extensive access to numerical data from surveys and experiments. This finding agrees with Baral (2017) who asserted that data can take many forms; it may be a set of numbers, alphanumeric or strings, descriptive, visual, or tactile. The numerical data (experimental data generated from Surveys Responses, and Experimental Results which are the major type of research data collected by academic librarians for scholarly purposes is one of the four broad categories of research data as categorized by the National Science Board (2005).

Services provided to promote the use and reuse of research data among researchers for scholarly purpose

Several services are provided by academic librarians to promote the use and reuse of research data among researchers for scholarly purposes. The analysis is presented in Table 3.

Table 3 provides a summary of various services offered to promote the use and reuse of research data among researchers. The table showed that the major service provided to promote the use and reuse of data is hosting data through the Institutional repository accounting for 85.71% of responses. This high percentage indicates a strong emphasis on making data comprehensible and reusable, which is crucial for validating research findings, promoting reproducibility, and facilitating further research.

Table 3: Services Provided to Promote the Use and Reuse of Research Data among Researchers for Scholarly Purpose

S/N	Services Provided to promote the use and reuse of research data	Frequency	Percentage
1	Advise on data embargoing and access to control issues	15	42.86
2	Awareness of RDM mandates	15	42.86
3	Data Citation	25	71.43
4	Data Documentation	20	57.14
5	Data management planning	10	28.57
6	Hosting data through an Institutional Repository	30	85.71
7	Repository selection	15	42.86
8	Facilitation data sharing and	20	57.14
9	Intellectual property and copyright	15	42.86
10	Data Preservation	20	57.14

On the other hand, data management planning services had the lowest response with 28.57%. The lower percentage here suggests that while important, data management planning might be less frequently emphasized or provided compared to other services. This could be due to a lack of awareness of the importance of data management planning by researchers. This finding agrees with the findings of Sinha *et al.* (2023) who investigated the current state of research data management (RDM) services in academic libraries in South Asian and Southeast Asian countries that data repository, data management training, and maintaining web resources are standard RDM services provided to promote use and reuse of research data.

Conclusions

Research Data management has been recognized as a vital service library can offer its patrons, unfortunately at Kashim Ibrahim Library Ahamadu Bello University data repository which had been identified as an important tool for research data management is not available. This has resulted in only collecting and ingesting research data embedded in the main research document. The varying collection rates of different data types suggest that the library tailors its data collection efforts to support specialized research areas, ensuring that researchers have access to the specific types of data they need. Based on the findings, it is therefore concluded that the Kashim Ibrahim Library at Ahmadu Bello University demonstrates a comprehensive approach to collecting various types of research data to support the evolving needs of researchers.

Recommendations

Based on the findings and conclusion, the following recommendations were made:

1. Management of Kashim Ibrahim Library should deploy a data repository that will be dedicated to the collection and management of research data
2. Efforts should be made to collect more numerical data generated by lab equipment, biological and environmental data, and derived data by partnering with specific departments to identify and collect these data types.
3. Librarians show increase awareness amongst scholars of data management planning services and it's important to research process to increase its patronage.

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