

INDEXING AND UTILIZATION OF INSTITUTIONAL REPOSITORIES BY AGRICULTURAL RESEARCH INSTITUTES IN NORTH WESTERN NIGERIA

¹AUWAL MAGAJI ABUBAKAR, ²DR PETER WAMAE, ³DR. MARTIN GICHUGU.

**1st PhD Student Department of Computing and Information Science
Kenyatta University Nairobi, Kenya.**

**2nd & 3rd Department of Computing and Information Science
Kenyatta University Nairobi, Kenya.**

Abstract

Institutional repositories (IRs) play a vital role in facilitating and distributing academic knowledge, serving as platforms to showcase research outputs and enhance institutional visibility and reputation. In Northwestern Nigeria, challenges in food production stem from limited access to agricultural information. In response, the Nigerian government has invested significantly in research institutions such as NAPRI, IAR, and NAERLS to address these issues. To this end, this study aimed to assess the Indexing and Utilization of Institutional Repositories by Agricultural Research Institutes in North Western Nigeria. The research design adopted in the study was a cross-sectional survey research design. The population of the study comprised 291 stakeholders in the management and use of IRs. A census methodology was used to sample all the stakeholders presented in the study. A questionnaire was used to gather quantitative data from the Respondents. Data analysis was conducted using descriptive statistics of frequency counts and percentages. The findings revealed challenges in indexing practices were evident, with most respondents dissatisfied with search engine inclusion and metadata quality, highlighting areas for improvement. Usability and awareness issues underscored the need for enhanced accessibility and communication to promote repository utilization. The study recommends that agricultural research institutes in Northwestern Nigeria should endeavor to improve visibility through effective indexing practices and usability enhancements, along with proactive evaluations and updates, which can optimize the impact and accessibility of institutional repositories.

Keywords: *Indexing, Utilization, Institutional Repositories, Agricultural Research Institutes*

Introduction

An institutional repository (IR) is defined as a digital collection that houses an institution's research outputs alongside other electronic publications, facilitated through an electronic system designed to preserve and disseminate the institution's intellectual contributions. This encompasses a variety of scholarly works, including research papers, theses, dissertations, and other pertinent academic contributions. The management of an institutional repository involves several key tasks, such as policy formulation, content procurement, material preservation, metadata generation, and resource dissemination. In the context of scholarly information management and dissemination, institutional repositories hold significant importance for the preservation and propagation of institutional knowledge, thereby enhancing the institution's productivity (Bashir et al., 2022, González-Pérez, Ramírez-Montoya, & García-Peñalvo, 2020). These platforms provide a reliable means of safeguarding and storing an organization's intellectual contributions, including research articles, theses, dissertations, and other scholarly publications. Narlock and Brower (2021) emphasize the critical role of IRs in facilitating the accessibility and availability of research outputs for future reference and utilization.

Research-based institutions, such as agricultural research institutes, are expected to operate well-managed institutional repositories (IRs) to ensure the sustained preservation and dissemination of their research outputs, as well as to empower their users (Hatab & Owusu-Sekyere, 2021). The users of agricultural information repositories within these institutes comprise a diverse group of professionals, including agricultural officers, veterinary doctors, livestock officers, and other related personnel (Makate & Makate, 2019; Ukwoma & Ngulube, 2019). These individuals play crucial roles in the agricultural sector, each with distinct responsibilities. Agricultural officers utilize research data to make informed decisions regarding resource allocation and market trends. Veterinary doctors access repositories for information on animal

health and disease control, while livestock officers rely on research findings for effective livestock management (Monteil et al., 2020). Furthermore, agricultural professionals, such as agronomists and extension workers, depend on these repositories for current research and best practices in their respective fields (Liao & Ma, 2018).

Nigeria has a well-distributed network of agricultural research institutes across its six geopolitical regions, including Northwestern. The country comprises fifteen National Agricultural Research Institutes, each with specific mandates. The Federal Ministry of Agriculture and Rural Development established the Agricultural Research Council of Nigeria to oversee these institutes (Akande, 2020). Additionally, five other research institutes operate independently of this national agency. These institutes aim to enhance agricultural output through scientific research and improving livestock and crop quality for both international and domestic markets. Achieving this goal requires the ongoing dissemination of innovative scientific knowledge, making well-managed institutional repositories essential for fulfilling their mandates due to their robustness and cost-effectiveness (Mbughuni et al., 2023). However, managing these repositories in Nigeria is significantly more capital-intensive than in developed countries (Adewumi, 2019), where advanced ICT infrastructure is already in place. In contrast, Nigeria's outdated IT systems hinder effective service delivery and access to information resources.

While Nigerian agricultural research institutions maintain over twenty repositories, the growth of three key ones the National Animal Production Research Institute (NAPRI), the Institute of Agricultural Research (IAR), and the National Agricultural Extension and Research Liaison Services (NAERLS) has been slow, with uncertain visibility and limited accessibility. The government and relevant entities must establish a sustainable framework to enhance the development and management of these repositories (Ejikeme & Ezema, 2019). In this respect, some of the ways to ensure IR is established are by indexing and utilizing the stored data.

A critical aspect of indexing institutional repositories is ensuring that their materials are included in major search engines. As noted by Suryanarayana and Arlappa (2018), indexing repository materials in platforms like Google Scholar is essential for enhancing the visibility and accessibility of research outputs. This inclusion facilitates easy access for researchers, ultimately leading to increased citations and greater research impact.

Various software solutions are utilized in the management of institutional repositories, including Open Repository, EPrints, Fedora, Greenstone, and SciELO. DSpace is particularly popular due to its capability to capture data in multiple digital formats, including audio, video, and text files. Its compatibility with the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) and adherence to Dublin Core and other national standards further contribute to its widespread use (Peter Wamae 2022). These features enable DSpace to index, preserve, and distribute digital content via the World Wide Web effectively, allowing agricultural research institutes to maintain their research outputs in accessible formats over extended periods. This capability supports the sustained sharing of agricultural knowledge among service providers, such as extension officers, and local farmers.

The study suggests that a well-managed institutional repository should be based on a comprehensive ICT platform that aligns with relevant protocols and established standards. However, Kounoudes et al. (2010) noted limitations in their research, particularly the lack of focus on the management of institutional repositories in the context of agricultural research and the failure to highlight how DSpace's favorable features can enhance service delivery. Challenges in this domain persist, as Smith (2015) indicates that maintaining consistent and up-to-date indexing practices can be resource-intensive, requiring ongoing effort and investment. The importance of meticulous metadata creation and management is emphasized by Recker (2021) who asserts that repositories with comprehensive and accurate metadata achieve higher visibility and usage. Addressing these challenges calls for an investigation of this nature.

The primary goal of integrating institutional repositories (IRs) in research institutes is to enhance the visibility of their research outputs to a broad audience, as noted by Mutwiri (2014). Improved visibility should lead to better accessibility and utilization of these outputs. Additionally, effective IR management aims to ensure sustained accessibility and use of knowledge through the long-term preservation, organization, and distribution of scholarly content within the institution's community (Magiri 2022). Consequently, the accessibility and utilization of agricultural research institutes' IRs should also address

strategies for long-term preservation, storage, and distribution of resources to current and potential users. This area is a key focus of the current study.

It is crucial to recognize that IRs may go unutilized if potential users, such as extension officers and farmers, are unaware of their existence. Gaundu (2022) highlighted that while researchers are aware of IRs, there is a strong desire for access. This underscores the need for IR managers to raise awareness among users. Nunda and Elia (2019) conducted a study to assess the awareness of IR services among postgraduate students in health sciences and agricultural disciplines, revealing a low level of awareness that contributed to limited access and usage of IR content. This study provides valuable insights for the current study regarding user awareness of IR services in various institutions.

This study focused on Northwestern Nigeria, a region with several agricultural research institutes that are vital to the development of its agricultural sector. Despite the presence of these institutes, Northwestern Nigeria faces significant challenges in food production. The Nigerian government has invested in key research institutes, including the National Animal Production Research Institute (NAPRI), the Institute of Agricultural Research (IAR), and the National Agricultural Extension and Research Liaison Services (NAERLS), to tackle various agricultural issues. These institutes have initiated the establishment of institutional repositories to generate, store, and disseminate relevant agricultural information. They research diverse agricultural topics, leading to the development of technologies and practices that can enhance productivity, thereby improving food security, livelihoods, and reducing poverty among farmers (Ojide, Maziya-Dixon & Abdoulaye, 2022).

The institutes also collaborate with stakeholders, including government agencies, NGOs, and private sector entities, to develop and implement agricultural policies and programs that support farming in the region. Overall, the agricultural research institutes in Northwestern Nigeria play a crucial role in enhancing agricultural productivity, improving livelihoods, and alleviating poverty (Raifu & Aminu, 2020). Against this backdrop, this study aims to establish whether adequate indexing and utilization of IR resources facilitates their prompt retrieval and access by all users of institutional repositories in the three selected agricultural research institutes in Northwestern Nigeria.

Purpose of the Study

The purpose of the study institutes is to investigate the indexing and utilization of institutional repositories by agricultural research in North Western Nigeria. Specifically, the study will:

- i. Examine the quality of the IR resources' indexing for prompt retrieval and access by the relevant users.
- ii. Determine the utilization levels of institutional repositories by users.

Research Questions

- i. To what level does the indexing of IR resources facilitate their prompt retrieval and access by all users?
- ii. To what level are the IR resources utilized by different members of the agricultural research institutes?

Methodology

This study employs a cross-sectional survey research design to include a representative sample from three National Agricultural Research Institutes in Northwestern Nigeria. This design facilitates the collection of diverse data from Institutional Repository Practitioners regarding repository management and service delivery at a single point in time, allowing for the observation of variables without interference (Hatab, 2021). The selection of sample institutions and the allocation from each stratum was done using the census approach. Census sampling, often referred to as a complete enumeration, is a sampling technique where every member of the population is included in the study. Unlike sampling methods that involve selecting a portion of the population, a census includes every individual, ensuring complete data collection and analysis (Levy & Lemeshow, 2008). This implies that the target population of 291 Respondents constituted the sample for the study using the census approach.

The sample distribution reveals that from the National Animal Production Research Institute (NAPRI, 104), there was 1 chief librarian (1.67%), 3 digital librarians (5.00%), 16 extension workers (26.67%), 11

veterinary doctors (18.33%), 21 livestock/agricultural officers (35.00%), and 9 researchers (15.00%). From the Institute for Agricultural Research (IAR, 96), the sample included 1 chief librarian (1.82%), 3 digital librarians (5.45%), 12 extension workers (21.82%), 13 veterinary doctors (23.64%), 18 livestock/agricultural officers (32.73%), and 9 researchers (16.36%). Additionally, the National Agricultural Extension Research and Liaison Services (NAERLS, 91) comprised 1 chief librarian (1.89%), 2 digital librarians (3.77%), 13 extension workers (24.53%), 14 veterinary doctors (26.42%), 16 livestock/agricultural officers (30.19%), and 8 researchers (15.09%).

A close-ended questionnaire was administered to digital librarians, extension workers, researchers, veterinary doctors, livestock officers, and agricultural officers in the study area to gather data. The questionnaire consisted of two sections: Section A and Section B. Section A included eight items focused on the indexing techniques used by institutional repository (IR) experts, and the responses were analyzed to determine these techniques. Section B contained ten items assessing the utilization level of IRs, with responses used to evaluate the extent of their use. The Five-point Likert scale of Strongly Disagree (SD=1), Disagree (D=2), Not Sure (N=3), Agree (A=4) and Strongly Agree (SD=5) were used to rate the responses of the Respondents (McLeod, 2008). The items were positively worded (Wolfe & Smith, 2007) to integrate a discrete outlook and ensure that Respondents identify the items as a consistent construct.

This study employed a quantitative statistical approach to analyze data collected from Respondents via close-ended questionnaires. The data were analyzed using frequency counts (f) and percentages (%), with Findings presented according to the study's specific objectives. The SPSS software facilitated data computation, providing answers to the research questions across all objectives, with Findings presented in tables.

Statement of the Problem:

Despite the significant role institutional repositories play in preserving and disseminating knowledge, there appears to be underutilization of these resources in agricultural research institutes in Northwestern Nigeria. Institutional repositories are designed to support the visibility and accessibility of research outputs, fostering knowledge exchange, collaboration, and the advancement of agricultural research. However, challenges such as inadequate indexing systems, limited technical infrastructure, insufficient training of staff, and lack of awareness regarding the benefits of repositories among researchers hinder the effective use of these digital platforms.

In particular, a gap exists between the development of institutional repositories and their actual utilization by researchers in agricultural institutes, potentially limiting the dissemination and impact of valuable research findings. This underutilization not only affects the global visibility of agricultural research conducted in Northwestern Nigeria but also restricts researchers from accessing relevant knowledge produced within and outside their institutions, ultimately affecting agricultural innovation and productivity in the region. Consequently, it is essential to investigate the extent to which these repositories are indexed and utilized, the challenges associated with their use, and the strategies that can be employed to enhance their effectiveness for agricultural research advancement in Northwestern Nigeria.

Results

Indexing is a crucial component of a repository, enabling effective data retrieval and querying. Proper indexing allows search algorithms to quickly locate specific records, enhancing system efficiency and reducing query response times. To assess the impact of indexing on the overall performance and scalability of repositories—essential for applications that rely heavily on data retrieval and analysis—this study examined indexing practices in institutional repositories.

Data were collected from 291 staff members using a closed-ended questionnaire regarding the indexing of materials uploaded to their repositories. The Findings are presented in Table 1.

Table 1: Summary of Frequency Count and Percentages of Responses on Indexing of Institutional Repositories

Construct of Measurement	Scale	NAPRI		IAR		NEARLS	
		n=101		n=94		n=89	
		Freq.	Percent	Freq.	Percent	Freq.	Percent
Our institutional repository materials are effectively included in major search engines like Google Scholar and others	1	19	18.8	20	21.3	19	21.4
	2	25	24.8	23	24.5	22	24.7
	3	21	20.8	26	27.7	25	28.1
	4	17	16.8	15	16.0	13	14.6
	5	19	18.8	10	10.6	10	11.2
The quality of metadata associated with our repository materials is consistently high and accurate.	1	22	21.8	20	21.3	22	24.7
	2	23	22.8	25	26.6	23	25.8
	3	21	20.8	22	23.4	21	23.6
	4	18	17.8	21	22.3	13	14.6
	5	17	16.8	6	6.4	10	11.2
Subject-based indexing is in place and enhances the precision of search Findings, helping users find relevant materials easily	1	22	21.8	22	23.4	19	21.4
	2	20	19.8	24	25.5	21	23.6
	3	23	22.8	21	22.3	17	19.1
	4	17	16.8	11	11.7	21	23.6
	5	19	18.8	16	17.0	11	12.4
Our repository demonstrates interoperability by seamlessly integrating with external systems and academic databases.	1	24	23.8	25	26.6	23	25.8
	2	25	24.8	26	27.7	28	31.5
	3	17	16.8	17	18.1	10	11.2
	4	19	18.8	15	16.0	20	22.5
	5	16	15.8	11	11.7	8	9.0
The inclusion of our repository in search engines enhances its visibility and accessibility to researchers and users.	1	21	20.8	13	13.8	25	28.1
	2	24	23.8	28	29.8	27	30.3
	3	19	18.8	25	26.6	19	21.4
	4	21	20.8	19	20.2	12	13.5
	5	16	15.8	9	9.6	6	6.7
High-quality metadata in a repository positively impact its discoverability and ease of use	1	22	21.8	20	21.3	23	25.8
	2	25	24.8	27	28.7	28	31.5
	3	17	16.8	16	17.0	14	15.7
	4	21	20.8	19	20.2	16	18.0
	5	16	15.8	12	12.8	8	9.0
Subject-based indexing significantly improves the relevance of search	1	20	19.8	19	20.2	21	23.6
	2	27	26.7	21	22.3	21	23.6

Findings in our repository, making it more user-friendly	3	15	14.9	15	16.0	15	16.9
	4	21	20.8	23	24.5	19	21.4
	5	18	17.8	16	17.0	13	14.6
Interoperability with external systems and databases has effectively extended the reach of our repository's content to a wider audience	1	25	24.8	27	28.7	28	31.5
	2	20	19.8	20	21.3	23	25.8
	3	21	20.8	15	16.0	15	16.9
	4	20	19.8	18	19.2	10	11.2
	5	15	14.9	14	14.9	13	14.6

1= Strongly Disagree, 2= Disagree, 3= Neutral, 4 = Agree, 5 = Strongly Agree

The Findings for Item 1 indicate that a large proportion of Respondents (18.8%), with a majority from NAPRI (24.8%), believe that repository materials are not effectively indexed in major search engines like Google Scholar. This finding aligns with responses from IAR (21.3%), supported by a majority of Respondents (24.5%) who share the same concern. Additionally, 21.4% of NEARLS Respondents, with a substantial majority (24.7%), affirmed that their institutional repository materials are similarly not effectively indexed. Consequently, users face difficulties locating materials from agricultural research institutes on Google and other search engines.

A higher proportion of Respondents from NAPRI (20.8%), IAR (27.7%), and NEARLS (28.1%) expressed uncertainty regarding indexing. Some Respondents (16.8% from NAPRI and 18.8%) reported that the NAPRI repository is easily found online. Similarly, 16.0% of IAR Respondents and 14.6% from NEARLS noted effective indexing in major search engines.

Regarding metadata quality, 21.8% of Respondents confirmed that the metadata associated with NAPRI repository materials is consistently low and inaccurate, emphasized by 22.8%. For the IAR repository, 21.3% reported low quality, with a majority (26.6%) affirming its inaccuracy. Similarly, 24.7% of NEARLS Respondents, along with a sensible proportion (25.8%), considered the metadata quality to be low and inaccurate. Notably, 20.8% of NAPRI, 23.4% of IAR, and 23.6% of NEARLS were indifferent to questions about metadata quality. In contrast, 17.8% from NAPRI and 16.8% from IAR agreed that their metadata is consistently high and accurate, with 23.4% from IAR affirming quality metadata presence.

For Item 3, 21.8% of Respondents indicated the absence of subject-based indexing, with 19.8% from NAPRI confirming this. Similarly, 23.4% from IAR and 21.4% from NEARLS reported a lack of subject-based indexing, supported by substantial majorities (25.5% from IAR and 23.6% from NEARLS). High percentages of Respondents across institutions were undecided (22.8% from NAPRI, 22.3% from IAR, and 19.1% from NEARLS). Conversely, 16.8% of NAPRI and 18.8% of IAR affirmed that subject-based indexing enhances search result precision.

Analysis of Item 4 reveals that 23.8% of Respondents reported that the NAPRI repository lacks interoperability with external systems and academic databases, supported by 24.8%. This trend continued at IAR (26.6%) and NEARLS (25.8%), with strong affirmation from 31.5% of NEARLS Respondents. A consistent number of Respondents were indifferent to questions about search functionality (16.8% from NAPRI, 18.1% from IAR, and 11.2% from NEARLS). However, 18.8% of NAPRI and 15.8% of IAR agreed on effective interoperability.

For Item 5, 20.8% of Respondents from NAPRI expressed dissatisfaction with the repository's inclusion in search engines, supported by 23.8%. This sentiment was echoed by IAR (13.8%) and NEARLS (28.1%), where a majority (30.3%) noted poor visibility due to non-inclusion in search engines. A significant number expressed uncertainty (18.8% from NAPRI, 26.6% from IAR, and 21.4% from NEARLS), while some acknowledged enhanced visibility from inclusion.

In Item 6, 21.8% disagreed that high-quality metadata positively influences discoverability, emphasized by 24.8% from NAPRI. Similar trends were observed for IAR (21.3%) and NEARLS (25.8%). Approximately 16.8% of NAPRI, 17.0% of IAR, and 15.7% of NEARLS did not provide opinions on discoverability. In contrast, 20.8% of NAPRI and 20.2% of IAR affirmed that high-quality metadata enhances discoverability. The Findings for Item 7 show that 19.8% disagreed that subject-based indexing improves relevance in NAPRI, supported by 26.7%. This was mirrored in IAR (20.2%) and NEARLS (23.6%), with lower

undecided percentages across institutions. Conversely, 20.8% of NAPRI and 24.5% of IAR affirmed that subject-based indexing enhances relevance.

Lastly, for Item 8, 24.8% of Respondents indicated that interoperability with external systems has not effectively extended the reach of NAPRI's content, supported by 19.8%. This finding was consistent across IAR (28.7%) and NEARLS (31.5%). A notable number of Respondents were indifferent to questions regarding interoperability (20.8% from NAPRI, 16.0% from IAR, and 16.9% from NEARLS). However, 19.8% of NAPRI and 19.2% of IAR agreed on effective interoperability extending content reach.

Utilization Levels of Institutional Repositories

Repository utilization levels are crucial as they reflect the effectiveness of data storage and retrieval. They indicate the percentage of storage space used, highlighting potential issues such as data bloat or inefficient storage practices. Identifying low utilization levels can reveal resource over-allocation, presenting opportunities to optimize storage capacity and reduce costs. Conversely, high utilization levels may signal the need for data archiving, backup plans, or storage upgrades to prevent data loss or degradation. Data were collected from 291 staff respondents through a questionnaire to assess this aspect. The Findings are presented in Table 2.

Table 2: Summary of Frequency Count and Percentages of Responses on Utilization of Institutional Repositories

Construct of Measurement	Scale	NAPRI n=101		IAR n=94		NEARLS n=89	
		Freq.	Percent	Freq.	Percent	Freq.	Percent
The Institutional Repository at the Agricultural Research Institute is easy to access	1	10	9.9	13	13.8	11	12.4
	2	25	24.8	23	24.5	25	28.1
	3	5	5.0	3	3.2	4	4.5
	4	8	7.9	8	8.5	8	9.0
	5	5	5.0	5	5.3	5	5.6
I am aware of the existence of the Institutional Repository at this agricultural research institute.	1	12	11.9	10	10.6	13	14.6
	2	27	26.7	27	28.7	24	27.0
	3	2	2.0	3	3.2	4	4.5
	4	3	3.0	5	5.3	4	4.5
	5	9	8.9	7	7.5	8	9.0
I have used the Institutional Repository at the institute to access research materials.	1	11	10.9	13	13.8	11	12.4
	2	21	20.8	22	23.4	27	30.3
	3	5	5.0	2	2.1	4	4.5
	4	13	12.9	11	11.7	8	9.0
	5	3	3.0	4	4.3	3	3.4
The search functionality of the Institutional Repository at the ARI is effective.	1	11	10.9	10	10.6	13	14.6
	2	29	28.7	28	29.8	27	30.3
	3	3	3.0	3	3.2	2	2.3
	4	7	6.9	9	9.6	8	9.0
	5	3	3.0	2	2.1	3	3.4
The Institutional Repository at the research institute provides a user-friendly interface.	1	11	10.9	9	9.6	11	12.4
	2	28	27.7	28	29.8	27	30.3
	3	7	6.9	5	5.3	3	3.4
	4	4	4.0	3	3.2	3	3.4

	5	3	3.0	7	7.5	9	10.1
The Institutional Repository at this agricultural research institute contains a wide range of relevant research materials.	1	15	14.9	12	12.8	11	12.4
	2	26	25.7	23	24.5	29	32.6
	3	3	3.0	9	9.6	7	7.9
	4	5	5.0	5	5.3	3	3.4
	5	4	4.0	3	3.2	3	3.4
I find it easy to navigate through the Institutional Repository to find the materials I need.	1	13	12.9	11	11.7	15	16.9
	2	23	22.8	28	29.8	24	27.0
	3	7	6.9	3	3.2	5	5.6
	4	6	5.9	6	6.8	6	6.7
	5	4	4.0	4	4.3	3	3.4
The Institutional Repository has contributed to the improvement of my research and work.	1	14	13.9	13	13.8	12	13.5
	2	21	20.8	22	23.4	24	27.0
	3	10	9.9	7	7.5	5	5.6
	4	5	5.0	8	8.5	7	7.9
	5	3	3.0	2	2.1	5	5.6
The Institutional Repository is regularly updated with new research materials.	1	10	9.9	11	11.7	13	14.6
	2	27	26.7	25	26.6	26	29.2
	3	5	5.0	4	4.3	4	4.5
	4	7	6.93	7	7.5	8	9.0
	5	4	4.0	5	5.3	4	4.5
The Institutional Repository has provided valuable support for my research projects.	1	12	11.9	10	10.6	11	12.4
	2	21	20.8	23	24.5	20	22.5
	3	9	8.9	7	7.5	10	11.2
	4	5	5.0	8	8.5	5	5.6
	5	6	5.9	4	4.3	7	7.9

1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree.

The Findings for Item 2 indicate that a significant proportion of Respondents (9.9%), with a majority from NAPRI (24.8%), expressed dissatisfaction with the utilization rate of the institutional repository. This finding aligns with responses from IAR (13.8%), where a majority (24.5%) also reported a low utilization rate. Respondents from NEARLS (12.4%) and a substantial majority (28.1%) similarly affirmed a low utilization rate. This suggests that the institutional repositories at the three agricultural research institutes are not easily accessible, contributing to their low utilization. However, a small proportion of Respondents expressed uncertainty: 5.0% from NAPRI, 3.2% from IAR, and 4.5% from NEARLS. Some Respondents reported a high level of utilization at NAPRI (7.9% and 5.0%), while 8.5% from IAR and 9.0% from NEARLS echoed similar sentiments, attributing this to ease of access.

Notably, 11.9% of Respondents were unaware of the NAPRI repository, with a substantial majority (26.7%) emphasizing this point. At IAR, 10.6% were unaware of the repository, supported by 28.7%, while 14.6% from NEARLS, along with 27.0%, confirmed their unawareness. Approximately 2.0% of NAPRI, 3.2% of IAR, and 4.5% of NEARLS did not respond to awareness-related questions. In contrast, 3.0% from NAPRI and 8.9% acknowledged the repository's existence, while 5.3% from IAR affirmed the presence of a digital information repository, with support from 7.5%. Similar Findings were observed for NEARLS, with 4.5% and 9.0% confirming repository awareness.

For Item 3, a significant proportion of Respondents (10.9%) reported non-utilization of the NAPRI repository for research materials, confirmed by 20.8%. Similarly, 13.8% of IAR reported non-utilization, with strong affirmation from 23.4%. This trend continued at NEARLS, where 12.4% reported non-utilization, supported by a substantial majority (30.3%). Lower percentages of undecided Respondents were noted: 5.0% from NAPRI, 2.1% from IAR, and 4.5% from NEARLS. Conversely, 12.9% from NAPRI and 3.0% confirmed accessing resources from the repository, similar to 11.7% from IAR and 9.0% from NEARLS.

The analysis of Item 4 reveals that 10.9% of Respondents reported ineffective search functionality in the NAPRI repository, supported by a majority (28.7%). This trend was consistent across IAR (10.6% ineffective, 29.8% affirming) and NEARLS (14.6% ineffective, 30.3% affirming). A consistent number of Respondents did not respond to questions about search functionality: 3.0% from NAPRI, 3.2% from IAR, and 2.3% from NEARLS. In contrast, 6.9% of NAPRI and 3.0% of IAR affirmed effective search functionality, with 9.0% from NEARLS supported by 3.4%.

For Item 5, a significant proportion of Respondents (10.9%) expressed dissatisfaction with the user-friendliness of the NAPRI repository interface, supported by 27.7%. Similar sentiments were observed at IAR (9.6%, 29.8%) and NEARLS (12.4%, 30.3%). A small proportion expressed uncertainty: 6.9% from NAPRI, 5.3% from IAR, and 3.4% from NEARLS. Some Respondents reported a friendly interface at NAPRI (4.0%, 3.0%), while 3.2% from IAR and 3.4% from NEARLS echoed similar sentiments.

Regarding Item 6, 14.9% disagreed that the NAPRI repository contains a wide range of relevant research materials, emphasized by 25.7%. At IAR, 12.8% confirmed insufficient materials, supported by 24.5%. Similarly, 12.4% and 32.6% of NEARLS reported a lack of relevant materials. Approximately 3.0% from NAPRI, 9.6% from IAR, and 7.9% from NEARLS did not respond. In contrast, 5.0% of NAPRI and 5.3% of IAR affirmed the presence of research materials, consistent with Findings from NEARLS (3.4%).

The Findings for Item 7 indicate that 12.9% of Respondents found it difficult to navigate the NAPRI repository, confirmed by 22.8%. At IAR, 11.7% reported navigation difficulties, with 29.8% affirming this. NEARLS had 16.9% reporting difficulties, supported by 27.0%. Lower undecided percentages were noted: 6.9% from NAPRI, 3.2% from IAR, and 5.6% from NEARLS. In contrast, 5.9% of NAPRI and 4.0% of IAR affirmed ease of navigation, consistent with NEARLS (6.3%, 3.4%).

For Item 8, 13.9% reported that the repository has not contributed to improving research, with robust support from 20.8% at NAPRI. This trend was consistent at IAR (13.8%, 23.4%) and NEARLS (13.5%, 27.0%). A consistent number did not respond: 9.9% from NAPRI, 7.5% from IAR, and 5.6% from NEARLS. Conversely, 5.0% from NAPRI and 3.0% affirmed contributions to research improvement, consistent with IAR (8.5%, 2.1%) and NEARLS (7.9%, 5.6%).

The Findings for Item 9 indicate that 9.9% disagreed that the NAPRI repository is regularly updated, supported by 26.7%. At IAR, 11.7% reported no updates, with 26.6% affirming this. NEARLS showed similar Findings (14.6%, 29.2%). Lower undecided percentages were noted: 5.0% from NAPRI, 4.3% from IAR, and 4.5% from NEARLS. In contrast, 6.9% of NAPRI and 7.5% of IAR affirmed regular updates, consistent with NEARLS (9.0%, 4.5%).

Finally, for Item 10, 11.9% reported that the repository has not provided valuable support for research projects, supported by 20.8% at NAPRI. This trend was consistent at IAR (10.6%, 24.5%) and NEARLS (12.4%, 22.5%). A consistent number did not respond: 8.5% from NAPRI, 7.5% from IAR, and 11.2% from NEARLS. In contrast, 5.0% of NAPRI and 5.9% of IAR affirmed valuable support, consistent with NEARLS (8.5%, 7.9%).

Discussion

Findings on Institutional Repository Indexing Practices

The study reveals that the limited inclusion of repositories in major search engines, such as Google Scholar, hampers the visibility and accessibility of repository materials. The quality of associated metadata does not significantly enhance this visibility, indicating inconsistencies in metadata accuracy and reliability. Additionally, perceived shortcomings in subject-based indexing may affect the precision and relevance of search Findings for users seeking specific materials.

The repository's ability to integrate with external systems is also limited, which undermines its usability across various platforms and databases. This inadequacy in subject-based indexing further detracts from

user-friendliness and discoverability. Consequently, these findings suggest that institutional repositories are not optimized for discoverability, which can impede users from accessing relevant information. The neglect of metadata, keywords, and effective indexing practices restricts the repositories' visibility both within the institutions and to external users.

To address these challenges, agricultural research institutes should prioritize the development of robust metadata and indexing strategies to enhance their repositories' optimization for search engines and user discovery. This sentiment is echoed by the Chief Librarian, who acknowledged the lack of attention to specific metadata and keywords that could improve repository visibility. Another librarian expressed dissatisfaction with current indexing methods, noting a lack of depth and precision necessary for effective resource access.

The findings underscore significant challenges in the indexing practices of institutional repositories in agricultural research institutes in North Western Nigeria. Most respondents raised concerns about the effectiveness of repository materials' inclusion in major search engines, the quality of associated metadata, and the impact of subject-based indexing on visibility and search relevance. These issues collectively suggest that current indexing methods may hinder the discoverability and accessibility of valuable research materials. The low mean score for indexing (2.06) further reflects general dissatisfaction among respondents regarding the state of indexing practices.

The Chief Librarian's acknowledgment of neglect in utilizing specific metadata or keywords aligns with another librarian's critique of the current indexing methods, reinforcing the need for improvement. These findings resonate with existing literature, emphasizing the crucial role of accurate and comprehensive metadata, effective search engine inclusion, and subject-based indexing in enhancing the visibility and impact of repository materials.

The findings are consistent Suryanarayana and Arlappa (2017), who highlighted the importance of indexing in improving visibility and accessibility, ultimately leading to increased citations and research impact. However, limitations in achieving these goals reflect ongoing challenges. Concerns regarding metadata quality were evident, with 63% of respondents expressing dissatisfaction, aligning with the work of Magiri et al. (2022) and Recker (2021) on the significance of comprehensive metadata.

Subject-based indexing also raised concerns, with 55% of respondents disagreeing about its effectiveness. Wamae (2022) noted that subject indexing enhances the precision and relevance of search Findings, indicating opportunities for improvement. While respondents showed mixed opinions on interoperability with external systems, a relatively positive perception emerged regarding the repository's integration capabilities, with 9% strongly agreeing. This agrees with Malakani et al. (2018), who emphasized the importance of interoperability in extending repository reach through integration with discipline-specific databases and academic networks.

Finding on Utilization of Institutional Repositories

The finding of the study revealed significant challenges users face in utilizing institutional repositories within agricultural research institutes in North Western Nigeria. A majority of respondents reported difficulties in accessing these repositories and a lack of awareness regarding their existence. Despite moderate utilization levels, concerns were raised about the effectiveness of search functionality, content diversity, ease of navigation, impact on research, regular updates, and support for research projects.

The prevailing disagreement about utilization levels underscores the urgent need for agricultural research institutes in the region to enhance repository accessibility, increase user awareness, improve search functionality, diversify content, and elevate the overall user experience. Additionally, investing in regular updates and support for research initiatives is crucial. Addressing these issues requires a concerted effort from various stakeholders within the institutes to unlock the full potential of their repositories, enabling them to serve as valuable tools for knowledge sharing, research collaboration, and innovation in the agricultural research community of North Western Nigeria.

The result supports those of Wamae (2021) and Makate (2019), who identified similar challenges in the utilization of institutional repositories. They emphasize the importance of revitalizing agricultural extension services to enhance the adoption of climate-smart agriculture technologies. Similarly, Ukwoma and Ngulube (2019) highlighted obstacles hindering the adoption of institutional repositories among researchers, pointing

to the need for improved infrastructure, awareness, and technical proficiency. Both studies stress the necessity of institutional policies and skill development to overcome barriers to effective utilization. While Makate and Makate (2019) focus on agricultural extension services and the adoption of climate-smart technologies, and Ukwoma and Ngulube (2019) concentrate on institutional repositories, their overarching themes of infrastructure enhancement, awareness promotion, and technical proficiency improvement resonate with the challenges identified in North Western Nigeria. However, the context-specific focus of these studies—Zimbabwe and Nigerian agricultural research institutes—may limit the generalizability of their findings to the broader context of North Western Nigeria.

Conclusion

This study highlights significant challenges in the indexing and utilization of institutional repositories within agricultural research institutes in North Western Nigeria. Key issues include limited visibility in major search engines, inconsistent metadata quality, and inadequate subject-based indexing, which hinder users from accessing relevant research materials. Additionally, many users are unaware of the repositories' existence and face difficulties in navigation and search functionality. These barriers underscore the urgent need for agricultural research institutes to improve repository usability through enhanced indexing practices, increased user awareness, and regular content updates.

The findings align with existing literature, emphasizing the importance of comprehensive metadata and effective indexing for improved visibility and impact. By addressing these challenges, institutions can transform their repositories into vital resources for knowledge sharing and collaboration, ultimately fostering innovation in the agricultural research community.

Recommendations

Based on the findings of the study, the following recommendations were proffered:

1. Agricultural research institutes should prioritize the development of comprehensive and consistent metadata standards and implement effective subject-based indexing. This will improve the visibility and accessibility of research materials, making it easier for users to locate relevant information.
2. Conduct targeted awareness campaigns to inform potential users about the existence and benefits of institutional repositories. Additionally, improve the usability of these repositories by enhancing search functionality and navigation, thereby facilitating easier access to valuable research outputs.

References

- Adewumi, A. O. (2018). *Deployment and usability evaluation of mobile access to institutional repository (Masters Dissertation) Ota, Nigeria: Covenant University*. Retrieved from http://eprints.covenantuniversity.edu.ng/1359/1/dissertation_compact.pdf
- Akande, T. F. (2020). *Self-management, awareness and use of electronic resources as predictors of scholarly publication output of researchers in National Agricultural Research Institutes in Nigeria* (Doctoral dissertation, University of Ibadan).
- Bashir, S., Gul, S., Bashir, S., Nisa, N. T., & Ganaie, S. A. (2022). Evolution of institutional repositories: Managing institutional research output to remove the gap of academic elitism. *Journal of Librarianship and Information Science*, 54(3), 518-531.
- Ejikeme, A. N., & Ezema, I. J. (2019). The potentials of open access initiative and the development of Institutional Repositories in Nigeria: Implications for scholarly communication. *Publishing Research Quarterly*, 3(5), 6-21.
- González-Pérez, L. I., Ramírez-Montoya, M., & García-Peñalvo, F. J. (2020). User Experience in Institutional Repositories: A Systematic Literature Review. In I. Management Association (Ed.), *Digital Libraries and Institutional Repositories: Breakthroughs in Research and Practice* (pp. 423-440). IGI Global. <https://doi.org/10.4018/978-1-7998-2463-3.ch026>.

- Hatab, A. A., & Owusu-Sekyere, E. (2021). Impact evaluation of research and development programs: Data and methodological considerations for CGIAR Research Program on Livestock.
- Levy, P. S., & Lemeshow, S. (2008). *Sampling of populations: Methods and applications* (4th ed.). John Wiley & Sons.
- Liao, Y., & Ma, T. (2018). Institutional repositories: a bibliometric study of the social sciences citation index (SSCI). *Electron. Libr.*
- Makate, C., & Makate, M. (2019). Interceding role of institutional extension services on the livelihood impacts of drought tolerant maize technology adoption in Zimbabwe. *Technology in Society*.
- Mbughuni, A. S., Mtega, W. P., & Malekani, A. W. (2023). Self-archiving of scholarly publications for improved access to local content in Tanzania: a study of open access institutional repositories in universities in Tanzania. *Journal of Librarianship and Information Science*, 09610006231155182.
- Monteil, T., González-Beltrán, A., Ioannidis, A., Allen, A., Lee, A., Bandrowski, A., Wilson, B., Mecum, B., Du, C., Robinson, C., Garijo, D., Katz, D., Long, D., Milliken, G., M'enager, H., Hausman, J., Spaaks, J., Fenlon, K., Vanderbilt, K., Hwang, L., Davis, L., Fenner, M., Crusoe, M., Hucka, M., Wu, M., Hong, N., Teuben, P., Stall, S., Druskat, S., Carnevale, T., & Morrell, T. (2020). Nine best practices for research software registries and repositories. *PeerJ Computer Science*.
- Narlock, M., & Brower, D. (2021). Product ownership of a legacy institutional repository. *Information Technology and Libraries*, 40(3), 21-33.
- Nunda, I., & Elia, E. (2019). Institutional Repositories Adoption and Use in Selected Tanzanian Higher Learning Institutions. *International Journal of Education and Development Using Information and Communication Technology*.
- Ojide, M., Maziya-Dixon, B., & Abdoulaye, T. (2022). Contribution of maize-based products to the livelihood of smallholder processors in rural northern Nigeria. 3(5), 22-38.
- Raifu, I. A., & Aminu, A. (2020). Financial development and agricultural performance in Nigeria: what role do institutions play? *Agricultural Fin Makate ance Review*, 80(2), 231-254.
- Ukwoma, S., & Ngulube, P. (2019). Obstacles to the utilization of institutional repositories by academics in higher education in Nigeria. *Webology*.
- Suryanarayana, P., Arlappa, N., Sai Santhosh, V., Balakrishna, N., Lakshmi Rajkumar, P., Prasad, U., ... & Ananthan, R. (2018). Prevalence of vitamin D deficiency and its associated factors among the urban elderly population in Hyderabad metropolitan city, South India. *Annals of Human Biology*, 45(2), 133-139.
- Parah, S. A., Sheikh, J. A., Loan, N. A., & Bhat, G. M. (2016). Robust and blind watermarking technique in DCT domain using inter-block coefficient differencing. *Digital Signal Processing*, 53, 11-24.
- Dini Kounoudes, A., Artemi, P., & Zervas, M. (2010). *Ktisis: Building an open access institutional and cultural repository*. In *Digital Heritage: Third International Conference, EuroMed 2010, Lemessos, Cyprus, November 8-13, 2010. Proceedings 3* (pp. 504-512). Springer Berlin Heidelberg.
- Recker, J. (2021). *Scientific research in information systems: a beginner's guide*. Springer Nature.
- Magiri, R., Gaundan, S., Singh, S., Pal, S., Bakare, A., Choongo, K., ... & Iji, P. A. (2022). The role of agricultural institutions in providing support towards sustainable rural development in South Pacific Island countries. *Journal of Agricultural Science*, 14(2), 104
- McLeod, K. D. (2008). A qualitative examination of culture shock and the influential factors affecting newly-arrived Korean students at Texas A&M University. *Texas A&M University*.
- Malekani, A. W., & Kavishe, G. (2018). The role of Institutional Repositories in making lost or hidden cultures accessible, a study across four African University Libraries. *Library Philosophy and Practice*, 1-22.
- Taurus, E., & Wamae, P. (2022). Land records digitization and service delivery in the ministry of lands in Kenya. *International Journal of Current Aspects*, 6(3), 59-69.
- Tanui, G., & Wamae, P. (2022). Utilization of Agricultural Information by Poultry Farmers in Enhancing Productivity: The Case of Menengai West, Nakuru County, Kenya. *International Journal of Current Aspects*, 6, 1-99.
- Ajayi, S. A., Wamae, P., & Muthee, D. W. (2021). Assessing Electronic Medical Records Readiness for Service Delivery in State Hospitals in Southwest Nigeria. *IJCAB*, 5(3), 1-17.