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RESEARCH ARTICLE

Performance of the Nigerian Open Access Repositories

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ABSTRACT

Research is undertaken to make human life better. This underscores the need to communicate the research results globally. The possibilities inherent in digital technologies coupled with the understanding that knowledge should be treated as a public good engender the emergence of the open access movement. The movement aims at making research literature more freely available. Open access is implemented in two major ways: the gold route and the green route. The gold route entails making research literature freely available on publishers' servers, whereas the green route entails using Open Access Repositories (OARs) to achieve the open access aims. To date, a few OARs have been hosted in Nigeria to communicate the research produced in the country with the rest of the world. Therefore, this study used content analysis to assess the functionality and effectiveness of OARs hosted in Nigeria. Data were extracted from the Directory of Open Access Repositories (OpenDOAR), and, additionally, the contents of Nigerian repositories were analyzed. The finding of the study revealed that there is a steady increase in OARs in Nigeria; however, the country lags when compared with its counterparts. It was also discovered that most Nigerian OARs were inaccessible owing to technical problems. At the same time, the contents of the accessible repositories are not consistent with OpenDOAR repository information sheets. DSpace repository software continues to be the most popular in Nigeria; however, libraries were found to be lagging in housing OARs for their universities. Therefore, it is recommended that stakeholders in Nigeria double their efforts to develop OARs in the country.

Keywords: Nigeria, open access, open access repository, scholarly communication, OpenDOAR

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IMPLICATIONS FOR PRACTICE

1. A lot of research literature that is produced in Nigeria is inaccessible to the global community.
2. End-users experience technical problems when accessing the content of Nigerian Open Access Repositories.
3. OpenDOAR *repository information* pages and advance search tool are not reliable tools to access the content of Nigerian Open Access Repositories.
4. Overall development of Open Access Repositories in Nigeria is lagging.

INTRODUCTION

Researchers do not undertake and communicate research for financial benefits; however, publishers have been reaping profit from disseminating the result of the research. Toward the end of the twentieth century, publishers' drive to maximize profit culminated in a *serial crisis* in which individual researchers and research institutions could no longer afford to subscribe to a good number of information resources (Mason, 2016; Swan, 2006). However, the twenty-first century was heralded by advancements in media technology and communication that enable research institutions to host Open Access Repositories (OARs) to bypass financial barriers erected by commercial publishers in the scholarly communication system. This enables research institutions to communicate the results of their research directly to research consumers. OARs are increasingly becoming an integral part of universities and other educational and research institutions (Imoro & Saurombe, 2024; Pinfield et al., 2014; Prosser, 2003).

In Nigeria, the first call to use OARs to mitigate the barriers in the international scholarly communication system, as well as the weakness of the local publishing system, was made by Christian (2008). Perhaps the call led to a workshop titled "Open Access Repositories: New Model for Scholarly Communication," organized in 2008 at Ahmadu Bello University Zaria with sponsorship from the Electronic Information for Libraries Network (eifl Net) and Nigerian University Libraries Consortium (NULIB) (Oguche, 2018). The workshop culminated in the emergence of the first set of OARs in the country by 2009. Studies by, for example, Ejikeme and Ezema (2019) and Posigha and Idjai (2022) were conducted to analyze the development; however, most of the studies fall short in analyzing the functionality and size of the OARs in comparison with other developing countries. Therefore, the present study will compare the size of Nigerian OARs in comparison with other developing countries before analyzing the internal functionalities and effectiveness of the OARs in providing global access to scholarly outputs produced in the country. It will assess the absolute size of the repositories in terms of the number of items (i.e., chapters, articles, data sets etc.) that they contain. The

study will also analyze the accessibility and inaccessibility due to technical problems, as well as the reliability of the repositories. The work will also assess the popularity of the various repository software among Nigerian OARs, as well as the role of libraries in providing a hosting base for the OARs.

LITERATURE REVIEW

Global adoption of OARs

OARs are a composite of services and infrastructure that are provided by scholarly communities and educational or research institutions to provide less restricted access to their scholarly and research outputs such as articles, book chapters, theses, dissertations, conference papers, data sets, etc. (Pinfield et al., 2014). Repositories play a crucial role in promoting and disseminating knowledge and increasing the accessibility of academic and research materials to the global audience. According to the Directory of Open Access Repositories (OpenDOAR), there are three major types of OARs, which include institutional repositories (IRs), subject or disciplinary repositories, and government repositories. OARs have been anchored on a tripod comprising a culture of sharing research results free of charge, advancement in media technology, and the need for researchers to mitigate the distress experienced in using the traditional research communication process (Kang & Oh, 2023).

The success of OARs at the disciplinary level made universities and other research centers find it cost-effective to manage and disseminate their scholarly outputs through OARs (Björk, 2014). In addition, academic libraries leveraging on their core missions and mandates of supporting the dissemination of and access to reliable information become a formidable base for the development of OARs (Burns, 2014; Smale, 2020, p.174). Although Palmer et al. (2008) observed that libraries were not active in supporting OARs, they argued that libraries were well positioned to house OARs. Subsequently, Burns et al. (2013) identified 160 academic libraries that manage institutional repositories in the United States alone. Also, Laddusaw (2024) reported that 310 (61%) of regional public universities in the United States have institutional repositories, and, in all cases, the repository is housed in the university library.

Many academic libraries in Nigeria have also followed suit (Ifijeh et al., 2018 pp. 3-4). In such arrangements, the IR is managed as a unit of the library, driving its finance from the oversight of the library. The first and largest OAR is arXiv.org. For most of its development, the repository was managed by Cornell University Library, where it garnered support, especially in staffing and finances (Butler, 2001; Ginsparg, 2021; Shieber & Suber, 2013; Steele, 2001). Burns et al. (2013) argue that support from libraries is important to the development and sustainability of the OARs.

Since the mid-2000s, advocacy for open access publishing models and the implementation of open access mandates by funding agencies and institutions has become very popular. Examples of such mandates include the National Institutes of Health (NIH) Public Access Policy, which requires researchers to deposit their publications resulting from publicly funded research in OARs. India also followed suit by making its open access policy public. The policy emphasizes the use of OARs to provide open access to research results (Rao & Rao, 2018; Singh, 2016). Many universities, especially those in Europe and North America, have made it a mandate for their staff to deposit a version of their article in their IR (Ferreras-Fernández et al., 2013; Huang et al., 2020). Thus, Ali et al., (2013) citing Lynch and Lippincott (2005) reported that 40% of higher institutions in the United States have IRs, whereas 80% of those remaining were planning to host one.

Moreover, Pinfield et al. (2014), citing Björk et al. (2013), discovered that 82% of the world research productive institutions have at least one IR. Morais and Borrell-Damian (2019) reported that, by 2014, between 52% and 62% of European institutions had an open access policy, whereas 72% to 77% of the institutions had already established OARs. In addition, Laakso (2013), as cited in Björk (2014), discovered that 61% of the major publishers allow authors to deposit a particular version of their papers in IRs. Björk et al. (2010), cited in Björk (2014), discovered that 20% of all articles published in 2008 were open access, with OARs contributing up to 12% of the share. Martín-Martín et al. (2018), in a survey involving over 2 million open access articles indexed by Google Scholar, discovered that 17% of the articles were made available from OARs. Similarly, Robinson-Garcia et al. (2020) based on the analysis of approximately 2 million open access articles, discovered that 77% of the articles were made open access using OARs.

Many academic institutions host their digital repositories where faculty, students, and researchers can deposit and access scholarly works produced in the institutions. Björk (2014) and Jayakanth et al. (2012) observed that IRs are easier to host because they leverage the already existing research infrastructure of the institutions. For example, library facilities, budgets, and staff are usually used to managing IRs. However, the availability of Information Technology infrastructure, awareness, policy, culture, and mandate determines the adoption of OARs in a university (Pinfield et al., 2014). Bashir et al. (2019) also emphasized the importance of advocacy and infrastructure in the development of OARs.

The philosophy behind OARs is grounded in the belief that scholarly research should be freely accessible to anyone, anywhere, without financial, legal, or technical barriers. Therefore, OARs are founded on the principle of universal access to knowledge. They aim to make scholarly research available to a global audience, including researchers, students, educators, policymakers, and the general public, regardless of their institutional affiliation or financial

resources. OARs also promote equity and inclusivity by removing barriers to accessing scholarly information. They prioritize the dissemination of knowledge to individuals and communities who may not have access to traditional, subscription-based journals or expensive academic databases. OARs also enable transparency in scholarly communication by providing unrestricted access to research outputs and repositories enable greater transparency in the research process, facilitating scrutiny, collaboration, and the advancement of knowledge. OARs recognize the societal benefits of freely accessible research. They support the notion that scholarly knowledge is a public good that should be shared for the betterment of society, fostering innovation, education, and social progress and justice (Furnival, 2010; Roh et al., 2020).

Furthermore, OARs uphold the principles of academic freedom by empowering researchers to disseminate their work without restrictions imposed by publishers or commercial interests. Researchers and research institutions retain control over their intellectual property and are free to share their findings openly. This also supports diversity and inclusivity in scholarly communication by providing a platform for researchers from around the world, including those from underrepresented regions and institutions, to share their work. This promotes the inclusion of diverse perspectives and voices in academic discourse. Toward this end, countries in the Global South, especially those in Africa, may leverage the development to communicate their research findings globally in order to change the global academic narration that has been promoted by the Global North-dominated publishing landscape (Kodua-Ntim & Fombad, 2020). On this background, more responsive research should be conceived that would ultimately address the immediate challenges of local communities. Collaboration and innovation could also be fostered when there is free flow and exchange of ideas and research findings among scholars, disciplines, and institutions. Therefore, OARs may serve as a platform for interdisciplinary collaboration, data sharing, and the development of new research directions. Long-term preservation of manuscripts and other ephemeral scholarly outputs can effectively be achieved through the use of OARs. By providing sustainable infrastructure for archiving research outputs, repositories ensure that valuable knowledge such as notes, assessments, working papers, and technical reports remains accessible and discoverable across time and geographical spaces.

Over time, the OAR movement expanded globally, with repositories established in various countries and regions. Efforts were made to standardize repository practices and metadata formats to enhance interoperability and discoverability. OARs continue to evolve, with ongoing efforts to improve infrastructure, enhance accessibility, and promote collaboration among repositories. Initiatives such as the Confederation of Open Access Repositories (COAR) work to strengthen the global network of repositories and advance open access principles. Aggregator repositories such as COnnecting Repositories (CORE) and Bielefeld Academic Search

Engine (BASE) began to emerge to aggregate content from various OARs worldwide, providing centralized access to a vast array of scholarly materials. Throughout their development, OARs played pivotal roles in democratizing access to research and fostering the dissemination of knowledge across disciplines and geographical boundaries. It is important to note that the Global North appears to be more attuned to the importance of research communication, as they embraced the idea to open their research through OARs (Ali et al., 2013).

OARs increased from 128 in December 2005 to 2253 in December 2012, but the development was led by Europe, with North America following and Africa lagging far behind (Pinfield et al., 2014; Singh, 2016). However, the more recent trend in the development of OARs indicated that Asia has overtaken the United States in the number of active repositories (Bashir et al., 2019). The new trend is influenced by the rise in number of repositories in Japan. As of 2020, India has individually hosted over 90 repositories alone (Nazim, 2021).

Research deposited in OARs is more easily discoverable by a global audience, leading to increased visibility and potential impact (Jayakanth et al., 2012; Lazarenko et al., 2022). Open access publications tend to receive more citations compared to those behind paywalls, as they are accessible to a wider range of researchers and practitioners (Sotudeh, 2020), enabling scholars, students, policymakers, and the general public to freely access and engage with scholarly content. This broader audience reach enhances the dissemination of knowledge and its impacts. Demetres et al. (2020) and Ferreras-Fernández et al. (2013) discovered that works that are deposited in IRs have more citation advantage and are more available on the Internet. The repositories are usually configured based on the Open Archive Initiative for Metadata Harvesting Protocol (OAI-MHP) (Pinfield et al., 2014). This makes the repositories align with the principles of open science by promoting transparency, reproducibility, and equitable access to research data and findings. This is important in increasing research impact and stimulating human progress across the world.

OARs in Africa

The development of OARs in Africa has been part of the broader global movement toward open access and digital preservation of scholarly artefacts. Since the late 1990s to the early 2000s, some African universities and research institutions began to establish OARs to showcase and preserve their scholarly outputs (Kodua-Ntim, 2023). According to Kodua-Ntim and Fombad (2020), it is now part of the operational requirement for public universities in Ghana to host OARs. According to Mir (2022), OARs from Africa were first indexed by OpenDOAR in 2005. OARs in Africa grew from just three in 2005 to one hundred and sixty-five in 2018 (Jain, 2019; Kodua-Ntim, 2023; Kodua-Ntim & Fombad, 2020) and further grew to two hundred and nineteen in 2020, with Kenya leading, followed by

South Africa and then Nigeria in the third place (Mir, 2022). Mwalubanda (2021) also submitted that Kenya is leading in the number of OARs in East Africa.

The development of repositories in Africa has been slow owing to limited awareness, resources and technical capacity (Björk, 2014; Jain, 2019; Mwalubanda, 2021; Pinfield et al., 2014). This is one of the major reasons that researchers in Africa miss a lot of opportunities to participate in the global scholarly system (Ejikeme & Ezema, 2019). Consequently, the continent is considered research-inactive (Alemna, 2005; Gbaje, 2009; Nkoudou, 2020). Moreover, repositories in Africa are faced with several challenges related to infrastructure, funding, and awareness, although significant progress has been made over the years (Imoro & Saurombe, 2024; Kakai, 2021; Mwilongo & Kachota, 2023). Adam and Kaur (2022) assessed the functionalities of the African OARs, concluding that most of the OARs function below the optimal level. The study discovered that OARs in South Africa, Kenya, Nigeria, Algeria, Sudan, and Egypt were more promising than in other countries of the region. With the support of international and local organizations, advocacy efforts, and capacity-building initiatives, awareness regarding the benefits of OARs among African researchers, librarians, and policymakers is increasing. Workshops, conferences, and training programs are organized to promote the adoption of open access practices and OAR management skills (Lwoga & Chilimo, 2006).

OARs in Nigeria

Many scholars, including Ezema (2011), Hussein and Smart (2006), Nwagwu (2013), and Smart (2007 and 2019) opine that the weakness of the journal publishing system, as well as the weak financial ability of Nigerian researchers to publish their research in well-circulated journals outside the country, restrict the global visibility of researches publish in the country. Recent studies by Limb (2024) and Zell (2022) reiterate the languishing nature of journal publishing in the country. Against this backdrop, OARs appear to be an alternative for the country to participate in the global scholarly communication system (Smart, 2019). Many studies, including Aliyu and Mohammed (2013), Anene et al. (2020), Ezema (2011), Christian (2008); Mohammed (2013), Ridwan (2015), and Utulu and Akadri (2010), have observed that OARs are important to increasing global visibility of the research produced in Nigeria. Therefore, by 2009, the first breeds of OARs were established in the country. In 2017, the number of functional OARs rose from 16 to 20 out of 152 universities in the country (Bamigbola & Adetimiri, 2017; Ejikeme & Ezema 2019; Oguche, 2018).

Similarly, Adam and Kaur (2019), combining two directories of OARs, discovered that there were 25 OARs in Nigeria. Moreover, the Covenant University repository appears to be the largest, perhaps owing to the existence of a policy mandating researchers to deposit their work

in the institution's repository (Christopher et al., 2014; Ifijeh et al., 2018). This assertion may be supported by Posigha and Idjai (2022), who discovered that only three out of nineteen OARs that they investigated in Nigeria had mandated researchers to deposit their work. In addition, Oshilalu (2012) reported uncoordinated use of OARs from two of the first-generation universities in Nigeria, which may be a result of a lack of policy to guide the practice. Moreover, Nwachi and Idoko (2021) reported low utilization of OARs from the other two universities.

Nevertheless, several studies were conducted to review, document, and agitate for the development of OARs in Nigeria. Some of the studies are case studies of a single institution, for example, Andrew (2018), Idiegbeyan-ose et al. (2020), Okiki et al. (2020), and Onwubiko (2020), whereas many studies reported a large-scale overview of OARs in the country, for example, Gbaje and Mohammed (2017), Ifijeh et al. (2018), and Musa et al. (2014). Specifically, Ukachi (2018) revealed that many university libraries in Nigeria have embraced an OAR practice to provide global access to the scholarly outputs of the parent institutions. Studies such as Adam and Kaur (2019), Adewole-Odeshi and Ezechukwu (2020), Aliyu and Mohammed (2013), Andrew (2018), Anene et al. (2020), Anenene et al. (2017), Ejikeme and Ezema (2019), Ezema (2011), Ezema and Eze (2024), Musa et al. (2014), Ogbomo and Muokebe (2015), Posigha and Idjai (2022), and Ukwoma and Dike (2017) have reported overviews of the development of OARs in Nigeria. Specifically, Awoyemi (2024), Ezema (2011), Oye et al. (2017), and Ridwan (2015) observed that developing OARs is one of the important steps to increase the visibility of the research produced in the country.

On the other hand, Ukachi (2018) had a similar observation and corroborated Ogbomo and Muokebe (2015), who felt that university libraries are important in the drive. Other studies by Anenene et al. (2017), Bamigbola and Adetimiri (2017), Nwachi and Idoko (2021), and Oguche (2018) confirm the importance of university libraries in the development of OARs in Nigeria. Most of these studies believe that Nigerian universities and other research centers can leverage OARs to preserve and disseminate their research and other intellectual outputs. Oguche (2018), in particular, assumes that Nigerian libraries can rely on repositories to share and access research literature devoid of payment of subscription charges, which is, in many cases, above the budgetary allocation of the libraries.

However, the majority of the studies conducted to document the development of OARs in Nigeria fall into one of the three categories. The first category is studies that reviewed the literature to promote and emphasize the need for OARs in the country. The second category is case studies to document the development or performance of a particular repository; for example, Akintunde (2009) reported the establishment of the University of Jos repository, which is the first OAR established in Nigeria. In the same

vein, Aliyu and Mohammed (2013) reported the deployment of an OAR at Ahmadu Bello UniversityZaria, Utulu and Akadri (2010) reported the experience of Redeemers University Ede in establishing an IR, Eromosele (2019) reported the development of an OAR at the University of Ilorin, Christopher et al. (2014) reported the performance of an OAR at Covenant University, Onwubiko (2020) reported the development of an OAR at Alex Ekwueme Federal University, and Idiegbeyan-ose et al. (2020) reported the development of an OAR at the Landmark University.

Another category of studies surveyed users' awareness and attitudes toward utilizing an OAR. For example, Okiki et al. (2020) reported that researchers at the University of Lagos were aware of the OAR of the university, and Andrew (2018) reported a similar finding from the Federal University of Kashere, whereas Bamigbola and Adetimiri (2017) reported similar findings from a study that covered five different universities. However, in all the cases, the awareness did not translate into optimum utilization of the OARs. Moreover, Ukwoma and Dike (2017) reported that academic researchers in Nigeria have a positive disposition toward OARs; however, the study did not make an explicit attempt to measure the pattern of using the repositories. However, another survey by Bamigbola and Adetimiri (2017) reported optimal use of OARs among Nigerian researchers, but there is a need for evidence beyond the self-reporting survey to understand the use of OARs among Nigerian researchers. Of the few studies that were designed to focus on the systems without relying upon users' responses that may be biased are Ejikeme and Ezema (2019) and Adam and Kaur (2019).

Despite the tendency that OARs have to improve scholarly communication in Nigeria, the repositories are faced with several challenges, ranging from technical and infrastructural limitations to issues related to funding, awareness, lack of technical knowledge and sustainability, copyright and licensing issues, as well as content quality and quantity. Perhaps little or no improvement can be seen in the challenges that hinder the growth of OARs as first observed by Christian (2008). Scholars such as Ogbomo and Muokebe (2015), Musa et al. (2014), Ukwoma and Dike (2017), Andrew (2018), Björk (2014), and Posigha and Idjai (2022) have reiterated the challenges. These challenges can impede the development and effectiveness of repositories in the region. On their part, Ezema and Okafor (2015) emphasize the need for all stakeholders to advocate for the development of OARs in the country.

METHODS

The present work adopted content analysis relying on the OpenDOAR database and, in extension, the individual OARs hosted from Nigeria. To determine the size of OARs in the selected countries including Nigeria, OpenDOAR list of repositions by country was

used (https://v2.sherpa.ac.uk/view/repository_by_country/). Therefore, the number of OARs in 20 middle-income countries including Nigeria was determined and ranked. The countries were selected purposely from the World Bank list of countries (Table 1). The countries that were selected should have a population of over 2 million according to the United Nations 2022 population estimates.

Country	Population in Million*	Economic Category**	No. of Repositories	Repository/ million	Rank
Turkey	85.34	Upper-middle income	184	2.16	1st
Bulgaria	6.78	Upper-middle income	12	1.77	2nd
Argentina	45.51	Upper-middle income	79	1.74	3rd
Georgia	3.74	Upper-middle income	4	1.07	4th
Kenya	54.03	Lower-middle income	49	0.91	5th
South Africa	59.89	Upper-middle income	51	0.85	6th
Brazil	215.31	Upper-middle income	174	0.81	7th
Indonesia	275.5	Upper-middle income	181	0.66	8th
Malaysia	54.03	Upper-middle income	25	0.46	9th
Algeria	44.9	Lower-middle income	20	0.45	10th
Mexico	127.5	Upper-middle income	56	0.44	11th
Zimbabwe	16.32	Lower-middle income	7	0.43	12th
Iran	88.55	Lower-middle income	16	0.18	13th
Nigeria	218.54	Lower-middle income	35	0.16	14th
Iraq	44.5	Upper-middle income	7	0.16	15th
Bangladesh	171.19	Lower-middle income	16	0.09	16th
Egypt	110.99	Lower-middle income	9	0.08	17th
India	1417.17	Lower-middle Income	109	0.08	18th
China	1425.89	Upper-middle income	66	0.05	19th
Pakistan	235.82	Lower-middle income	4	0.02	20th

* United Nations data: https://data.un.org/_Docs/SYB/PDFs/SYB66_1_202310_Population,%20Surface%20Area%20and%20Density.pdf

** World Bank data: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Table 1. Ranking of 20 middle-income countries in relation to the number of OARs

After identifying the OARs hosted in Nigeria as aggregated by the OpenDOAR database, information regarding each of the repositories was captured from the OpenDOAR *repository information* pages. To assess the accessibility of the repository servers, attempts were made to visit each of the servers using links provided on *repository information* pages in order to widen

the scope of Adam and Kaur's (2019) work, which analyzed the servers for 1 month. Attempts to visit the servers were made in six different sessions across 6 months. The servers were visited within the second week of every month from March to August 2024. The visits were made using Mozilla Firefox and Google Chrome browsers simultaneously. Each browser was used at the default setting. In addition, the Google mail server was used as a control server as every attempt to visit the OAR servers and the Google mail server were run simultaneously for the Google mail server to serve as a control. If the Google mail server was launched and the repository server failed and was inaccessible, it meant that the failure was not from the researchers' network but was due to a technical problem. During every session, OARs that were accessible were recorded along with those that were not accessible online.

For each of the servers that was found to be accessible at any of the six sessions, an attempt was made to determine its size in terms of the number of items (i.e., articles, books, book chapters, metadata etc.) in the repository. This was achieved by summing the number of items contained in each collection on the repository accessible, as was tried earlier by Laddusaw (2024). Duplicate repositories were counted once; however, if an institution has more than one repositories that are separate from one another and all were accessible, the items in all of the repositories were summed up together (Table 2).

Serial Number	Repository	No. of Items
1.	Covenant University Repository	14,499
2.	University Ilorin Repository	14,212
3.	University of Lagos Institutional Repository	11,125
4.	Ahmadu Bello University Zaria Repository	10,992
5.	University of Ibadan Repository	8521
6.	Nasarawa State University Keffi Repository	6573
7.	Federal University of Technology Akure Repository	4663
8.	Landmark University Repository	3202
9.	University of Jos Institutional Repository	3113
10.	Elizade University Repository	1372
11.	National Library of Nigeria Repository	1228
12.	Afe Babalola University Repository	839
13.	Federal University of Technology Owerri Repository	791
14.	Central Bank of Nigeria Repository	756
15.	Ajayi Crowther University Institutional Repository	375
16.	Ebonyi State University	354

Table 2. Content of Nigerian OARs

Furthermore, an attempt was made to compare the OpenDOAR *repository information* of each accessible repository and the actual contents of the repository. Focus was placed on the type of items in the repositories, the subject coverage of the repositories, and the software used to host the repositories.

Finally, based on the information contained on all the repository websites accessed, attempts were made to identify the unit responsible for hosting the repository server in order to identify whether the server is maintained by the university libraries or another unit in the universities.

RESULTS

Size of Nigerian OARs

The result of this study discovered that there were 35 OARs listed by OpenDOAR from Nigeria as of August 2024. Out of that number, 33 were hosted by 25 of the Nigerian universities, which are the focus of the present study. Each of the remaining two was hosted by the Central Bank of Nigeria and the National Library of Nigeria (Table 3). The number is up from what Ejikeme and Ezema (2019) and Adam and Kaur (2019) discovered. It is important to note that no single subject/disciplinary repository could be identified from Nigeria. However, to understand the development of OARs in Nigeria in comparison with other developing countries, an attempt was made to compare the country with 19 middle-income countries, each with a population of more than 2 million. The countries were ranked in relation to the number of OARs in every 1 million people, with Turkey topping the list as the first with 2.16 OARs in every 1 million people, whereas Pakistan comes in last in the 20 countries, with 0.02 OARs in every 1 million people. However, Nigeria, together with Iraq, hold the 14th position in the list, with 0.16 OARs in every 1 million people, which is far below Kenya (5th position) and South Africa (6th position; Table 1).

Moreover, the study discovered that, among the Nigerian OARs that were accessed and analyzed, the Covenant University repository, with 14,499 items, was the largest, whereas the Ebonyi State University repository was the smallest, with 354 items. The mean number of items in the Nigerian OARs is 5163 (Table 2). This is up from the global mean size of 3093 items, as estimated by Pinfield et al. (2014), but below the average among regional public university repositories in the United States (i.e., 10,952) as reported by Laddusaw (2024). Already, Ifijeh et al. (2018) and Christopher et al. (2014) reported that the Covenant University repository appears to be the largest OAR in Nigeria.

Serial Number	University	No. of Repositories
1.	Afe Babalola University	1
2.	Ahmadu Bello University Zaria	2
3.	Ajayi Crowther University	1
4.	Ambrose Alli University Ekpoma	1
5.	American University of Nigeria	1
6.	Benue State University	1
7.	Bingham University	1
8.	Central Bank of Nigeria	1
9.	Covenant University	3
10.	Ebonyi State University	1
11.	Elizade University	1
12.	Federal University Dutsin-ma	1
13.	Federal University Lokoja	1
14.	Federal University Ndufu-Alike Ikwo	2
15.	Federal University of Technology Owerri	1
16.	Federal University of Technology Akure	1
17.	Federal University of Technology Minna	1
18.	Federal University Oye-Ekiti	1
19.	Landmark University	1
20.	Nasarawa State University Keffi	1
21.	National Library of Nigeria	1
22.	University Ilorin	2
23.	University of Ibadan	3
24.	University of Jos Institutional	1
25.	University of Lagos Institutional	1
26.	University of Nigeria Nsukka	2
27.	Usmanu Danfodio University Sokoto	1

Table 3. Nigerian universities with an OAR

The functionality of Nigerian OARs

Enhancing accessibility and dissemination is one of the important functions of OARs. However, the study discovered that the accessibility of the repositories was challenged by technical problems. When the study started in March 2024, there were 32 OARs in Nigeria, and, at the end of the study, in August 2024, there were 35 OARs in the country. Out of this number,

only 16 could be accessed at least once in the study period, and, out of the 16, only 9 could be accessed during all six visits in the 6 months of the study. This is similar to Adam and Kaur's (2019) study, in which data were collected at one point in time to discover that only 16 out of the OARs investigated from Nigeria were active. Furthermore, the study attempted to check the compliance between the actual contents of the repositories and the OpenDOAR *repository information*. It was discovered that there was no compliance in almost all of the repositories regarding the type of items that they contain and the subject coverage of the repositories.

Repository software adoption by Nigerian repositories

The result of this study shows that DSpace continues to lead among Nigerian OARs, as 30 (81%) out of 37 repositories hosted in Nigeria have adopted DSpace software, 3 have adopted EPrint software, and the remaining 2 installations used unidentified software. This is up from what Ejikeme and Ezema (2019) discovered, that 70% of the institutional repositories in Nigeria used DSpace.

Library support of OARs

The study used the available data on the individual repositories to determine whether the repository is hosted in the university library. The result reveals that only seven of sixteen repositories accessed were explicitly under the university library. Although some of the repositories could not be made available where the repository is placed administratively, many OARs in Nigerian universities may be standalone services or under the Information and Communication Technology (ICT) unit of the institutions.

DISCUSSION

The finding of the present study indicates an increase in the number of OARs hosted in Nigeria within the span of the last few years. However, the country can be said to be lagging because it was behind its African counterparts such as Kenya and South Africa. It is also important to note that no subject repository could be identified in Nigeria; therefore, many researchers, especially those that are not affiliated with universities, lack representation. Against this backdrop, a lot of research outputs of Nigerian scholars may lack an alternative avenue to reach the global communities because the majority of the local journals are in print-only formats, whereas many researchers either lack financing or expertise to publish their work in reputable journals, as observed by Christian (2008) and Ezema (2011). The situation may further obscure the country in terms of the global knowledge production landscape.

The findings of the study also show that, although there is an increase in the number of OARs in Nigeria, the development shows a lagging in relative terms, as Nigeria could not parallel countries such as Kenya and South Africa despite the bursting number of more than 200 universities in addition to other research centers. This implies that a lot of scholarly works and research results are hidden in the Nigerian university system because a majority of the universities have not hosted OARs, which can provide global access to their scholarly outputs.

The largest repository regarding the number of items in the repository among the repositories analyzed was the Covenant University repository. Although earlier studies attributed the relative size of the repository to a policy that mandates researchers in the university to deposit their work in the repository, it is pertinent to note that the university is one of the private universities that are relatively new in the Nigerian university system. However, public universities in the country have a longer history, and they usually have a large number of researchers and students enrolled. In addition, public universities are directly funded by governments. Against this background, it may be assumed that public universities in Nigeria are lagging in the development of OARs, which means a lot of research outputs from the universities lack a means to be communicated globally. This calls for more research on the adoption of OARs among Nigerian universities.

The finding of the study also discovered that OARs servers hosted in Nigeria experience accessibility challenges owing to technical problems. Therefore, they may not be reliable outlets to disseminate or access the scholarly works of the country. Already Adam and Kaur (2022) concluded that African OARs function below the optimal level. This may also question the effectiveness of OpenDOAR administrators in monitoring and safeguarding the reliability of OARs. As OARs are aimed at making their content available globally, they need to be always online, enabling users to have access at any time of their choice. Anything short of that would render the repositories ineffective.

The OpenDOAR service allows repositories, right from the installation and configuration, to indicate the type of items that they want to make available, as well as the subject limitation of the repository. OpenDOAR relies on such information to connect repositories with intending users. However, the finding of the present study discovered a mismatch between *repository information* on OpenDOAR and the actual contents of the repositories of the Nigerian universities. In almost all the repositories, the contents do not tally with the *repository information* as presented on the OpenDOAR website in relation to the type of contents contained in the repositories, as well as the subject coverage of the repositories. For example, in one instance, the repository according to the OpenDOAR *repository information* does not contain journal articles, but the majority of the contents of the repository were journal articles. In another instance, the OpenDOAR *repository information* shows that the repository does not contain

books, but there were books in the repository. On the other hand, the majority of the repositories according to the OpenDOAR *repository information* contain items in all subjects. However, the contents of many repositories were delimited to certain disciplines, or the index shows limitations, whereas the actual contents of the repository have exceeded the disciplinary limitation. This may affect the discoverability of items in the Nigerian university OARs.

This study reveals that the majority of OARs in Nigeria use DSpace open repository software. Although it will be good to unveil the reason behind the growing popularity of DSpace among OARs in Nigeria, overreliance on the software may deny the repositories to enjoy some good services from other software. For example, Eprint software has adopted the Library of Congress Classification Scheme in grouping resources. This provides a more standard and uniform way of browsing and navigating across repositories. However, DSpace allows repository administrators to organize their resources in line with their chosen terms and subjects. This separates related items and puts unrelated items together, making browsing and navigation a difficult task.

Evidence of libraries championing the development of OARs is available everywhere (Shieber & Suber, 2013). It has been a common practice to place OARs under the library, especially in the university setting. This provides robust support and infrastructure for OAR projects because they can tap from the Information Technology infrastructure, manpower, oversight, and other existing resources of the library. Nevertheless, Ifijeh et al. (2018) submitted that the lack of capacity to maintain institutional repositories among academic libraries in Nigeria hinders the development of OARs in the country. However, it may be assumed that OARs in many Nigerian universities are orphan, standalone projects, which would not guarantee the long-term development of OARs, especially when the seed funding stops.

CONCLUSION

Increasingly, OARs have become a common organ of universities, especially in developed countries. Universities in developing countries have been following the development. Similarly, Nigerian universities are increasingly hosting OARs to document, organize, and make available their scholarly output to all those who need it across the world. However, the present work discovered that the increase in hosting OARs in Nigeria is not encouraging when considering the number of universities in the country, as well as the number of OARs hosted by other countries. The present work also discovered that few repositories hosted in the country experience accessibility and discoverability challenges. This makes repositories ineffective and unreliable in providing global access to Nigerian research literature.

In addition, many of the repositories are orphan or standalone projects. This would deny them administrative support, especially in the long term. The present work concludes that Nigeria OARs could not effectively provide access to the scholarly outputs produced in the country. Therefore, the following are recommended:

1. Nigerian university libraries need to take charge of hosting and maintaining OARs in their universities.
2. Repository managers in Nigeria need to be more effective in making their repositories accessible and reliable.
3. Researchers need to focus their attention to uncover why research institutions in Nigeria lag in hosting OARs.

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