

# TRENDS IN TRANSFORMING LIBRARIES FOR ECONOMIC DEVELOPMENT

A Festschrift in Honour of



Edited by

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Bitagi**

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# **FRAMEWORKS FOR THE ADOPTION AND IMPLEMENTATION OF RESEARCH DATA MANAGEMENT (RDM) POLICY IN ACADEMIC LIBRARIES**

Fatimah Jibril Abduldayan, Rilwanu Adamu, & Kabiru Ibrahim

## **Introduction**

Research data management (RDM) is a process of organising, storing, and preserving data created in the course of research (Abduldayan et al., 2021). Generally, a policy is a written document adopted or adapted by organisations or institutions to explain a set of ideas or plans on how to achieve specific objectives in the management of affairs. A research data management policy can be seen as a set of guidelines and principles designed to guide researchers and institutions on how to manage research data effectively throughout its lifecycle. Research Data Management services in university libraries support the organisation, storage, preservation, and sharing of research data throughout its lifecycle (Abduldayan et al., 2018). The services are essential in helping researchers comply with data policies, manage data ethically, and maximise the impact of their research.

University libraries are well-positioned to offer these services because they already specialise in information organisation and access. However, to do this, they need to have a policy document to guide them. Thus, this chapter introduces stakeholders to the general knowledge of research data management with a specific emphasis on policy adoption and implementation through a conceptual framework. The examination of the social contexts' structure involves a detailed analysis of the various elements, relationships, and dynamics within social settings. In the context of studying the frameworks for the adoption and implementation of RDM policies in university libraries, this examination aims to understand how frameworks such as the DCC Lifecycle Model, Research Data Alliance (RDA) guidelines, and Data Management Plans influence the clear development and implementation of RDM policies in university libraries. Specifically, therefore, the chapter examines the concept of research data management under the following subtopics:

## **The Concept of Research Data and Research Data Management:**

The word "data" in data management is usually referred to as "research data." In foreign literature, research data is often expressed as data-intensive, scientific data, e-research, e-sciences, and open data; however, there is no clear distinction between these terms. They refer to the original, basic data in scientific research activities, and they can be used interchangeably (Zhou & Zhou, 2018). Research data, as defined by UNISE (n.d.), encompasses any information collected, observed, generated, or created to support and validate original research findings. It can exist in various formats—digital or physical—and includes items such as documents, spreadsheets, notebooks, transcripts, audiovisual recordings, photographs, test responses, artifacts, algorithms, workflows, and protocols. Thus, effective management of research data depends on factors such as its method of generation, purpose, and subject matter, ensuring it remains accessible, interpretable, and usable for its intended research context.

The concept of **Research Data Management** revolves around the principles, processes, and practices associated with handling research data throughout its lifecycle. This lifecycle begins with the creation and collection of data and extends through stages like processing, analysis, preservation, and sharing. Pinfield et al. (2014) defined RDM as the active collection and organisation of research data produced in particular investigations or research projects from its entry to the research cycle taking into account processes and activities involving the design and creation of data, storage, security, preservation, retrieval, sharing, and reuse, as well as technical capabilities, ethical considerations, legal issues and governance frameworks.

Research data management is the process of providing the appropriate labelling, storage, and access for data at all stages of a research project (*What Is Research Data Management*, n.d.) emphasising that research today not only has to be rigorous, innovative, and insightful - it also has to be organised as improved technology creates more capacity to create and store data, it increases the challenge of making data FAIR: Findable, Accessible, Interoperable, and Reusable. The ultimate goal of RDM is to ensure that data is managed in ways that promote its usability, integrity, and long-term accessibility. In universities, RDM has become a central focus, particularly in the light of growing expectations for transparency, reproducibility, and compliance with funder requirements.

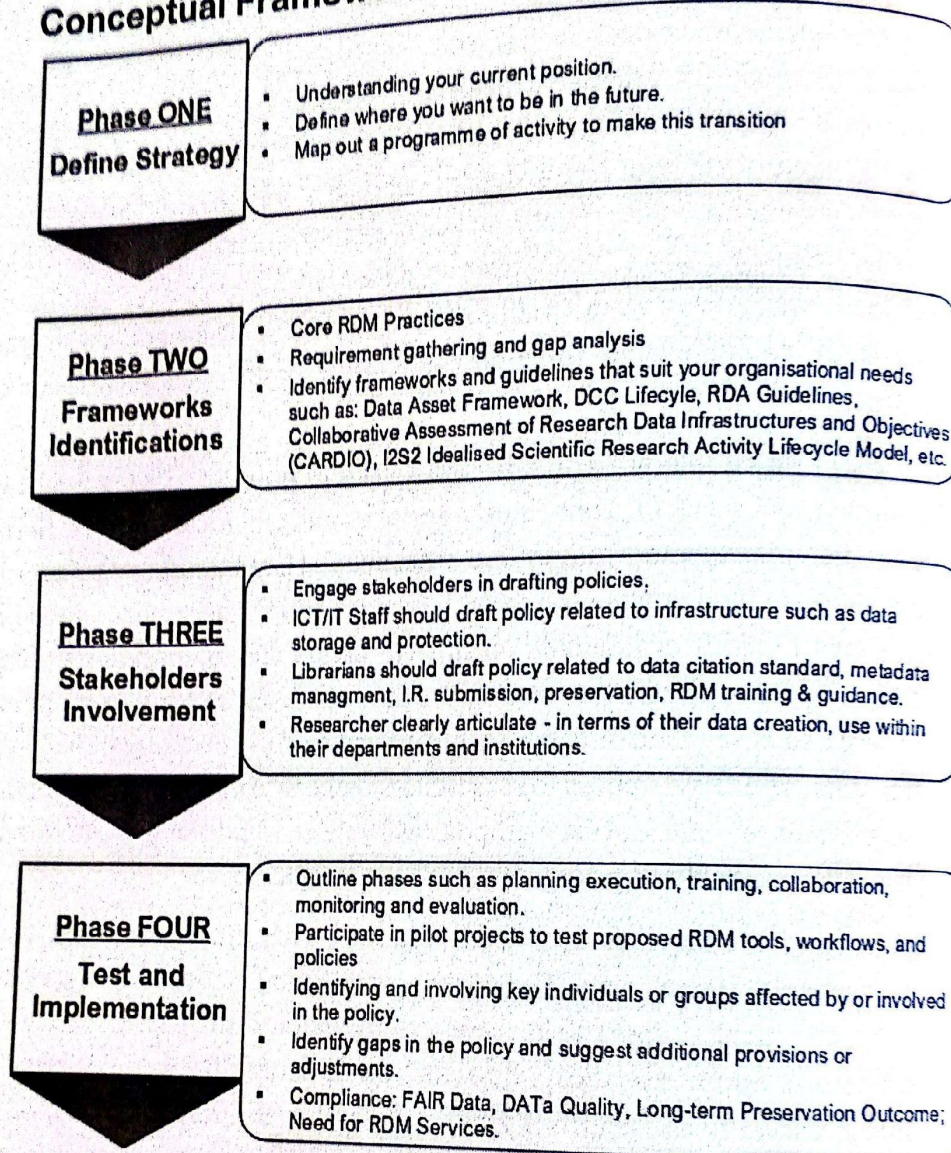
## **Research Data Management Services in Libraries**

Research Data Management services in libraries encompass a kind of service that libraries provide to their users, particularly those who are actively engaged in research activities. Libraries at higher institutions of learning and other research centres are the ones providing this kind of service. For instance, university libraries in the advanced world have taken a prominent role in RDM services, as they are uniquely regarded as helping researchers manage, share, and preserve data. Thus, libraries contribute to RDM in ways that extend far beyond traditional library services by addressing the specialised needs of data-intensive research while promoting open science, data integrity, and accessibility.

Adamu et al., (2021) stated that academic libraries used to provide RDM services in the form of informational services, consultative services and technical services. Some libraries called it data management supportive assistance offered to users particularly researchers and scholars who engage in research data creation. The services aimed at consulting with faculty, staff or students on how to create data management plans, assist researchers in creating metadata standards, provide researchers with reference support for finding and citing data or datasets, locate repository where researchers will deposit research data, create awareness to researchers on how to collaborate with other researchers on campus or outside the campus, as well as create a web guides by libraries to assist the researchers finding aids for data or datasets.

All these aforementioned services are what Adamu *et al.*, (2021) referred to as informational or consultative services. The other service, known as technical services, involves offering technical support to researchers by helping them prepare data or datasets for deposition into a repository, de-selection of data or datasets for removal from a repository, assisting in identifying data or datasets eligible for deposit in a repository, assist in transforming metadata for datasets as well as directly involving librarians to participate with researchers on a project as a team member. For instance, in some situations where an academic institution does not have a good storage infrastructure, librarians can recommend self-deposits of data sets in disciplinary or general open access repositories, such as FIGSHARE and Zenodo for data sharing (Adamu *et al.*, 2021).

## Conceptual Framework



*Figure 1: Conceptual Framework for the Adopting and Implementing RDM Policy in Academic Libraries.*

The conceptual framework illustrates how the various components, comprising four phases, interact to facilitate the successful adoption and implementation of RDM policy in academic libraries. In the first phase, there are three key steps to defining organisational strategy. To take stock of the current situation, you need to be aware of the context in which you are working. What internal and external factors influence research? You should also be aware of your institution's mission statement so that you can map RDM activities and benefits to it as a means of encouraging support.

The second phase consists of foundational guidance on whether RDM is being practised. It is necessary to gather requirements and undertake a gap analysis to inform the development of RDM services. One needs to identify any gaps between their current position and where they hope to be in the future in order to plan the necessary contingencies between steps to establish a logical sequence of activities. This enables the identification of suitable frameworks and guidelines for considerations and adoption/adaptation of RDM for policy development.

In the third phase, a component of the framework reflects the engagement of stakeholders in drafting RDM policy for implementation. Core infrastructure necessary for implementing RDM policies, such as institutional repositories, DMPs, and data stewardship, is essential for day-to-day management.

The fourth stage focuses on the implementation and support structures (Training, Collaboration, and Compliance) necessary for the effective implementation and sustainability of the core practices. Without training, collaboration, and monitoring, the system may falter. Other layers reflect how well-structured policies contribute to high-quality, accessible data and institutional success, thereby enforcing researchers to comply with legal, ethical, and funder requirements. Ultimately, the end goals reflect where libraries see the need for developing and implementing research data management services in academic libraries.

### **Research Data Management Frameworks**

A framework is like a basic structure or foundation that helps someone to build something. In research, a theoretical framework provides researchers with ideas and concepts on how to conduct their research. According to Salawu, Bolatitio, and Masibo (2023), a conceptual framework is an expression, either narratively or graphically, of the study being undertaken. It consists of the study variables, including dependent, independent, and at times, intervening or control variables, as well as the presumed relationships among these variables. This chapter reviewed frameworks that provide a structured approach to the adoption, adaptation, and implementation of Research Data Management (RDM) policies in university libraries. Although there are several widely used models and tools relevant to university libraries, this discussion will focus on the Digital Curation Centre (DCC) Lifecycle Model, the Research Data Alliance (RDA) Guidelines, and Data Management Plans (DMPs). There are successful stories of the adoption and implementation of these frameworks from the University of Edinburgh, the University of California, and other universities across the

globe. When libraries adopt these approaches, they become essential partners supporting research excellence in an academic environment.

### **Digital Curation Centre (DCC) Lifecycle Model**

The Digital Curation Centre (DCC) Lifecycle Model, developed by the UK-based Digital Curation Centre, provides a foundational framework for managing and curating digital data, from initial planning through to long-term preservation and reuse. Its structured approach ensures research data remains accessible, usable, and reliable over time, aligning with academic libraries' mission to preserve knowledge and enhance data accessibility (Curation Lifecycle Model | DCC, n.d.).

Libraries are increasingly adopting the DCC Lifecycle Model, as it supports systematic research data management (RDM), thereby aligning with mandates from funding agencies and institutions (Ngulube & Masenya, 2020; Madibi, 2021). This model provides university libraries with a structured guide to deliver essential RDM services to researchers throughout the data lifecycle, thereby enhancing both data integrity and accessibility. This section provides an overview of the model's stages with practical insights into library services within each phase. The first stage, **Conceptualise**, focuses on pre-project data planning. Here, libraries assist researchers in drafting data management plans (DMPs) using tools such as DMPTool or DMPonline, ensuring alignment with institutional standards, including the FAIR principles. Libraries provide training on data policies and requirements to help researchers prepare for effective data handling.

The **Create** phase involves data collection, during which libraries guide the documentation and structure of the data. They recommend metadata standards such as Dublin Core or MARC21, which support discoverability and data sharing. **Appraise and Select** is the third stage, where researchers and librarians assess the long-term value of datasets and decide what should be preserved. Libraries contribute by providing criteria for identifying datasets with significant reuse potential. The **Ingest** phase focuses on preparing data for repository submission, where libraries assist with metadata enrichment, cleaning, and standardising data for easy access. Libraries also manage institutional repositories by ensuring that data can be uniquely identified through persistent identifiers (PIDs), such as DOIs.

During **Preservation**, libraries play a key role in maintaining data accessibility and integrity over time by offering strategies such as format migration and regular backups to mitigate the impact of technology changes. Integrity checks using methods like checksums are also performed to detect corruption. The **Access, Use, and Reuse** phase

emphasizes data sharing and discoverability. Libraries facilitate data access through structured repositories and ensure compliance with data sharing policies, including those related to privacy and licensing requirements. Data literacy programmes further support researchers in discovering and reusing data.

Finally, *Transform* involves data adaptation for future use, including format conversion and data enrichment. Libraries support researchers by facilitating data migrations to new formats, thereby ensuring long-term accessibility despite technological evolution. The DCC Lifecycle Model enables university libraries to play a crucial role in each stage of data management, fostering transparency, accessibility, and collaboration within the framework of open science. By adopting this model, libraries can establish themselves as integral research partners, enhancing the quality and impact of institutional research.

### **Research Data Alliance (RDA) Guidelines**

The Research Data Alliance (RDA), established in 2013, is a global organisation committed to promoting the open sharing, interoperability, and reuse of research data across disciplines and borders. The RDA develops community-driven guidelines to foster collaboration, standardisation, and openness, which have become essential tools for academic libraries implementing Research Data Management (RDM) services (About the RDA - RDA, n.d.). Libraries leverage RDA guidelines to align their RDM practices with international standards, ensuring that institutional data is well-managed, accessible, and reusable by the broader research community.

Central to RDA's guidelines are the FAIR principles (Findability, Accessibility, Interoperability, and Reusability), which outline best practices for RDM. For data to be **findable**, it requires persistent identifiers (PIDs) like DOIs or ORCIDs to ensure that datasets are easily discoverable and searchable through rich metadata. Data becomes **accessible** through standardised protocols, with libraries promoting access management strategies that protect sensitive information. To ensure **interoperability**, libraries encourage the use of machine-readable, open standards and controlled vocabularies to facilitate integration with other datasets. Finally, making data **reusable** entails licensing it under clear reuse terms, such as Creative Commons, to support lawful and beneficial data sharing.

Libraries provide essential RDM services rooted in RDA's guidelines, including training sessions to help researchers structure data according to FAIR principles for offering repository services to store data linked with PIDs securely, and supporting metadata creation using standards such as Dublin Core or MARC21. Metadata

standardisation, as emphasised by the RDA, is crucial for data discoverability, and libraries play a vital role in training researchers in discipline-specific metadata frameworks, maintaining repository metadata, and ensuring long-term accessibility of research outputs. RDA also champions the widespread adoption of **persistent identifiers (PIDs)**, such as DOIs for datasets and ORCIDs for researchers. Libraries facilitate DOI assignment for institutional research outputs and help researchers manage their ORCID profiles, thereby ensuring that their work is easily citable, discoverable, and accurately attributed. PIDs thus reinforce the credibility and visibility of research, while also ensuring continuity of access.

Libraries further support **Data Management Plans (DMPs)**, which are critical for guiding data collection, storage, sharing, and preservation across a project's lifecycle. With RDA's encouragement, libraries assist researchers in creating DMPs that meet funder requirements, integrating tools like DMPonline or DMPTool, and offering templates and consultation services. DMPs ensure that researchers adhere to best practices and meet funding requirements. Beyond supporting technical and procedural standards, the RDA promotes open science principles, encouraging data sharing as a default practice in alignment with funder mandates for transparency and reproducibility. Libraries help to develop institutional data-sharing policies and guide researchers in selecting appropriate open licenses. Furthermore, they play a central role in **data stewardship** by providing curation services, training staff as data stewards, and supporting compliance with legal and ethical standards, such as the GDPR. This stewardship enables libraries to safeguard data integrity, privacy, and reuse rights thereby making research data not only a valuable institutional asset but also a resource for global scientific progress.

### **Data Management Plans (DMPs)**

A Data Management Plan (DMP) is another model in the form of a formal document outlining how research data will be generated, handled, stored, shared, and preserved throughout and beyond the lifespan of a research project (Dublin City University et al., 2022). It serves as a roadmap to ensure that data management practices align with the requirements of funders, institutional policies, and research best practices. DMPs help promote transparency, reproducibility, and data reuse, while also mitigating risks related to data loss, ethical issues, or non-compliance with policies. The academic libraries play a crucial role in assisting researchers with developing and implementing DMPs, thereby ensuring compliance with institutional mandates and external funders' requirements as part of the grant application process. Some key components of a data management plan include data description that deals with data collected, generated,

reused, the specific type, volume, and format of the data (e.g., raw data, survey responses, images, or video files). Metadata standards and documentation, storage and backup strategies, data sharing and access policies, ethics, legal, and compliance issues, long-term preservation and archiving, roles and responsibilities and budget and resource allocation.

Libraries play a crucial role in supporting the development of Data Management Plans (DMPs) by offering a range of services designed to assist researchers. They provide access to DMP tools like DMPonline and DMPTool, which include funder-specific templates to guide the creation of effective DMPs. In addition, libraries offer one-on-one consultation services for helping researchers tailor their plans to meet specific funder requirements. They also assist institutions with compliance monitoring to ensure timely submission of DMPs and alignment with funder policies. Furthermore, libraries organise workshops and training sessions to educate researchers on the principles of data management and the importance of creating comprehensive DMPs.

### **Practices for Implementing RDM Policies in Academic Libraries**

Abduldayan (2020), in her study titled "Research Data Management: The Nigerian Perspective," developed a framework for incorporating Research Data Management (RDM) services in Nigerian Federal Universities of Technology (FUTs). It emphasises the importance of conducting an initial qualitative study, using interviews and observations, to understand current research practices and workflows for ensuring that the RDM service aligns with researchers' existing systems. Key stakeholders, including university management, library staff, ICT staff, legal and research offices, are crucial to the successful implementation. Continuous awareness, education, and service tracking ensure sustainability. The framework also includes a feedback mechanism to foster continuous improvement, providing libraries with a foundation for adequate RDM support in Nigerian academic institutions. In addition to that, libraries can effectively adopt and implement RDM policies through practical strategies whereby libraries integrate these practices into their real services provision, which can be achieved under the following subheadings:

#### **Training and Capacity Building for Research Data Management (RDM) in Academic Libraries**

Training and capacity building are crucial for the successful implementation of research data management in academic libraries as they equip researchers and library staff with the necessary skills to handle data throughout its lifecycle. Academic

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libraries play a leading role in offering structured training programmes, workshops, and one-on-one consultations to help researchers develop data management plans, adopt metadata standards, and comply with data sharing and preservation requirements. Also, libraries facilitate ongoing professional development for staff, ensuring they are well-versed in the technical and advisory aspects of RDM, including legal and ethical compliance (Abduldayan, 2020).

### **Collaborations across Departments for Effective Research Data Management Policy Implementation in Academic Libraries**

Collaborations across departments are crucial to the successful implementation of research data management policies in academic libraries. RDM is a multifaceted process that requires expertise from various areas, such as IT services, research offices, ethics committees, and academic faculties. No single department has all the necessary skills to handle the complexities of data management; therefore, effective collaboration ensures a well-rounded approach for fostering compliance, promoting data sharing, and improving the overall quality of research data management. Building this cross-functional network will create a comprehensive RDM strategy that supports researchers in institutions (Abduldayan, 2020).

### **Developing Institutional Repositories for Data Storage in Academic Libraries**

Institutional repositories (IRs) are essential components of research data management infrastructures in academic libraries. These digital platforms allow institutions to collect, manage, store, and disseminate research data and outputs. When implemented, it will support long-term data preservation, ensure compliance with funder's mandates, and promote open access to research, thereby enhancing the visibility and impact of scholarly work. Therefore, academic libraries play a central role in developing and managing institutional repositories by ensuring that they meet technical, legal, and disciplinary standards for data storage and sharing. (Imoro and Saurombe, 2024).

### **Establishing Clear Data Ownership and Access Policies for Effective Research Data Management**

Establishing clear data ownership and access policies is a cornerstone for effective Research Data Management (RDM) in academic libraries. These policies help clarify who owns the data generated during research, how the data can be shared, and what access restrictions may apply. Clear policies prevent disputes, ensure compliance with legal and ethical standards, and promote open science by striking a balance between

data protection and transparency (Abduldayan, 2020). Academic libraries play a crucial role in developing, communicating, and enforcing these policies in collaboration with legal, research, and ethics offices. With well-defined ownership rights, access controls, and sharing agreements, institutions can build a data management framework that supports high-quality research and fosters trust, collaboration, and innovation. (Kaye, 2012).

### **Monitoring and Compliance Support in Research Data Management**

Monitoring and compliance support are integral to effective Research Data Management in academic libraries. Establishing mechanisms for tracking adherence to data policies, providing compliance training, and supporting researchers in meeting legal and funder requirements ensures that data is handled ethically and securely (Subaveerapandiyan, 2023). Libraries play a crucial role in guiding researchers through the complexities of RDM compliance, from developing data management plans (DMPs) to conducting audits and training. With robust monitoring practices, academic institutions can foster a culture of compliance that supports high-quality research, protects data, and aligns with open science principles (Abduldayan, 2020).

### **Offering Data Stewardship Services in Academic Libraries**

Data stewardship services are essential components of Research Data Management in academic libraries. These services ensure that research data is well-organised, adequately documented, and accessible for long-term use. Data stewards support researchers by providing expertise in data management planning, quality control, sharing, and compliance. While challenges such as limited expertise, researcher engagement, and infrastructure sustainability exist, libraries can overcome these by building capacity, raising awareness, and adopting flexible stewardship models. With effective data stewardship services, academic libraries foster high-quality research, promote open science, and ensure that data remains an asset for future discoveries (Abduldayan, 2020).

### **Needs for RDM Services in Academic Libraries in Nigeria**

Research Data Management (RDM) services are essential for ensuring the effective stewardship of research data throughout its lifecycle, from creation to preservation. These services are increasingly recognised as a critical component of the research ecosystem, particularly in higher education institutions, driven by the need for compliance with funding requirements, improved research quality, and long-term data reuse. The development of RDM services is motivated by several factors. *Effective*

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data management enhances research quality, increases visibility, and fosters collaboration. Well-managed data are easier to discover, access, and reuse, thereby ensuring that research remains reproducible and impactful. The long-term stewardship of data not only benefits researchers by enhancing the citation rates and impact of their work, but also serves the institution by safeguarding the outputs of publicly funded research. (Jones et al., 2013).

The establishment and operation of RDM services involve various stakeholders within an institution, each with defined roles and responsibilities:

1. **University Management:** Responsible for endorsing and sustaining RDM services as part of the institution's infrastructure. Senior leadership must provide strategic oversight to ensure that RDM is integrated into institutional business plans and policies.
2. **Support and Administrative Services:** Key players include the library, IT services, records management, and research administration. These groups collaborate to identify data management requirements, develop policies, and implement the necessary infrastructure. They also provide training, advocacy, and ongoing support to researchers.
3. **Researchers:** As the primary creators of research data, researchers play a crucial role in ensuring the successful adoption of RDM services. They must engage with the development of RDM policies, contribute to defining service requirements, and utilise these services to manage their data effectively throughout the research lifecycle (Jones et al., 2013).

Components of RDM services are multi-faceted and encompass several core components:

1. **Data Management Planning (DMP):** DMPs are required by many funders and provide a structured way for researchers to outline how data will be handled during and after a project. Institutions can support researchers by offering templates, guidance, and tools such as the Digital Curation Centre's (DCC) DMPOnline, which helps researchers develop plans tailored to funder requirements (Jones et al., 2013).
2. **Managing Active Data:** RDM services must provide adequate storage solutions for active research data. This can include cloud services, institutional repositories, or collaborative platforms like Dropbox alternatives tailored to academic needs. These systems should be flexible, secure, and easily

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accessible to accommodate the diverse needs of research teams (Jones et al., 2013).

3. **Data Preservation and Repositories:** Not all data generated during research projects need to be preserved. Institutions must establish selection criteria to identify data of long-term value and ensure they are archived in reliable repositories for future use (Jones et al., 2013).
4. **Training and Advocacy:** Offering training and raising awareness about good data management practices are crucial for ensuring researchers understand how to create, manage, and share their data responsibly. These activities can include formal courses, consultancy services, and helpdesk support (Jones et al., 2013).

In conclusion, the adoption and implementation of Research Data Management (RDM) policies in academic libraries require well-structured and strategic frameworks that address the unique needs of these institutions. These frameworks serve as essential tools to guide libraries in developing policies that ensure the effective organisation, preservation, and accessibility of research data. By aligning RDM practices with institutional goals and leveraging global best practices, academic libraries can establish policies that not only support researchers in managing their data but also enhance the overall quality of research outputs. Implementing these frameworks fosters a culture of data stewardship, ensures compliance with regulatory requirements, and positions academic libraries as central players in the evolving landscape of data-driven research and knowledge dissemination. These frameworks also streamline the integration of technical, organisational, and human resources, thereby creating a cohesive strategy for RDM policy development. They also ensure consistency, scalability, and alignment with institutional goals and international standards.

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