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Integrating Digital Information Retrieval Systems and E-Resources for Sustainable Development in Nigeria

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Abstract

This paper examines how digital information retrieval systems and electronic resources can help advance sustainable development in Nigeria. As the country works towards the Sustainable Development Goals (SDGs), access to well organized information is increasingly important in education, healthcare, agriculture, and governance. This study reviews current digitization efforts at Nigeria's National Library; Tertiary Education Trust Fund (TETFund) digital platforms for beneficiary institutions, including the National Repository of Nigeria and the Online Public Access Catalogue; and initiatives such as the Raw Materials Research and Development Council (RMRDC) Digital Archive and E-Library System. The article discusses how structured information management, based on linked data principles and open-access knowledge platforms like Wikidata and Wikibase, can improve the discoverability, preservation, and use of Nigerian intellectual and cultural resources. A documentary and multiple-case-study approach suggests that while progress has been made in building digital infrastructure, challenges remain. These include a lack of digitization equipment and internet connectivity, inconsistent metadata standards, and gaps in digital literacy. The findings indicate that integrated information systems can significantly enhance research efficiency, support evidence-based policymaking, and preserve indigenous knowledge for future generations. The article ends with suggestions for aligning policies, investing in infrastructure, building capacity, and encouraging public-private partnerships to enhance the role of digital information systems in Nigeria's sustainable development efforts.

Keywords: Digital information retrieval, electronic resources, sustainable development, linked data, Nigeria

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Introduction

The shift to digital information ecosystems has changed how societies create, store, access, and use knowledge to support societal development. For developing countries like Nigeria, this change offers both new opportunities and substantial challenges in achieving sustainable development. The Sustainable Development Goals (SDGs), set by the United Nations in 2015, provide a framework for tackling poverty, inequality, climate change, environmental damage, peace, and justice by 2030. A central factor in achieving these goals is the availability of reliable and accessible information that aids policy decisions, supports education and research, and empowers individuals with knowledge to improve their lives.

Digital information retrieval systems include the technologies, protocols, and methods that help users find and access relevant information from electronic resources. These systems can be as simple as online catalogues, academic websites such as ResearchGate, or as advanced as linked data platforms that connect related information across various networks. E-resources like e-books, academic journals, databases, digital repositories, and multimedia content make up the information these systems provide. Together, they form the foundation of modern knowledge infrastructure, which facilitates the flow of information vital for sustainable development in all sectors.

In recent years, Nigeria has made significant strides in digitizing information resources and improving retrieval capabilities. The National Library of Nigeria has taken a leading role in this change. It has introduced virtual library services, established the National Repository of Nigeria, and started using linked data technologies for authority control and knowledge organization. These efforts align with Nigeria's broader goals for digital transformation, including joining the Digital Public Goods Alliance, which promotes open-source technologies to help achieve the SDGs. This article looks at the current state of digital information retrieval systems and e-resources in Nigeria, evaluates their contributions to sustainable development, and suggests ways to enhance their integration and impact.

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Literature Review

Scholars have increasingly focused on the connection between information systems and sustainable development as the global community aims for the 2030 agenda. Ekhator, Miller, and Igbinosa highlight Nigeria's approach to the SDG framework, pinpointing knowledge gaps and the importance of collaborative partnerships in reaching development goals. Their study emphasizes how accessible information is essential for evidence-based policymaking and points out the need for strong information infrastructure to support sustainable development across different sectors in Nigeria.

Digital library services have shown great potential in improving information retrieval in academic settings. Fagbemi *et al.* (2024) examined how digital library services contribute to effective information retrieval in federal university libraries in Nigeria. They found that online databases, e-books, and digital repositories greatly enhance access to academic resources for students and academic staff. Their research identified digital literacy, infrastructure quality, and user engagement as crucial factors for the success of digital library services, suggesting that investments in technology should go hand in hand with efforts to develop human capacity.

Applying linked data principles to sustainability information is a promising area in knowledge management. Tribelhorn and Heng (2025) described a project at San Diego State University that integrated building data and sustainability features into Wikidata, creating organized, machine-readable information about campus sustainability initiatives. This method significantly improved the visibility of sustainability efforts and showed how linked data can aid research, decision-making, and public awareness used during pandemic periods. The project's challenges, including varying data formats and a lack of standard recording practices, offer useful lessons for Nigerian institutions that are starting similar digitization efforts.

Open access knowledge platforms and digital public goods are recognized as vital elements of sustainable information infrastructure. Nigeria's inclusion in the Digital Public Goods Alliance demonstrates a commitment to open-source technologies that support the SDGs. Digital public goods, such as open software, open data, open AI systems, and open content collections, provide foundational resources that

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countries can freely use to speed up digital transformation. Platforms like Wikidata and Wikibase exemplify this method, allowing libraries and information institutions to create data systems that follow international standards while promoting and preserving local knowledge.

Methodology

This study used a mixed-methods research design that combined document analysis and multiple case studies to explore how digital information retrieval systems and e-resources contribute to sustainable development in Nigeria. The document analysis looked at policy documents, project reports, and institutional publications from key stakeholders, including the National Library of Nigeria, the Federal Ministry of Communications, Innovation and Digital Economy, TETFund and research institutions involved in digitization projects.

The case study component focused on three selected digitization initiatives in Nigeria:

I. The digital transformation program of the National Library of Nigeria,

II. The RMRDC Digital Archive and E-Library System, and

III. The National Repository of Nigeria initiative.

Table 1 shows the Digital Information Infrastructure Initiatives in Nigeria. Data were gathered by examining project documentation, official publications, and media reports related to these initiatives from 2022 to 2025. The study also explored Nigeria's involvement in international digital infrastructure initiatives, including the Digital Public Goods Alliance and Wikimedia Deutschland's Wikidata training programs.

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Table 1: Digital Information Infrastructure Initiatives in Nigeria

Initiative	Lead Institution	Key Features	Current Status
National Repository of Nigeria (NRN)	National Library of Nigeria	Digital preservation of intellectual and cultural resources; open access to Nigerian materials	Operational
Online Public Access Catalogue (OPAC)	National Library of Nigeria	Unified bibliographic access to library materials; replacement of card catalogues	Operational
RMRDC Digital Archive and E-Library	Raw Materials Research and Development Council	Digital repository for research publications, technical reports, and patent information	75% completed (as of 2025)
Wikidata and Wikibase Integration	National Library of Nigeria with AfLIA and Wikimedia Deutschland	Authority control; linked data for Nigerian authors and publications	Training completed; implementation ongoing
Digital Public Goods Adoption	Federal Ministry of Communications, Innovation and Digital Economy	Open-source platforms, including OpenCRVS, DHIS2, and KoboToolbox	Ongoing
Source: Compiled by author from National Library of Nigeria (2025), RMRDC (2025), and Federal Ministry of Communications, Innovation and Digital Economy (2025)			

Results and Discussions

The results and discussion look into the progress made in digital infrastructure development, developments in linked data and open access knowledge systems,

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challenges and constraints, and sustainable development implications.

Progress in Digital Infrastructure Development

The investigation shows significant improvements in Nigeria's digital information infrastructure during the period reviewed (2022-2025) as outlined in Table 1. The National Library of Nigeria has discontinued card catalogs and launched a unified Online Public Access Catalogue (OPAC) that provides bibliographic access to materials across all library locations. This change marks a significant shift in how users find and access information, transitioning from physical browsing to efficient digital searches.

The National Repository of Nigeria (NRN) represents a major achievement in preserving and sharing Nigerian intellectual and cultural heritage. As the primary repository for the Federal Republic of Nigeria, the NRN systematically gathers and stores materials published in Nigeria, by Nigerians worldwide, and about Nigeria in electronic format. This effort addresses a crucial need to preserve national memory, ensuring that indigenous knowledge, local authorship, and community publications are documented and remain accessible over the long term.

The RMRDC Digital Archive and E-Library System showcases how research institutions can drive digital transformation. As of 2025, this project is 75% complete. It has digitized research reports, publications, and patent records, creating organized access for researchers, policymakers, and industry stakeholders. The project's achievements include converting historical publications to digital format, incorporating structured metadata, and enhancing staff skills in digital archiving processes.

Table 2: Socio-Economic Impacts of Digital Information Systems

Impact Area	Observed Contribution	Sustainable Development Goal Alignment
Research and Education	Enhanced access to academic resources; improved information retrieval efficiency for students and faculty (Fagbemi et al., 2024)	SDG 4 (Quality Education)
Policy and Investment	Evidence-based policymaking through	SDG 9 (Industry, Innovation

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Decisions	accessible industrial research; informed investment decisions (RMRDC, 2025)	and Infrastructure); SDG 17 (Partnerships)
Cultural Preservation	Documentation of family history in indigenous languages; preservation of oral traditions and local authorship (National Library of Nigeria, 2025)	SDG 11 (Sustainable Cities and Communities)
Innovation and Technology Transfer	Wide availability of research outputs is accelerating industrial development and technology adoption (RMRDC, 2025)	SDG 9 (Industry, Innovation and Infrastructure)
Collaboration and Partnerships	Enhanced cooperation between research institutions, industry, and government agencies	SDG 17 (Partnerships for the Goals)
Source: Compiled by author from Fagbemi et al. (2024), RMRDC (2025), and National Library of Nigeria (2025)		

Linked Data and Open-Access Knowledge Systems

This research highlights how linked data technologies are changing information management in Nigeria. The National Library of Nigeria took a major step by joining Wikidata and Wikibase training organized by the African Library and Information Associations and Institutions (AfLIA) with Wikimedia Deutschland. This move aims to create data systems that connect with international bibliographic standards (National Library of Nigeria, 2025). The initiative helps Nigerian information professionals learn to manage structured, linked data. This improves the discoverability of Nigerian authors and publications on global platforms.

Using linked data principles can solve long-standing issues in Nigerian bibliographic control. Problems like inconsistent author names, vague subject headings, and missing metadata have led to fragmented and limited visibility representation of Nigerian intellectual output in worldwide catalogs. The authority control features of Wikidata and Wikibase can unify all references to specific authors, works, or subjects, regardless of language or cataloging system (National Library of Nigeria, 2025). This infrastructure ensures that Nigerian authors receive accurate indexing and citation, while

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publishers benefit from better organization and promotion of their catalogs.

The potential of linked data goes beyond bibliographic control; it also involves preserving indigenous knowledge. Nigeria has a wealth of indigenous knowledge that has not been formally documented. Oral traditions, local authorship, and community publications are often underrepresented in digital knowledge systems. With Wikidata and Wikibase, these knowledge forms can be captured in structured, machine-readable formats that improve preservation and accessibility while keeping cultural authenticity intact (National Library of Nigeria, 2025). This development has significant implications for authors and publishers focused on indigenous or cultural content, providing platforms where their work can gain global recognition and scholarly interest.

Challenges and Constraints

Despite notable progress, this research points out ongoing challenges that limit the effectiveness of digital information systems in Nigeria. Infrastructure issues remain a major hurdle. Inadequate digitization equipment, unreliable power, and limited internet connectivity hinder systematic digitisation and provide access to users. The National Library of Nigeria acknowledges that while digitization efforts have started, the institution still needs to acquire the necessary scanners and technology (National Library of Nigeria, 2025). This resource gap delays digitization timelines and creates backlogs in converting physical collections to electronic formats.

Data standardization is another significant challenge across various initiatives. The experiences of linked data projects globally show that unstructured data formats and inconsistent recording practices complicate integration efforts (Tribelhorn and Heng, 2025). Nigerian institutions face similar issues, with data presented in different formats, including unstructured text, scanned documents, and spreadsheets that vary in their fields. The lack of centralized data management and standard procedures leads to fragmented datasets that are difficult to integrate efficiently into well-structured knowledge systems.

Digital literacy gaps also pose a significant challenge. Fagbemi et al. (2024) point out that digital literacy is a key factor affecting the success of digital library services in Nigerian universities. Using digital information systems effectively requires not just the right technology but also the skills

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to navigate, evaluate, and use electronic resources. Students, faculty, and the general public need training and support to get the most out of available digital resources; however, such training programs remain limited in scope and reach.

Implications for Sustainable Development

The reviewed evidence suggests the connection between digital information systems and sustainable development outcomes. Better access to research and educational resources directly supports SDG 4 (Quality Education) by providing students and faculty with the information they need for learning and scholarship (Fagbemi et al., 2024). Digital repositories allow academic materials to reach beyond physical libraries, providing educational opportunities to distance learners and institutions with limited print resources.

In the economic area, accessible industrial research and technical information support evidence-based policymaking and informed investments that drive innovation and industrial growth. The RMRDC Digital Archive contributes to SDG 9 (Industry, Innovation and Infrastructure) by making research outputs widely accessible, potentially facilitating technology adoption, and fostering collaboration among research institutions, industry players, and government agencies (RMRDC, 2025). This infrastructure reduces reliance on physical archives, saving costs on storage, retrieval, and document management while supporting the innovation ecosystem.

Cultural preservation efforts align with SDG 11 (Sustainable Cities and Communities) by documenting and preserving cultural heritage that might otherwise be lost due to modernization and globalization. The National Library's program for documenting family history in indigenous languages improves literacy while preserving cultural heritage in both print and digital formats (National Library of Nigeria, 2025). By collaborating with traditional institutions, government bodies, and families, the library ensures that Nigeria's diverse cultural landscape is systematically documented for future generations.

Conclusion

The introduction of digital information retrieval systems and electronic resources in Nigeria represents a powerful opportunity to advance sustainable development across many sectors. This article has looked at current initiatives at the National Library of Nigeria, the Raw Materials Research and Development Council, and within the

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context of Nigeria's digital public goods strategy, showing substantial progress in digitizing collections, implementing linked data technologies, and broadening access to electronic resources.

The National Repository of Nigeria and the Online Public Access Catalogue have changed how users find and access information. They have replaced manual card catalogues with systematic digital searching, leading to potential improvements in retrieval efficiency. The RMRDC Digital Archive illustrates how specialized research institutions can preserve and share technical information that supports industrial growth and evidence-based policymaking. Nigeria's adoption of linked data technologies through Wikidata and Wikibase positions the country to engage fully in global knowledge networks while preserving and promoting indigenous intellectual and cultural heritage.

However, this research also highlights persistent challenges that need to be addressed to realize the full potential of digital information systems for sustainable development. Issues like infrastructure gaps, inadequate digitization equipment, inconsistent data standards, and digital literacy challenges limit the reach and effectiveness of current initiatives. Overcoming these challenges requires ongoing investment, policy coordination, and capacity building throughout the information sector.

The link between digital information systems and sustainable development is mutual and supportive. As Nigeria strengthens its digital information infrastructure, it enhances its ability to achieve the Sustainable Development Goals through better education, informed policymaking, cultural preservation, and support for innovation. At the same time, progress in sustainable development creates demand for reliable information and generates resources that can be reinvested in information infrastructure. This positive cycle, if nurtured properly, can speed up Nigeria's progress toward the 2030 agenda while establishing resilient knowledge systems for present and future generations.

Based on the findings of this research, the following recommendations are proposed for improving the integration of digital information retrieval systems and electronic resources for sustainable development in Nigeria:

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i. Policy and Coordination: The Federal Ministry of Communications, Innovation and Digital Economy, along with the National Library of Nigeria and the National Information Technology Development Agency, should create a unified national framework for digital information infrastructure. This framework should set common standards, encourage interoperability, and coordinate investments across sectors. It should align with Nigeria's Digital Public Infrastructure framework and include principles of open knowledge and digital public goods.

ii. Infrastructure Investment: Governments at all levels should prioritize investment in digitization equipment, reliable power supply, and internet connectivity for libraries, research institutions, and educational facilities. Public-private partnerships can help deploy infrastructure more quickly while sharing costs and risks between public institutions and experienced private sector partners.

iii. Capacity Building: The National Library of Nigeria should expand training programs in digital librarianship, metadata management, and linked data technologies. These programs should reach information professionals across federal and state institutions, ensuring that skills keep pace with technological advancements.

iv. Standardization: Nigerian information institutions should adopt international metadata standards and authority control protocols to ensure interoperability with global knowledge systems. The National Library of Nigeria, as the leading library, should provide guidance in establishing national standards that balance international compatibility with local needs for representing Nigerian languages, cultures, and knowledge forms.

v. Indigenous Knowledge Documentation: Systematic programs should be set up for documenting indigenous knowledge in structured, machine-readable formats that preserve cultural authenticity while enhancing

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discoverability and reuse. Traditional institutions, community leaders, and local knowledge holders should be involved as partners in these documentation efforts to ensure that indigenous communities maintain control over their cultural heritage.

vi. Digital Literacy: Educational institutions at all levels should integrate digital literacy into their curricula. This will help students develop skills for navigating, evaluating, and applying electronic resources. Public libraries should offer community programs that extend digital literacy training to the general public, bridging the digital divide and ensuring equal access to digital information resources.

vii. Research and Innovation: Nigerian universities and research institutions should conduct continued research into how effective digital information systems are. This includes finding best practices, documenting challenges, and developing innovative solutions suited to Nigerian contexts. Collaborating with international partners can help share knowledge and adapt successful strategies from both developing and developed countries.

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