

Digitization of Archival Materials: A Technology-Organization-Environment (TOE) Analysis of Adoption Challenges and Prospects at the Federal College of Education (Technical) Umunze

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Abstract

Digitisation of archival materials is a strategic approach to improving academic access, preserving institutional memory, and enhancing the operational capacity of higher education institutions. This study examines the challenges, prospects, and a sustainable framework for digitisation at the Federal College of Education (Technical), Umunze, Nigeria, using the Technology–Organization–Environment (TOE) framework. The major challenges identified include inadequate technology infrastructure, limited human capacity, financial constraints, organizational inertia, and legal or ethical concerns. At the same time, notable opportunities exist in improved access through e-learning, increased collaboration, adoption of emerging technologies, and enhanced institutional reputation. Based on these insights, the study proposes a sustainable digitisation framework encompassing systematic assessment of archival holdings, appropriate technology selection, structured workflows with quality assurance, continuous staff training, and active stakeholder involvement. Each element of the framework aligns with the TOE dimensions to ensure technological viability, organizational readiness, and environmental adaptability. The study recommends the formulation of institutional policies, regularized capacity development programs, investment in cloud infrastructure, adherence to legal and ethical guidelines, and participation in wider digital initiatives. Implementing this framework will enable FCE(T) Umunze to establish a resilient, scalable, and sustainable digital archive that supports teaching, research, and institutional visibility. Ultimately, the study contributes to Nigeria's digital education ecosystem by presenting a context-specific, empirically grounded model for sustainable archival digitisation across higher education institutions.

Keywords: Digitization, Technology Organization–Environment (TOE), Higher Education Nigeria

Introduction

The digitisation of archival materials represents a critical advancement in library and information science, fundamentally transforming how institutional records and historical documents are preserved and accessed (Espina-Romero & Guerrero-Alcedo, 2022). By systematically converting fragile physical archives into digital formats, tertiary institutions can facilitate wider dissemination, enable remote access, and enhance research utility (Ashikuzzaman, 2024), thereby safeguarding institutional memory and supporting academic curriculum development (Gbaje, 2007; Pepler, 2014; Rathore et al., 2023).

The Federal College of Education (Technical) Umunze, a specialized institution focused on technical and vocational teacher training, maintains extensive archival holdings, including administrative records, unique technical theses, and departmental histories. While digitisation is essential for preserving these specialized collections and making them accessible to a broader audience (students, faculty, and industry partners), research on digital archive adoption often overlooks the specific challenges faced by technical education colleges in Nigeria. Studies highlight that Nigerian archival institutions face infrastructure deficits, limited technical skills for metadata management, and resource constraints, which can hinder effective digitisation and long-term preservation of unique technical archives (Owojuyigbe & Owojuyigbe, 2022). Furthermore, scholars emphasize that archival digitisation is not only a preservation strategy but also a tool for sustainable development and educational innovation (Owojuyigbe & Owojuyigbe, 2022).

To move beyond general discussions of ICT adoption, this paper employs the Technology–Organization–Environment (TOE) framework as its analytical lens. The TOE framework provides a systematic structure for analyzing internal and external factors that influence the successful adoption of digital innovations. Applying this framework to FCE(T) Umunze ensures a comprehensive, strategic analysis that yields context-specific and actionable recommendations.

Accordingly, this paper seeks to:

1. Identify and categorize the major challenges impeding effective digitisation at FCE(T) Umunze within the Technological, Organizational, and Environmental contexts of the TOE framework.
2. Explore the prospects and strategic opportunities offered by digital archives for enhancing teaching, research, and institutional reputation.
3. Propose a sustainable digitisation framework and practical recommendations aligned with TOE analysis and national ICT policies.

Conceptual and Theoretical Context

Digitisation refers to the systematic conversion of analog archival materials such as paper documents, photographs, and microfilms into digital formats. This process encompasses image

capture, metadata assignment, cataloguing, and secure electronic storage (Gbaje, 2007; Pepler, 2014). Effective digitisation requires adherence to rigorous technical standards, specified metadata schemas (such as Dublin Core), and legal frameworks (Meghanandha & Naik, 2025; Society of American Archivists, 2007). Compliance with these protocols ensures digital integrity, interoperability among repositories, and long-term preservation of archival content, thereby supporting research, teaching, and institutional memory.

The Technology–Organization–Environment (TOE) framework provides a robust lens for understanding the adoption of digitisation in institutional settings. This framework categorizes challenges and opportunities into three interrelated domains: technological, organizational, and environmental (Oliveira & Martins, 2011). Recent studies applying the TOE framework in library and archival contexts emphasize that technological readiness, organizational support, and environmental pressures jointly determine the success of digitisation initiatives in higher education and cultural heritage institutions.

The Technological context examines the internal technologies and infrastructure that facilitate digitisation. At FCE(T) Umunze, this encompasses the availability, adequacy, and quality of ICT infrastructure, digitisation hardware such as scanners and servers, software tools, and adherence to established technical standards and file formats (Ajah & Nweke, 2019). The technological domain is critical because it determines the feasibility, efficiency, and quality of the digitisation process (Owojuyigbe & Owojuyigbe, 2022; Meghanandha & Naik, 2025).

The Organizational context considers the internal characteristics and resources of the institution. Key variables include staff competency and training, institutional policies governing archival management, leadership support, and coordination of workflows (Nwosu, 2013; Okello-Obura & Kigongo-Bukenya, 2011). These factors influence how effectively digitisation initiatives are planned, executed, and sustained within the institution (Oliveira & Martins, 2011; Gbamwuan & Agidi, 2023).

The Environmental context addresses the external factors shaping digitisation adoption. For FCE(T) Umunze, this includes national ICT policies, funding mechanisms, regulatory frameworks, intellectual property laws, and broader socio-economic conditions (Okebukola, 2006; Ahmed, 2007). Understanding the environmental domain is essential for aligning institutional initiatives with external expectations, securing resources, and ensuring compliance with legal and policy frameworks.

By integrating these three domains, the TOE framework provides a comprehensive lens for analyzing the multifaceted factors affecting digitisation adoption, offering both explanatory and prescriptive insights for institutions like FCE(T) Umunze.

Research Approach and Analytical Lens

This study adopts a conceptual review and policy analysis approach, firmly grounded in the TOE framework. Challenges and opportunities were systematically mapped and analyzed through a

synthesis of global and Nigerian literature, ensuring the findings were contextualized to the unique archival environment of FCE(T) Umuze. Insights were drawn from studies on digital libraries, ICT adoption, and higher education reforms in Nigeria (Gbaje, 2007; Nwosu, 2013; Okello-Obura & Kigongo-Bukenya, 2011), providing a robust foundation for actionable recommendations aligned with the TOE framework.

Digitisation Challenges at FCE(T) Umuze

1. Technological Limitations (TOE: Technology)

Technological constraints constitute a major barrier to effective digitisation at FCE(T) Umuze. One of the most pressing challenges is the inconsistent internet connectivity and unreliable power supply, which disrupts digitisation workflows and limits real-time access to digital repositories (Barakabitze et al., 2019). These infrastructural deficiencies hinder not only routine processing of archival materials but also the integration of advanced digital tools that require stable network connections (Nwogo Ezeani, 2009).

Another significant limitation is the restricted access to preservation-quality digitisation hardware and software. The institution experiences shortages of archival-grade, high-resolution scanners, adequate storage servers, and specialized metadata management software, all of which are essential for maintaining digital integrity, adherence to metadata schemas, and long-term usability of digitised archives (Oyeleye et al., 2014). Without such equipment, both the quality and durability of digital collections are compromised, undermining their value for research and institutional memory (Owojuyigbe & Owojuyigbe, 2022; Gbamwuan & Agidi, 2023).

Furthermore, maintenance challenges and limited technical support threaten the sustainability of digital archives. Regular system upkeep, software updates, and troubleshooting are crucial to preserve digital collections, yet the scarcity of skilled technical personnel impedes consistent maintenance (Nwosu, 2013). This technological fragility endangers the continuity and reliability of digitisation services for staff, students, and external users (Nwogo Ezeani, 2009; Gbamwuan & Agidi, 2023).

Collectively, these infrastructural and equipment deficits severely constrain the Technological Context for digitisation at FCE(T) Umuze. This fragility not only affects digital workflows but also places additional strain on human and organizational resources, which is further explored in the following section on the Organizational Context (Owojuyigbe & Owojuyigbe, 2022).

2 Human Resource and Skills Deficits (TOE: Organization)

Within the Organizational Context, human resource and skills limitations represent a critical barrier to effective digitisation at FCE(T) Umuze. Many staff members lack formal training in digital archiving, metadata standards, and ICT management, which directly affects the accuracy, consistency, and reliability of digitised collections (Okello-Obura & Kigongo-Bukenya, 2011; Bediang et al., 2013). This skills gap constrains the institution's ability to implement best

practices in digital preservation, leading to variability in cataloguing quality and metadata application.

Limited awareness of established digitisation workflows and archival standards further reduces the quality and usability of digital outputs. Staff who are unfamiliar with contemporary approaches to information organization, metadata frameworks, or long-term digital preservation are less able to maintain standards essential for interoperability and research utility (Gbaje, 2007).

Consequently, these human resource and skills deficits, often coupled with institutional inertia and resistance to new workflows, exacerbate technological limitations by preventing optimal use of available equipment and software. Addressing these challenges requires targeted training programs, continuous professional development, and capacity-building initiatives to strengthen the institution's organizational readiness for sustainable digitisation.

3 Financial Constraints (TOE: Environment)

Within the Environmental Context of the TOE framework, the absence of dedicated national or institutional funding mandates and subsequent financial limitations pose a significant barrier to the effective digitisation of archival materials at FCE(T) Umuze. Budgetary restrictions hinder the institution's ability to procure essential digitisation tools, maintain adequate ICT infrastructure, and provide staff with specialized training necessary for high-quality digital archiving (Pepler, 2014). Without sufficient funding, investments in archival-grade scanners, servers, metadata management software, and reliable power backups remain inconsistent, directly undermining the sustainability and quality of digital archives.

Furthermore, the institution's reliance on external grants and ad hoc funding for digitisation projects introduces additional sustainability risks. While grant support can temporarily supplement financial shortfalls, it often comes with restrictions on usage, fixed timelines, or limited scope, leaving ongoing maintenance, system upgrades, and capacity-building activities inadequately funded (Ahmed, 2007). Such dependency creates uncertainty in long-term planning and reduces the institution's ability to sustain continuous digitisation initiatives.

Collectively, these financial constraints exacerbate both technological and organizational challenges, limiting the institution's ability to establish a robust and enduring digital archival infrastructure. Addressing these funding gaps requires strategic budget allocation, advocacy for institutional support, and the development of sustainable financing models to ensure that digitisation efforts are both effective and resilient.

4 Structural and Managerial Barriers (TOE: Organization)

Within the Organizational Context, human resource and skills limitations represent a critical barrier to effective digitisation at FCE(T) Umuze. Many staff members lack formal training in digital archiving, metadata standards, and ICT management, which directly affects the accuracy,

consistency, and reliability of digitised collections. This skills gap constrains the institution's ability to implement best practices in digital preservation, leading to variability in cataloguing quality and metadata application (Mutsagondo & Khumalo, 2023)

Limited awareness of established digitisation workflows and archival standards further reduces the quality and usability of digital outputs. Staff who are unfamiliar with contemporary approaches to information organization, metadata frameworks, or long-term digital preservation are less able to maintain standards essential for interoperability and research utility (Daniel & Ndumbaro, 2023). In fact, a lack of awareness and qualified staff is frequently cited as a major challenge to effective digital preservation efforts (Daniel & Ndumbaro, 2023).

Consequently, these human resource and skills deficits, often coupled with institutional inertia and resistance to new workflows, exacerbate technological limitations by preventing optimal use of available equipment and software (Çoban Kumbalı, 2024; Fiaz & Qureshi, 2024). Addressing these challenges requires targeted training programs, continuous professional development, and capacity-building initiatives to strengthen the institution's organizational readiness for sustainable digitisation.

5 Legal and Ethical Issues (TOE: Environment)

Within the Environmental Context of the TOE framework, legal and ethical considerations constitute a critical challenge to the digitisation of archival materials at FCE(T) Umunze. Copyright and intellectual property rights complicate the reproduction, dissemination, and sharing of archival content, particularly for rare theses, historical records, and specialized technical documents. Libraries and archives face immense difficulty ensuring that their preservation and access activities comply with existing copyright laws, which were primarily designed for the analogue era (Mutsagondo & Khumalo, 2023).

Institutions must navigate these legal constraints carefully, often necessitating the implementation of Digital Rights Management (DRM) protocols to control access and usage. However, while DRM ensures compliance, it can often create a burdensome user experience, which leads to frustration and can restrict access to valuable digital collections (Ertl, 2024).

Data privacy and protection represent another crucial aspect of the legal and ethical landscape. Digitised archives frequently contain personal information, research data, or sensitive institutional records. Ensuring adherence to national regulations and international standards, such as the principles of the General Data Protection Regulation (GDPR), is essential to safeguard user privacy and prevent unauthorized access or misuse (Jamal, 2023). Inadequate privacy measures can undermine user trust, reduce engagement, and expose the institution to legal liability, especially when handling sensitive materials.

These legal and ethical issues intersect closely with technological, organizational, and financial factors. Compliance with copyright laws and data protection requirements may demand specialized software, secure servers, or additional staff training. Simultaneously, institutional

policies, awareness programs, and monitoring mechanisms are necessary to ensure ethical and lawful practices. Addressing these challenges in a coordinated manner supports sustainable, compliant, and trustworthy digitisation initiatives, enhancing both access and preservation of FCE(T) Umuze's archival holdings.

Prospects and Strategic Opportunities

1 Enhanced Access and Preservation

Digitisation offers significant strategic opportunities for FCE(T) Umuze, particularly in the areas of accessibility and preservation. By converting physical archival materials into digital formats, the institution can provide remote, 24/7 access to students, faculty, and external researchers, thereby supporting academic research, teaching, and collaborative learning initiatives (Gbaje, 2007; Nwosu, 2013). This enhanced accessibility reduces dependency on physical handling of fragile documents, minimizes wear and tear, and improves the usability of rare or specialized collections.

In addition to improving access, digitisation plays a critical role in preserving institutional memory. Archival materials such as administrative records, technical theses, and departmental histories are often vulnerable to deterioration, misplacement, or environmental hazards. Digital preservation ensures that these records are safeguarded against physical degradation while maintaining continuity for future institutional planning, curriculum development, and historical research (Okello-Obura & Kigongo-Bukenya, 2011; Agu & Gbamwuan, 2023; Balogun & Adjei, 2019).

By integrating digital access with robust preservation protocols, FCE(T) Umuze can strengthen both the academic utility and the longevity of its archival holdings. These benefits directly mitigate the Organizational challenges of limited physical access and workflow inefficiencies, as well as the Technological risks associated with document degradation, thereby establishing a foundation for sustainable knowledge management and long-term institutional development.

2 Integration with E-Learning

Digitisation provides a strategic opportunity for FCE(T) Umuze to enhance the integration of archival materials into e-learning environments. By converting institutional records, theses, and specialized documents into digital formats, educators can enrich curriculum content and support blended learning approaches, combining traditional classroom instruction with online resources (Barakabize et al., 2019; Bediang et al., 2013; Unwin, 2008; Oye et al., 2012). This integration ensures that students have timely access to relevant academic materials, fostering more interactive and flexible learning experiences.

Furthermore, the availability of digitised resources encourages student-centered learning by allowing learners to explore content independently, engage with supplementary materials, and collaborate online. It also contributes to the development of digital literacy skills, enabling

students to navigate, evaluate, and apply digital information effectively a critical competence for contemporary technical and vocational education (Bediang et al., 2013).

Through the systematic incorporation of digitised archives into e-learning platforms, FCE(T) Umuze can improve teaching effectiveness and enhance student engagement. This strategic alignment strengthens the Organizational Context of the institution by embedding the digital archive within core academic functions, promoting curriculum innovation, and ensuring the sustained utility and accessibility of its digital collections.

3 Collaboration and Networking

Digitisation presents a strategic opportunity for FCE(T) Umuze to enhance collaboration and networking within the library and information science community. Participation in national and international digital library initiatives enables the institution to expand its access to digital resources, share specialized archival materials, and engage in knowledge exchange with peer institutions (Okello-Obura & Kigongo-Bukenya, 2011; Gbaje, 2007 Ocholla, 2008). Such collaboration ensures that FCE(T) Umuze remains informed about emerging trends, standards, and innovative practices in archival digitisation.

Additionally, strategic partnerships with other academic institutions, professional organizations, and technology providers facilitate technology transfer, professional development, and the adoption of best practices in digital archiving (Okebukola, 2006). These partnerships are particularly crucial for access to pooled resources, shared infrastructure, and joint grant funding opportunities, enabling the institution to overcome internal resource and skill constraints, strengthen staff capacity, and implement more effective and sustainable digitisation workflows.

From a TOE perspective, collaboration and networking primarily enhance the Environmental Context by providing external support, guidance, and resources, while also mitigating financial risks. They indirectly strengthen the Organizational Context by fostering professional growth, encouraging standardization, and embedding a culture of continuous learning within the institution. Through systematic engagement with external networks, FCE(T) Umuze can achieve greater resilience, sustainability, and innovation in its digital archival initiatives.

4 Technological Advancements

The advancement of digital technologies presents a strategic opportunity for FCE(T) Umuze to modernize and optimize its archival management systems. Cloud storage solutions, artificial intelligence (AI), and big data analytics offer enhanced scalability, automation, and efficiency, enabling the institution to store large volumes of digitised records securely, manage workflows more effectively, and streamline archival processes. The cost-efficiency and flexibility of these solutions also help mitigate the persistent financial constraints identified earlier, reducing the need for costly local infrastructure (Ajah & Nweke, 2019; Chen et al., 2024). By leveraging these technologies, the college can address previously identified technological limitations, such as inadequate storage capacity, inefficient data handling, and fragmented access.

Emerging technologies further enhance indexing, retrieval, and predictive analytics within digital archives. AI-driven algorithms can automatically categorize and tag archival materials, enabling faster and more accurate information retrieval, while big data tools provide insights into usage patterns, resource demand, and emerging research trends (Jha, 2023; Zhou et al., 2017; Ajah & Nweke, 2019). These capabilities improve operational efficiency and support informed decision-making for resource allocation, preservation priorities, and academic planning.

From a TOE perspective, technological advancements directly strengthen the Technological Context by improving infrastructure, tools, and operational capabilities. Indirectly, they bolster the Organizational Context by reducing manual workload, enabling staff to focus on higher-order tasks, and promoting adoption of best practices. Additionally, the Environmental Context benefits through cost-effective scalability and the facilitation of collaborative initiatives with other institutions. By strategically integrating these innovations, FCE(T) Umunze can ensure that its digitisation initiatives remain efficient, scalable, and sustainable, positioning the institution at the forefront of modern digital archival management.

5 Institutional Reputation

Digitisation provides FCE(T) Umunze with a strategic opportunity to elevate its institutional reputation both nationally and internationally. By developing comprehensive and accessible digital archives, the institution positions itself as a modern knowledge hub, demonstrating commitment to innovation, transparency, and the preservation of scholarly and historical resources (Nwosu, 2013; Pepler, 2014). High-quality digital collections signal academic rigor and administrative efficiency, enhancing the college's standing among peer institutions, research partners, and prospective students.

Compliance with national and international digitisation standards further strengthens credibility. Implementing standardized metadata practices, digital preservation protocols, and robust data protection measures safeguards archival integrity and aligns the institution with global best practices in library and information management (Okebukola, 2006). This alignment facilitates participation in collaborative networks, enhances visibility in national and international projects, and positions FCE(T) Umunze as a benchmark for excellence in archival digitisation.

From a TOE perspective, the enhancement of institutional reputation primarily strengthens the Environmental Context, as recognition and credibility are essential for attracting external partnerships, dedicated funding, and regulatory confidence. Indirectly, these external advantages bolster the Organizational Context by embedding digital excellence into core institutional processes, improving internal morale, and fostering a culture that supports sustainable digital innovation. Strategically leveraging digitisation in this way ensures long-term growth, resilience, and visibility for the college as a forward-looking institution in higher education.

Proposed Sustainable Framework for Digitisation

To ensure the long-term success and sustainability of digitisation initiatives at FCE(T) Umunze, a phased, TOE-aligned framework is proposed. The framework addresses the challenges identified in Section 4 and leverages the strategic opportunities outlined in Section 5, integrating Technological, Organizational, and Environmental considerations.

Phase	Framework Component	Description	TOE Context
Phase 1: Readiness	Assessment and Audit	Conduct a systematic audit of archival materials, prioritizing items based on historical value, fragility, and usage frequency (Okello-Obura & Kigongo-Bukenya, 2011; Gbaje, 2007). This ensures efficient resource allocation and prepares the institution for scalable digitisation.	Organizational & Technological
	Stakeholder Engagement	Involve leadership, faculty, staff, and students to foster ownership, align initiatives with institutional goals, and encourage acceptance of new workflows (Nwosu, 2013; Pepler, 2014). Engagement strategies may include awareness campaigns, participatory planning, and feedback mechanisms.	Organizational
Phase 2: Implementation	Technology Selection	Select suitable digitisation technologies, including scanners, metadata management software, and storage solutions, considering quality, cost-effectiveness, and sustainability (Pepler, 2014). Integrate emerging technologies such as cloud storage, AI, and big data analytics to enhance scalability, automation, and archival management efficiency.	Technological & Environmental
	Workflow and Quality Control	Implement structured workflows covering material preparation, scanning, metadata creation, and secure storage. Integrate regular quality control checks to ensure consistency, accuracy, and compliance with national and international standards (Gbaje, 2007; Pepler, 2014).	Organizational & Technological
Phase 3: Sustainability	Capacity Building	Train staff in digital preservation, ICT tools, and metadata standards. Embed these skills into continuous professional development programs to address human resource deficits,	Organizational

		enhance confidence, and reduce resistance to technological adoption (Okello-Obura & Kigongo-Bukenya, 2011; Bediang et al., 2013).	
	Sustainability and Resource Advocacy	Establish dedicated institutional budget lines for digital archiving, seek external funding opportunities (e.g., TETFUND grants), and formalize partnerships or MOUs for resource sharing. These actions address financial constraints and ensure long-term maintenance and expansion of the digital archive.	Environmental

By systematically integrating these phases, FCE(T) Umunze can establish a sustainable, scalable, and resilient digital archive, mitigating technological, organizational, human resource, and environmental challenges while maximizing the strategic benefits of digitisation for teaching, research, and institutional reputation. This framework not only operationalizes the TOE model but also provides a practical roadmap for long-term, institution-wide digital transformation.

Conclusion

Digitisation at FCE(T) Umunze represents a transformative opportunity to enhance academic access, preserve institutional memory, and strengthen overall institutional development. Converting archival materials into digital formats enables remote, 24/7 access to critical records, supports e-learning, and fosters collaborative research, while safeguarding fragile documents from deterioration. Strategic digitisation also enhances the college's national and international reputation as a modern knowledge hub.

The TOE-based analysis indicates that while technological limitations exist, the main challenges to sustainable digitisation lie in the Organizational Context (policy gaps, human capacity deficits, resistance to change) and the Environmental Context (financial constraints, legal and regulatory considerations). Systematic interventions across technological, organizational, and environmental dimensions are essential to ensure sustainability, scalability, and long-term impact.

Recommendations

To establish a sustainable and scalable digital archive, the following recommendations are proposed:

1. Develop Comprehensive Digitisation Policies

Formulate institutional policies aligned with national ICT reforms to standardize workflows and ensure accountability in archival management (Okebukola, 2006; Nwosu, 2013).

2. Institutionalizing Staff Training and Cross-Disciplinary Collaboration

Implement continuous professional development programs on digital preservation, ICT tools, and metadata standards. Encourage cross-departmental collaboration to strengthen digital capacity and reduce resistance to technology adoption (Okello-Obura & Kigongo-Bukenya, 2011; Bediang et al., 2013).

3. Invest in Modern Digitization Technologies and Cloud Infrastructure

Acquire high-quality scanners, metadata management software, and secure cloud storage solutions to improve scalability, efficiency, and automation in archival management (Ajah & Nweke, 2019).

4. Ensure Legal and Ethical Compliance

Implement protocols for copyright protection, intellectual property management, and data privacy in accordance with national and international standards (Ahmed, 2007; Pepler, 2014). This safeguards institutional and user data while ensuring ethical stewardship of digitised content.

5. Leverage Emerging Technologies and Collaborations

Integrate AI, big data analytics, and cloud-based tools to optimize indexing, retrieval, and predictive insights. Engage in national and international digital library initiatives to facilitate knowledge exchange, professional development, and adoption of best practices (Ajah & Nweke, 2019).

References

- Agidi, P. A. (2023). Digital preservation of Nigeria's National Archives: Opportunities and challenges. *Alkebulan: A Journal of West and East African Studies*, 3(1), 35–45.
- Ahmed, A. (2007). Open access towards bridging the digital divide: Policies and strategies for developing countries. *Information Technology for Development*, 13(4), 337–352. <https://doi.org/10.1002/itdj.20067>
- Ajah, I. A., & Nweke, H. F. (2019). Big data and business analytics: Trends, platforms, success factors and applications. *Big Data and Cognitive Computing*, 3(2), Article 32. <https://doi.org/10.3390/bdcc3020032>
- Ashikuzzaman, M. (2024, October 24). Challenges associated with digitizing archival materials. *LIS Edutech Network*. <https://www.lisedunetwork.com/challenges-associated-with-digitizing-archival-materials/>
- Balogun, T., & Adjei, E. (2019). Challenges of digitization of the National Archives of Nigeria. *Information Development*, 35(4), 612–623.
- Barakabitze, A. A., et al. (2019). Transforming African education systems in science, technology, engineering, and mathematics (STEM) using ICTs: Challenges and opportunities. *Education Research International*, 2019, Article 1462021. <https://doi.org/10.1155/2019/1462021>
- Bediang, G., et al. (2013). Computer literacy and e-learning perception in Cameroon: The case of Yaounde Faculty of Medicine and Biomedical Sciences. *BMC Medical Education*, 13(1), Article 57. <https://doi.org/10.1186/1472-6920-13-57>
- Chen, M., et al. (2014). Big data: A survey. *Mobile Networks and Applications*, 19(2), 171–209.
- Çoban Kumbalı, H. (2024). The effect of digitization on human resource management practices: A bibliometric analysis. *Marmara University Journal of Economic & Administrative Sciences*, 46(3), 621–642. <https://doi.org/10.14780/muiibd.1513054>
- Daniel, J., & Ndumbaro, F. (2023). An assessment of human resource capabilities in supporting digital records preservation: A case of RAMD and RITA, Tanzania. *Records Management Journal*, 33(1), 1–19. <https://doi.org/10.1108/RMJ-02-2021-0003>
- Ertl, B. (2024). 4 biggest digital rights management challenges. *Kiteworks*. <https://www.kiteworks.com/digital-rights-management/digital-rights-management-challenges/>
- Espina-Romero, L., & Guerrero-Alcedo, J. (2022). Fields touched by digitalization: Analysis of scientific activity in Scopus. *Sustainability*, 14(21), Article 14425. <https://doi.org/10.3390/su142114425>

Fiaz, S., & Qureshi, S. (2024). Unraveling the conceptual ambiguity of digital human resource management: A state-of-the-art review. *Cogent Social Sciences*, 10(1), Article 2395101.

<https://doi.org/10.1080/23311886.2024.2395101>

Gbaje, E. S. (2007). Implementing a national virtual library for higher institutions in Nigeria. *LIBRES*, 17(1), 1–17.

Gbamwuan, A., & Agidi, P. A. (2023). Digital preservation protocols in contemporary African academic libraries. *Journal of Archival Science*, 8(2), 112–125.

Jamal, S. (2023). Data privacy and protection in the digital era. *Journal of Computer Engineering and Information Technology*, 12(4). <https://doi.org/10.4172/2324-9307.1000276>

Jha, S. (2023). Application of artificial intelligence in libraries and information centers services: Prospects and challenges. *Library Hi Tech News*, 40(7), 1–5.

Meghanandha, N., & Naik, R. (2025). A comparative review of metadata, communication, content, and digital preservation standards in modern libraries. *American Journal of Information Science and Technology*, 9(1), 24–33. <https://doi.org/10.11648/j.ajist.20250901.13>

Mutsagondo, S., & Khumalo, N. (2023). E-skills scarcity and the digital records management landscape in Zimbabwe. *Library Philosophy and Practice*, 1–22. <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=14642&context=libphilprac>

Nwogo Ezeani, C. (2009). Digitizing projects in developing countries: The case of the University of Nigeria. *Library Hi Tech News*, 26(5/6), 14–15.

Nwosu, R. O. (2013). Comparative study of library and information science curricula in tertiary institutions in south-east Nigeria. *IOSR Journal of Research & Method in Education*, 5(5), 33–41.

Ocholla, D. N. (2008). The current status and challenges of collaboration in library and information studies (LIS) education and training in Africa. *New Library World*, 109(9–10), 466–479.

Okebukola, P. (2006). Principles and policies guiding current reforms in Nigerian universities. *Journal of Higher Education in Africa*, 4(3), 127–142. <https://doi.org/10.3366/jhea.2006.0305>

Okello-Obura, C., & Kigongo-Bukenya, I. M. N. (2011). Library and information science education and training in Uganda: Trends, challenges, and the way forward. *Education Research International*, 2011, Article 706862. <https://doi.org/10.1155/2011/706862>

Oliveira, T., & Martins, R. (2022). Literature review of information technology adoption models at firm level. *Electronic Journal of Information Systems Evaluation*, 14(1), 110–121.

Owojuyigbe, A. O., & Owojuyigbe, S. B. (2022). Archival digitization: A vibrant education and research tool for sustainable development. *Lagos Journal of Library and Information*, 10(1–2), 14–26. <https://www.ajol.info/index.php/ljilis/article/view/236454>

Oye, N. D., et al. (2012). The impact of e-learning on students' performance in tertiary institutions. *International Journal of Computer Networks and Wireless Communications*, 2(2), 121–130.

Oyeleye, C. A., et al. (2014). The impact and challenges of cloud computing adoption on public universities in southwestern Nigeria. *International Journal of Advanced Computer Science and Applications*, 5(8), 17–23. <https://doi.org/10.14569/IJACSA.2014.050803>

Pepler, G. (2014). Developing policies to stimulate the uptake of OER in Europe. *eLearning and Software for Education*, 1, 276–282.

Rathore, S. H. (2023). Archival libraries and digital archiving: A systematic review. *Journal of Advanced Research in Library and Information Science*, 10(1), 1–15.

Society of American Archivists. (2007). *Dublin Core Metadata Element Set (DCMES): ISO 15836-2003; ANSI/NISO Z39.85-2007*. SAA Standards Committee.

Unwin, T. (2008, May). *Survey of e-learning in Africa*. EduLib. <https://edulibpretoria.wordpress.com/wp-content/uploads/2008/05/survey-elearning-africa.pdf>

Zhou, L., et al. (2017). Machine learning on big data: Opportunities and challenges. *Neurocomputing*, 237, 350–361.