

ASSESSMENT OF TECHNOLOGICAL INFRASTRUCTURE FOR DIGITISATION OF LIBRARY INFORMATION RESOURCES IN THE FEDERAL COLLEGES OF EDUCATION IN NORTH-CENTRAL NIGERIA

By
KAMALUDDEEN ISA EL-KALASH
HABIBA M. BARAU
and
SAMAILA B. MOHAMMED

Abstract

This study assessed the technological infrastructure for digitizing library information resources in the Federal Colleges of Education Libraries (FCELs) in North-Central Nigeria, focusing on availability, effectiveness, and challenges. Specifically, it examined the types of infrastructure available, their effectiveness, and obstacles to their use. A cross-sectional survey design was adopted, targeting six FCELs in the region. A simple random sample of 141 library staff participated, using a validated questionnaire (reliability coefficient = 0.79). Data were analyzed using SPSS version 23 with frequency tables and percentages. Findings revealed that while basic infrastructure such as scanners, computers, and LANs are available in many institutions, essential components like storage systems, servers, and digital cameras are lacking. Software tools such as Optical Character Recognition (OCR) and digital preservation software were found to be largely effective, though network infrastructure performance varied. Major challenges reported include inadequate software, and network infrastructure (86.7%), limited staff technological skills (78.1%), copyright concerns, and resistance to change (over 50%). The study recommends increased investment in advanced digitisation software. Enhancing staff training and addressing copyright and change management issues will further support effective digitisation. These steps are essential to strengthen the digitisation capacity of FCELs and improve access to digital resources in the study area.

Key words: Availability, digitisation, federal colleges of education, library materials, technological infrastructure.

Introduction

The 21st century has ushered in a digital transformation that continues to redefine the ways in which information is generated, accessed, preserved, and disseminated. Within this evolving context, academic libraries have had to transition from traditional repositories of physical books and documents to dynamic digital knowledge hubs. They play a pivotal role in

facilitating teaching, learning, and research through the provision of both physical and electronic information resources (Salisu & Ibrahim, 2017). One of the most transformative advancements in library services is digitisation, the process of converting analogue materials into digital formats. This shift enables easier access to library resources, promotes long-term preservation of fragile and outdated materials, and supports collaborative research and knowledge sharing across geographical boundaries (Ocholla & Manyasi, 2018). Digitisation has particularly strong potential in developing countries such as Nigeria, where infrastructural challenges often impede access to current academic resources.

In the FCEs in North-Central Nigeria, these constraints are especially pronounced. Many of these institutions face challenges such as poor funding, limited acquisitions, and deteriorating physical collections, among others. These issues significantly affect the ability of students and lecturers to access relevant academic resources (Hussaini, Mustapha, & Muhammad, 2021). As a solution, digitisation presents a valuable opportunity to bridge the gap in resource access by converting traditional materials into formats that are more easily stored, retrieved, and shared electronically. The digitisation process relies heavily on technological infrastructure such as hardware, software, and networking components. Key hardware tools such as scanners, computers, servers, and storage devices are critical for the initial conversion and ongoing management of digital content. For instance, the use of high-resolution scanners ensures that texts, images, and maps are captured with clarity and fidelity (Ibrahim, 2019). Similarly, computers with high processing speed facilitate the manipulation and editing of digitised content. Software applications also play an indispensable role in enhancing the effectiveness of digitisation. Optical Character Recognition (OCR) tools, digital repository software such as DSpace and Greenstone, and image-editing applications like Adobe Photoshop enable libraries to create searchable, editable, and well-organized digital collections (Ocholla & Manyasi, 2018). Without these software tools, digital resources may remain static and less useful to end-users.

More so, network infrastructure including internet connectivity, local area network (LAN), and cloud storage systems forms the backbone of digitisation in modern libraries. These systems support the distribution and remote access of digital content because fast and reliable

internet is particularly crucial for uploading digitised materials, conducting remote backups, and providing seamless access to online resources for users (El-Kalash, 2021).

Despite the recognized importance of these technologies however, many FCEs in North-Central Nigeria continue to struggle with inadequate technological infrastructure. Although some colleges may have access to basic equipment, the quantity, and functionality of these tools are often lacking. Hence, a systematic assessment of the availability, effectiveness, and challenges related to technological infrastructure for digitisation in the FCEs in North-Central Nigeria is both timely and necessary. Such an assessment will provide critical insights into current resource gaps, operational inefficiencies, and policy shortcomings.

Statement of the Problem

Digitisation has become a critical component of modern library services, enabling institutions to expand access, enhance resource preservation, and improve information service delivery. However, in many developing countries like Nigeria, the implementation of digitisation initiatives remains hampered by infrastructural limitations, poor maintenance culture, lack of skilled personnel, and inconsistent policy support. While Federal Colleges of Education (FCEs) are established to train competent teachers that would contribute to educational development through access to quality information resources, preliminary observations suggest that their libraries, especially in North-Central Nigeria, are grappling with inadequate or obsolete technological infrastructure that are required for digitising their library holdings. Where infrastructure exists, their effectiveness in supporting digitisation processes and the challenges confronting library staff in deploying such technologies become an issue.

Despite the growing contribution of digital technologies to education, there is limited empirical research assessing the state of technological infrastructure for digitisation in FCE libraries, particularly in North-Central Nigeria. Without a clear understanding of what technologies are available, how effective they are, and the obstacles that hinder their use, it is difficult for policymakers, institutional leaders, and librarians to make informed decisions for improvement. Hence, this study seeks to fill this gap by assessing the availability, effectiveness,

and challenges of technological infrastructure for digitisation of library information resources in the Federal Colleges of Education in North-Central Nigeria.

Research Questions

The following research questions guided the study:

RQ1: What are the technological infrastructures for digitisation available in the FCELs in North-Central Nigeria?

RQ2: How effective are the available technological infrastructure for digitisation in the FCELs in North-Central Nigeria?

RQ3: What are the challenges faced in the effective use of the technological infrastructure for digitisation in the FCELs in North-Central Nigeria?

Literature Review

Globally, digitisation has become integral to library operations, revolutionising access to information, preservation of cultural heritage, and support for teaching, learning and research. In support of the above assertion, Verleyen (2012) reported that since the beginning of the Web and the automation of processes, European institutions such as libraries, research centres, museums, universities, etc. have been running projects to digitise the content they hold. Digitisation is a concept that has been embedded into memory institutions like libraries, museums and archives, and has brought many positive changes to the library and information science (LIS) landscape. It implies the computerized conversion of the contents of information materials that have been created in other formats, to provide such content for preservation purposes, easy access and a wider audience (El-Kalash, 2019).

According to Ukpanah, Ebong and Enang (2018), library digitisation is a new environment for achieving an old goal. Buttressing further, the authors stated that it is an old goal that entails the adoption of technological innovations in the capturing, storage, organisation and preservation of library and information resources. Ogunode and Ndayebom (2023) opined that digitisation has the potential to transform the entire higher education system by making teaching, research and the provision of community service more effective and efficient. It is an activity

that has the potential to improve flexibility, broaden the scope of instruction, and raise the standard of higher education in the country. Yet, the implementation of digitisation projects in Nigerian institutions of higher learning remains uneven, with numerous infrastructure limitations hindering progress.

Being hubs of learning and research, FCEs must be equipped with modern digitisation infrastructure to meet the evolving needs of their users. The issue of technological infrastructure is fundamental to any successful digitisation initiative. Technological infrastructure for digitisation encompasses both the physical (hardware) and virtual (software) components that support the entire digitisation workflow, ensuring efficient conversion, management, and preservation of digital content. Key hardware components include high-resolution scanners, computers with sufficient processing power and memory, servers for storage, digital cameras, and backup storage devices such as external hard drives and cloud storage systems. On the software side, infrastructure involves applications like Optical Character Recognition (OCR) tools for converting scanned images into searchable texts, digital repository management systems (such as DSpace and Greenstone), image editing software, and database management programs that organize and provide user-friendly access to digital collections (Choudhury and Choudhury, 2007). Additionally, network infrastructure comprising internet connectivity, local area networks (LAN), and cloud computing platforms is critical for enabling the seamless transfer, sharing, and remote access of digitised resources. In the Nigerian context, however, the development and deployment of such robust technological infrastructures often face significant challenges, such as hardware breakdown, software problems, unreliable and epileptic power supply, inadequate funding, staff training deficiency, and planned obsolescence of commercial software (Adegboye, 2010).

No doubt, the effectiveness of the technological infrastructure for digitisation plays a crucial role in determining the success or failure of digitisation projects. According to Ogar and Tangkat (2018), the transformation of library services through innovative technologies hinges largely on the willingness of library staff to embrace technological changes. However, Hussaini, Mustapha, and Muhammad (2021) found that Nigerian university libraries often face challenges

due to the insufficient digital skills of their staff, which limits the ability to digitise and manage information resources efficiently. Therefore, investing in ongoing training and development is essential for enhancing the skills of library staff, ensuring that they are equipped to handle the technical and organisational aspects of digitisation and improve the overall effectiveness of library services.

While libraries in the developed world have adapted to the challenges of information explosion and the need to preserve useful information for posterity, libraries in developing countries like Nigeria continually face serious problems in the digitisation and preservation of their valuable information (Kari & Baro, 2016). This is evidenced by the studies by Alagbeleye (2009), Baro and Otiode (2014), Anene, Ozor, and Baro (2020) who averred that the digitisation of materials and the setting up of institutional repositories in many African settings has faced serious problems ranging from low internet connectivity; software and hardware challenges; lack of highly skilled personnel; inadequate power supply; low bandwidth; copyright issues; poor funding; lack of organizational infrastructure and policies; project sustainability and many others. These challenges are likely to resonate with FCELs, underscoring the importance of conducting a systematic appraisal of the technological infrastructure for digitisation to identify specific areas for improvement. Such an appraisal is no doubt, essential for addressing the challenges hindering the effective digitisation of library resources.

Methodology

The study used a cross-sectional survey design to explore the technological infrastructure for digitisation in the FCELs across North-Central Nigeria. The population consisted of all library staff working in six FCELs located in the North-Central geopolitical zone, including Makurdi (Benue State), Lokoja (Kogi State), Ilorin (Kwara State), Minna (Niger State), Jos (Plateau State), Abuja (Federal Capital Territory), and Lafia (Nasarawa State). Using a simple random sampling technique, 141 library staff members were selected to participate. Data were collected through a questionnaire, which was carefully validated by experts in library and information science to ensure accuracy and relevance. The reliability of the instrument was confirmed with a coefficient of 0.79. Collected data were analyzed using frequency tables and

percentages, with the statistical analysis carried out through SPSS version 23. This approach allowed for a clear and comprehensive understanding of the current state of technological infrastructure for digitisation within these institutions.

Results and Discussion of the Findings

RQ1: What are the available technological infrastructures for digitisation in the FCELs in North-Central Nigeria?

Table 1: Available Technological Infrastructure for Digitisation in the FCELs in North-Central Nigeria

Available Technological Infrastructure for Digitisation	Yes		No	
	F	%	F	%
Computers and associated components	74	70.5	31	29.5
High-resolution scanners (flatbed, sheet-fed, overhead scanners)	83	79.0	22	21.0
Digital cameras for capturing images of documents and artefacts	33	31.4	72	68.6
Storage systems such as external hard drives and Network Attached Storage (NAS) for backup and archival	6	5.7	99	94.3
Servers to host digital collections and support data management	33	31.4	72	68.6
Software Components				
Optical Character Recognition (OCR) software, which converts scanned images of text into machine-readable and searchable documents	11	10.5	94	89.5
Document management software and digital repository systems (e.g., DSpace, Greenstone) that organize and provide access to digital collections	54	51.4	51	48.6
Image editing software to improve the quality and readability of scanned materials	52	49.5	53	50.5
Document conversion software to facilitate format transformation and interoperability	33	31.4	72	68.6
Digital preservation tools (such as Bit Curator and DigPress) that ensure the long-term maintenance and accessibility of digital assets	11	10.5	94	89.5
Network Infrastructure				
Network infrastructure devices, including routers and switches that support Local Area Networks (LAN)	74	70.5	31	29.5
High-speed internet access and cloud storage services for remote data access and off-site backup	52	49.5	53	50.5
Cloud computing platforms to enable off-site storage,	33	31.4	72	68.6

collaboration, and disaster recovery

Table 1 above presents the availability of technological infrastructure for digitisation in the FCELs in North-Central Nigeria. The findings reveal a mixed pattern across hardware, software, and network components, indicating partial readiness for digitisation initiatives. In terms of hardware, for example, certain essential tools are relatively available. High-resolution scanners (79.0%) and computers with adequate computing power (70.5%) are present in many of the libraries, suggesting a foundational capacity to initiate digitisation processes. Additionally, 70.5% of the institutions reported the availability of local area network (LAN) infrastructure, which supports internal digital connectivity.

However, other critical hardware components remain largely unavailable. Only 31.4% of the colleges reported access to digital cameras and servers, and a mere 5.7% has adequate storage solutions such as external hard drives and network-attached storage (NAS). These deficiencies significantly undermine the capacity to capture, process, and securely store digital content at scale.

On the software front, the situation is similarly imbalanced. While document management systems and repository platforms are available in 51.4% of the institutions, and image editing software in 49.5%, essential specialised software such as optical character recognition (OCR) tools and digital preservation systems are available in only 10.5% of cases. The limited availability of these tools restricts the ability of the libraries to ensure full-text searchability and long-term accessibility of digital resources. Also, network infrastructure also reflects partial implementation. High-speed internet and cloud storage services are available in 49.5% of the libraries, enabling some level of online access and offsite data security. However, the underutilisation of cloud computing platforms is just 31.4% of the institutions, suggesting limited engagement with more scalable and modern digital infrastructure solutions.

These findings, in response to research question one underscores the uneven distribution and availability of digitisation infrastructure across FCELs in North-Central Nigeria. While basic tools are in place in several institutions, the absence of critical hardware and specialised software

limits the scalability, effectiveness, and sustainability of digitisation efforts. The results corroborate the observations of El-Kalash (2019), who noted that although digitisation efforts have commenced in many Nigerian institutions, infrastructural limitations continue to pose a significant challenge. Similarly, Ukpanah, Ebong, and Enang (2018) reported disparities in the availability of digitisation infrastructure in school libraries in Akwa Ibom State, where basic facilities were present, but advanced technological tools were lacking. These patterns reflect a broader issue within the Nigerian educational system, where incremental progress in digitisation is often constrained by resource inadequacies and uneven implementation.

RQ2: How effective are the available technological infrastructure for digitisation in the FCELs in North-Central Nigeria?

Table 2: Effectiveness of the Technological Infrastructure for Digitisation in the FCELs in North-Central Nigeria.

Items	VI		I		Neutral		Effective		VE		Mean	STD
	F	%	F	%	F	%	F	%	F	%		
Computers and associated components	16	15.2	18	17.1	14	13.3	26	24.8	31	29.5	3.36	1.45
High-resolution scanners (flatbed, sheet-fed, overhead scanners).	22	21.0	46	43.8	28	26.7	7	6.7	2	1.9	2.02	1.07
Digital cameras for capturing images of documents and artefacts.	24	22.9	16	15.2	6	5.7	56	53.3	3	2.9	2.98	1.32
Storage systems such as external hard drives and Network Attached Storage (NAS) for backup and archival.	22	21.0	32	30.5	8	7.6	34	32.4	9	8.6	2.77	1.33
Servers to host digital collections and support data management.	46	43.8	16	15.2	18	17.1	20	19.0	5	4.8	2.26	1.32
Software Components	46	43.8	16	15.2	18	17.1	20	19.0	5	4.8	2.26	1.32
Optical Character Recognition (OCR) software that converts scanned images of text into machine-readable and searchable documents	46	43.8	22	21.0	28	26.7	7	6.7	2	1.9	2.02	1.07
Document management	28	24.8	18	17.1	4	3.8	44	41.9	13	12.4	3.00	1.45

software and digital repository systems (e.g., DSpace, Greenstone) that organize and provide access to digital collections												
Image editing software to improve the quality and readability of scanned materials	44	41.9	20	19.0	26	24.8	13	12.4	2	1.9	2.13	1.15
Document conversion software to facilitate format transformation and interoperability	46	43.8	22	21.0	28	26.7	7	6.7	2	1.9	2.02	1.07
Digital preservation tools (such as Bit Curator and DigPress) that ensure the long-term maintenance and accessibility of digital assets	46	43.8	22	21.0	28	26.7	7	6.7	2	1.9	2.02	1.07
Network Infrastructure												
Network infrastructure devices, including routers and switches that support Local Area Networks (LAN)	30	28.6	22	21.0	10	9.5	32	30.5	11	10.5	2.73	1.42
High-speed internet access and cloud storage services for remote data access and off-site backup	14	13.3	20	19.0	38	36.2	25	23.8	8	7.6	2.93	1.13
Cloud computing platforms to enable off-site storage, collaboration, and disaster recovery	22	21.0	46	43.8	28	26.7	7	6.7	2	1.9	2.02	1.07

Key: Very Ineffective 1, Ineffective 2, Neutral 3, Effective 4, Very Effective 5 (Field survey, 2025).

Table 2 presents the respondents' perceptions regarding the effectiveness of available technological infrastructure for digitisation in the FCELs in North-Central Nigeria. The data indicate that computers and associated components were considered the most effective tools for digitisation, with 54.3% of respondents rating them as either effective or very effective (Mean = 3.36, SD = 1.45). This suggests that basic computing infrastructure is relatively adequate in supporting digitisation activities across the institutions.

Document management software, such as DSpace and Greenstone, was also perceived as moderately effective (Mean = 3.00, SD = 1.45). This indicates some level of functionality in managing and organising digital collections, though potential remains for optimisation. Though, specialised digitisation tools such as high-resolution scanners (Mean = 2.02, SD = 1.07), optical character recognition (OCR) software, document conversion tools, and digital preservation technologies were generally rated as ineffective. A majority of respondents classified these tools as ineffective or very ineffective, reflecting either limited utility, inadequate implementation, or a lack of capacity to deploy these technologies effectively within the library system.

Similarly, cloud computing platforms (Mean = 2.02) and dedicated servers (Mean = 2.26) received low effectiveness ratings. These findings highlight significant weaknesses in digital storage and data accessibility infrastructure, which are critical for supporting robust and sustainable digitisation efforts, while mixed perceptions were recorded on network infrastructure. High-speed internet (Mean = 2.93) and local area networks (LANs) (Mean = 2.73) were perceived as moderately effective, suggesting that while connectivity exists in some form, it is not consistently reliable or sufficiently strong to support intensive digitisation and remote access activities.

In addressing research question two, which focused on evaluating the effectiveness of available technological infrastructure, the findings reveal that while basic technologies like computers and document management systems demonstrate moderate effectiveness in supporting digitisation in FCELs, advanced and specialised tools required for comprehensive digitisation processes are largely ineffective or underutilised. These findings align with earlier studies like that of Hussaini, Mustapha, and Muhammad (2021) who reported that although ICTs are increasingly adopted in university libraries, the effective use of advanced technologies is constrained by poor integration and inadequate maintenance. Similarly, Ibrahim (2019) observed that many academic libraries struggle with outdated hardware and software, limiting their ability to leverage ICT for comprehensive digitisation—a concern also evident in the current study.

Overall, the evidence underscores the need for strategic investment in specialised digitisation tools, improved infrastructure for storage and connectivity, and the development of technical capacity to ensure effective utilisation of digitisation technologies in FCELs.

RQ3: What are the challenges faced in the effective use of the technological infrastructure for digitisation in the FCELs in North-Central Nigeria?

Table 3: Challenges to the Effective use of the Technological Infrastructure for Digitisation in the FCELs in North-Central Nigeria

Items	Yes		No	
	F	%	F	%
Challenges/ Barriers				
Limited technological skills	82	78.1	23	21.9
Inadequate Technologies such hardware technologies, software and network infrastructures	91	86.7	14	13.3
Copyright and Legal Issues	54	51.4	51	48.6
Resistance to Change	54	51.4	51	48.5

Table 3 above presents the challenges encountered in the effective utilisation of technological infrastructure for digitisation in FCELs in North-Central Nigeria. The most frequently reported challenge was the inadequacy of technological resources—comprising hardware, software, and network infrastructure—with 86.7% of respondents identifying this as a major impediment. This was followed by limited technological skills among library staff, reported by 78.1% of respondents. Other significant challenges included copyright and legal concerns (51.4%) and resistance to organisational change (51.4%), highlighting a combination of institutional, technical, and policy-related barriers to successful digitisation initiatives.

The data suggests that infrastructural inadequacies remain a primary concern, corroborating the assertions of Ogunode and Ndayebom (2023), which emphasised the prevalence of infrastructural deficits and a lack of skilled personnel as critical limitations in the digitisation efforts of Nigerian higher education institutions. Similarly, Ocholla and Manyasi (2018) identified comparable obstacles in rural library environments, noting that the absence of

adequate infrastructure and training hinders the delivery of digital services. Ogar and Tangkat (2018) argued that the adoption of innovative technologies could significantly enhance service delivery if these barriers are systematically addressed. This perspective aligns with the present study's recommendation for increased investment in technological infrastructure and staff capacity building.

In addition, a comparative insight from Verleyen (2012) revealed that European institutions have achieved more advanced stages of digitisation, supported by robust infrastructure and sustained policy backing. This contrast underscores the regional disparities in digitisation progress, with Nigerian institutions, particularly the FCELs that are lagging behind. Salisu and Ibrahim (2017) similarly advocated for the evolution of resource management strategies within Nigerian libraries to better accommodate digitisation demands, a viewpoint that reinforces the current study's findings on infrastructural and human capacity gaps.

In sum, the challenges identified in this study reflect a multidimensional problem requiring policy attention, institutional reform, and sustained investment to foster a more enabling environment for the digitisation of library resources in Nigeria's Colleges of Education.

Recommendations

Based on the above findings from the study, the following recommendations are proffered:

1. FCELs in North-Central Nigeria should prioritize investing in essential and current hardware that are lacking in their ambiances such as storage systems, servers, and digital cameras. Additionally, acquiring and implementing critical software tools like Optical Character Recognition (OCR) and digital preservation software will significantly improve their digitisation capacity and sustainability.
2. To achieve an effective and efficient digitisation outcome, regular maintenance, upgrades, and integration of existing digitisation technologies should frequently be conducted by the FCELs in the study area.
3. To overcome the challenges related to limited technical skills and resistance to change, the FCELs in North-Central Nigeria should conduct regular professional development trainings and capacity-building workshops for their library staff. Such training programs

will upskill the technological competencies of their staff and enable them to fully utilize available modern digitisation tools that can enhance their digitisation workflows, as well as maximize the effectiveness of their technological resources.

4. Clear policies addressing copyright and legal issues should be developed and communicated to support compliant and ethical digitisation practices.
5. Lastly, FCEs in North-Central Nigeria should intensify their lobbying strategies to generate increased funding from the Federal Government, to address the infrastructural gaps and to foster a supportive environment for digitisation initiatives.

Conclusion

In conclusion, the study revealed that the technological infrastructure for digitisation in the FCEs in North-Central Nigeria are inconsistently available, with essential hardware like storage systems and servers, as well as critical software such as OCR and digital preservation tools, largely lacking. The effectiveness of existing infrastructure is limited, as basic tools are only moderately functional while specialized digitisation technologies perform poorly. Furthermore, significant challenges—including inadequate infrastructure, limited technical skills, copyright concerns, and resistance to change—continue to hinder the successful implementation and sustainability of digitisation efforts in these institutions.

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