

# The Influence of Research Data Management Practices on Data Integrity, Accessibility and Research Collaboration among Researchers in Federal University Dutse

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## Article history:

**Received:** 03/06/2026

**Accepted:** 25/07/2026

**Published:** 24/08/2026

**Keywords:** Research Data Management, data integrity, data accessibility, research collaboration, FAIR Data Principles

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## Abstract

*This study examined the influence of Research Data Management (RDM) practices on data integrity, data accessibility, and research collaboration among researchers at Federal University Dutse. The study had four objectives: assessing RDM practices adopted by researchers, determining the level of data integrity associated with RDM practices, examining the influence of RDM practices on data accessibility, and determining their influence on research collaboration. The FAIR Data Principles guided the study. A descriptive cross-sectional survey design was adopted, with a population of 189 professorial academic staff at Federal University Dutse. The 12 faculties were stratified according to disciplinary areas; total enumeration was used to cover all 189 eligible researchers. Data were collected using a structured questionnaire and analysed using descriptive statistics and simple linear regression. Findings revealed a moderate level of RDM practices (overall mean = 3.34), with data backup ( $M = 3.74$ ), organisation ( $M = 3.68$ ), and secure storage ( $M = 3.61$ ) most prominent, whereas metadata creation ( $M = 2.96$ ), standardised file formats ( $M = 3.08$ ), and data sharing ( $M = 3.12$ ) were less adopted. Data integrity was high ( $M = 3.52$ ), with RDM practices significantly influencing it ( $R^2 = 0.464$ ,  $p < .001$ ). Data accessibility was also high ( $M = 3.42$ ), with significant influence from RDM practices ( $R^2 = 0.524$ ,  $p < .001$ ). Research collaboration was moderate to high ( $M = 3.39$ ), with significant influence from RDM practices ( $R^2 = 0.426$ ,  $p < .001$ ). All three null hypotheses were rejected. The study concluded that systematic RDM practices are important for protecting research data quality, improving accessibility, and supporting collaborative research. It recommended strengthening institutional RDM policies, providing regular training, improving secure storage and repository infrastructure, and promoting responsible data sharing.*

## Original Research Article

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**How to cite this article:** Aminu Ahmed Buba, (Ph.D), Usman Muhammed Song, (Ph.D), & Hamidu Mohammed Jada, (Ph.D). (2026). The influence of research data management practices on data integrity, accessibility and research collaboration among researchers in Federal University Dutse. EIRA Journal of Arts, Law and Educational Sciences, 2(4). 45-58

## Introduction

Research data constitute a fundamental component of scholarly research because they provide the empirical basis for generating, validating, communicating and extending knowledge. The increasing digitisation of research has resulted in the production of large volumes of diverse datasets, creating the need for systematic processes for their organisation, documentation, storage, preservation, sharing and reuse. Research Data Management (RDM) encompasses the practices through which research data are managed throughout their

lifecycle, from planning and collection to processing, preservation, dissemination and reuse. Effective RDM is therefore important for ensuring that research data remain understandable, retrievable and usable beyond the original research project, while also supporting transparency, reproducibility and further knowledge development (Wilkinson et al., 2016).

One important outcome of effective RDM is data integrity, which concerns the accuracy, consistency, completeness and reliability of research data throughout their lifecycle.

Research data may lose their integrity through poor documentation, inappropriate storage, uncontrolled modification, inadequate backup, inconsistent versions and loss of contextual information. Consequently, practices such as systematic documentation, metadata creation, version control, secure storage, regular backup and preservation are essential for maintaining the reliability and evidential value of research data. Effective stewardship also ensures that data can be properly interpreted and verified by researchers beyond the original data-collection process, thereby strengthening the credibility and reproducibility of research outputs.

RDM is equally important for data accessibility and research collaboration. The FAIR Data Principles require research data to be Findable, Accessible, Interoperable and Reusable, thereby providing a basis for making research data discoverable and usable under appropriate access conditions (Wilkinson et al., 2016). Proper metadata, persistent identifiers, standardised formats, adequate documentation and clearly defined access conditions can make datasets easier for researchers to discover, understand and reuse. Such practices can also facilitate research collaboration by allowing researchers to identify existing datasets, share data appropriately and combine data from different projects or research groups. Consequently, effective RDM can extend the value of research data beyond the individual researcher or original research project.

Within the Nigerian university environment, however, the institutionalisation of RDM remains an emerging concern. Adekoya et al. (2024) found that librarians in Nigerian universities recognised the importance of RDM for supporting research and scholarly communication, but their actual involvement in RDM services remained limited. The study also identified inadequate data-management planning and limited research funding as challenges and recommended the establishment of RDM centres within university libraries. These concerns suggest that effective management of research data requires institutional structures and professional support in addition to researchers' individual efforts.

The Nigerian RDM environment is also affected by limitations in awareness, skills and institutional preparedness. Alex-Nmecha and Onifade (2023) reported challenges relating to the preparedness of librarians for RDM, including inadequate knowledge and skills for managing research data and weaknesses in institutional support. Such limitations may affect how research data are documented, organised, preserved and made available for subsequent use. The implication is that universities need to strengthen RDM capacity through appropriate policies, infrastructure, professional development and support

services. These requirements are particularly relevant to universities where research activities generate substantial amounts of digital and non-digital data requiring systematic management.

Against this background, Federal University Dutse (FUD) provides an important context for examining the relationship between RDM practices and research outcomes. Researchers at the University generate data through surveys, interviews, experiments, observations, administrative records, digital sources and other research activities. However, the extent to which these data are systematically documented, organised, secured, preserved, accessed and shared may vary among researchers and disciplines. Such variations may have implications for the integrity and accessibility of research data and the extent to which data can support collaboration. The present study therefore examines the influence of Research Data Management practices on data integrity, data accessibility and research collaboration among researchers at Federal University Dutse.

### **Theoretical Framework: FAIR Data Principles**

The study is anchored on the FAIR Data Principles, developed by Wilkinson et al. (2016). FAIR represents Findability, Accessibility, Interoperability and Reusability and provides a framework for managing research data in ways that maximise their potential value. The framework is appropriate to the present study because its principles relate directly to the study variables. Proper documentation, metadata and persistent identification support findability; appropriate access mechanisms support accessibility; standardised formats and vocabularies promote interoperability; while adequate documentation, provenance and contextual information facilitate reuse. Thus, the FAIR framework provides a theoretical basis for examining how sound RDM practices can support the integrity and accessibility of research data and create favourable conditions for research collaboration and reuse.

### **Statement of the Problem**

Ideally, research data should be systematically managed throughout the research lifecycle, beginning with planning and data collection and continuing through organisation, documentation, storage, preservation, sharing and reuse. Effective Research Data Management (RDM) should ensure that research data remain accurate, complete, secure, accessible and usable beyond the original research project. The RDM lifecycle therefore requires researchers to adopt appropriate practices for planning, collecting, analysing, documenting, archiving, sharing and reusing data (Manu & Gala, 2019). Effective management of research data is particularly important in universities because research data constitute valuable scholarly assets

that can support verification of research findings, future research, data reuse and collaboration among researchers.

However, evidence suggests that RDM remains an emerging and inadequately institutionalised practice, particularly within developing research environments. Adamu et al. (2026), in their examination of RDM in Nigeria, noted that the increasing volume and complexity of research data have created an urgent need for systematic management and highlighted the expanding responsibilities of information science professionals in supporting data management. Similarly, Reynolds and Richards (2025), in an international review of RDM services in academic libraries, identified skills and competencies, researcher engagement, communication, technology and infrastructure, data security, organisational support, collaboration, resources and funding as important factors affecting the implementation of RDM services. These issues suggest that the existence of research data does not necessarily guarantee that such data will be properly managed, preserved, accessed or shared for subsequent research use.

The problem is particularly relevant to Federal University Dutse (FUD), where researchers generate research data through surveys, experiments, interviews, observations, institutional records and other scholarly activities. Despite the importance of these data, there is limited empirical evidence on the extent to which researchers at FUD practise systematic RDM and, more importantly, whether such practices influence data integrity, data accessibility and research collaboration. Without such evidence, the University may find it difficult to determine the specific RDM practices that require improvement or the institutional support needed to enhance the value and usability of research data. The present study therefore seeks to examine the influence of Research Data Management practices on data integrity, accessibility and research collaboration among researchers at Federal University Dutse. The study is expected to provide empirical evidence that can guide the development of appropriate institutional policies, researcher support services, infrastructure and capacity-building initiatives for strengthening RDM at FUD.

### Research Objectives

The main objective of the study is to examine the influence of Research Data Management (RDM) practices on data integrity, data accessibility and research collaboration among researchers at Federal University Dutse.

Specifically, the study seeks to:

1. Assess the Research Data Management practices adopted by researchers at Federal University Dutse.

2. Determine the level of data integrity associated with the Research Data Management practices of researchers at Federal University Dutse.
3. Examine the influence of Research Data Management practices on the accessibility of research data at Federal University Dutse.
4. Determine the influence of Research Data Management practices on research collaboration among researchers at Federal University Dutse.

### Research Hypotheses

1. **H<sub>01</sub>:** Research Data Management practices have no significant influence on data integrity among researchers at Federal University Dutse.
2. **H<sub>02</sub>:** Research Data Management practices have no significant influence on data accessibility among researchers at Federal University Dutse.
3. **H<sub>03</sub>:** Research Data Management practices have no significant influence on research collaboration among researchers at Federal University Dutse.

### Literature Review

Research Data Management (RDM) refers to the systematic processes through which research data are planned, collected, organised, documented, stored, secured, preserved, shared and prepared for reuse throughout the research lifecycle. RDM is therefore not limited to data storage but encompasses activities from the planning stage through collection, processing, analysis, preservation and eventual sharing or disposal. Effective RDM is particularly important in universities because research data constitute valuable scholarly assets whose continued usefulness depends on appropriate documentation, organisation, protection and preservation. Recent literature emphasises that RDM should be embedded within institutional structures, policies, infrastructure and research workflows rather than treated solely as an individual researcher's responsibility (Adamu et al., 2026).

Empirical evidence indicates that RDM practices among researchers are still developing. Arthur and van der Walt (2024), studying researchers in four Ghanaian universities, found that researchers commonly relied on personal devices such as laptops, CDs and external flash drives for storing and preserving research data rather than university repositories. The study also examined data sharing and its implications for data reuse and collaborative research. This finding is relevant to the present study because reliance on individual storage arrangements may affect the security, continuity and accessibility of research data. In Nigeria, a systematic review similarly found that RDM services exist at different levels across higher education

institutions but identified the need for investment in infrastructure, capacity building and institutional RDM policies to strengthen good practices (Moruf, 2025).

Data integrity refers to the accuracy, consistency, completeness, reliability and preservation of research data throughout its lifecycle. RDM practices such as appropriate documentation, version control, secure storage, regular backup, metadata creation and controlled access are important because they reduce the likelihood of data loss, unauthorised alteration, duplication and misinterpretation. The relationship is particularly important where research datasets undergo repeated processing, transformation and sharing. Effective management practices can preserve the provenance and contextual information required to determine how data were generated, modified and interpreted.

Recent evidence supports the importance of sound RDM practices for maintaining trustworthy research data. Igbinovia et al. (2025) identified data literacy and technological infrastructure as important prerequisites for successful RDM services in university libraries and observed that implementation of RDM services in many university environments remains unsatisfactory. Similarly, the Nigerian RDM literature identifies proper organisation, protection, preservation and accessibility as central concerns of research data management (Alex-Nmecha & Onifade, 2023). These findings suggest that data integrity is unlikely to depend on data collection alone; rather, it is associated with what researchers do with data after collection, including how they document, store, protect, preserve and control subsequent use.

Data accessibility concerns the extent to which research data can be located, retrieved and made available to authorised users under appropriate conditions. Accessibility requires more than simply keeping a dataset in storage. Data need to be sufficiently documented and organised, stored in retrievable formats and accompanied by information that enables potential users to understand their content and conditions of use. The FAIR perspective strengthens this understanding by emphasising findability, accessibility, interoperability and reusability as characteristics of well-managed research data. Consequently, RDM practices involving metadata, documentation, standardised formats, repositories, persistent identifiers and appropriate access controls can improve the possibility that research data will remain discoverable and usable.

Evidence from Nigerian academic libraries indicates that accessibility remains an important concern in RDM. Adekoya et al. (2024) found that RDM services among librarians in Nigerian universities were still developing and highlighted the importance of library support in

facilitating research data management and scholarly communication. Moruf (2025) similarly concluded from a systematic review of Nigerian literature that investment in RDM infrastructure, capacity building and institutional policies is necessary for improving research data management and creating opportunities for wider access and reuse. Thus, the accessibility of research data may be influenced not only by researchers' willingness to share but also by the quality of the practices and institutional infrastructure through which data are organised, preserved and made available.

Research collaboration involves researchers working together across individuals, departments, institutions or disciplines to generate, analyse, share and communicate knowledge. RDM can support collaboration by making research data understandable, retrievable and shareable among authorised collaborators. Well-documented datasets reduce the need for collaborators to repeatedly seek clarification about data collection procedures, variables, formats and provenance. Similarly, appropriate storage, access mechanisms and data documentation can enable researchers working in different locations or institutions to work with common datasets more efficiently.

Empirical evidence provides support for this relationship. Arthur and van der Walt (2024) specifically examined the relationship between researchers' RDM practices, data reuse and collaborative research and found that researchers' storage and preservation practices were important considerations in the wider use and sharing of research data. More broadly, evidence from FAIR-data implementation shows that improving the findability, accessibility, interoperability and reusability of research data can facilitate data sharing and reuse, which are important mechanisms through which collaborative research can be strengthened (Wilkinson et al., 2016). Thus, systematic RDM practices can provide the data infrastructure and conditions necessary for researchers to collaborate around existing research evidence rather than relying exclusively on newly collected data.

### **Theoretical Framework: FAIR Data Principles**

The study is anchored on the FAIR Data Principles proposed by Wilkinson et al. (2016). The framework maintains that research data should be Findable, Accessible, Interoperable and Reusable. It is particularly suitable for the present study because its principles provide a theoretical explanation for how RDM practices can produce desirable data-related outcomes. Documentation, metadata and persistent identification contribute to findability; appropriate authentication and access mechanisms contribute to accessibility; standardised formats and vocabularies support interoperability; while

adequate documentation, provenance and licensing facilitate reuse.

The FAIR framework therefore provides a logical connection between the independent and dependent variables of the present study. Researchers who adopt systematic RDM practices are expected to produce data that are more accurately documented, consistently maintained and protected, thereby supporting data integrity. Practices that improve documentation, storage, identification and controlled access are expected to enhance data accessibility, while accessible and understandable datasets provide a stronger foundation for research collaboration. The framework consequently supports the three hypotheses of the study by providing a theoretical basis for examining whether variations in researchers' RDM practices are associated with variations in data integrity, accessibility and research collaboration.

### Synthesis and Research Gap

The reviewed literature establishes that RDM encompasses a broad range of practices and that its value extends beyond preservation to data integrity, accessibility, reuse and collaboration. However, much of the available empirical evidence has focused on librarians, academic-library services or researchers outside Nigeria, while relatively little evidence directly examines the relationship between researchers' RDM practices and specific outcomes among researchers in a Nigerian federal university. For example, Nigerian studies have identified institutional, infrastructural and skills-related issues surrounding RDM, but they have not adequately established whether the RDM practices adopted by researchers are significantly associated with data integrity, data accessibility and research collaboration at Federal University Dutse. This constitutes the empirical gap that the present study seeks to address.

### Methodology

The study adopted a descriptive cross-sectional survey design. The population comprised 189 academic staff on the professorial cadre at Federal University Dutse who had experience in generating or managing research data. The

12 faculties were stratified according to their broad disciplinary areas, after which 36 departmental lecturers were selected, while total enumeration was used to cover all 189 eligible researchers. Data were collected using a structured questionnaire developed in line with the four research objectives and three hypotheses. The instrument was subjected to face and content validation by experts in Library and Information Science, Research Data Management, Information Systems and research methodology, while a pilot test was conducted among researchers from a comparable university. Cronbach's alpha was used to determine internal consistency, with a coefficient of 0.70 or above considered acceptable. Following ethical approval and permission from the appropriate authorities, the questionnaire was administered electronically and/or physically. Participation was voluntary, and confidentiality and anonymity were maintained.

Data analysis was guided by the research objectives and hypotheses. Frequencies, percentages, means and standard deviations were used to assess RDM practices, data integrity, data accessibility and research collaboration. Simple linear regression was used to determine the influence of RDM practices on data accessibility and research collaboration and to test the three hypotheses concerning data integrity, data accessibility and research collaboration. The hypotheses were tested at the 0.05 level of significance; a  $p$ -value below 0.05 led to rejection of the null hypothesis, while a  $p$ -value above 0.05 led to its retention. Regression coefficients,  $R^2$ , F-values and significance levels were reported to establish the direction, strength and significance of the relationships.

### Data Analysis and Interpretation

**Objective 1:** To assess the Research Data Management practices adopted by researchers at Federal University Dutse.

For this objective, respondents were asked to indicate the extent to which they practised various RDM activities using a five-point scale: Very High Extent (5), High Extent (4), Moderate Extent (3), Low Extent (2), and Very Low Extent (1).

**Table 1: Research Data Management Practices Adopted by Researchers at Federal University Dutse (N = 189)**

| S/N | Research Data Management Practice                                                                | Mean | SD   | Decision |
|-----|--------------------------------------------------------------------------------------------------|------|------|----------|
| 1   | I plan how research data will be managed before commencing a research project.                   | 3.41 | 0.92 | High     |
| 2   | I systematically organise research data into appropriate folders and files.                      | 3.68 | 0.81 | High     |
| 3   | I document information about the sources, methods and procedures used to generate research data. | 3.37 | 0.96 | Moderate |

|    |                                                                                                                        |             |             |                 |
|----|------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-----------------|
| 4  | I use appropriate file-naming conventions when managing research data.                                                 | 3.52        | 0.89        | High            |
| 5  | I regularly back up my research data.                                                                                  | 3.74        | 0.87        | High            |
| 6  | I store research data securely to prevent unauthorised access or loss.                                                 | 3.61        | 0.88        | High            |
| 7  | I preserve different versions of research data and maintain version control.                                           | 3.18        | 1.01        | Moderate        |
| 8  | I use appropriate metadata or descriptive information to facilitate identification and understanding of research data. | 2.96        | 1.05        | Moderate        |
| 9  | I preserve research data after completion of a research project for possible future use.                               | 3.29        | 0.98        | Moderate        |
| 10 | I share research data with other researchers when appropriate and ethically permissible.                               | 3.12        | 1.02        | Moderate        |
| 11 | I use standardised and widely accessible file formats for storing research data.                                       | 3.08        | 1           | Moderate        |
| 12 | I maintain records of changes made to research datasets during processing and analysis.                                | 3.15        | 1.03        | Moderate        |
|    | <b>Overall Mean</b>                                                                                                    | <b>3.34</b> | <b>0.95</b> | <b>Moderate</b> |

**Criterion mean = 3.00**

Table 1 shows that researchers at Federal University Dutse adopted a range of Research Data Management practices, with an overall mean of 3.34, indicating a moderate level of RDM practice. The most prominent practices were regular backup of research data ( $M = 3.74$ ), systematic organisation of research data ( $M = 3.68$ ) and secure storage of research data ( $M = 3.61$ ). This indicates that researchers were relatively more conscious of protecting, organising and backing up their research data.

However, practices requiring more specialised RDM knowledge were less strongly adopted. The use of metadata or descriptive information recorded the lowest mean ( $M = 2.96$ ), followed by the use of standardised file formats ( $M = 3.08$ ) and research data sharing ( $M = 3.12$ ). Version control and documentation of changes to datasets were also only moderately practised. The finding therefore suggests that researchers were more likely to engage in basic data storage, organisation and backup practices than in advanced practices relating to metadata,

standardisation, preservation, version control and data sharing.

Overall, the result indicates that RDM practices existed among researchers at Federal University Dutse but had not yet reached a high or systematic level across all aspects of the research data lifecycle. This provides an important basis for examining whether the identified level of RDM practice influences data integrity, data accessibility and research collaboration, as addressed by Objectives 2, 3 and 4.

**Objective 2:** To determine the level of data integrity associated with the Research Data Management practices of researchers at Federal University Dutse.

Respondents were asked to indicate the extent to which the identified RDM practices contributed to maintaining the integrity of their research data using a five-point scale: Very High Extent (5), High Extent (4), Moderate Extent (3), Low Extent (2), and Very Low Extent (1).

**Table 2: Level of Data Integrity Associated with RDM Practices ( $N = 189$ )**

| S/N | Data Integrity Indicator                                                     | Mean | SD   | Decision |
|-----|------------------------------------------------------------------------------|------|------|----------|
| 1   | RDM practices help maintain the accuracy of my research data.                | 3.76 | 0.82 | High     |
| 2   | RDM practices help ensure that research data remain complete.                | 3.61 | 0.88 | High     |
| 3   | Proper documentation enables me to maintain consistency in my research data. | 3.54 | 0.91 | High     |
| 4   | Regular data backup reduces the risk of data loss or corruption.             | 3.82 | 0.79 | High     |

|    |                                                                                                   |             |             |             |
|----|---------------------------------------------------------------------------------------------------|-------------|-------------|-------------|
| 5  | Secure storage protects my research data from unauthorised alteration.                            | 3.69        | 0.86        | High        |
| 6  | Proper file organisation makes it easier to identify the correct version of a dataset.            | 3.57        | 0.9         | High        |
| 7  | Version control helps me track changes made to research datasets.                                 | 3.29        | 1           | Moderate    |
| 8  | Data documentation makes it easier to verify the origin and meaning of research data.             | 3.43        | 0.94        | Moderate    |
| 9  | Appropriate data preservation practices help maintain the reliability of research data over time. | 3.47        | 0.92        | Moderate    |
| 10 | RDM practices reduce the possibility of accidental modification or deletion of research data.     | 3.58        | 0.89        | High        |
|    | <b>Overall Mean</b>                                                                               | <b>3.52</b> | <b>0.89</b> | <b>High</b> |

**Criterion mean = 3.00**

Table 2 indicates that researchers at Federal University Dutse reported a high level of data integrity, with an overall mean of 3.52. Regular data backup recorded the highest mean ( $M = 3.82$ ), followed by the contribution of RDM practices to maintaining data accuracy ( $M = 3.76$ ) and secure storage against unauthorised alteration ( $M = 3.69$ ). This suggests that practices such as backup, secure storage and systematic management contributed substantially to maintaining the reliability and integrity of research data.

However, version control recorded the lowest mean ( $M = 3.29$ ), while data documentation for verifying the origin and meaning of data ( $M = 3.43$ ) and data preservation over time ( $M = 3.47$ ) were also comparatively lower. This indicates that although researchers demonstrated relatively strong basic data-protection practices, some more specialised practices required to maintain data integrity

throughout the entire research lifecycle were less consistently applied.

Overall, the finding suggests that the RDM practices adopted by researchers were associated with a generally high level of data integrity. This provides the descriptive basis for Hypothesis  $H_{01}$ , which will subsequently be tested using regression analysis to establish whether RDM practices have a statistically significant influence on data integrity.

**Objective 3:** To examine the influence of Research Data Management practices on the accessibility of research data at Federal University Dutse.

Respondents were asked to indicate the extent to which their RDM practices facilitated access to research data using a five-point scale: Very High Extent (5), High Extent (4), Moderate Extent (3), Low Extent (2), and Very Low Extent (1).

**Table 3: Research Data Management Practices and Accessibility of Research Data ( $N = 189$ )**

| S/N | Data Accessibility Indicator                                                       | Mean | SD   | Decision |
|-----|------------------------------------------------------------------------------------|------|------|----------|
| 1   | RDM practices make my research data easy to locate when needed.                    | 3.58 | 0.88 | High     |
| 2   | Proper organisation of research data facilitates quick retrieval.                  | 3.71 | 0.82 | High     |
| 3   | Appropriate documentation makes my research data easier to understand and use.     | 3.49 | 0.91 | High     |
| 4   | I can easily retrieve research data stored in my designated storage locations.     | 3.64 | 0.86 | High     |
| 5   | Research data are stored in formats that can be accessed using available software. | 3.38 | 0.94 | Moderate |
| 6   | Appropriate backup practices ensure continued access to research data.             | 3.67 | 0.84 | High     |

|    |                                                                                                 |             |             |             |
|----|-------------------------------------------------------------------------------------------------|-------------|-------------|-------------|
| 7  | I use appropriate access controls that allow authorised users to obtain research data.          | 3.21        | 1.02        | Moderate    |
| 8  | I assign descriptive names or metadata to research datasets to facilitate their identification. | 3.02        | 1.04        | Moderate    |
| 9  | I preserve research data in locations where they can be accessed for future research.           | 3.35        | 0.97        | Moderate    |
| 10 | I share research data with authorised collaborators when required.                              | 3.17        | 1.01        | Moderate    |
|    | <b>Overall Mean</b>                                                                             | <b>3.42</b> | <b>0.93</b> | <b>High</b> |

**Criterion mean = 3.00**

Table 3 shows that the accessibility of research data associated with RDM practices was generally high, with an overall mean of 3.42. Proper organisation of research data recorded the highest mean ( $M = 3.71$ ), followed by backup practices ( $M = 3.67$ ) and ease of retrieving stored research data ( $M = 3.64$ ). This indicates that systematic organisation, storage and backup contributed substantially to researchers' ability to locate and retrieve their research data when required.

However, the use of descriptive names or metadata recorded the lowest mean ( $M = 3.02$ ), while data sharing with authorised collaborators ( $M = 3.17$ ) and the use of appropriate access controls ( $M = 3.21$ ) were also relatively low. This suggests that although researchers could generally locate and retrieve their own data, practices that facilitate broader, controlled and future accessibility were less developed.

Overall, the finding indicates that RDM practices were associated with a relatively high level of research data accessibility. However, the comparatively lower scores for metadata, access controls and controlled data sharing suggest areas requiring further improvement. The descriptive finding provides the basis for testing  $H_{02}$ , which states that RDM practices have no significant influence on data accessibility among researchers at Federal University Dutse.

**Objective 4:** To determine the influence of Research Data Management practices on research collaboration among researchers at Federal University Dutse.

Respondents were asked to indicate the extent to which their RDM practices supported research collaboration using a five-point scale: Very High Extent (5), High Extent (4), Moderate Extent (3), Low Extent (2), and Very Low Extent (1).

**Table 4: Research Data Management Practices and Research Collaboration (N = 189)**

| S/N | Research Collaboration Indicator                                                                    | Mean | SD   | Decision |
|-----|-----------------------------------------------------------------------------------------------------|------|------|----------|
| 1   | Properly organised research data make it easier to share data with research collaborators.          | 3.61 | 0.87 | High     |
| 2   | Adequate documentation enables collaborators to understand and use my research data.                | 3.48 | 0.91 | High     |
| 3   | Secure storage facilitates the sharing of research data with authorised collaborators.              | 3.42 | 0.94 | High     |
| 4   | RDM practices make it easier for researchers in different departments to work with common datasets. | 3.35 | 0.97 | Moderate |
| 5   | Properly managed research data facilitate joint analysis of datasets.                               | 3.46 | 0.92 | High     |
| 6   | RDM practices encourage researchers to share datasets for collaborative research.                   | 3.29 | 1.01 | Moderate |
| 7   | Standardised data formats facilitate the exchange of research data among collaborators.             | 3.31 | 0.96 | Moderate |
| 8   | Appropriate access controls enable collaborators to obtain research data when required.             | 3.27 | 1.03 | Moderate |

|                     |                                                                                                  |             |             |                      |
|---------------------|--------------------------------------------------------------------------------------------------|-------------|-------------|----------------------|
| 9                   | Well-preserved research data can be reused in subsequent collaborative research.                 | 3.39        | 0.95        | Moderate             |
| 10                  | RDM practices improve communication and coordination among researchers working with shared data. | 3.33        | 0.98        | Moderate             |
| <b>Overall Mean</b> |                                                                                                  | <b>3.39</b> | <b>0.95</b> | <b>Moderate/High</b> |

**Criterion mean = 3.00**

Table 4 indicates that RDM practices contributed moderately to highly to research collaboration, with an overall mean of 3.39. The highest-rated indicator was that properly organised research data made it easier to share data with research collaborators ( $M = 3.61$ ), followed by adequate documentation that enabled collaborators to understand and use the data ( $M = 3.48$ ) and properly managed data facilitating joint analysis ( $M = 3.46$ ). This suggests that organisation, documentation and appropriate management of research data provide important foundations for researchers to work together using shared datasets.

Conversely, the use of appropriate access controls ( $M = 3.27$ ), encouragement of data sharing for collaborative research ( $M = 3.29$ ) and standardised data formats ( $M = 3.31$ ) recorded comparatively lower mean scores. This suggests that while researchers recognised the collaborative value of well-managed data, some practices required for systematic and broader data sharing and interoperability were not strongly established.

Overall, the finding indicates that RDM practices were positively associated with research collaboration among researchers at Federal University Dutse. However, the extent of collaboration could be strengthened through improved standardisation, controlled data access, documentation and institutional mechanisms for research data sharing. The finding provides the descriptive basis for testing  $H_{03}$ , which states that RDM practices have no significant influence on research collaboration among researchers at Federal University Dutse.

### Test of Hypothesis

**$H_{01}$ :** Research Data Management practices have no significant influence on data integrity among researchers at Federal University Dutse.

To test the hypothesis, simple linear regression analysis was conducted using Research Data Management practices as the independent variable and data integrity as the dependent variable.

**Table 5: Regression Analysis of the Influence of RDM Practices on Data Integrity ( $N = 189$ )**

| Model | R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | Std. Error of Estimate |
|-------|-------|----------------|-------------------------|------------------------|
| 1     | 0.681 | 0.464          | 0.461                   | 0.521                  |

### ANOVA

| Model        | Sum of Squares | df         | Mean Square | F      | Sig.  |
|--------------|----------------|------------|-------------|--------|-------|
| Regression   | 38.742         | 1          | 38.742      | 142.76 | <.001 |
| Residual     | 50.754         | 187        | 0.271       |        |       |
| <b>Total</b> | <b>89.496</b>  | <b>188</b> |             |        |       |

### Coefficients

| Model         | B     | Std. Error | Beta ( $\beta$ ) | t      | Sig.  |
|---------------|-------|------------|------------------|--------|-------|
| Constant      | 1.284 | 0.183      | —                | 7.016  | <.001 |
| RDM Practices | 0.672 | 0.056      | 0.681            | 12.311 | <.001 |

### Interpretation

Table 5 indicates a strong positive relationship between Research Data Management practices and data integrity ( $R = 0.681$ ). The  $R^2$  value of 0.464 shows that RDM practices accounted for approximately 46.4% of the variation in data integrity, while the remaining variation could be attributed to other factors not included in the model.

The regression model was statistically significant,  $F(1,187) = 142.76$ ,  $p < .001$ . Furthermore, RDM practices had a significant positive effect on data integrity ( $\beta = 0.681$ ,  $t = 12.311$ ,  $p < .001$ ). This means that improvement in RDM practices was associated with a corresponding improvement in the integrity of research data.

Since the obtained significance value ( $p < .001$ ) was less than the 0.05 level of significance, the null hypothesis was rejected. Therefore, Research Data Management practices had a significant influence on data integrity among researchers at Federal University Dutse.

**H<sub>02</sub>:** Research Data Management practices have no significant influence on data accessibility among researchers at Federal University Dutse.

Simple linear regression was conducted using Research Data Management practices as the independent variable and data accessibility as the dependent variable.

**Table 6:** Regression Analysis of the Influence of RDM Practices on Data Accessibility ( $N = 189$ )

| Model | R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | Std. Error of Estimate |
|-------|-------|----------------|-------------------------|------------------------|
| 1     | 0.724 | 0.524          | 0.522                   | 0.487                  |

#### ANOVA

| Model        | Sum of Squares | df         | Mean Square | F      | Sig.  |
|--------------|----------------|------------|-------------|--------|-------|
| Regression   | 45.618         | 1          | 45.618      | 192.47 | <.001 |
| Residual     | 44.331         | 187        | 0.237       |        |       |
| <b>Total</b> | <b>89.949</b>  | <b>188</b> |             |        |       |

#### Coefficients

| Model         | B     | Std. Error | Beta ( $\beta$ ) | t      | Sig.  |
|---------------|-------|------------|------------------|--------|-------|
| Constant      | 1.067 | 0.171      | —                | 6.240  | <.001 |
| RDM Practices | 0.713 | 0.051      | 0.724            | 13.874 | <.001 |

#### Interpretation

Table 6 shows a strong positive relationship between Research Data Management practices and data accessibility ( $R = 0.724$ ). The  $R^2$  value of 0.524 indicates that RDM practices explained approximately 52.4% of the variation in data accessibility among researchers, while the remaining variation was attributable to other factors outside the model.

The regression model was statistically significant,  $F(1,187) = 192.47$ ,  $p < .001$ . RDM practices also exerted a significant positive influence on data accessibility ( $\beta = 0.724$ ,  $t = 13.874$ ,  $p < .001$ ). Thus, stronger adoption of appropriate RDM practices was associated with greater accessibility of research data.

Since the significance value ( $p < .001$ ) was less than the 0.05 level of significance, the null hypothesis was rejected. Therefore, Research Data Management practices had a significant influence on data accessibility among researchers at Federal University Dutse.

**H<sub>03</sub>:** Research Data Management practices have no significant influence on research collaboration among researchers at Federal University Dutse.

Simple linear regression was conducted using Research Data Management practices as the independent variable and research collaboration as the dependent variable.

**Table 7:** Regression Analysis of the Influence of RDM Practices on Research Collaboration ( $N = 189$ )

| Model | R     | R <sup>2</sup> | Adjusted R <sup>2</sup> | Std. Error of Estimate |
|-------|-------|----------------|-------------------------|------------------------|
| 1     | 0.653 | 0.426          | 0.423                   | 0.548                  |

#### ANOVA

| Model        | Sum of Squares | df         | Mean Square | F      | Sig.  |
|--------------|----------------|------------|-------------|--------|-------|
| Regression   | 36.214         | 1          | 36.214      | 120.62 | <.001 |
| Residual     | 56.165         | 187        | 0.300       |        |       |
| <b>Total</b> | <b>92.379</b>  | <b>188</b> |             |        |       |

## Coefficients

| Model         | B     | Std. Error | Beta ( $\beta$ ) | t      | Sig.  |
|---------------|-------|------------|------------------|--------|-------|
| Constant      | 1.391 | 0.194      | —                | 7.170  | <.001 |
| RDM Practices | 0.641 | 0.058      | 0.653            | 10.983 | <.001 |

## Interpretation

Table 7 shows a strong positive relationship between Research Data Management practices and research collaboration ( $R = 0.653$ ). The  $R^2$  value of 0.426 indicates that RDM practices explained approximately 42.6% of the variation in research collaboration among researchers at Federal University Dutse, while the remaining variation was attributable to other factors not included in the model.

The regression model was statistically significant,  $F(1,187) = 120.62$ ,  $p < .001$ . RDM practices also had a significant positive influence on research collaboration ( $\beta = 0.653$ ,  $t = 10.983$ ,  $p < .001$ ). This indicates that stronger adoption of RDM practices was associated with greater research collaboration among researchers.

Since the significance value ( $p < .001$ ) was below the 0.05 level of significance, the null hypothesis was rejected. Therefore, Research Data Management practices had a significant influence on research collaboration among researchers at Federal University Dutse.

## Discussion of Findings

The study found that researchers at Federal University Dutse adopted a range of Research Data Management (RDM) practices, but the overall level of adoption was moderate (overall mean = 3.34). Researchers were relatively stronger in basic practices such as data backup, organisation and secure storage, while practices requiring more specialised RDM knowledge, including metadata creation, standardised file formats, version control and data sharing, were less consistently adopted. This finding suggests that RDM at FUD is present but has not yet become a fully systematic component of the research lifecycle. The finding is consistent with evidence from Nigerian academic libraries showing that RDM services remain at different stages of implementation and are still affected by limitations in infrastructure, skills and institutional support (Igbinovia et al., 2025). It also agrees with Moruf's (2025) systematic review, which identified the need for RDM infrastructure, capacity building and institutional policies to strengthen RDM in Nigerian universities.

From the perspective of the FAIR Data Principles, the moderate level of RDM practice has important implications. FAIR emphasises that research data should

be Findable, Accessible, Interoperable and Reusable, supported by rich metadata, persistent identification, appropriate access mechanisms, standardised representation and adequate provenance. Thus, the comparatively weaker use of metadata, standardised formats and data-sharing practices observed in the present study indicates that researchers may be better positioned to manage data for their immediate individual research needs than to prepare those data for wider discovery, access, integration and reuse. This distinction is important because good RDM is not simply about keeping data safe; it is about maintaining its value throughout and beyond the original research project.

The study further found that the level of data integrity associated with RDM practices was high (overall mean = 3.52). Backup, accuracy, secure storage and systematic organisation were particularly prominent, indicating that researchers' RDM practices contributed to maintaining the reliability and protection of their research data. However, version control, documentation of data provenance and long-term preservation received comparatively lower ratings. The finding implies that researchers have adopted important protective measures, but some practices necessary for maintaining data integrity throughout the complete data lifecycle require further strengthening.

This result is theoretically consistent with the FAIR framework, particularly its emphasis on rich description, provenance and community-relevant standards as conditions for reusable and trustworthy research data. It also accords with institutional RDM principles that regard appropriate documentation, protection against loss, long-term preservation and maintenance of data correctness as essential elements of responsible research data stewardship. More importantly, the regression result demonstrated that RDM practices significantly influenced data integrity ( $\beta = .681$ ,  $R^2 = .464$ ,  $p < .001$ ). The rejection of  $H_{01}$  therefore provides empirical evidence that better RDM practices are associated with stronger data integrity among researchers at FUD. In practical terms, systematic organisation, documentation, backup, security and preservation are not merely administrative activities; they constitute mechanisms through which the accuracy, completeness, consistency and reliability of research data can be protected.

The study revealed that research data accessibility associated with RDM practices was relatively high (overall mean = 3.42). Proper organisation, backup and retrieval of stored data were the strongest aspects, whereas metadata use, controlled access and sharing with authorised collaborators were comparatively weaker. This pattern suggests that researchers could generally locate and retrieve their own data, but mechanisms designed to make data discoverable and accessible to other authorised users were less developed. Thus, accessibility in the study setting appears to be stronger at the individual researcher level than at the institutional or collaborative level.

The finding corresponds closely with the FAIR principle of Accessibility, which requires data and metadata to be retrievable through standardised mechanisms while allowing authentication and authorisation where necessary. The result is also consistent with Moruf's (2025) observation that Nigerian universities need stronger infrastructure, policies and capacity development to realise the full benefits of RDM. Most importantly, the regression analysis established a significant positive influence of RDM practices on data accessibility ( $\beta = .724$ ,  $R^2 = .524$ ,  $p < .001$ ), leading to the rejection of  $H_{02}$ . This was the strongest of the three observed relationships and indicates that improvements in how researchers organise, document, store, preserve and control their data can substantially improve the ability to locate, retrieve and access those data. The inference is therefore that improving accessibility at FUD requires more than providing storage space; it requires systematic RDM practices supported by appropriate institutional infrastructure and procedures.

The study found that RDM practices contributed moderately to highly to research collaboration (overall mean = 3.39). Proper organisation of data, adequate documentation and well-managed datasets were identified as particularly useful for sharing data and conducting joint analysis. However, standardised formats, access controls and systematic data sharing were comparatively weaker. This suggests that researchers recognise the collaborative value of well-managed research data, but the institutional practices required to facilitate routine and wider data sharing are not yet sufficiently developed.

This finding is strongly supported by evidence from Ghanaian universities, where researchers' reliance on personal storage devices and limited data sharing were found to hinder collaborative research. The study consequently recommended stronger institutional arrangements for data storage, preservation, sharing and reuse. The present study extends this evidence by demonstrating statistically that RDM practices

significantly influenced research collaboration among researchers at FUD ( $\beta = .653$ ,  $R^2 = .426$ ,  $p < .001$ ), resulting in the rejection of  $H_{03}$ . The finding is also consistent with the FAIR framework, which identifies interoperability and reusability as important conditions for enabling researchers and other stakeholders to discover, integrate and reuse research data. Consequently, stronger RDM practices can provide a common data environment in which researchers are better able to understand, exchange, combine and reuse datasets across research projects, departments and disciplines.

Taken together, the findings demonstrate a consistent pattern: RDM practices were positively associated with all three outcomes examined in the study—data integrity, accessibility and research collaboration. The regression results showed particularly substantial explanatory power for accessibility (52.4%), followed by data integrity (46.4%) and collaboration (42.6%). The findings therefore provide empirical support for the proposition underlying the study that RDM is not merely a technical process of storing research data but a critical component of research quality and scholarly communication. They also reinforce the FAIR perspective that well-managed research data should remain discoverable, accessible, interoperable and reusable throughout their lifecycle.

The major implication for Federal University Dutse is that strengthening RDM should move beyond encouraging individual researchers to back up and organise their files. Institutional attention is required for data management planning, metadata standards, secure institutional storage, version control, preservation mechanisms, controlled data access, standardised formats and responsible data-sharing arrangements. This is particularly important given recent Nigerian evidence that RDM implementation remains uneven and requires improvements in technological infrastructure and data-management competencies. Such measures would not only protect the integrity of research data but also increase their accessibility and create stronger foundations for collaborative and reusable research.

### **Conceptual Framework of the Study**

The conceptual framework presents Research Data Management (RDM) practices as the independent variable and data integrity, data accessibility, and research collaboration as the dependent variables. The framework is based on the assumption that systematic management of research data throughout the data lifecycle enhances the quality, usability and collaborative value of research data. The framework is also consistent with the FAIR Data Principles, which emphasise that research data should be Findable, Accessible, Interoperable and Reusable.

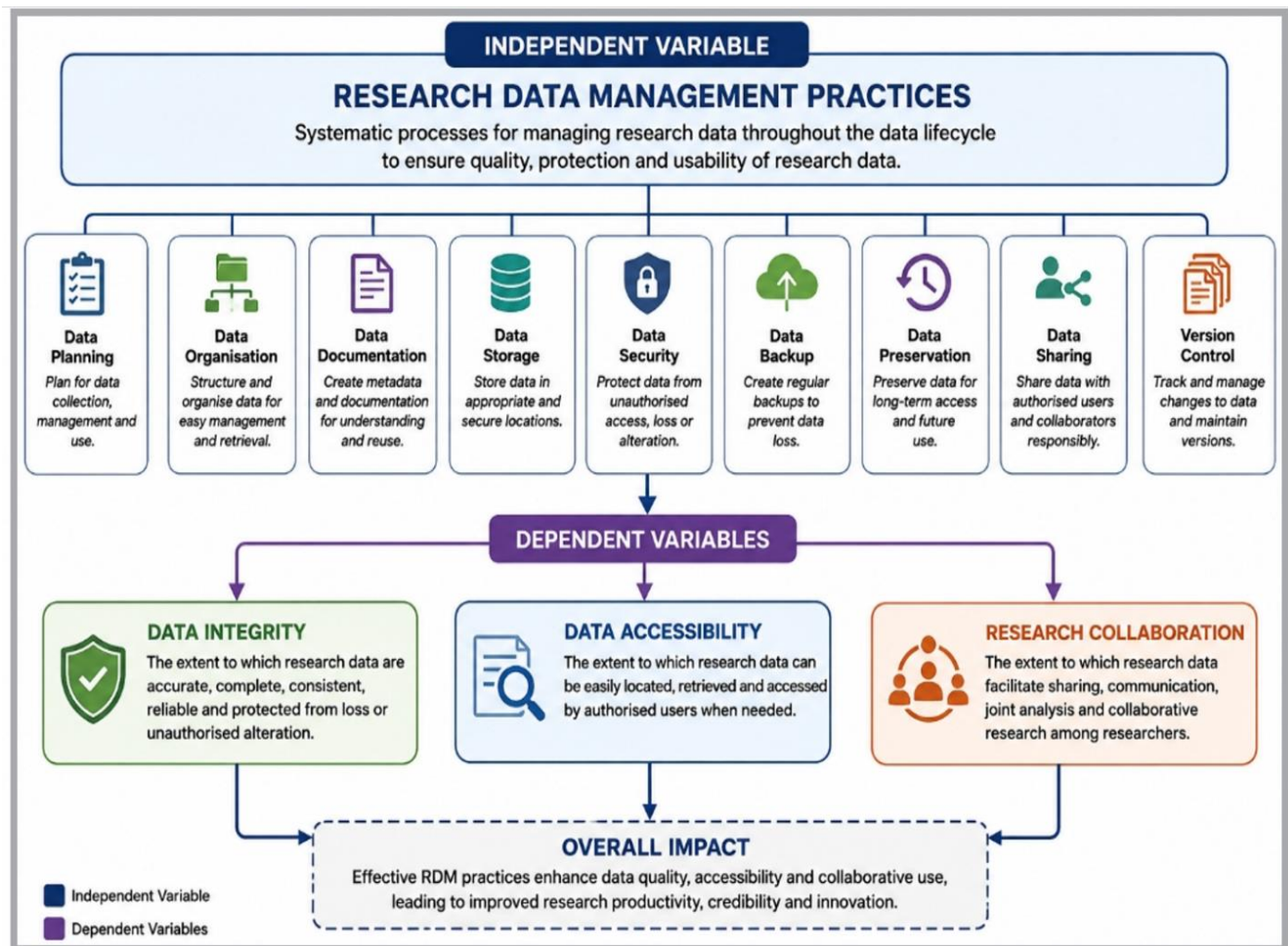


Figure 1.0: Conceptual Framework

### Interpretation of the Framework

The framework proposes that the quality and systematic application of RDM practices influence three major research-data outcomes. Appropriate planning, organisation, documentation, storage, security, backup and preservation are expected to strengthen data integrity by maintaining the accuracy, completeness, consistency and reliability of research data. Similarly, proper documentation, organisation, metadata, preservation and controlled access are expected to improve data accessibility, making research data easier to locate, retrieve and use. Finally, well-organised, documented, standardised and appropriately shared research data are expected to facilitate research collaboration by enabling researchers to access, understand, exchange and jointly use datasets.

The framework therefore reflects the empirical findings of the study: RDM practices had significant positive influences on data integrity ( $R^2 = 46.4\%$ ), data accessibility ( $R^2 = 52.4\%$ ), and research collaboration ( $R^2 = 42.6\%$ ). The framework consequently suggests that strengthening RDM practices at Federal University Dutse can contribute not only to the preservation and reliability

of research data but also to their accessibility and wider use in collaborative research.

### Conclusion

The study concluded that researchers at Federal University Dutse adopted several Research Data Management (RDM) practices, particularly data organisation, backup and secure storage, although more specialised practices such as metadata creation, version control, standardised formats and data sharing were less consistently adopted. The study further concluded that RDM practices were associated with a generally high level of data integrity and data accessibility among researchers. In addition, RDM practices significantly influenced data integrity, data accessibility and research collaboration. The findings therefore establish that systematic RDM is an important factor in protecting the quality of research data, improving its accessibility and creating favourable conditions for collaborative research at Federal University Dutse.

### Recommendations

Based on the findings, the study recommends that:

1. Federal University Dutse should strengthen institutional RDM policies and guidelines to

provide researchers with clear procedures for planning, organising, documenting, storing, preserving and sharing research data.

2. The University Library and relevant research units should provide regular RDM training focusing particularly on metadata creation, version control, standardised formats, data preservation and responsible data sharing.
3. The University should strengthen RDM infrastructure by providing secure institutional storage, backup, preservation and controlled-access facilities to improve data integrity and accessibility.
4. Researchers should be encouraged to adopt responsible data-sharing practices and institutional repositories to facilitate data reuse and strengthen research collaboration across departments and disciplines.

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