Towards a Reliable Metadata: Enhancing Data Integrity of Institutional Repositories in the Era of Information Explosion in Nigeria

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Abstract

Amid Nigeria's information explosion, institutional repositories stand as crucial infrastructures for managing and preserving scholarly output. This study explores metadata integrity within Nigerian institutional repositories amidst challenges such as inconsistent standards, accuracy issues, and the lack of quality control. Through an investigative approach utilising data from OpenDOAR, the study identifies 23 institutional repositories out of the 265 NUC-approved universities in Nigeria, highlighting a low adoption rate of repositories. DS*pace* emerges as the predominant repository software of choice (87.5%), with journal articles being the most common content type. The study recommended increased adoption of institutional repositories in Nigeria, standardization, enhanced metadata practices, and continuous evaluation. Implementation of these recommendations can bolster repository efficacy, uniform metadata schema, better interoperability, and visibility, and enhance research impact nationally and internationally.

Keywords

Data Integrity, Institutional Repositories, Information Explosion, Metadata, Nigeria

1. Introduction

In today's digital age, the proliferation of information has reached unprecedented levels, profoundly impacting how knowledge is created, disseminated, and preserved. Nigeria, like many other nations, finds itself amidst an era of information explosion, where the volume and diversity of data generated across various sectors are growing at an exponential rate. Within this landscape, institutional repositories emerge as vital infrastructures, tasked with managing and preserving the intellectual output of academic institutions, research organizations, and cultural entities.

At the heart of these repositories lies metadata – the structured information that describes and provides context for digital resources. Metadata serves as the backbone of institutional repositories, enabling efficient organization, discovery, and retrieval of scholarly materials.

Metadata facilitates not only the efficient organization and retrieval of digital resources but also ensures the integrity and reliability of the information stored within institutional repositories. It bridges users and the vast array of scholarly materials, providing essential details such as authorship, publication dates, keywords, and subject classifications. This contextual information not only aids in discovering relevant resources but also enhances their credibility and trustworthiness.

The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), as stated by [1], offers a framework for interoperability that is not tied to any specific application. It allows metadata to be harvested providing a straightforward technical solution for data providers to share their metadata with services. Within the OAI-PMH framework, there are two main types of participants:

1. Data Providers: These are entities that manage systems supporting OAI-PMH. They use this protocol to make their metadata available for harvesting.
2. Service Providers: These participants utilise the harvested metadata from OAI-PMH to develop additional services that offer value to users. They rely on the metadata made accessible by data providers to create their services.

Similarly, [2] describes OAI-PMH as a protocol specification based on a client/server architecture. Its purpose is to enable the sharing and dissemination of metadata.

According to [3], the elements involved in metadata creation include title, subject, description, resource type, source, relation, coverage, creator, publisher, contributor, right management, date, format, identifier, language, audience, provenance, rights holder, and instructional method.

In the context of Nigeria's information explosion, the role of metadata becomes even more crucial. With the rapid growth of digital data across various sectors, including academia, research, and cultural heritage, the effective management and preservation of this information rely heavily on robust metadata practices. However, challenges such as inconsistencies in metadata standards, data accuracy issues, and the lack of quality control measures pose significant obstacles to achieving reliable metadata within institutional repositories. [4] defined data integrity as the assurance of data accuracy and consistency throughout its lifecycle. Inaccurate or compromised data poses significant risks to enterprises, particularly concerning the loss of sensitive information. Hence, maintaining data integrity stands as a fundamental focus for many enterprise security solutions. Therefore, addressing these challenges and enhancing the integrity of metadata is paramount to ensuring the continued efficacy of institutional repositories in Nigeria.

An institutional repository is a digital collection or archive managed by an academic institution, research organization, or cultural heritage institution to preserve, disseminate, and provide access to scholarly and research outputs produced by its members or affiliated entities. These repositories typically include various types of digital content such as research articles, conference papers, theses and dissertations, datasets, multimedia materials, and other scholarly works [5].

The institutional repository (IR) holds the potential to enhance the visibility, reputation, ranking, and public perception of researchers and universities. In response to the [6] directive urging academic libraries to provide access to both print and electronic resources, particularly those originating within the university, Nigerian universities have begun to recognize the importance of increasing access to information resources and enhancing their institutions' visibility internationally. However, despite the potential benefits of managing digital scholarship effectively, it is disheartening to note that only a fraction of Nigerian universities, specifically 23 out of 265 NUC-approved universities as of March 2024, have established a presence in OpenDOAR [7]. The absence of most Nigerian universities on OpenDOAR can be attributed to their lack of visibility, with many failing to create institutional repositories to showcase their research outputs to the global community.

2. Statement of the Problem

In Nigeria, institutional repositories are facing challenges in maintaining the integrity of metadata amidst the increasing volume of information. These repositories are struggling with inconsistencies in metadata standards, formats, and practices, which hinder effective data representation and interoperability. Additionally, there are concerns regarding the accuracy and completeness of metadata, as inadequate verification mechanisms lead to the inclusion of erroneous or incomplete information. The absence of robust quality control measures exacerbates these issues, allowing for the proliferation of low-quality metadata, including spelling errors and outdated information. Furthermore, the lack of systematic procedures for verifying and validating metadata accuracy undermines the reliability of institutional

repositories, posing risks of misinformation and diminished scholarly impact. Moreover, there are concerns about intentional manipulation or tampering with metadata, highlighting the need for safeguards to detect and prevent such malicious activities. Overall, these challenges impede the ability of institutional repositories to serve as reliable platforms for open scholarly communication and knowledge dissemination in Nigeria's information landscape.

3. Research Objectives

The general objective of this study is to determine the data integrity of institutional repositories in the era of information explosion in Nigeria. The specific objectives are to:
1. identify the institutional repositories available in Nigeria
2. identify the software used by these institutional repositories
3. identify the types of content available in the institutional repositories

4. Research Questions

1. What are the available institutional repositories available in Nigeria?
2. What is the software used by these institutional repositories?
3. What are the types of content available in the institutional repositories?

5. Literature Review

5.1 Metadata

[8] defines metadata as data about data, encompassing descriptive elements that define and elaborate on an asset. It essentially encapsulates the essence of an intellectual or creative piece, encompassing all relevant details. He further categorizes metadata into three primary types:
- Descriptive metadata serves the purpose of describing a resource, facilitating its discovery and identification (e.g., details used in a search). This can encompass elements like title, subject, creator, date, location, and keywords.
- Structural (technical) metadata pertains to the arrangement of compound objects, including aspects like file format, file dimensions, length, size, and other technical specifications.
- Administrative metadata furnishes information crucial for managing an asset. It encompasses two common subsets: rights management metadata (dealing with intellectual property rights) and preservation metadata (containing details necessary for archiving and safeguarding an asset).

[9] suggest that structured representations with clearly defined content facilitate enhanced sharing and discovery processes.

[10] defines metadata as information that conveys essential details about an object, potentially aiding in understanding its significance.

[11] characterizes metadata as information that describes data, ensuring its utility, value, comprehensibility, and fostering collaboration.

[12] study reveals that definitions of metadata within ISO standards vary significantly, with 96 standards offering definitions ranging from simple "data about data" to more elaborate explanations. Furner suggests two interpretations of these findings: one, that the inconsistency in ISO standards poses a challenge in understanding what metadata entails across information and data domains; and two, that the diverse definitions reflect community-specific interpretations tailored to their respective needs.

Furthermore, the diversity in defining metadata extends to its categorization and conceptualization. Different conceptions and motivations among individuals lead to various metadata typologies. For instance, [13] categorizes metadata into five types—administrative, descriptive, preservation, use, and technical—in her article aimed at library and information professionals.

These attributes of metadata remain consistent across different technologies, institutions, and over time. For instance, [14] demonstrates how the Dublin Core metadata schema reflects the cultural perspectives of its creators, particularly regarding concepts like authorship and ownership. However, this

framework may not adequately accommodate information originating from diverse cultural contexts, such as indigenous communities.

[15] asserts that the primary purpose of metadata is to describe documents. Thus, it's essential to briefly examine the nature of "descriptions" and the qualities they impart to metadata. The term "description" can refer to both objects and actions, similar to words like communication, illustration, and information. In the context of metadata, descriptions are commonly understood as attributes of objects, such as library resources or archival materials, stored in information systems for cataloguing purposes. Nevertheless, sociological research over many years has focused on description as an active process. While a comprehensive discussion of this literature is beyond the scope here, it offers valuable insights into how descriptions, when used as metadata, should be interpreted and utilized.

5.2 Institutional Repository

In recent years, educational institutions across Africa, notably universities, have recognized the importance of integrating technology into their operations. This integration is viewed as a means of enhancing efficiency and fostering development, particularly in the context of digitizing and preserving academic content. University libraries play a crucial role in this endeavor, as they serve as the custodians of the intellectual contents of these institutions [16]. Therefore, there is a growing emphasis on organizing and digitizing this content to ensure its accessibility and usability. This process of organizing and making academic content available for use through digital means is commonly referred to as digitization.

According to [17], an institutional repository is a digital platform managed by an academic institution, typically a university or college, to collect, preserve, and disseminate scholarly and intellectual outputs created by the institution's faculty, researchers, students, and staff. These outputs may include research articles, theses and dissertations, conference papers, reports, datasets, multimedia materials, and other scholarly works.

The primary purpose of an institutional repository is to provide open access to the institution's intellectual output, thereby increasing its visibility, impact, and accessibility. Institutional repositories serve as centralized repositories for storing and organizing scholarly materials such as research data, articles, conference papers and all intellectual output from the institution [5], making them easily discoverable and accessible to a global audience. They also support the long-term preservation of digital content, ensuring that it remains accessible and usable for future generations [18].

[19] in their study analyzed the advancement of open access institutional repositories in Nigeria over the past decade. Using data from OpenDoar, a quality-assured global directory that allows for the identification, browsing, and searching of repositories, the study gathered statistics on Nigerian institutional repositories based on parameters such as type, status, total number of records, and content uploaded. The findings reveal that between 2009 and 2019, a total of 25 open access institutional repositories were established in Nigeria. These repositories collectively uploaded 68,610 items, with the University of Nigeria, Nsukka contributing the most with 23,367 items. Majority of these repositories were found to be multidisciplinary. The study recommends that establishing institutional repositories should be a prerequisite for accreditation by the Nigerian Universities Commission (NUC) and that funding should be provided to set up functional institutional repositories in Nigeria.

Similarly, [20] reported that publishing and promoting local content on IR facilitates the visibility of the university and staff. Interviews and observation checklists was the instruments used in collecting data. The study revealed that the Federal University of Technology, Akure and the University of Nigeria, Nsukka archived the most varying types of content with the University of Nigeria, Nsukka having the highest number of contents (21461). The selected universities use Dspace as the software for their digital library. The study recommends that awareness should be created through workshops within academic institutions on IR to enhance global visibility.

[21] investigated the availability of institutional repository policies guiding the development of institutional repositories in Nigerian university libraries. The study employed an investigation of institutional repositories (IRs) and interviews to collect data on IR policies and challenges from 19 IRs in

Nigeria. It highlighted several IR-related policies essential for the implementation and management of content in institutional repositories. The study identified several challenges faced by repository administrators and librarians in developing and implementing IRs in Nigerian universities. These challenges include a lack of funding, inadequate facilities, absence of IR-related policies, difficulties in collecting content from various contributors, issues with copyright considerations, lack of a mandatory self-archiving policy, and a lack of interest from contributors in submitting to the IR. Therefore, the study recommends that universities planning to establish IRs should consider formulating policy statements related to access, content, submission, and preservation to guide the successful development and management of IRs.

[22] reported staff use of IR for academic purposes in Nigerian university libraries. It aimed to achieve three specific objectives: determining the extent of use of institutional repositories by staff in the two university libraries, identifying the challenges affecting the use of these repositories, and developing strategies to address these challenges. A descriptive survey research design was employed. Out of a total population of 5,000, 300 staff members were selected using stratified and multi-stage sampling techniques. Data were collected through structured questionnaires and analyzed using means, tables, and frequency counts. The findings revealed that the most accessed materials in the institutional repositories by staff were journal articles, theses and dissertations, books, faculty and departmental journals, and book chapters. Key issues identified included the user-unfriendliness of the repositories, inadequate training for researchers on their use, frequent power outages, and insufficient awareness among the academic community regarding the existence and benefits of the institutional repositories. To address these challenges, it was recommended that institutional repositories be made more user-friendly by incorporating familiar keywords and metadata. Additionally, librarians should actively promote the repository contents to staff and researchers to enhance their awareness and utilization for academic and research purposes.

In addition to providing access to scholarly content, institutional repositories often offer features such as search and discovery tools, metadata management, usage statistics, and support for digital preservation standards. These repositories may be managed by the institution's library or other administrative units responsible for research support and scholarly communication.

Overall, institutional repositories play a crucial role in supporting open access to scholarly research, promoting knowledge sharing and collaboration, and enhancing the visibility and impact of an institution's research output.

6. Research Methodology

This study utilized an investigative approach to gather data. Data was collected from the OpenDOAR website (www.opendoar.org).

6.1 Presentation of Results

6.1.1 For research question 1: What are the available institutional repositories in Nigeria?

Table 1
Institutional Repositories in Nigeria

University/Institution	Web Address
Afe Babalola University	http://eprints.abuad.edu.ng
Ahmadu Bello University	http://kubanni.abu.edu.ng
Ajayi Crowther University	http://repository.acu.edu.ng
Ambrose Alli University Ekpoma	http://154.68.224.61:8080
American University of Nigeria	http://digitallibrary.aun.edu.ng:8080/xmlui

Benue State University	http://bsuir.bsum.edu.ng
Covenant University	http://eprints.covenantuniversity.edu.ng
Alex Ekwueme Federal University Ndufu-Alike	http://dspace.funai.edu.ng/
Elizade University	http://repository.elizadeuniversity.edu.ng
Ebonyi State University	http://ebsu-ir.dspacedirect.org
Federal University Dutsun-Ma	http://dspace.fudutsinma.edu.ng/jspui
Federal University Lokoja	http://repository.fulokoja.edu.ng
Federal University Oye-Ekiti	https://repository.fuoye.edu.ng
Federal University of Technology Minna	http://dspace.futminna.edu.ng/jspui
Federal University of Technology Akure	http://futaspace.futa.edu.ng:8080/xmlui
Landmark University	http://eprints.lmu.edu.ng
Nasarawa State University	http://keffi.nsuk.edu.ng:8080/xmlui
Central Bank of Nigeria	http://library.cbn.gov.ng:8092/jspui
Usman Dan Fodio University	http://oer.udusok.edu.ng:8080/xmlui
University of Ilorin	http://uilspace.unilorin.edu.ng
University of Ibadan	http://ir.library.ui.edu.ng
University of Jos	http://irepos.unijos.edu.ng/jspui
University of Lagos	http://ir.unilag.edu.ng
University of Nsukka	http://www.repository.unn.edu.ng

It is evident from Table 1 that 23 universities out of 265 NUC-approved universities as of March 2024, have established a presence in OpenDOAR [7]. This means that 8.68% of the total NUC-approved universities have institutional repositories. Central Bank of Nigeria, the apex bank, and a federal institution also possess an institutional repository. It shows that there is a poor level of adoption of institutional repositories in the country.

6.1.2 For research question 2: What is the software used by these institutional repositories?

Table 2
Common Repository Management Software
Afe Babalola University, Covenant University and Landmark University are the only institutional repositories running on Eprints. All other repositories are running on the DSpace platform. The 3 institutional repositories operating on Eprints represent 12.5% of the institutions. Conversely, the remaining 21 institutions representing 87.5% use DSpace for their operation. This portrays that DSpace software is the common and widely used digital library software among universities/institutions in Nigeria.

6.1.3 For research question 3: What are the types of content available in the institutional repositories?

Table 3
Contents of Institutional Repositories in Nigeria

University/Institution	Type of Contents
Afe Babalola University	Journal Articles

Ahmadu Bello University	Conference/Workshop Papers, Theses and Dissertations, Journal Articles
Ajayi Crowther University	Journal Articles, Conference/Workshop Papers, Theses and Dissertations
Ambrose Alli University Ekpoma	Journal Articles, Theses and Dissertations
American University of Nigeria	Journal articles, Theses and Dissertations, Books (Chapters and Sections), other Special Items
Benue State University	Books (chapters and sections), Theses and Dissertations
Covenant University	Journal Articles, Theses and Dissertations
Alex Ekwueme Federal University Ndufu-Alike	Journal Articles, Conference/Workshop Papers, Theses and Dissertations, Journal Articles, Reports and Working Papers
Elizade University	Journal Articles, Books (Chapters and Sections),
Ebonyi State University	Journal Articles, Conference and Workshop Papers, Reports and Working Papers, Books (Chapters and Sections), Datasets, Learning Objects, Software, Patents, and other Special Items
Federal University Dutsun-Ma	Journal Articles, Bibliographic References, Conference and Workshop Papers, Theses and Dissertations, Books (Chapters and Sections)
Federal University Lokoja	Journal Articles
Federal University Oye-Ekiti	Journal Articles
Federal University of Technology Minna	Journal Articles, Theses and Dissertations, Learning Objects
Federal University of Technology Akure	Journal Articles, Conference and Workshop papers, Theses and Dissertations, Reports and Working Papers, Books (Chapters and Sections), Datasets, and other Special Items
Landmark University	Journal Articles
Nasarawa State University	Journal Articles, Conference and Workshop Papers, Theses and Dissertations, Books (Chapters and Sections), Datasets, Learning Objects
Central Bank of Nigeria	Journal Articles, Reports and Working Papers
Usman Dan Fodio University	Journal Articles, Conference and Workshop Papers, Theses and Dissertations, Books (Chapters and Sections)
University of Ilorin	Journal Articles, Theses and Dissertations
University of Ibadan	Journal Articles, Bibliographic References, Theses and Dissertations, Books (Chapters and Sections)
University of Jos	Bibliographic References, Conference and Workshop Papers, Learning Objects, other Special Items
University of Lagos	Journal Articles, Conference and Workshop Papers, Theses and Dissertations, Learning Objects
University of Nsukka	Journal Articles, Theses and Dissertations, Books (Chapters and Sections), Reports and Working Papers

Table 3 indicates the type of contents available in these repositories ranging from journal articles, theses and dissertations, books, conference and workshop papers, reports and working papers, datasets, learning objects, software, bibliographic references, and other special types. 4 out of the 24 institutional repositories are limited to only journal articles with the content type representing 16.7%. 12.5% of the repositories (3 out of the 24) have limited their contents to accommodate journal articles, theses and dissertations. It is however worth noting that the remaining 17 (66.7%) institutional repositories contain a variety of content types. Central Bank of Nigeria repository included only journal articles, reports and working papers.

7. Discussion of Findings

From the data obtained from the Nigerian University Commission (NUC), 265 universities are accredited and running various programs. Findings revealed that 23 universities out of 265 NUC-approved universities as of March 2024 established a presence in OpenDOAR. This agrees with the findings of [18] who reported that Nigeria took over a decade to register 23 repositories to date despite the establishment of many universities.

Findings from the study revealed that Dspace software is the most preferred software used by Nigerian universities. This agrees with the study of [23] which reported that Dspace is the most common and popular software used by libraries to manage and provide access to institutional outputs, scholars, and researchers.

The type of content available in the Nigerian institutional repositories are of different categories. They range from journal articles, books (chapters & sections), theses and dissertations, conference/workshop papers, reports and working papers, datasets, patents, software, learning objects, bibliographical references, and special items. Journal articles and theses and dissertations are the most common contents available in all the repositories. This study is similar to the study of [24]and [25] who reported that theses and dissertations, and journal articles are common among repositories.

8. Conclusion

The analysis of institutional repositories in Nigeria reveals several significant findings. Firstly, despite the increasing volume of information in the digital age, only a fraction of Nigerian universities have established institutional repositories, representing a mere 8.68% of NUC-approved universities. This indicates a low level of adoption of repository platforms, hindering the visibility and global presence of Nigerian research outputs.

Secondly, Dspace emerges as the predominant software choice among universities, with 87.5% of repositories utilizing this platform. This uniformity suggests a standardized approach to digital library management within the Nigerian academic landscape, facilitating interoperability and resource sharing.

Lastly, the types of content available in institutional repositories vary widely, with journal articles being the most common. However, there is also a diverse range of materials, including theses and dissertations, books, conference papers, reports, datasets, learning objects, and software. This diversity reflects the multifaceted nature of scholarly communication and underscores the repositories' role in preserving and disseminating a broad spectrum of academic outputs.

9. Recommendations

1. Increased Adoption of Institutional Repositories: Nigerian universities should prioritize the establishment and promotion of institutional repositories to enhance the visibility and accessibility of their research outputs. Institutional commitment, financial support, and capacity-building initiatives are crucial for fostering repository development and sustainability.

2. Standardization and Collaboration: While DSpace is widely used, efforts should be made towards standardizing metadata practices and interoperability across repositories. Collaborative initiatives between universities, research institutions, and government agencies can facilitate knowledge sharing, resource pooling, and the development of common standards and best practices.

3. Enhanced Metadata Practices: Institutions should prioritize the implementation of robust metadata standards and quality control measures to ensure the accuracy, completeness, and reliability of metadata. Training programs and workshops on metadata management should be organized for repository administrators and staff to enhance their skills and competencies.

4. Continuous Evaluation and Improvement: Institutions should regularly evaluate the effectiveness and impact of their repositories, soliciting feedback from users and stakeholders to identify areas for improvement. Continuous monitoring, assessment, and refinement of repository policies, services, and infrastructure are essential for ensuring their relevance and sustainability in the evolving information landscape.

By implementing these recommendations, Nigerian universities can strengthen their institutional repositories, enhance the integrity of scholarly communication support open science, and contribute to the advancement of knowledge dissemination and research impact both nationally and internationally.

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