



Research Data Management Practices: Preparedness and Challenges among Librarians in Nigeria

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Abstract

There is a global deluge in research data generation in academia and industries as a result of the proliferation of modern information and communication technologies (ICTs). This data deluge has raised concerns that research data be properly managed for easy accessibility, retrieval, use, and reuse for scientific progress. Funding agencies and institutions have gradually set standards or requested researchers to provide necessary data management plans for their research. Based on these backgrounds, this study sought to investigate research data management (RDM) practices, the level of preparedness, and the challenges being faced by librarians in Nigeria. The study adopted a survey research design of quantitative methodology. Questionnaire developed using Google Forms and administered electronically on LIS platforms, was used for data collection from librarians across the six geopolitical zones in Nigeria. The data collected was presented in charts and analysed descriptively. Findings from the study show that lack there is a lack of awareness about RDM policy, and skills to organise research data among librarians. The study recommends the formulation of comprehensive RDM policies, awareness campaigns, and professional development initiatives to address these challenges, fostering a culture of effective RDM in Nigeria.

Keywords: Librarians, Nigeria, Preparedness, Research Data, Research Data Management

Introduction

Research is increasingly data-intensive in today's global academic and scientific landscape, largely driven by advancements in information and communication technologies (ICTs). This surge in the generation, preservation, and dissemination of research data has become integral to addressing critical issues such as climate change, disease outbreaks, resource management, and transportation improvement (Hanson, Snyder, & Albert, 2011, as cited in Ngeno, 2018). As a result, the significance of research data management (RDM) has come to the forefront, challenging traditional perceptions that relegated research data to a secondary status in the scientific and publishing world (Monastersky, 2013).

RDM aims to enhance the efficiency of the research process, elevate research impact, cultivate

a culture of data preservation in repositories, ensure proper maintenance across the data lifecycle, meet grant requirements, promote open access, and facilitate scientific discoveries (Nwabugwu & Godwin, 2020). Despite the potential benefits of RDM, there has been a notable absence of comprehensive investigations into RDM practices, especially regarding the level of preparedness in terms of skills and the challenges faced by librarians in Nigeria. With the increasing reliance on computationally generated data driving scientific advancements, researchers encounter various needs and challenges related to data management, spanning from data collection to dissemination (Tenopir, Birch, & Allard, 2012).

The importance of exploring RDM practices among librarians in Nigeria cannot be overstated. Librarians play multifaceted roles as researchers,

information producers, and knowledge managers, necessitating their active involvement in data management. Sadly, many research publications authored by librarians and researchers in diverse fields often end up on library shelves without effectively harnessing the valuable research data they contain to address societal challenges or foster development. Some librarians work in environments where there are no RDM policies and may not fully comprehend the significance and impact of RDM, while others who recognize the importance may not be adequately prepared due to a lack of the necessary skills to engage in RDM practices. Consequently, this study seeks to investigate the preparedness and challenges associated with RDM practices among librarians in Nigeria.

Statement Of The Problem

In the rapidly evolving landscape of global research, characterised by an increasing reliance on data-intensive methodologies and advancements in ICTs, the effective management of research data has emerged as a critical concern. While the significance of research data management (RDM) is widely acknowledged, there remains a dearth of comprehensive studies examining the availability of RDM policies, the level of preparedness, and the challenges faced by librarians, who play pivotal roles as information stewards, in the context of Nigeria. This research aims to address this gap by investigating the extent of librarians' preparedness to engage in RDM practices and identifying the key challenges they encounter in Nigeria.

Research Objectives

This study will be guided by the following research objectives:

1. find out if library institutions have research data management policies;
2. evaluate skills possessed by librarians concerning RDM practices in Nigeria;
3. Ascertain if library institutions have ICT tools, technical infrastructures, and support systems for RDM practices; and
4. Find out what challenges librarians face in RDM practices in Nigeria.

Research Questions

This study is guided by the following research questions:

1. Do library institutions have research data management policies?

2. What skills are possessed by librarians concerning RDM practices in Nigeria?

3. Do library institutions have ICT tools, technical infrastructures, and support systems for RDM practices?

4. What challenges do librarians face in RDM practices in Nigeria?

Literature Review

Research serves as a mechanism for exploration, investigation, examination, and explanation of new realms, often driven by data and data intensity. Researchers, corporations, and countries generate vast amounts of data daily in various formats, consciously and unconsciously, to address problems, improve decision-making, and enhance operational functions (Kahn et al., 2014). The proliferation of inexpensive data-capture devices has resulted in a significant increase in research-generated data (Cox & Pinfield, 2014). This pervasive use of computing technologies across disciplines demonstrates that an increasing number of researchers are utilising large datasets as part of their research processes. Scientists, academics, and scholars across various fields, including librarians, engage in data collection and analysis to support their research findings.

Research data has received various scholarly definitions. Kirub (2016) defines research data as facts, observations, or experiences on which arguments, theories, or tests are based, which can be numerical, descriptive, or visual. According to the Federation University Australia Act (2019) in Ng'eno (2018), research data encompasses facts, images, observations, computer program results, samples, recordings, measurements, or experiences on which arguments, tests, hypotheses, or other research outputs are founded. The Act further states that this data can take various forms and may be held in any format or media, including laboratory notebooks and computer code, necessary for constructing and evaluating research results.

Hodson and Jones (2013), citing the Royal Society's landmark report, emphasise the potential benefits of research data accessibility and reuse in addressing global challenges. Meanwhile, Erway (2013) argues that research data not only supports validation and reproducibility but can also lead to unexpected collaborations and the exploration of new research areas. Research data management (RDM) has become essential for protecting research data in tangible and intangible formats from irreparable loss,

damage, or obsolescence. However, research data management practices in Nigeria have not received sufficient attention. This gap has arguably hindered the use of research data to address societal challenges, leading to a lack of coherence in policy formulation and implementation. Librarians, as custodians of knowledge, play a crucial role in RDM to maximise the benefits of research for development.

Galetto (2016) defines RDM as an administrative process encompassing the acquisition, validation, storage, protection, and processing of research data to ensure timely accessibility, reliability, and usability. RDM practices rely on policy and institutional frameworks that support research activities and data throughout their lifecycle, from generation to dissemination and reuse (Donnelly, 2012). Lewis (2010), cited in Chiware and Mathe (2015), highlights the potential rewards of RDM, including data sharing, reducing duplication of work, ensuring data longevity, enabling multidisciplinary data use, upholding research integrity, and fostering multidisciplinary research teams. These benefits have driven the development of RDM services in libraries. To offer effective RDM services, librarians must possess the expertise to guide patrons from diverse disciplines in data management and best practices (Donnelly, 2012).

Successful RDM activities depend on adequate preparation, including the availability of RDM policy, skills, and technical infrastructures. Donnelly (2012) points out that RDM practices require skills in data management planning, data storage, metadata creation, adherence to metadata standards, and data sharing procedures. Because librarians operate in complex environments, RDM services require a systematic and holistic approach involving various key players, such as researchers, librarians, administrators, ethics advisors, and IT professionals (Davidson et al., 2014). RDM activities ensure the long-term value and utility of research data for new analyses and study replication, contributing to the expansion of knowledge through innovative breakthroughs (Flores et al., 2015).

The institutionalisation of RDM practices for librarians and researchers in developing countries like Nigeria is crucial. Librarians have to take a leading role in this process to address challenges faced by researchers and RDM service providers. Coates (2014) and Reed (2015) emphasise the importance of conducting environmental scanning, including needs assessments related to technical infrastructure, ICT tools, and staff preparedness. Gathering input from an institution's research stakeholders, including

researchers, librarians, IT teams, and administrators, can identify their known and unknown needs (Coates, 2014; Reed, 2015; Mushi, Pienaar & van Deventer, 2019).

Challenges in RDM practices are diverse and include a lack of awareness, specialized skills among librarians, technical infrastructure fragility, dearth of motivation, inadequate funding, and more (Gibson and Gross, 2013). Librarians' main challenges in offering RDM services are the unavailability or incomprehensive RDM policy, understanding the diversity of research data, domain-specific knowledge gaps, limited skillsets, and the need to balance existing roles with new RDM responsibilities (Cox, Verbaan & Sen, 2012). Kennan and Markauskaite (2015) identify other challenges such as technology obsolescence, fragility, lack of guidelines for good RDM practices, insufficient resources, and a lack of evidence about the best infrastructures. Kahn et al. (2014) conducted a study on skill gaps in RDM, highlighting the significance of database development and software skills. They argue that ICT skills are crucial for proper RDM practices, given the computational nature and formats of research data generated today.

The complexity of RDM services offered by librarians spans researchers at different academic levels, creating a challenge in skills development (Taylor, 2014). The training needs for RDM, influenced by ICTs, should encompass skills in data generation, processing, preservation, dissemination, sharing, and reuse (Henty, 2014). Brown, Bruce, and Kernohan (2015) suggest that RDM professionals should possess skills in policy development, business analysis, advocacy, project management, metadata cataloguing, and data archiving and preservation. These professionals should also have a good working knowledge of data management planning, institutional procedures, legal and ethical issues, researcher workflows, and the IT environment. Overcoming these skill challenges requires collaboration among stakeholders, recognizing the complementary nature of their contributions (Brown et al., 2015).

RDM practices have not received adequate attention in Nigeria, and librarians can play a pivotal role in shaping national research data policy. This study contributes to the understanding of RDM practices among librarians in Nigeria, focusing on their skills and challenges. It underscores the importance of collaboration among stakeholders and the need for a multifaceted approach to address these challenges and advance RDM practices in the country.

Methodology

This study adopted a survey design of quantitative research method for data collection. The design was chosen due to the diverse population of respondents and geographic locations. Majid, Foo, and Zhang (2019), Manu (2018), Anilkumar (2018), Triasih, Rahmi, and Devi (2020) also used survey design in their respective studies of RDM. The respondents for the study comprised librarians from the six geopolitical zones in Nigeria, i.e., North-East, North-Central, North-West, South-East, South-South, and South-West. Questionnaire developed with Google form was the main instrument for data collection. The literature reviewed provided a foundational understanding of the relevant concepts and informed the formulation of questionnaire items. The draft questionnaire was then subjected to expert review; particularly an expert in the field of library science and data management evaluated the questionnaire for relevance, clarity, and comprehensiveness. The validity of the content was established through the expert review process, ensuring that the questionnaire items adequately covered the relevant dimensions of RDM practices, policy, skills, and challenges.

The questionnaire was divided into four sections. Section One (Demographic Data) was used to collect information about respondents' demographic characteristics, such as geographical location, years of professional experience, type of institution, and highest academic qualification. Section Two (RDM Policy) collected information on the availability of RDM policies in the librarians' institutions on research data generation, organisation, storage/preservation, retrieval, dissemination, use, and re-use. Section Three (Librarian Preparedness) assessed the preparedness of librarians in terms of skills related to RDM practices, ICT infrastructures and tools, and support systems. Section Four (Challenges in RDM Practices) focused on the challenges faced by librarians in their RDM practices within the Nigerian context. The questionnaire was administered via social media platforms (WhatsApp and Facebook), specifically, the Nigerian Library Association (NLA) and the National Association of Library and Information Science Educators (NALISE), for eleven (11) days. The findings from the data collected were presented descriptively using percentages to summarise the demographic characteristics of the respondents, the availability of RDM policies, the preparedness of librarians, and the challenges faced in RDM practices. This provided a

clear overview of the survey findings. The results were interpreted in the context of the research objectives and the relevant literature. The findings were used to draw conclusions and make recommendations based on the analysis of the collected data.

Research Findings

Demographic Information

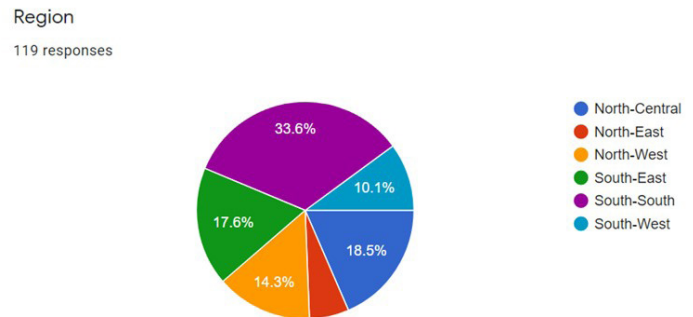


Figure 1: Response rate across the six geopolitical zones in Nigeria

The questionnaire was administered online to librarians across the six geopolitical zones in Nigeria. There were 119 responses to the questionnaire. A breakdown of the response rates as shown in Figure 1 revealed that the South-South region had the highest response rate, 40 respondents (33.6%), and the North-East region had the lowest, 7 respondents (5.9%). Most of the respondents, 82 (68.9%), were librarians working in university libraries, and 44 (37%) had worked for 11 years and above in their respective institutions. This depicts the respondents have sufficient professional experience about services being rendered and RDM activities in their institutions. Meanwhile, more than half of the respondents, 68 (57.1) had their highest academic qualification as a master's degree; and the closest are respondents who have had doctorate degrees, 39 (32.8). This study found from the data collected that research data were available/generated in most of the respondents' institutions. A significant number of the respondents, 56 (47.1%) and 26 (21.8%) either strongly agreed or agreed respectively that research data were available/generated in their institution.

Findings from the study showed that 41 (34.5%) of the librarians agreed and 34 (28.6%) disagreed on the availability of RDM policy for research data management in their institutions. Meanwhile, 30 (25.2%) of the librarians were neutral based on the research finding; which depicts a significant number of the librarians were not certain whether their institutions have an RDM policy on RD generation.

Importantly, it can be inferred from the data collected that more than half of the librarians, i.e., 58.8% either disagreed or were uncertain about the availability of RDM policy on RD generation in their institutions.

Availability of Research Data Management Policy

Question	My institution has RDM policy for research data generation	My institution has RDM policy for research data organisation	My institution has RDM policy for research data storage/preservation	My institution has RDM policy for research data retrieval	My institution has RDM policy for research data dissemination	My institution has RDM policy for research data use and re-use
Strongly Agree	8 (6.7%)	8 (6.7%)	9 (7.6%)	10 (8.4%)	10 (8.4%)	11 (9.2%)
Agree	41 (34.5%)	42 (36.1%)	49 (41.2%)	47 (36.1%)	43 (36.1%)	44 (37%)
Neutral	30 (25.2%)	30 (25.2%)	24 (20.2%)	24 (20.2%)	30 (25.2%)	25 (21%)
Disagree	34 (28.6%)	31 (26.1%)	28 (23.5%)	32 (25.2%)	30 (25.2%)	35 (29.4%)
Strongly Disagree	6 (5%)	8 (6.7%)	9 (7.6%)	6 (5%)	6 (5%)	4 (3.4%)
	119 (100%)	119 (100%)	119 (100%)	119 (100%)	119 (100%)	119 (100%)

Table 1. Availability of RDM Policy

Furthermore, while 7 (7.9%) strongly agreed and 43 (36.1%) agreed respectively, 31 (26.1%) disagreed and 8 (6.7%) strongly disagreed about the availability of RDM policy on RD organisation in their institutions. Thirty (25.2%) of the respondents were neutral, also revealing that uncertainty largely characterizes the availability of RDM policy on RD organisation in most institutions where librarians work in Nigeria. Meanwhile, the research finding revealed that most of the librarians, 49 (41.2%) agreed that their institutions have RDM policy on RD storage/preservation; while 28 (23.5%) disagreed. This revelation may not be unconnected with the advocacy that has been made about the importance of institutional repositories by librarians, LIS professionals, and other stakeholders in higher institutions of learning. There has been advocacy, over the years, for a central archive where intellectual and research outputs of academic and research institutions are collected, stored, and disseminated, digitally.

Also, this study finding showed that 47 (39.5%) agreed and 32 (26.9%) librarians disagreed about the availability of RDM policy on RD retrieval in their respective institutions. However, data collected about the availability of RDM policy on RD dissemination revealed that while 43 (36.1%) of the librarians agreed to its availability in their institutions, 30 (25.2%) were equally neutral or disagreed with its availability. Significantly, librarians who were either neutral or disagreed with the availability of RDM policy on RD use and reuse in their institutions were 35 (29.4%) and 25 (21%), respectively.

Generally, the research findings revealed that the majority of institutions in Nigeria do not have an RDM policy for RD generation, organisation, storage/preservation, retrieval, dissemination, use, and reuse. Librarians, therefore, have remarkable roles to play in formulating a comprehensive RDM policy that should be known and can be domesticated in LIS institutions across Nigeria.

Skills Possessed by Librarians Concerning RDM Practices

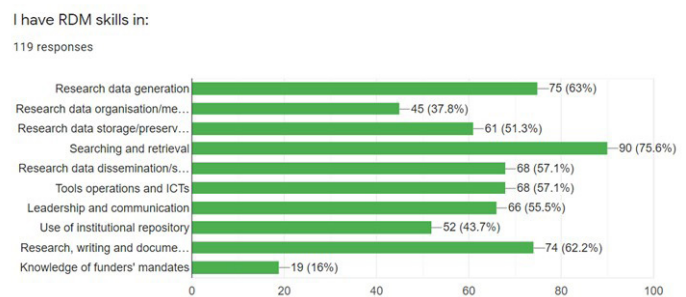


Fig. 2: Librarians' Skills Preparedness for RDM Practices

The research found that the topmost skill that depicts librarians' preparedness for RDM practices was in research data searching and retrieval, while the least knowledge was about funders' mandates. Ninety (75.6%) of the librarians claimed they have RDM skills in searching and retrieval of research data, and nineteen (16%) disclosed that they have RDM skills and knowledge about funders' mandates. However, more than half of all the librarians as shown in Figure 2

do not have RDM skills in research data organisation/ metadata schema and use of institutional repository; as only 45 (37.8%) and 52 (43.7%) indicated having RDM skills in these areas. This means research data available/ generated in most institutions may not be properly organised in the institutional repository; hence, searching for retrieval, accessibility, dissemination, use, and reuse of research data by other researchers may be ineffective or truncated in the long run.

Availability of ICT Tools and Infrastructures for RDM Practices

My institution has ICT tools and infrastructures for RDM practices.

119 responses

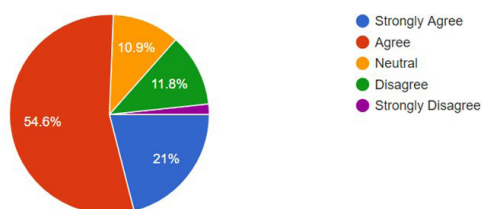


Fig. 3: Availability of ICT Tools and Infrastructures for RDM Practices

Furthermore, the research findings revealed that a larger number of the librarians, 65 (54.6%) agreed and 25 (21%) strongly agreed, respectively, that their institutions have ICT tools and infrastructures for RDM practices, as shown in Figure 3. Despite this finding, it is worrisome that just a little above half of the librarians, 68 (57.1%) have RDM skills in tools operations and ICTs as shown in the figure above. With the proliferation of ICTs, librarians are expected to be vanguards in using ICTs for the generation, organisation, and dissemination of information in various formats. More so, ICTs have become an integral aspect of LIS as a professional that no librarian, regardless of the unit/department, should be lacking skills in operating ICT tools.

Meanwhile, the availability of ICT tools and infrastructures does not seem to be matched with an adequate support system. Due to the dynamism, fragility, and pace at which ICT tools are developed, an adequate support system for researchers and staff is necessary for effective and efficient RDM practices among librarians. While 54 (45.4%) and 12 (10.1%) agreed and strongly agreed that their institutions have a support system on RDM for researchers and staff, 23 (19.3%) either disagreed or were neutral about the availability of the support system in their institutions.

Challenges of RDM Practices

What RDM challenges do you face in your institution?

119 responses

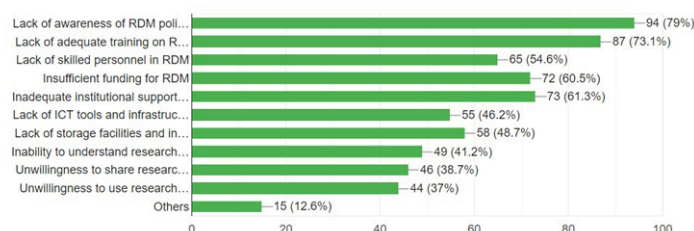


Fig. 4: Challenges of RDM Practices

The greatest challenge faced by librarians in RDM practices is a lack of awareness of RDM policy and guidelines by researchers and staff. Most of the librarians, 94 (79%) identified lack of awareness of RDM policy and guidelines as the major challenge they faced. As shown in figure 4, this is followed by lack of adequate training, 65 (54.6%); inadequate institutional support, 73 (61.3%) and insufficient funding, 72 (60.5%). Notably, more than half of the librarians, 65 (54.6%) also identified lack of skilled personnel in RDM as a challenge. All these challenges are indicators that for RDM practices to be engendered in Nigeria, there should be a comprehensive RDM policy, and awareness campaigns about the proper RDM practices, benefits and gains should be promulgated by librarians, archivists, and other stakeholders in the country.

Discussion

The present study explored the state of research data management (RDM) practices, skills preparedness, and challenges faced by librarians in Nigeria. The findings provide valuable insights into the current landscape of RDM within the country and highlight several areas where improvement is needed which are highlighted below.

Availability of RDM Policies in Nigerian Institutions

One of the central findings of this study is that a significant portion of librarians reported a lack of awareness or uncertainty regarding the existence of RDM policies in their respective institutions. This lack of clarity regarding institutional policies for research data management is a cause for concern. RDM policies play a crucial role in guiding and standardising data management practices, ensuring data integrity, accessibility, and compliance with regulatory requirements. To address this issue, it is imperative for Nigerian academic institutions to establish comprehensive RDM policies, clearly communicate

these policies to their staff, and provide training and support to ensure compliance.

Librarians' Skills Preparedness in RDM

The study revealed varying levels of skills preparedness among librarians in different aspects of RDM. While many librarians reported skills in research data searching and retrieval, there were gaps in skills related to data organisation, metadata schema, and the use of institutional repositories. This suggests a need for targeted training and development programmes to equip librarians with the necessary skills to manage and curate research data effectively. Additionally, considering the increasing role of ICT tools in data management, the finding that only a little over half of the librarians have skills in ICT tools operation emphasises the urgency of enhancing digital literacy among library professionals.

Availability of ICT Tools and Technical Infrastructures

The study found that many institutions had ICT tools and infrastructures in place for RDM. However, this positive aspect was somewhat mitigated by the fact that not all librarians possessed the skills needed to utilize these tools effectively. To maximise the benefits of these ICT resources, institutions should not only provide the necessary tools but also offer training and support to ensure that librarians can make full use of them.

Challenges in RDM Practices

The challenges faced by librarians in RDM practices are diverse and multifaceted. Lack of awareness among researchers and staff about RDM policies and guidelines was identified as the most significant challenge. This highlights a critical need for advocacy and awareness campaigns within institutions to educate stakeholders about the importance of RDM and the benefits it offers. Inadequate training, insufficient institutional support, and funding constraints were also major challenges, and these issues require immediate attention and strategic planning.

Limitation Of The Study

While this research study provides valuable insights into the research data management (RDM) practices, preparedness, and challenges faced by librarians in Nigeria, it is essential to acknowledge that certain limitations may impact the generalizability of the study. Firstly, the sample size of 119 respondents, while providing valuable data, may be considered

relatively small for drawing generalizable conclusions about the entire population of librarians in Nigeria. A larger sample size could enhance the study's representativeness. Secondly, the study relied on an online survey administered through social media platforms. This approach may have introduced sampling bias as it primarily reached librarians with internet access and active participation in professional online groups. As a result, the findings may not represent the entire population of librarians in Nigeria, especially those in remote or underserved areas. Lastly, the questionnaire was administered for eleven (11) days due to late notice of the call for paper and could have reached more librarians if the days were extended.

Conclusion

In conclusion, this study highlights the pressing need for comprehensive research data management (RDM) policies and the imperative for skills development among librarians in Nigeria. The research unveiled notable RDM challenges that pose significant obstacles to librarians such as lack of awareness, inadequate training, and limited technical support. To address these issues, there is a need for the formulation of RDM policies, active advocacy campaigns, professional development initiatives, and investments in digital literacy. These steps are essential in fostering a culture of effective RDM in Nigeria, ultimately contributing to research advancement and the utilization of research data for societal progress.

Recommendations

Based on the findings of this study, the following recommendations are made:

- A comprehensive, national RDM policy should be formulated and institutionalised in Nigeria. This policy should have inputs from various stakeholders whose academic backgrounds and professional practices will be complementary in the formulation process of the policy. Importantly, the RDM policy should be domesticated in all LIS institutions, and staff and researchers should be aware of the provisions and benefits of their research lifecycle.

- LIS bodies and special interest groups like the Nigerian Library Association (NLA), National Association of Library and Information Science Educators (NALISE), etc. should increase advocacy programmes targeted toward engendering RDM practices in the country. This should be promulgated through workshops, seminars, and conferences, and

be integrated into programmes of discussion outlined during library weeks across the country.

- Special training and retraining dedicated to reskilling and up-skilling of librarians in various aspects of RDM practices, especially research data organisation/metadata schema and use of institutional repositories, should be encouraged. Likewise, the diffusion of skills among personnel should be supported by institutional stakeholders to enhance RDM practices.

- RDM should be made a stand-alone module or be incorporated into Research Method(ology) curricula at undergraduate and postgraduate levels across library schools in Nigeria. This will get librarians acquainted with the best RDM practices ahead of their professional lives in library and information science institutions.

- Further studies should be conducted on various aspects of RDM in Nigeria. This study is limited to identifying the general preparedness and challenges of RDM. Further studies should be conducted on specific skills, tools, technical infrastructures, and causes of the challenges, among others.

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